# Supporting Information

## Palladium-Catalyzed Intramolecular Redox-Relay Heck Cyclization: Access to Heterocycles Bearing All-Carbon Quaternary Centers

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## 1. General Information

All reactions were carried out in glassware under ambient atmosphere unless otherwise noted. Reactions were concentrated under reduced pressure using a rotary evaporator unless otherwise noted. Commercial reagents, including all of solvents, were used as received or purified using the methods indicated herein. All of chiral ligands were obtained from commercial sources.

**Chromatography**: Analytical thin-layer chromatography (TLC) was carried out with silica gel pre-coated glass plates. The TLC was visualized with a UV lamp (254 or 365 nm). Flash Column chromatography was carried out on silica gel (200-300 mesh) with technical grade solvents as the eluent.

**Nuclear magnetic resonance (NMR) spectroscopy**: NMR spectra were recorded using $CDCl_3$ as the solvent and on the Bruker AVANCE spectrometer, operating at 400 MHz for $^1H$ NMR and 100 MHz for $^{13}C$ NMR. Chemical shifts (δ) were given in parts per million from tetramethylsilane (δ 0) and were measured relative to the signal of $CDCl_3$ ($^1H$ NMR: δ 7.26 ppm and $^{13}C$ NMR: 77.0 ppm). Coupling constants (*J* values) were given in Hertz (Hz) and reported to the nearest 0.1 Hz. $^1H$ NMR spectral data are tabulated in the order: multiplicity (s, singlet; d, doublet; t, triplet; q, quartet; sept, septet; m, multiplet; br broad), coupling constants, number of protons.

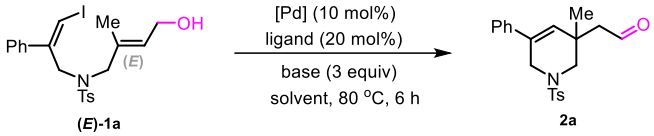
**High resolution mass spectrometry (HRMS)**: HRMS were recorded on a liquid chromatography/quadrupole time-of-flight mass spectrometer (MicroTof-Q II mass spectrometer, Bruker Daltonics) using electrospray ionization-time of flight (ESI-TOF). The calculated values are based on the most abundant isotope.

**High performance liquid chromatography (HPLC)**: HPLC analysis was performed on a SHIMADZU LC-20AT equipped with a variable wavelength UV-Vis detector SPD-20A and Daicel Chiralpak chiral column.

**Optical rotations**: Optical rotations were measured on an Autopol IV-T polarimeter. The optical rotation values ($[\alpha]_D$) were reported at the indicated temperature in deg. mL $g^{-1}$ $dm^{-1}$.

## 2. Optimization of Reaction Conditions

### Table S1: Optimization for the Synthesis of 2a

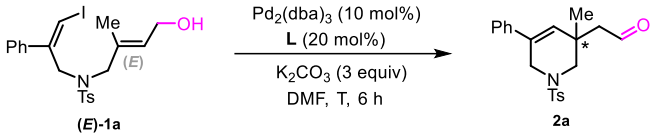



(*E*)-1a 2a

| entry | catalyst | ligand | base | solvent | **2a** (yield[b] %) |
|---|---|---|---|---|---|
| 1 | $Pd_2(dba)_3$ | bpy | - | DMF | 13 |
| 2 | $Pd_2(dba)_3$ | bpy | - | DMA | 10 |
| 3 | $Pd_2(dba)_3$ | bpy | - | $CH_3CN$ | <10 |
| 4 | $Pd_2(dba)_3$ | bpy | - | MeOH | trace |
| 5 | $Pd_2(dba)_3$ | bpy | - | THF | ND |
| 6 | $Pd_2(dba)_3$ | bpy | - | DCE | ND |
| 7 | $Pd_2(dba)_3$ | bpy | $Li_2CO_3$ | DMF | 46 |
| 8 | $Pd_2(dba)_3$ | bpy | $Cs_2CO_3$ | DMF | 58 |
| 9 | $Pd_2(dba)_3$ | bpy | $Na_2CO_3$ | DMF | 83 |
| 10 | $Pd_2(dba)_3$ | bpy | $K_2CO_3$ | DMF | 93 |
| 11 | $Pd_2(dba)_3$ | bpy | $K_3PO_4$ | DMF | 88 |
| 12 | $[Pd(allyl)Cl]_2$ | bpy | $K_2CO_3$ | DMF | 65 |
| 13 | $Pd(MeCN)_2Cl_2$ | bpy | $K_2CO_3$ | DMF | 90 |
| 14 | $Pd(OAc)_2$ | bpy | $K_2CO_3$ | DMF | <10 |
| 15 | $Pd(OAc)_2$ | $PPh_3$ | $K_2CO_3$ | DMF | 62 |
| 16 | $Pd(OAc)_2$ | dppb | $K_2CO_3$ | DMF | 82 |
| 17 | - | bpy | $K_2CO_3$ | DMF | ND |
| 18 | $Pd_2(dba)_3$ | - | $K_2CO_3$ | DMF | <10 |
| 19 | - | - | $K_2CO_3$ | DMF | ND |

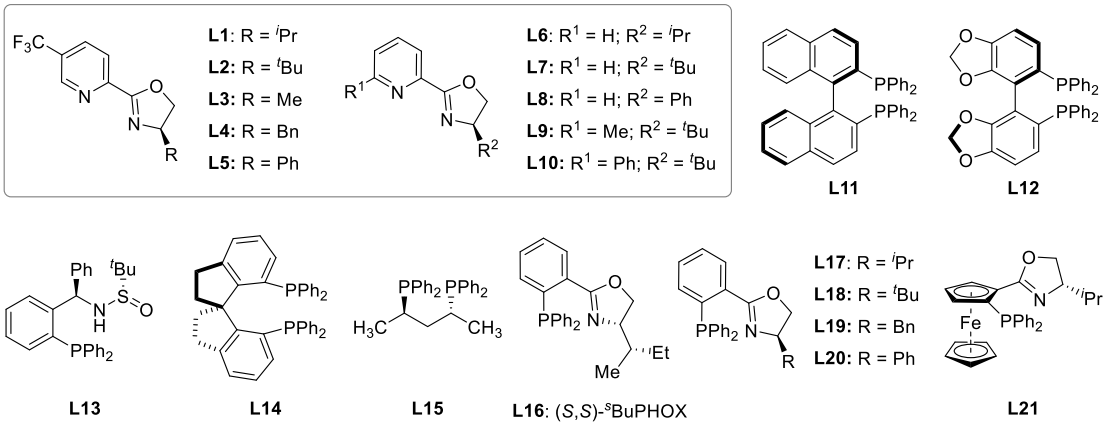
[a]Reaction conditions: **(*E*)-1a** (0.1 mmol), Pd catalyst (0.01 mmol), ligand (0.02 mmol) in solvent (1.5 mL) at 80 °C for 6 h under air. [b]Determined by $^1$HNMR with 1,3,5-trimethoxybenzene as the internal standard.

## Table S2: Optimization for the Synthesis of Chiral Product 2a

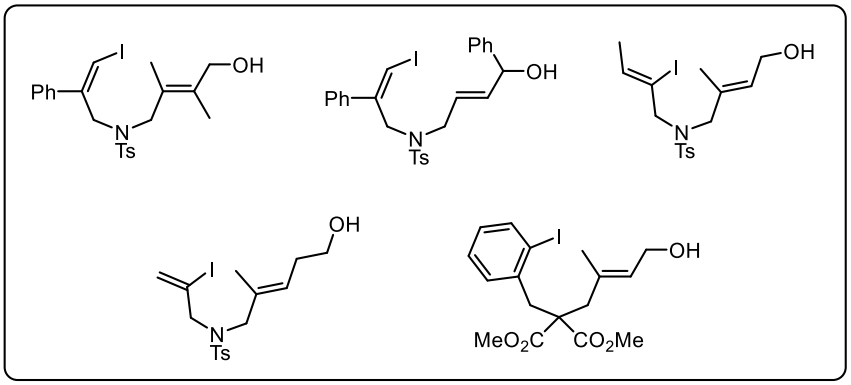



| entry | L | T (°C) | **2a** (yield[b] %) | ee[c] (%) |
|---|---|---|---|---|
| 1 | **L1** | 80 | 93 | <1 |
| 2 | **L2** | 80 | 94 | 16 |
| 3 | **L3** | 80 | 90 | <1 |
| 4 | **L4** | 80 | 86 | 8 |
| 5 | **L5** | 80 | 87 | 7 |
| 6 | **L6** | 80 | 93 | 7 |
| 7 | **L7** | 80 | 93 | 10 |
| 8 | **L8** | 80 | 86 | <1 |
| 9 | **L9** | 80 | 82 | <1 |
| 10 | **L10** | 80 | 92 | <1 |
| 11 | **L2** | 60 (12 h) | 90 | 23 |
| 12 | **L2** | 50 | 86 | 22 |
| 13 | **L2**[d] | 60 | 90 | 23 |
| 14 | **L2**[e] | 60 | 90 | 23 |
| 15 | **L11** | 60 | 24 | 16 |
| 16 | **L12** | 60 | 35 | 28 |
| 17 | **L13** | 60 | 39 | 24 |
| 18 | **L14** | 60 | <10 | <1 |
| 19 | **L15** | 60 | 58 | 8 |
| 20 | **L16** | 60 | 76 | 53 |
| 21 | **L17** | 60 | 75 | 46 |
| 22 | **L18** | 60 | 72 | 42 |
| 23 | **L19** | 60 | 65 | 35 |
| 24 | **L20** | 60 | 64 | 14 |
| 25 | **L21** | 60 | 55 | 37 |

[a]Reaction conditions: ***(E)*-1a** (0.1 mmol), $Pd_2(dba)_3$ (0.01 mmol), **L** (0.02 mmol) in DMF (1.5 mL) under air. [b]Determined by $^1$HNMR with 1,3,5-trimethoxybenzene as the internal standard. [c]Determined by HPLC analysis. [d]$[Pd(allyl)Cl]_2$. [e]$Pd(MeCN)_2Cl_2$.

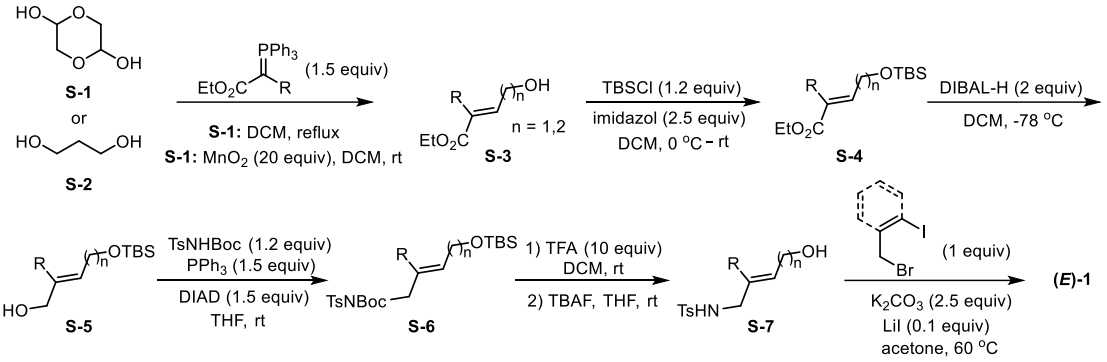



## Table S3: Unsuccessful Substrates



## 3. Preparation of Starting Materials

**General Synthetic Procedures for the Preparation of (*E*)-1**:




To a solution of compound **S-1** (200 mmol), in DCM (200 mL) was added ethyl 2-(triphenyl-λ5-phosphanylidene) propanoate (1.5 eq, 300 mmol) and the resulting mixture was stirred at 45 °C for 72 h. The reaction was quenched with water, and extracted with DCM. It was purified by column chromatography to give compound **II**. After completion, concentrate the solvent under reduced pressure. The obtained crude product **S-3** was used in the next step without further purification.

To a solution of compound **S-2** (200 mmol), in DCM (200 mL) was added ethyl 2-(triphenyl-λ5-phosphanylidene) propanoate (1.5 eq, 300 mmol) and $MnO_2$ (20 equiv). The resulting mixture was stirred at room temperature for 72 h and then filter through Celite. Wash the filtrate with DCM then concentrate the combined organic layer in vacuo. Purify the crude residue by flash chromatography obtain product **S-3**.

To a solution of **S-3** (100 mmol) and imidazol (250 mmol, 2.5 equiv) in DCM (100 mL) at 0 ºC was slowly added TBSCl (120 mmol, 1.2 equiv). Then, the reaction mixture was warmed up to room temperature and further stirred overnight. Concentrate the combined organic layer in vacuo and purify the crude residue by flash chromatography obtain product **S-4**.

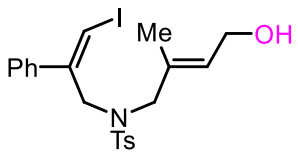
To a solution of **S-4** (50 mmol) in DCM (70 mL) at -78 ºC was slowly added DIBALH (1,5 M in toluene, 2 equiv). The resulting mixture was stirred at -78 ºC for 2 h and further warmed up to 0 ºC for 30 min. After completion, the mixture was quenched with the addition of MeOH (5 mL) at 0 °C. Allow the reaction mixture to reach ambient temperature and add saturated aqueous NaCl solution (50 mL) and DCM (50 mL) to the reaction mixture. Filter the reaction mixture through a plug of Celite and extracted

with DCM. Concentrate the combined organic layer in vacuo and purify the crude residue by flash chromatography to give the **S-5**.

To a solution of **S-5** (30 mmol), TsNHBoc (36 mmol, 1.2 equiv) and $PPh_3$ (45 mmol, 1.5 equiv) in THF (60 mL) at 0 °C was slowly added DIAD (45 mmol, 1.5 equiv). Then, the reaction mixture was warmed up to room temperature and further stirred overnight. Concentrate the combined organic layer in vacuo and purify the crude residue by flash chromatography obtain product **S-6**.

To a solution of **S-6** (20 mmol) in DCM (40 mL) at 0 °C was slowly added TFA (200 mmol, 10 equiv). Then, the reaction mixture was warmed up to room temperature and further stirred for 3 h. After completion, the solution was washed with saturated $NaHCO_3$ solution and extracted with DCM. Concentrate the combined organic layer in vacuo. The crude residue was dissolved in THF (20 mL), then TBAF (100 mmol, 5 equiv) was added into the mixture. The reaction mixture was stirred at room temperature for 3 h. After completion, the mixture was quenched by saturated NaCl solution and extracted with EtOAc. The combined organic layers were dried with $Na_2SO_4$ and concentrated under reduced pressure. Purify the crude residue by flash chromatography obtain product **S-7**.

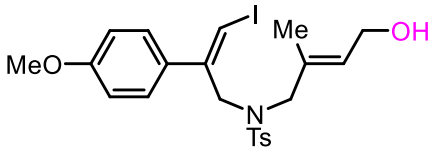
In an oven-dried tube, alcohol **S-7** (6 mmol), $K_2CO_3$ (15 mmol, 2.5 eq) and LiI (0.6 mmol, 0.1 eq) was dissolved in acetone (12 mL), the reaction mixture was stirred at room temperature for 30 min. Then a solution of vinyl/aryl iodines (6 mmol) in acetone was added dropwise and the mixture was stirred at 60 °C for overnight. After completion, the reaction was quenched with water, and extracted with EtOAc. Organic solvents were removed under reduced pressure and the crude reaction mixture was purified by chromatography on silica gel (petroleum ether/ethyl acetate = 2/1) to afford the compound **(*E*)-1**.




**1a**

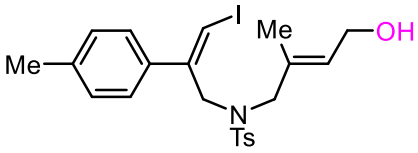
Compound **1a** was prepared according to the general procedure. Colorless oil. **$^1$H NMR**

(400 MHz, $CDCl_3$) δ 7.53 (d, $J$ = 8.0 Hz, 2H), 7.21 – 7.17 (m, 7H), 6.47 (s, 1H), 5.33 (t, $J$ = 6.4 Hz, 1H), 4.33 (s, 2H), 3.97 (d, $J$ = 6.4 Hz, 2H), 3.37 (s, 2H), 2.35 (s, 3H), 1.93 (s, 1H), 1.16 (s, 3H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 146.3, 143.6, 138.3, 135.7, 133.4, 129.7, 128.4, 128.3, 127.5, 127.5, 127.2, 82.9, 59.2, 56.0, 54.0, 21.6, 14.2. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{21}H_{25}INO_3S^+$: 498.0594; found: 498.0594.



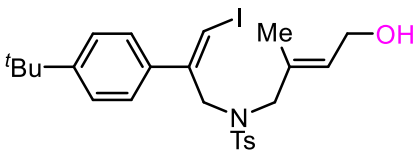

**1b**

Compound **1b** was prepared according to the general procedure. Colorless oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 7.63 (d, $J$ = 8.0 Hz, 2H), 7.31 – 7.28 (m, 2H), 7.24 – 7.21 (m, 2H), 6.83 – 6.79 (m, 2H), 6.46 (s, 1H), 5.45 – 5.42 (m, 1H), 4.40 (s, 2H), 4.07 (d, $J$ = 6.4 Hz, 2H), 3.80 (s, 3H), 3.47 (s, 2H), 2.44 (s, 3H), 1.90 (s, 1H), 1.27 (s, 3H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 159.6, 145.5, 143.5, 135.8, 133.6, 130.7, 129.7, 128.4, 127.5, 127.3, 113.7, 81.1, 59.2, 56.0, 55.3, 54.1, 21.6, 14.2. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{22}H_{27}INO_4S^+$: 528.0700; found: 528.0701.




**1c**

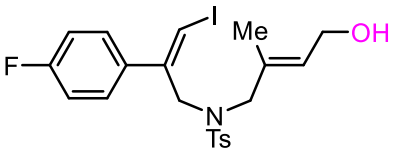
Compound **1c** was prepared according to the general procedure. Colorless oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 7.61 (d, $J$ = 8.0 Hz, 2H), 7.28 (d, $J$ = 8.0 Hz, 2H), 7.15 (d, $J$ = 8.0 Hz, 2H), 7.07 (d, $J$ = 8.0 Hz, 2H), 6.51 (s, 1H), 5.42 (t, $J$ = 6.4 Hz, 1H), 4.41 (s, 2H), 4.07 (d, $J$ = 6.4 Hz, 2H), 3.46 (s, 2H), 2.44 (s, 3H), 2.32 (s, 3H), 1.85 (s, 3H), 1.28 (s, 3H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 146.1, 143.5, 138.3, 135.9, 135.4, 133.7, 129.7, 129.1, 127.5, 127.2, 127.0, 82.1, 59.3, 55.8, 54.0, 21.6, 21.2, 14.2. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{22}H_{27}INO_3S^+$: 512.0751; found: 512.0750.




**1d**

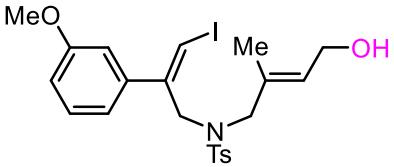
Compound **1d** was prepared according to the general procedure. Colorless oil. **$^1$H NMR**

(400 MHz, $CDCl_3$) δ 7.63 (d, $J$ = 8.0 Hz, 2H), 7.31 – 7.28 (m, 4H), 7.23 (d, $J$ = 8.4 Hz, 2H), 6.55 (s, 1H), 5.43 (t, $J$ = 5.6 Hz, 1H), 4.43 (s, 2H), 4.06 (d, $J$ = 6.4 Hz, 2H), 3.46 (s, 2H), 2.44 (s, 3H), 2.00 (s, 1H), 1.32 (s, 9H), 1.25 (s, 3H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 151.4, 146.0, 143.5, 135.7, 135.4, 133.5, 129.7, 127.6, 127.4, 126.9, 125.3, 82.2, 59.2, 55.9, 54.0, 34.6, 31.3, 21.6, 14.1. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{25}H_{33}INO_3S^+$: 554.1220; found: 554.1219.



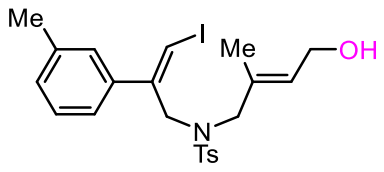

**1e**

Compound **1e** was prepared according to the general procedure. Colorless oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 7.53 (d, $J$ = 8.0 Hz, 2H), 7.21 – 7.14 (m, 4H), 6.86 (t, $J$ = 8.4 Hz, 2H), 6.42 (s, 1H), 5.34 (t, $J$ = 6.0 Hz, 1H), 4.29 (s, 2H), 3.98 (d, $J$ = 6.4 Hz, 2H), 3.37 (s, 2H), 2.34 (s, 3H), 2.12 (s, 1H), 1.16 (s, 3H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 162.6 (d, $J_{C\text{-}F}$ = 246.7 Hz), 144.5 (d, $J_{C\text{-}F}$ = 167.0 Hz), 135.7, 134.4 (d, $J_{C\text{-}F}$ = 3.3 Hz), 133.2, 129.8, 129.0 (d, $J_{C\text{-}F}$ = 8.1 Hz), 127.7, 127.4, 115.4, 115.2, 82.7, 59.1, 56.3, 54.2, 21.6, 14.1. **$^{19}$F NMR** (376 MHz, $CDCl_3$) δ -112.4. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{21}H_{24}FINO_3S^+$: 516.0500; found: 516.0502.



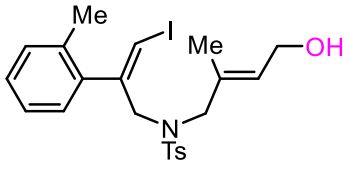

**1f**

Compound **1f** was prepared according to the general procedure. Colorless oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 7.64 (d, $J$ = 8.0 Hz, 2H), 7.31 – 7.28 (m, 2H), 7.22 – 7.18 (m, 1H), 6.87 – 6.85 (m, 3H), 6.59 (s, 1H), 5.51 – 5.42 (m, 1H), 4.41 (s, 2H), 4.08 (d, $J$ = 6.4 Hz, 2H), 3.82 (s, 3H), 3.48 (s, 2H), 2.45 (s, 3H), 1.86 (s, 1H), 1.28 (s, 3H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 159.3, 146.2, 143.5, 139.7, 135.7, 133.5, 129.7, 129.3, 127.6, 127.5, 119.8, 114.1, 112.7, 82.9, 59.2, 56.2, 55.4, 54.2, 21.6, 14.1. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{22}H_{27}INO_4S^+$: 528.0700; found: 528.0701.



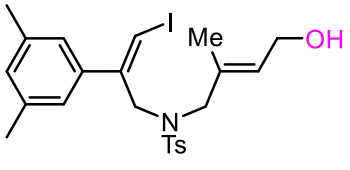

**1g**

Compound **1g** was prepared according to the general procedure. Colorless oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 7.63 (d, *J* = 8.4 Hz, 2H), 7.30 (d, *J* = 8.4 Hz, 2H), 7.18 (t, *J* = 7.6 Hz, 1H), 7.13 (d, *J* = 7.6 Hz, 1H), 7.07 – 7.03 (m, 2H), 6.54 (s, 1H), 5.45 (td, *J* = 6.4, 1.2 Hz, 1H), 4.44 (s, 2H), 4.10 (d, *J* = 6.4 Hz, 2H), 3.49 (s, 2H), 2.46 (s, 3H), 2.33 (s, 3H), 1.62 (s, 1H), 1.32 (s, 3H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 146.4, 143.4, 138.4, 138.0, 136.0, 133.7, 129.6, 129.0, 128.2, 128.0, 127.5, 127.4, 124.3, 82.6, 59.3, 55.8, 53.8, 21.6, 21.4, 14.2. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{22}H_{27}INO_3S^+$: 512.0751; found: 512.0750.




**1h**

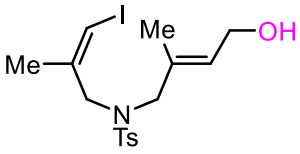
Compound **1h** was prepared according to the general procedure. Colorless oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 7.54 (d, *J* = 8.4 Hz, 2H), 7.19 – 7.12 (m, 3H), 7.05 – 7.01 (m, 2H), 6.86 (d, *J* = 7.6 Hz, 1H), 6.21 (s, 1H), 5.35 (dd, *J* = 6.4, 5.6 Hz, 1H), 4.20 (s, 2H), 4.05 (d, *J* = 6.4 Hz, 2H), 3.40 (s, 2H), 2.38 – 2.32 (m, 4H), 2.14 (s, 3H), 1.26 (s, 3H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 147.4, 143.3, 138.6, 136.1, 135.4, 132.9, 130.2, 129.6, 129.5, 128.5, 128.1, 127.6, 125.7, 82.9, 59.1, 56.1, 53.3, 21.6, 19.6, 14.0. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{22}H_{27}INO_3S^+$: 512.0751; found: 512.0750.




**1i**

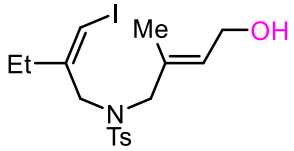
Compound **1i** was prepared according to the general procedure. Colorless oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 7.62 (d, *J* = 8.4 Hz, 2H), 7.29 – 7.27 (m, 2H), 6.94 (s, 1H), 6.79

(s, 2H), 6.49 (s, 1H), 5.46 (td, $J$ = 6.4, 1.2 Hz, 1H), 4.42 (s, 2H), 4.12 (d, $J$ = 6.4 Hz, 2H), 3.50 (s, 2H), 2.45 (s, 3H), 2.28 (s, 6H), 1.78 (s, 1H), 1.36 (s, 3H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 146.5, 143.3, 138.4, 137.8, 136.2, 133.6, 129.9, 129.6, 127.5, 125.0, 82.5, 59.2, 55.6, 53.5, 21.6, 21.3, 14.2. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{23}H_{29}INO_3S^+$: 526.0907; found: 526.0906.



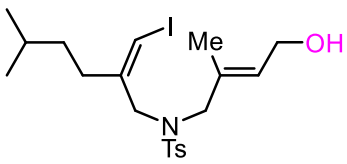

**1j**

Compound **1j** was prepared according to the general procedure. Colorless oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 7.69 (d, $J$ = 8.0 Hz, 2H), 7.31 (d, $J$ = 8.0 Hz, 2H), 6.00 (s, 1H), 5.49 (t, $J$ = 6.0 Hz, 1H), 4.11 (d, $J$ = 6.4 Hz, 2H), 3.84 (s, 2H), 3.59 (s, 2H), 2.42 (s, 3H), 1.86 (s, 3H), 1.58 (s, 3H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 143.6, 142.8, 136.4, 132.9, 129.8, 128.6, 127.4, 59.2, 56.4, 55.3, 22.0, 21.6, 14.4. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{16}H_{23}INO_3S^+$: 436.0438; found: 436.0436.



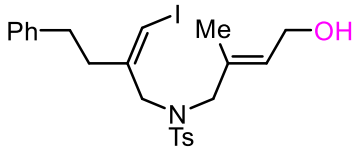

**1k**

Compound **1k** was prepared according to the general procedure. Colorless oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 7.62 (d, $J$ = 8.0 Hz, 2H), 7.24 (d, $J$ = 8.0 Hz, 2H), 5.96 (s, 1H), 5.41 (t, $J$ = 6.0 Hz, 1H), 4.01 (d, $J$ = 6.4 Hz, 2H), 3.80 (s, 2H), 3.49 (s, 2H), 2.34 (s, 3H), 2.21 (s, 1H), 2.15 (q, $J$ = 7.6 Hz, 2H), 1.49 (s, 3H), 0.93 (t, $J$ = 7.6 Hz, 3H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 147.9, 143.6, 136.0, 132.7, 129.8, 128.4, 127.4, 77.8, 59.0, 56.4, 54.6, 27.9, 21.6, 14.4, 12.3. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{17}H_{25}INO_3S^+$: 450.0594; found: 450.0593.



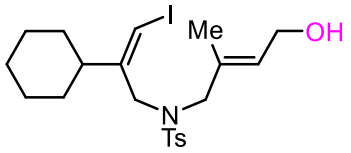

**1l**

Compound **1l** was prepared according to the general procedure. Colorless oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 7.69 (d, *J* = 8.4 Hz, 2H), 7.31 (d, *J* = 8.0 Hz, 2H), 6.03 (s, 1H), 5.49 (td, *J* = 6.4, 1.0 Hz, 1H), 4.10 (d, *J* = 6.4 Hz, 2H), 3.87 (s, 2H), 3.57 (s, 2H), 2.42 (s, 3H), 2.17 – 2.13 (m, 2H), 1.74 (s, 1H), 1.58 (s, 3H), 1.45 (dt, *J* = 13.6, 6.8 Hz, 1H), 1.28 – 1.22 (m, 2H), 0.85 (d, *J* = 6.8 Hz, 6H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 147.9, 143.6, 136.0, 132.7, 129.8, 128.4, 127.4, 77.8, 59.0, 56.4, 54.6, 27.9, 21.6, 14.4, 12.3. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{20}H_{31}INO_3S^+$: 492.1064; found: 492.1066.



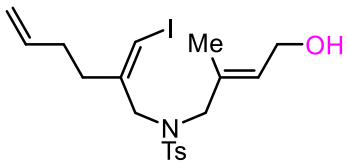

**1m**

Compound **1m** was prepared according to the general procedure. Pale yellow oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 7.64 (d, *J* = 8.4 Hz, 2H), 7.24 – 7.18 (m, 4H), 7.14 – 7.08 (m, 3H), 5.99 (s, 1H), 5.42 (td, *J* = 6.4, 1.0 Hz, 1H), 4.02 (d, *J* = 6.4 Hz, 2H), 3.86 (s, 2H), 3.53 (s, 2H), 2.69 – 2.65 (m, 2H), 2.46 – 2.42 (m, 2H), 2.34 (s, 3H), 1.50 – 1.48 (m, 4H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 145.7, 143.7, 140.9, 136.2, 133.1, 129.8, 128.5, 128.4, 128.1, 127.4, 126.1, 79.4, 59.2, 56.4, 54.4, 36.8, 34.3, 21.6, 14.4. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{23}H_{29}INO_3S^+$: 526.0907; found: 526.0908.



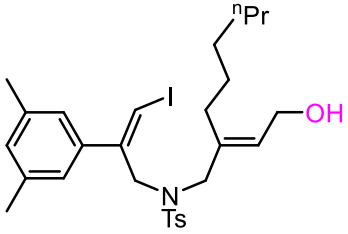

**1n**

Compound **1n** was prepared according to the general procedure. Colorless oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 7.66 (d, *J* = 8.4 Hz, 2H), 7.28 (d, *J* = 8.4 Hz, 2H), 6.01 (s, 1H), 5.46 (t, *J* = 6.0 Hz, 1H), 4.05 (d, *J* = 6.4 Hz, 2H), 3.85 (s, 2H), 3.53 (s, 2H), 2.38 (s, 3H), 2.22 (s, 1H), 2.15 (t, *J* = 12.0 Hz, 1H), 1.69 – 1.56 (m, 8H), 1.21 – 0.96 (m, 5H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 151.4, 143.6, 136.0, 133.0, 129.8, 128.0, 127.4, 78.9, 59.1, 56.4, 54.3, 41.7, 32.5, 26.6, 26.2, 21.6, 14.4. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{21}H_{31}INO_3S^+$: 504.1064; found: 504.1064.



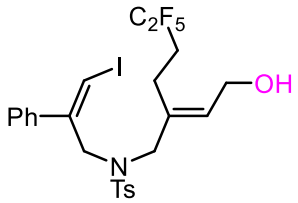

**1o**

Compound **1o** was prepared according to the general procedure. Colorless oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 7.69 (d, *J* = 7.6 Hz, 2H), 7.31 (d, *J* = 7.6 Hz, 2H), 6.06 (s, 1H), 5.75 – 5.65 (m, 1H), 5.49 (t, *J* = 6.0 Hz, 1H), 5.01 – 4.95 (m, 2H), 4.10 (d, *J* = 6.4 Hz, 2H), 3.86 (s, 2H), 3.58 (s, 2H), 2.42 (s, 3H), 2.31 – 2.27 (m, 2H), 2.18 – 2.13 (m, 2H), 1.66 (s, 1H), 1.58 (s, 3H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 145.7, 143.6, 137.2, 136.1, 133.0, 129.8, 128.2, 127.4, 115.5, 78.9, 59.2, 56.4, 54.4, 34.1, 31.7, 21.6, 14.4. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{19}H_{27}INO_3S^+$: 476.0751; found: 476.0750.



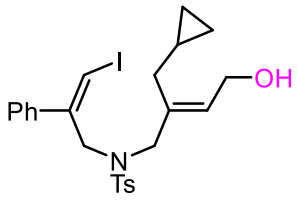

**1p**

Compound **1p** was prepared according to the general procedure. Yellow oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 7.52 (d, *J* = 8.0 Hz, 2H), 7.17 (d, *J* = 8.4 Hz, 2H), 6.83 (s, 1H), 6.68 (s, 2H), 6.37 (s, 1H), 5.29 (t, *J* = 6.8 Hz, 1H), 4.32 (s, 2H), 3.99 (d, *J* = 6.4 Hz, 2H), 3.39 (s, 2H), 2.33 (s, 3H), 2.17 (s, 6H), 1.91 (s, 1H), 1.65 – 1.62 (m, 2H), 1.20 – 1.06 (m, 8H), 0.78 (t, *J* = 7.6 Hz, 3H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 146.6, 143.3, 138.5, 137.7, 137.3, 136.3, 129.9, 129.6, 127.9, 127.5, 125.1, 82.5, 59.0, 53.6, 53.4, 31.6, 29.3, 28.5, 28.2, 22.7, 21.6, 21.3, 14.2. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{28}H_{39}INO_3S^+$: 596.1690; found: 596.1690.



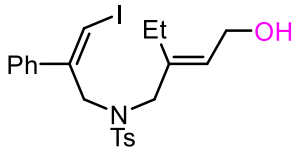

**1q**

Compound **1q** was prepared according to the general procedure. Yellow oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 7.57 (d, $J$ = 8.4 Hz, 2H), 7.25 – 7.19 (m, 7H), 6.52 (s, 1H), 5.42 (t, $J$ = 6.4 Hz, 1H), 4.35 (s, 2H), 4.00 (d, $J$ = 6.4 Hz, 2H), 3.43 (s, 2H), 2.38 (s, 3H), 1.85 – 1.76 (m, 4H), 1.67 (s, 1H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 145.9, 144.0, 138.0, 135.1, 134.4, 130.0, 129. 9, 128.5, 127.6, 127.2, 120.4 (t, $J_{C\text{-}F}$ = 36.0 Hz), 115.4 (q, $J_{C\text{-}F}$ = 37.5 Hz), 83.0, 58.7, 54.5, 54.0, 29.1 (t, $J_{C\text{-}F}$ = 21.6 Hz), 21.6, 18.7. **$^{19}$F NMR** (376 MHz, $CDCl_3$) δ -85.4, -118.8. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{24}H_{26}F_5INO_3S^+$: 630.0593; found: 630.0595.




**1r**

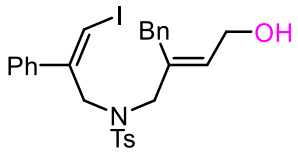
Compound **1r** was prepared according to the general procedure. Colorless oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 7.66 (d, $J$ = 8.4 Hz, 2H), 7.32 – 7.27 (m, 7H), 6.57 (s, 1H), 5.39 (t, $J$ = 6.8 Hz, 1H), 4.45 (s, 2H), 4.05 (d, $J$ = 6.8 Hz, 2H), 3.59 (s, 2H), 2.46 (s, 3H), 1.60 (s, 3H), 0.64 – 0.57 (m, 1H), 0.39 – 0.36 (m, 2H), 0.01 – -0.03 (m, 2H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 146.4, 143.6, 138.4, 137.2, 135.7, 129.7, 128.4, 128.3, 127.6, 127.4, 127.2, 82.9, 59.0, 54.2, 54.1, 32.5, 21.6, 10.2, 4.7. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{24}H_{29}INO_3S^+$: 538.0907; found: 538.0907.




**1s**

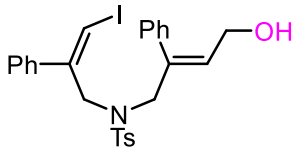
Compound **1s** was prepared according to the general procedure. Colorless oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 7.66 (d, $J$ = 8.4 Hz, 2H), 7.33 – 7.28 (m, 7H), 6.58 (s, 1H), 5.35 (t, $J$ = 6.8 Hz, 1H), 4.46 (s, 2H), 4.07 (d, $J$ = 6.8 Hz, 2H), 3.51 (s, 2H), 2.47 (s, 3H), 1.69 (q, $J$ = 7.6 Hz, 2H), 1.53 (s, 1H), 0.81 (t, $J$ = 7.6 Hz, 3H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 146.4, 143.5, 139.1, 138.3, 135.8, 129.7, 128.4, 128.3, 127.6, 127.21, 127.0, 82.8, 59.0, 54.0, 53.4, 21.6, 21.1, 13.3. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for

$C_{22}H_{27}INO_3S^+$: 512.0751; found: 512.0750.



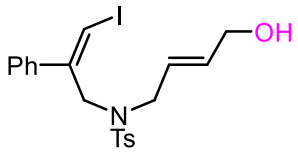

**1t**

Compound **1t** was prepared according to the general procedure. Colorless oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 7.61 (d, *J* = 8.0 Hz, 2H), 7.35 – 7.19 (m, 10 H), 7.06 (d, *J* = 6.8 Hz, 2H), 6.52 (s, 1H), 5.56 (t, *J* = 6.8 Hz, 1H), 4.45 (s, 2H), 4.19 (d, *J* = 6.8 Hz, 2H), 3.45 (s, 2H), 3.06 (s, 2H), 2.45 (s, 3H), 1.68 (s, 1H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 146.1, 143.6, 138.6, 138.3, 135.4, 135.3, 129.7, 128.6, 128.6, 128.5, 128.4, 128.3, 127.6, 127.2, 126.3, 83.0, 59.3, 54.2, 53.7, 34.1, 21.6. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{27}H_{29}INO_3S^+$: 574.0907; found: 574.0905.




**1u**

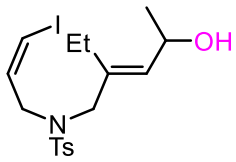
Compound **1u** was prepared according to the general procedure. Colorless oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 7.52 (d, *J* = 8.4 Hz, 2H), 7.34 – 7.26 (m, 8H), 7.21 (d, *J* = 8.0 Hz, 2H), 7.01 – 6.99 (m, 2H), 6.68 (s, 1H), 5.64 (t, *J* = 6.8 Hz, 1H), 4.56 (s, 2H), 3.94 (d, *J* = 6.8 Hz, 2H), 3.87 (s, 2H), 2.44 (s, 3H), 1.62 (s, 1H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 146.2, 143.3, 138.4, 137.4, 137.3, 136.3, 129.6, 129.1, 128.5, 128.4, 128.3, 127.6, 127.4, 127.1, 83.8, 60.0, 53.5, 53.4, 21.6. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{26}H_{27}INO_3S^+$: 560.0751; found: 560.0751.




**1v**

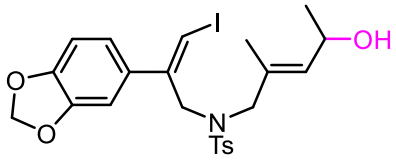
Compound **1v** was prepared according to the general procedure. Colorless oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 7.57 (d, *J* = 8.0 Hz, 2H), 7.32 – 7.25 (m, 7H), 6.61 (s, 1H), 5.67 (dt, *J* = 15.2, 5.2 Hz, 1H), 5.41 – 5.34 (m, 1H), 4.46 (s, 2H), 3.99 (d, *J* = 5.2 Hz, 2H), 3.53 (d, *J* = 6.4 Hz, 2H), 2.42 (s, 3H), 2.09 (s, 1H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ

146.5, 143.6, 138.5, 136.1, 134.1, 129.7, 128.5, 128.4, 127.5, 127.2, 125.1, 83.0, 62.7, 52.6, 49.0, 21.6. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{20}H_{23}INO_3S^+$: 484.0438; found: 484.0439.



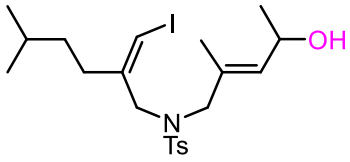

**1w**

Compound **1w** was prepared according to the general procedure. Pale yellow oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 7.69 (d, $J$ = 8.4 Hz, 2H), 7.31 (d, $J$ = 8.0 Hz, 2H), 6.27 (dt, $J$ = 7.6, 1.6 Hz, 1H), 6.09 – 6.04 (m, 1H), 5.30 (d, $J$ = 8.4 Hz, 1H), 4.61 – 4.54 (m, 1H), 3.76 (dd, $J$ = 5.6, 1.6 Hz, 2H), 3.65 (q, $J$ = 14.4 Hz, 2H), 2.42 (s, 3H), 2.16 – 2.02 (m, 2H), 1.69 (s, 1H), 1.21 (d, $J$ = 6.4 Hz, 3H), 1.00 (t, $J$ = 7.6 Hz, 3H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 143.7, 137.0, 136.5, 136.3, 133.8, 129.9, 127.3, 84.1, 64.2, 53.2, 51.6, 23.7, 21.6, 21.2, 13.4. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{17}H_{25}INO_3S^+$: 450.0594; found: 450.0596.



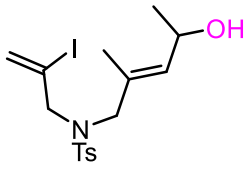

**1x**

Compound **1x** was prepared according to the general procedure. Yellow oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 7.63 (d, $J$ = 8.4 Hz, 2H), 7.29 (d, $J$ = 8.0 Hz, 2H), 6.77 (dd, $J$ = 8.0, 1.6 Hz, 1H), 6.72 – 6.70 (m, 2H), 6.45 (s, 1H), 5.95 (s, 2H), 5.25 (dd, $J$ = 8.4, 1.2 Hz, 1H), 4.51– 4.44 (m, 1H), 4.40– 4.30 (m, 2H), 3.46 (q, $J$ = 15.2 Hz, 2H), 2.43 (s, 3H), 1.74 (s, 1H), 1.36 (d, $J$ = 0.8 Hz, 3H), 1.18 (d, $J$ = 6.4 Hz, 3H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 147.7, 147.5, 145.8, 143.5, 135.9, 132.4, 132.3, 132.2, 129.7, 127.5, 121.2, 108.1, 107.6, 101.3, 81.7, 64.5, 55.9, 54.0, 23.2, 21.6, 14.4. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{23}H_{27}INO_5S^+$: 556.0649; found: 556.0647.



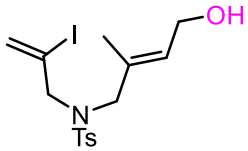

**1y**

Compound **1y** was prepared according to the general procedure. Colorless oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 7.68 (d, *J* = 8.0 Hz, 2H), 7.30 (d, *J* = 8.0 Hz, 2H), 6.01 (s, 1H), 5.26 (d, *J* = 8.4 Hz, 1H), 4.51 – 4.45 (m, 1H), 3.87 (q, *J* = 14.8 Hz, 2H), 3.57 – 3.49 (m, 2H), 2.40 (s, 3H), 2.18 – 2.14 (m, 2H), 1.89 (s, 1H), 1.60 (s, 3H), 1.50 – 1.40 (m, 1H), 1.29 – 1.23 (m, 2H), 1.14 (d, *J* = 6.4 Hz, 3H), 0.85 (d, *J* = 6.8 Hz, 6H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 146.9, 143.6, 136.2, 132.6, 131.6, 129.8, 127.4, 78.2, 64.4, 56.2, 54.7, 36.8, 32.8, 27.7, 23.0, 22.5, 22.4, 21.6, 14.5. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{21}H_{33}INO_3S^+$: 506.1220; found: 506.1220.



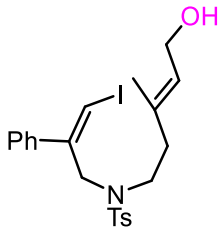

**1z**

Compound **1z** was prepared according to the general procedure. Colorless oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 7.68 (d, *J* = 8.4 Hz, 2H), 7.30 – 7.28 (m, 2H), 6.22 (d, *J* = 1.6 Hz, 1H), 5.83 (d, *J* = 1.6 Hz, 1H), 5.29 – 5.27 (m, 1H), 4.54 – 4.47 (m, 1H), 3.99 – 3.90 (m, 2H), 3.74 (d, *J* = 14.4 Hz, 1H), 3.63 (d, *J* = 14.4 Hz, 1H), 2.41 (s, 3H), 2.07 (s, 1H), 1.57 (d, *J* = 0.8 Hz, 3H), 1.18 (d, *J* = 6.0 Hz, 3H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 143.7, 136.8, 134.6, 130.7, 129.7, 127.8, 127.4, 104.6, 64.4, 58.3, 55.6, 23.2, 21.6, 14.6. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{16}H_{23}INO_3S^+$: 436.0438; found: 436.0439.



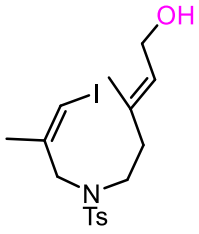

**1aa**

Compound **1aa** was prepared according to the general procedure. Yellow oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 7.69 (d, *J* = 8.4 Hz, 2H), 7.28 (d, *J* = 8.0 Hz, 2H), 6.21 (d, *J* = 1.6 Hz, 1H), 5.83 (s, 1H), 5.48 (t, *J* = 6.4 Hz, 1H), 4.12 (d, *J* = 6.4 Hz, 2H), 3.97 (s, 2H), 3.74 (s, 2H), 2.41 (s, 3H), 1.72 (s, 1H), 1.57 (s, 3H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 143.6, 137.0, 132.7, 129.7, 129.2, 127.9, 127.4, 104.4, 59.1, 58.2, 55.4, 21.6, 14.5. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{15}H_{21}INO_3S^+$: 422.0281; found: 422.0281.



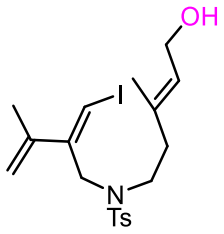

**1ab**

Compound **1ab** was prepared according to the general procedure. Colorless oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 7.45 (d, *J* = 8.0 Hz, 2H), 7.21 – 7.14 (m, 7H), 6.59 (s, 1H), 5.21 (t, *J* = 6.4 Hz, 1H), 4.42 (s, 2H), 3.96 (d, *J* = 6.8 Hz, 2H), 2.92 – 2.88 (m, 2H), 2.32 (s, 3H), 2.04 – 2.00 (m, 2H), 1.78 (s, 1H), 1.48 (s, 3H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 146.4, 143.4, 138.2, 136.2, 135.8, 129.7, 128.6, 128.50, 127.4, 127.0, 125.0, 83.3, 59.1, 52.8, 46.4, 37.7, 21.6, 16.4. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{22}H_{27}INO_3S^+$: 512.0751; found: 512.0753.




**1ac**

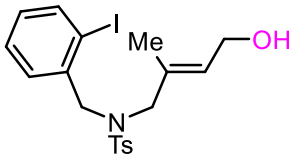
Compound **1ac** was prepared according to the general procedure. Colorless oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 7.69 (d, *J* = 8.0 Hz, 2H), 7.31 (d, *J* = 8.0 Hz, 2H), 6.08 (d, *J* = 0.8 Hz, 1H), 5.40 – 5.37 (m, 1H), 4.09 (d, *J* = 6.8 Hz, 2H), 3.93 (s, 2H), 3.15 – 3.11 (m, 2H), 2.42 (s, 3H), 2.20 – 2.16 (m, 2H), 1.90 (d, *J* = 1.2 Hz, 3H), 1.62 (s, 3H), 1.58 (s, 1H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 143.5, 143.0, 136.8, 135.8, 129.8, 127.2, 126.0, 77.7, 59.2, 55.1, 47.2, 38.0, 22.0, 21.6, 16.4. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{17}H_{25}INO_3S^+$: 450.0594; found: 450.0594.




**1ad**

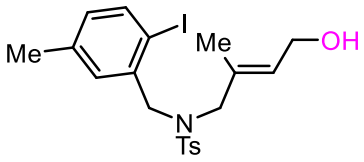
Compound **1ad** was prepared according to the general procedure. Colorless oil. **$^1$H**

**NMR** (400 MHz, $CDCl_3$) δ 7.61 (d, *J* = 8.4 Hz, 2H), 7.22 (d, *J* = 8.0 Hz, 2H), 6.16 (d, *J* = 1.6 Hz, 1H), 5.76 (s, 1H), 5.22 (t, *J* = 7.2 Hz, 1H), 3.87 (s, 2H), 3.64 (s, 2H), 3.51 (t, *J* = 6.4 Hz, 2H), 2.34 (s, 3H), 2.20 – 2.15 (m, 2H), 2.11 (s, 1H), 1.45 (s, 3H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 143.6, 136.8, 132.0, 129.7, 127.5, 127.3, 126.9, 104.8, 61.9, 58.1, 55.9, 31.5, 21.6, 14.5. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{19}H_{27}INO_3S^+$: 476.0751; found: 476.0753.



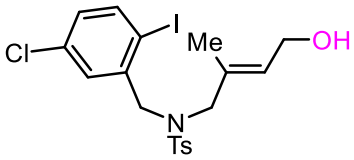

**1ae**

Compound **1ae** was prepared according to the general procedure. Colorless oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 7.72 (d, *J* = 8.4 Hz, 3H), 7.48 (dd, *J* = 8.0, 1.2 Hz, 1H), 7.34 – 7.27 (m, 3H), 6.92 (td, *J* = 7.6, 1.6 Hz, 1H), 5.31 (td, *J* = 6.4, 0.8 Hz, 1H), 4.32 (s, 2H), 3.89 (d, *J* = 6.4 Hz, 2H), 3.67 (s, 2H), 2.43 (s, 3H), 1.48 (s, 1H), 1.42 (s, 3H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 143.6, 139.2, 138.5, 136.4, 132.9, 129.9, 129.6, 129.2, 128.8, 128.4, 127.3, 98.6, 59.0, 56. 9, 56.7, 21.6, 14.4. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{19}H_{23}INO_3S^+$: 472.0438; found: 472.0436.



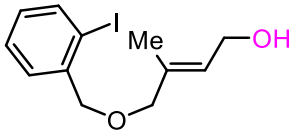

**1af**

Compound **1af** was prepared according to the general procedure. Colorless oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 7.70 (d, *J* = 8.4 Hz, 2H), 7.55 (d, *J* = 8.0 Hz, 1H), 7.30 (d, *J* = 8.0 Hz, 2H), 7.12 (s, 1H), 6.71 (dd, *J* = 8.0, 1.6 Hz, 1H), 5.30 (t, *J* = 6.0 Hz, 1H), 4.28 (s, 2H), 3.88 (d, *J* = 6.8 Hz, 2H), 3.65 (s, 2H), 2.41 (s, 3H), 2.19 (s, 3H), 1.62 (s, 1H), 1.43 (s, 3H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 143.6, 138.9, 138.4, 137.9, 136.7, 132.8, 130.3, 130.2, 129.9, 128.9, 127.2, 94.6, 58.9, 56.6, 56.4, 21.6, 21.0, 14.4. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{20}H_{25}INO_3S^+$: 486.0594; found: 486.0592.



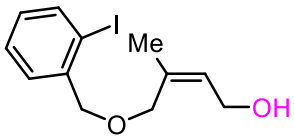

**1ag**

Compound **1ag** was prepared according to the general procedure. Colorless oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 7.69 (d, *J* = 8.4 Hz, 2H), 7.60 (d, *J* = 8.4 Hz, 1H), 7.31 (d, *J* = 8.0 Hz, 2H), 7.28 – 7.27 (m, 1H), 6.88 (dd, *J* = 8.4, 2.4 Hz, 1H), 5.34 – 5.31 (m, 1H), 4.25 (s, 2H), 3.90 (d, *J* = 6.4 Hz, 2H), 3.66 (s, 2H), 2.41 (s, 3H), 1.98 (s, 1H), 1.45 (s, 3H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 143.9, 140.4, 140.2, 136.2, 134.8, 132.2, 130.0, 129.5, 129.2, 127.2, 95.2, 58.9, 57.0, 56.2, 21.6, 14.4. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{19}H_{22}ClINO_3S^+$: 506.0048; found: 506.0050.




**(*E*)-1ah**

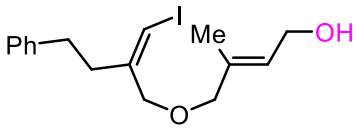
Compound **(*E*)-1ah** was prepared according to the general procedure. Colorless oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 7.73 (dd, *J* = 8.0, 1.2 Hz, 1H), 7.37 (dd, *J* = 7.6, 1.6 Hz, 1H), 7.26 (td, *J* = 7.6, 1.2 Hz, 1H), 6.89 (td, *J* = 7.6, 1.6 Hz, 1H), 5.64 – 5.60 (m, 1H), 4.38 (s, 2H), 4.11 (d, *J* = 7.6 Hz, 2H), 3.90 (s, 2H), 2.71 (s, 1H), 1.65 (s, 3H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 140.5, 139.2, 134.9, 129.3, 128.9, 128.3, 126.8, 98.0, 76.0, 75.8, 58.8, 14.3. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{12}H_{16}INO_2^+$: 319.0189; found: 319.0189.




**(*Z*)-1ah**

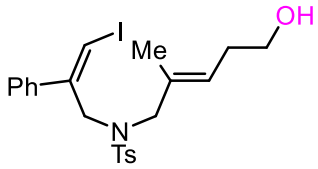
Compound **(*Z*)-1ah** was prepared according to the general procedure. Colorless oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 7.81 (dd, *J* = 8.0, 0.8 Hz, 1H), 7.42 (dd, *J* = 7.6, 1.2 Hz, 1H), 7.34 (td, *J* = 7.6, 1.2 Hz, 1H), 6.98 (td, *J* = 7.6, 1.6 Hz, 1H), 5.67 – 5.64 (m, 1H), 4.46 (s, 2H), 4.15 (dd, *J* = 7.2, 0.8 Hz, 2H), 4.09 (s, 2H), 2.00 (s, 1H), 1.85 (d, *J* = 1.2 Hz, 3H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 140.2, 139.3, 135.9, 129.4, 128.9, 128.4, 128.3,

98.0, 76.1, 69.2, 58.6, 22.1. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{12}H_{16}INO_2^+$: 319.0189; found: 319.0188.



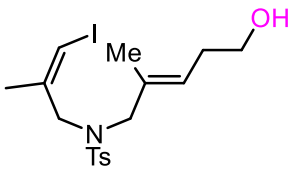

**1ah'**

Compound **1ah'** was prepared according to the general procedure. Colorless oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 7.22 – 7.16 (m, 2H), 7.13 – 7.07 (m, 3H), 6.00 (s, 1H), 5.62 – 5.59 (m, 1H), 4.12 (d, $J$ = 6.8 Hz, 2H), 4.04 (s, 2H), 3.78 (s, 2H), 2.71 – 2.67 (m, 2H), 2.51 – 2.48 (m, 2H), 1.87 (s, 1H), 1.63 (s, 3H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 147.4, 141.2, 135.2, 128.5, 128.4, 126.7, 126.1, 77.8, 75.6, 73.5, 59.0, 37.6, 34.3, 14.2. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{16}H_{22}IO_2^+$: 373.0659; found: 373.0657.




**1ai**

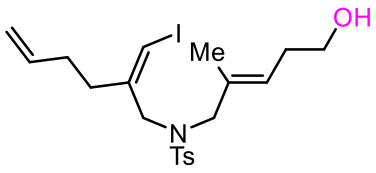
Compound **1ai** was prepared according to the general procedure. Colorless oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 7.53 (d, $J$ = 8.4 Hz, 2H), 7.20 – 7.19 (m, 7H), 6.46 (s, 1H), 5.14 (t, $J$ = 6.8 Hz, 1H), 4.33 (s, 2H), 3.49 (t, $J$ = 6.4 Hz, 2H), 3.35 (s, 2H), 2.35 (s, 3H), 2.12 (q, $J$ = 6.4 Hz, 2H), 1.90 (s, 1H), 1.15 (s, 3H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 146.6, 143.5, 138.4, 135.6, 133.3, 129.7, 128.4, 128.3, 127.6, 127.3, 124.6, 82.6, 62.0, 56.5, 54.1, 31.5, 21.6, 14.3. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{22}H_{27}INO_3S^+$: 512.0751; found: 512.0753.




**1aj**

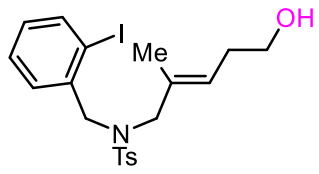
Compound **1aj** was prepared according to the general procedure. Colorless oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 7.69 (d, $J$ = 8.4 Hz, 2H), 7.31 (d, $J$ = 8.0 Hz, 2H), 5.99 (d,

$J$ = 1.2 Hz, 1H), 5.30 – 5.26 (m, 1H), 3.83 (s, 2H), 3.61 – 3.57 (m, 4H), 2.42 (s, 3H), 2.24 (q, $J$ = 6.4 Hz, 2H), 1.88 (d, $J$ = 1.2 Hz, 3H), 1.70 (s, 1H), 1.58 (s, 3H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 143.5, 143.0, 136.2, 132.8, 129.8, 127.4, 125.6, 77.42, 76.9, 62.0, 57.0, 55.6, 31.6, 22.0, 21.6. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{17}H_{25}INO_3S^+$: 450.0594; found: 450.0592.




**1ak**

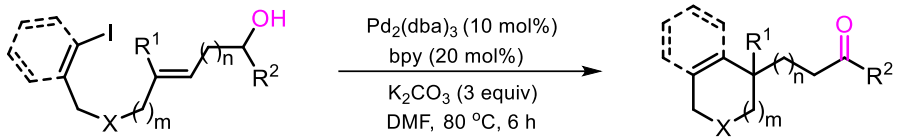
Compound **1ak** was prepared according to the general procedure. Colorless oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 7.67 (d, $J$ = 8.4 Hz, 2H), 7.29 (d, $J$ = 8.0 Hz, 2H), 6.06 – 5.98 (m, 1H), 5.74 – 5.64 (m, 1H), 5.27 (t, $J$ = 6.8 Hz, 1H), 5.00 – 4.93 (m, 2H), 3.84 (s, 2H), 3.58 – 3.54 (m, 4H), 2.40 (s, 3H), 2.31 – 2.12 (m, 6H), 1.97 (s, 1H), 1.56 (s, 3H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 145.9, 143.6, 137.2, 136.0, 132.8, 129.8, 127.4, 125.2, 115.5, 78.5, 61.9, 57.0, 54.6, 34.2, 31.7, 31.5, 21.6, 14.5. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{20}H_{29}INO_3S^+$: 490.0907; found: 490.0908.




**1al**

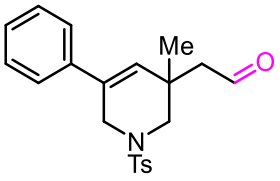
Compound **1al** was prepared according to the general procedure. Colorless oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 7.71 (d, $J$ = 8.4 Hz, 3H), 7.51 (dd, $J$ = 8.0, 1.2 Hz, 1H), 7.33 – 7.27 (m, 3H), 6.91 (td, J = 7.6, 1.6 Hz, 1H), 5.14 – 5.11 (m, 1H), 4.28 (s, 2H), 3.66 (s, 2H), 3.39 (t, $J$ = 6.4 Hz, 2H), 2.42 (s, 3H), 2.07 – 2.02 (m, 2H), 1.70 (s, 1H), 1.40 (s, 3H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 143.6, 139.4, 138.6, 136.4, 132.5, 129.9, 129.4, 129.1, 128.4, 127.5, 126.1, 98.3, 61.8, 57.5, 56.8, 31.5, 21.6, 14.5. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{20}H_{25}INO_3S^+$: 486.0594; found: 486.0594.

## 4. General Reaction Procedures



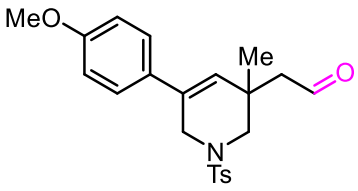

(*E*)-1 2

In an oven-dried 25 mL Schlenk tube, the mixture of vinyl/aryl iodide–alkenol substrates **(*E*)-1** (0.2 mmol), $Pd_2(dba)_3$ (0.02 mmol, 18.3 mg), bpy (0.04 mmol, 6.2 mg) and $K_2CO_3$ (0.6 mmol, 82.9 mg) were dissolved in DMF (3.0 mL). The tube was stirred at 80 °C in oil bath for 6 h. Upon completion, the mixture was cooled to room temperature and was washed with water (20 mL), brine (20 mL). The resulting mixture was extracted with EtOAc (2 × 20 mL) and the organic phase was dried with $Na_2SO_4$. The solvents were removed under reduced pressure and the crude reaction mixture was purified by chromatography on silica gel (petroleum ether/ethyl acetate = 5/1) to afford the product **2**.



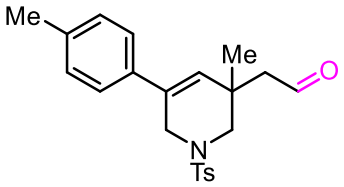

**2a**

Compound **2a** was obtained in 92% yield (68.0 mg). Colorless oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 9.83 (t, *J* = 2.0 Hz, 1H), 7.74 (d, *J* = 8.0 Hz, 2H), 7.37 – 7.28 (m, 7H), 6.02 (s, 1H), 4.14 (d, *J* = 15.6 Hz, 1H), 3.67 (dd, *J* = 15.6, 1.6 Hz, 1H), 3.42 (d, *J* = 11.4 Hz, 1H), 2.76 (dd, *J* = 16.0, 2.4 Hz, 1H), 2.68 (d, *J* = 11.4 Hz, 1H), 2.61 (dd, *J* = 16.0, 2.0 Hz, 1H), 2.44 (s, 3H), 1.25 (s, 3H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 201.2, 144.0, 137.9, 132.9, 132.9, 130.0, 129.9, 128.6, 128.2, 127.7, 125.5, 53.2, 53.0, 46.5, 36.2, 24.7, 21.6. The spectroscopic data is consistent with the reported values in the literature (*ACS Catal.* **2025**, *15*, 72−80).



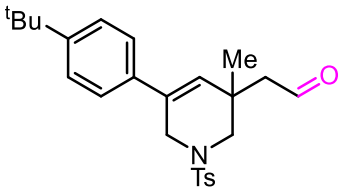

**2b**

Compound **2b** was obtained in 88% yield (70.3 mg). Colorless oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 9.82 (t, *J* = 2.0 Hz, 1H), 7.71 (d, *J* = 8.0 Hz, 2H), 7.34 (d, *J* = 8.0 Hz, 2H), 7.24 – 7.20 (m, 2H), 6.86 – 6.83 (m, 2H), 5.90 (s, 1H), 4.10 (dd, *J* = 15.6, 1.2 Hz, 1H), 3.80 (s, 3H), 3.60 (dd, *J* = 15.6, 1.6 Hz, 1H), 3.37 (d, *J* = 11.2 Hz, 1H), 2.74 (dd, *J* = 15.6, 2.4 Hz, 1H), 2.64 – 2.56 (m, 2H), 2.43 (s, 3H), 1.22 (s, 3H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 201.3, 159.6, 143.9, 132.9, 132.3, 130.3, 129.9, 128.4, 127.7, 126.6, 114.0, 55.4, 53.2, 53.1, 46.5, 36.2, 24.7, 21.6. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{22}H_{26}NO_4S^+$: 400.1577; found: 400.1581.




**2c**

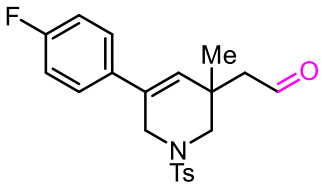
Compound **2c** was obtained in 95% yield (72.9 mg). Colorless oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 9.82 (t, *J* = 2.4 Hz, 1H), 7.71 (d, *J* = 8.0 Hz, 2H), 7.34 (d, *J* = 8.0 Hz, 2H), 7.18 (d, *J* = 8.0 Hz, 2H), 7.13 (d, *J* = 8.0 Hz, 2H), 5.96 (s, 1H), 4.11 (dd, *J* = 15.6, 1.2 Hz, 1H), 3.62 (dd, *J* = 15.6, 2.0 Hz, 1H), 3.38 (d, *J* = 11.2 Hz, 1H), 2.75 (dd, *J* = 15.6, 2.8 Hz, 1H), 2.64 – 2.57 (m, 2H), 2.43 (s, 3H), 2.33 (s, 3H), 1.23 (s, 3H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 201.3, 143.9, 138.1, 135.0, 133.0, 132.8, 129.9, 129.3, 129.1, 127.7, 125.3, 53.2, 53.1, 46.5, 36.2, 24.7, 21.6, 21.1. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{22}H_{26}NO_3S^+$: 384.1628; found: 384.1626.




**2d**

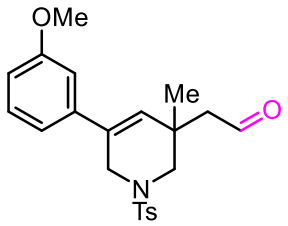
Compound **2d** was obtained in 93% yield (79.2 mg). Colorless oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 9.82 (t, *J* = 2.0 Hz, 1H), 7.71 (d, *J* = 8.4 Hz, 2H), 7.36-7.33 (m, 4H), 7.23 (d, *J* = 8.4 Hz, 2H), 5.97 (s, 1H), 4.13 (d, *J* = 15.6 Hz, 1H), 3.64 (dd, *J* = 15.6, 1.6 Hz, 1H), 3.38 (d, *J* = 11.2 Hz, 1H), 2.74 (dd, *J* = 16.0, 2.4 Hz, 1H), 2.64 (d, *J* = 11.2 Hz, 1H), 2.59 (dd, *J* = 15.6, 2.0 Hz, 1H), 2.43 (s, 3H), 1.31 (s, 9H), 1.23 (s, 3H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 201.2, 151.4, 143.9, 134.9, 133.0, 132.7, 129.9, 129.3, 127.7, 125.5,

125.2, 53.2, 53.1, 46.5, 36.2, 34.6, 31.2, 24.7, 21.6. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{25}H_{32}NO_3S^+$: 426.2097; found: 426.2095.



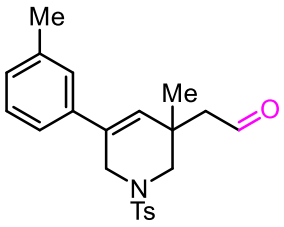

**2e**

Compound **2e** was obtained in 92% yield (71.3 mg). Colorless oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 9.75 (t, *J* = 2.0 Hz, 1H), 7.64 (d, *J* = 8.4 Hz, 2H), 7.28 (d, *J* = 8.0 Hz, 2H), 7.20 – 7.16 (m, 2H), 6.97 – 6.91 (m, 2H), 5.88 (s, 1H), 4.01 (dd, *J* = 15.6, 1.2 Hz, 1H), 3.53 (dd, *J* = 15.6, 2.0 Hz, 1H), 3.32 (d, *J* = 11.6 Hz, 1H), 2.69 (dd, *J* = 16.0, 2.0 Hz, 1H), 2.58-2.51 (m, 2H), 2.36 (s, 3H), 1.17 (s, 3H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 201.0, 162.6 (d, $J_{C\text{-}F}$ = 248.5 Hz), 144.0, 134.0 (d, $J_{C\text{-}F}$ = 3.0 Hz), 133.0, 132.0, 130.0, 129.9, 127.7, 127.2 (d, $J_{C\text{-}F}$ = 8.1 Hz), 115.5 (d, $J_{C\text{-}F}$ = 22.2 Hz), 53.1, 53.0, 46.5, 36.2, 24.6, 21.6. **$^{19}$F NMR** (376 MHz, $CDCl_3$) δ -113.7. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{21}H_{23}FNO_3S^+$: 388.1377; found: 388.1378.



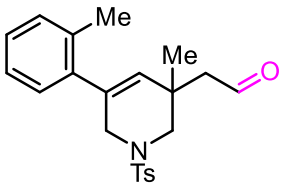

**2f**

Compound **2f** was obtained in 86% yield (68.7 mg). Colorless oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 9.82 (t, *J* = 2.0 Hz, 1H), 7.71 (d, *J* = 8.4 Hz, 2H), 7.34 (d, *J* = 8.0 Hz, 2H), 7.23 (d, *J* = 8.0 Hz, 1H), 6.88-6.86 (m, 1H), 6.84 – 6.80 (m, 2H), 6.00 (s, 1H), 4.10 (dd, *J* = 16.0, 1.2 Hz, 1H), 3.81 (s, 3H), 3.61 (dd, *J* = 16.0, 1.6 Hz, 1H), 3.39 (d, *J* = 11.6 Hz, 1H), 2.75 (dd, *J* = 16.0, 2.4 Hz, 1H), 2.65-2.58 (m, 2H), 2.43 (s, 3H), 1.23 (s, 3H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 201.1, 159.7, 143.9, 139.4, 132.9, 132.8, 130.2, 129.9, 129.6, 127.7, 118.0, 113.1, 111.7, 55.4, 53.2, 53.0, 46.6, 36.2, 24.6, 21.6. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{22}H_{26}NO_4S^+$: 400.1577; found: 400.1577.



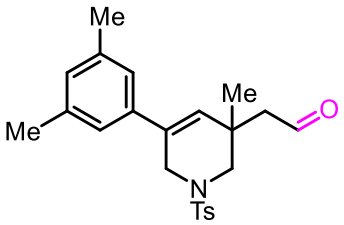

**2g**

Compound **2g** was obtained in 90% yield (69.0 mg). Colorless oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 9.83 (t, *J* = 2.0 Hz, 1H), 7.71 (d, *J* = 8.0 Hz, 2H), 7.35 (d, *J* = 8.0 Hz, 2H), 7.21 (t, *J* = 8.0 Hz, 1H), 7.09 (dd, *J* = 11.6, 8.0 Hz, 3H), 5.97 (s, 1H), 4.12 (d, *J* = 16.0 Hz, 1H), 3.64 (dd, *J* = 16.0, 1.6 Hz, 1H), 3.38 (d, *J* = 11.6 Hz, 1H), 2.75 (dd, *J* = 16.0, 2.4 Hz, 1H), 2.64 (d, *J* = 11.6 Hz, 1H), 2.59 (dd, J = 16.0, 2.0 Hz, 1H), 2.43 (s, 3H), 2.35 (s, 3H), 1.24 (s, 3H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 201.1, 143.9, 138.3, 137.9, 133.1 (2C), 129.9, 129.8, 128.9, 128.5, 127.7, 126.2, 122.6, 53.2, 53.1, 46.6, 36.2, 24.6, 21.5, 21.4. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{22}H_{26}NO_3S^+$: 384.1628; found: 384.1629.



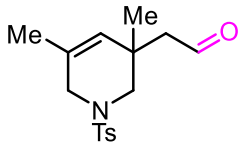

**2h**

Compound **2h** was obtained in 89% yield (68.3 mg). Colorless oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 9.86 (t, *J* = 2.4 Hz, 1H), 7.66 (d, *J* = 8.0 Hz, 2H), 7.33 (d, *J* = 8.0 Hz, 2H), 7.22 – 7.11 (m, 3H), 7.01 (d, *J* = 7.2 Hz, 1H), 5.55 (s, 1H), 3.83 (dd, *J* = 16.0, 1.2 Hz, 1H), 3.44 – 3.40 (m, 2H), 2.77 – 2.68 (m, 2H), 2.60 (dd, *J* = 15.6, 2.0 Hz, 1H), 2.43 (s, 3H), 2.23 (s, 3H), 1.24 (s, 3H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 201.2, 143.9, 138.6, 135.5, 134.3, 133.0, 131.8, 130.4, 129.9, 128.6, 127.9, 127.7, 125.8, 53.2, 53.1, 48.2, 36.1, 24.8, 21.6, 19.7. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{22}H_{26}NO_3S^+$: 384.1628; found: 384.1627.



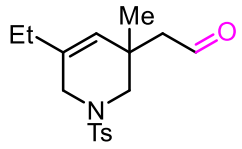

**2i**

Compound **2i** was obtained in 88% yield (70.0 mg). Colorless oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 9.82 (t, *J* = 2.0 Hz, 1H), 7.71 (d, *J* = 8.4 Hz, 2H), 7.35 (d, *J* = 8.0 Hz, 2H), 6.94 – 6.89 (m, 3H), 5.94 (t, *J* = 2.0 Hz, 1H), 4.11 (dd, *J* = 15.6, 1.2 Hz, 1H), 3.61 (dd, *J* = 15.6, 2.0 Hz, 1H), 3.37 (d, *J* = 11.6 Hz, 1H), 2.75 (dd, *J* = 16.0, 2.4 Hz, 1H), 2.64 – 2.55 (m, 2H), 2.43 (s, 3H), 2.30 (s, 6H), 1.23 (s, 3H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 201.3, 143.9, 138.2, 137.9, 133.2, 133.0, 129.9, 129.8, 129.6, 127.7, 123.4, 53.2, 53.1, 46.6, 36.2, 24.7, 21.6, 21.3. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{23}H_{28}NO_3S^+$: 398.1784; found: 398.1785.




**2j**

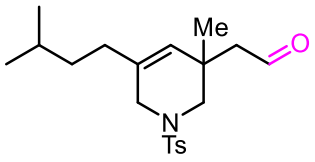
Compound **2j** was obtained in 95% yield (58.4 mg). Colorless oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 9.76 (t, *J* = 2.4 Hz, 1H), 7.65 (d, *J* = 8.4 Hz, 2H), 7.33 (d, *J* = 8.0 Hz, 2H), 5.36 (s, 1H), 3.56 (d, *J* = 16.0 Hz, 1H), 3.26 (d, *J* = 11.6 Hz, 1H), 3.15 (d, *J* = 16.0 Hz, 1H), 2.60 (dd, *J* = 15.6, 2.4 Hz, 1H), 2.50 (d, *J* = 11.6 Hz, 1H), 2.47 – 2.41 (m, 4H), 1.63 (s, 3H), 1.09 (s, 3H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 201.7, 143.8, 132.9, 129.8, 129.6, 127.8, 127.6, 53.3, 53.1, 48.3, 35.8, 24.8, 21.6, 20.4.**HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{16}H_{22}NO_3S^+$: 308.1315; found: 308.1314.




**2k**

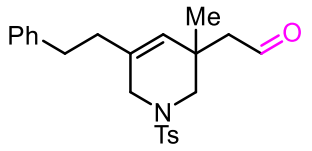
Compound **2k** was obtained in 94% yield (60.4 mg). Colorless oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 9.76 (t, *J* = 2.4 Hz, 1H), 7.66 (d, *J* = 8.0 Hz, 2H), 7.33 (d, *J* = 8.0 Hz, 2H), 5.35 (s, 1H), 3.60 (d, *J* = 15.6 Hz, 1H), 3.26 (d, *J* = 11.6 Hz, 1H), 3.19 (d, *J* = 15.6 Hz,

1H), 2.60 (dd, *J* = 15.6, 2.6 Hz, 1H), 2.51 (d, *J* = 11.6 Hz, 1H), 2.48 – 2.41 (m, 4H), 1.94 (q, *J* = 7.6 Hz, 2H), 1.11 (s, 3H), 0.97 (t, *J* = 7.6 Hz, 3H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 201.7, 143.8, 135.2, 133.0, 129.8, 127.7, 126.0, 53.5, 53.2, 47.3, 35.6, 27.1, 24.9, 21.6, 12.1. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{17}H_{24}NO_3S^+$: 322.1471; found: 322.1470.



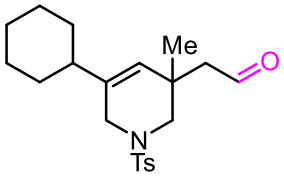

**2l**

Compound **2l** was obtained in 92% yield (66.9 mg). Colorless oil. **$^{1}$H NMR** (400 MHz, $CDCl_3$) δ 9.76 (t, *J* = 2.4 Hz, 1H), 7.66 (d, *J* = 8.4 Hz, 2H), 7.33 (d, *J* = 8.0 Hz, 2H), 5.35 (s, 1H), 3.59 (d, *J* = 15.6 Hz, 1H), 3.25 (d, *J* = 11.2 Hz, 1H), 3.19 (d, *J* = 16.0 Hz, 1H), 2.60 (dd, *J* = 15.6, 2.4 Hz, 1H), 2.51 (d, *J* = 11.2 Hz, 1H), 2.46 – 2.43 (m, 4H), 1.93 – 1.89 (m, 2H), 1.52 – 1.42 (m, 1H), 1.26 – 1.20 (m, 2H), 1.10 (s, 3H), 0.85 (d, *J* = 6.8 Hz, 6H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 201.6, 143.7, 134.1, 133.1, 129.8, 127.7, 126.8, 53.5, 53.2, 47.3, 36.8, 35.7, 32.3, 27.8, 24.9, 22.5, 22.4, 21.5. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{20}H_{30}NO_3S^+$: 364.1941; found: 364.1942.



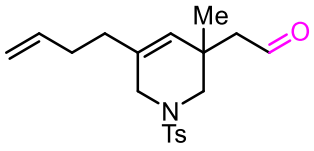

**2m**

Compound **2m** was obtained in 92% yield (73.1 mg). Colorless oil. **$^{1}$H NMR** (400 MHz, $CDCl_3$) δ 9.61 (t, *J* = 2.4 Hz, 1H), 7.65 (d, *J* = 8.0 Hz, 2H), 7.34 (d, *J* = 8.0 Hz, 2H), 7.23 (d, *J* = 7.6 Hz, 2H), 7.18 – 7.15 (m, 1H), 7.09 (d, *J* = 7.2 Hz, 2H), 5.32 (s, 1H), 3.63 (d, *J* = 16.0 Hz, 1H), 3.24 – 3.17 (m, 2H), 2.75 – 2.63 (m, 2H), 2.56 (dd, *J* = 15.6, 2.4 Hz, 1H), 2.48 (d, *J* = 11.2 Hz, 1H), 2.45 (s, 3H), 2.40 (dd, *J* = 15.6, 2.4 Hz, 1H), 2.24 (t, *J* = 8.0 Hz, 2H), 1.06 (s, 3H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 201.7, 143.8, 140.9, 133.0, 132.7, 129.8, 128.4 (2C), 128.2, 127.7, 126.1, 53.4, 53.1, 47.2, 36.0, 35.7, 34.1, 24.7, 21.6. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{23}H_{28}NO_3S^+$: 398.1784; found: 398.1785.



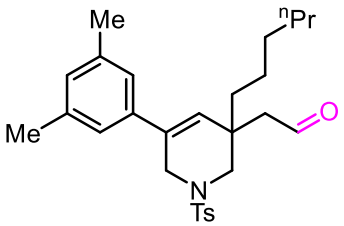

**2n**

Compound **2n** was obtained in 88% yield (66.1 mg). Colorless oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 9.76 (t, *J* = 2.4 Hz, 1H), 7.66 (d, *J* = 8.4 Hz, 2H), 7.34 (d, *J* = 8.0 Hz, 2H), 5.34 (s, 1H), 3.63 (d, *J* = 15.6 Hz, 1H), 3.26 – 3.19 (m, 2H), 2.59 (dd, *J* = 15.6, 2.8 Hz, 1H), 2.50 (d, *J* = 11.6 Hz, 1H), 2.46 – 2.41 (m, 4H), 1.78 – 1.62 (m, 6H), 1.27 – 1.07 (m, 8H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 201.8, 143.7, 138.9, 133.0, 129.8, 127.7, 125.4, 53.6, 53.3, 46.3, 42.9, 35.6, 32.1, 32.0, 26.5, 26.1, 25.1, 21.6. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{21}H_{30}NO_3S^+$: 376.1941; found: 376.1943.




**2o**

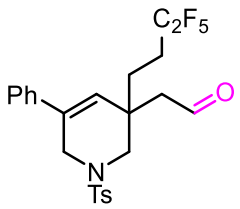
Compound **2o** was obtained in 86% yield (59.8 mg). Colorless oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 9.76 (t, *J* = 2.4 Hz, 1H), 7.67 (d, *J* = 8.4 Hz, 2H), 7.34 (d, *J* = 8.0 Hz, 2H), 5.77 – 5.67 (m, 1H), 5.39 (s, 1H), 5.00 – 4.94 (m, 2H), 3.60 (d, *J* = 16.0 Hz, 1H), 3.26 (d, *J* = 11.2 Hz, 1H), 3.20 (d, *J* = 16.0 Hz, 1H), 2.61 (dd, *J* = 15.6, 2.4 Hz, 1H), 2.52 (d, *J* = 11.2 Hz, 1H), 2.48 – 2.42 (m, 4H), 2.16 – 2.11 (m, 2H), 2.04 – 2.00 (m, 2H), 1.11 (s, 3H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 201.6, 143.8, 137.3, 133.0, 132.9, 129.8, 127.7 (2C), 115.3, 53.4, 53.1, 47.3, 35.7, 33.5, 31.8, 24.9, 21.6. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{19}H_{26}NO_3S^+$: 348.1628; found: 348.1628.




**2p**

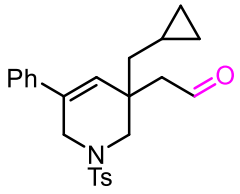
Compound **2p** was obtained in 88% yield (82.3 mg). Colorless oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 9.81 (t, *J* = 2.4 Hz, 1H), 7.71 (d, *J* = 8.4 Hz, 2H), 7.35 (d, J = 8.0 Hz, 2H), 6.94 – 6.89 (m, 3H), 5.96 (s, 1H), 4.06 (dd, *J* = 15.6, 1.2 Hz, 1H), 3.65 (dd, *J* = 15.6,

1.6 Hz, 1H), 3.28 (d, $J$ = 11.2 Hz, 1H), 2.75 (d, $J$ = 11.2 Hz, 1H), 2.70 (dd, $J$ = 15.6, 2.8 Hz, 1H), 2.59 (dd, $J$ = 15.6, 2.4 Hz, 1H), 2.44 (s, 3H), 2.31 (s, 6H), 1.62 – 1.53 (m, 2H), 1.26 (s, 8H), 0.87 (t, $J$ = 6.8 Hz, 3H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 201.6, 143.9, 138.2, 138.0, 133.6, 133.0, 129.9, 129.8, 128.9, 127.7, 123.4, 51.4, 51.1, 46.8, 39.2, 38.1, 31.7, 29.8, 23.8, 22.6, 21.6, 21.3, 14.1. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{28}H_{38}NO_3S^+$: 468.2567; found: 468.2568.




**2q**

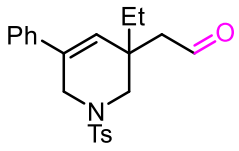
Compound **2q** was obtained in 87% yield (87.3 mg). Pale yellow oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 9.79 (t, $J$ = 2.0 Hz, 1H), 7.71 (d, $J$ = 8.0 Hz, 2H), 7.39 – 7.27 (m, 7H), 5.96 (s, 1H), 4.03 (dd, $J$ = 16.0, 1.2 Hz, 1H), 3.80 (dd, $J$ = 16.0, 1.6 Hz, 1H), 3.25 (d, $J$ = 11.6 Hz, 1H), 2.89 (d, $J$ = 11.6 Hz, 1H), 2.77 (dd, $J$ = 16.6, 2.0 Hz, 1H), 2.67 (dd, $J$ = 16.6, 1.6 Hz, 1H), 2.44 (s, 3H), 2.13 – 2.03 (m, 2H), 1.99 – 1.92 (m, 2H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 200.1, 144.2, 137.5, 135.4, 132.8, 130.0, 128.8, 128.6, 127.7, 127.0, 125.5, 50.9, 50.6, 46.6, 38.3, 27.0 (d, $J_{C\text{-}F}$ = 233.3 Hz), 25.8 (d, $J_{C\text{-}F}$ = 43.4 Hz), 21.6. **$^{19}$F NMR** (376 MHz, $CDCl_3$) δ -85.2, -118.4. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{24}H_{25}F_5NO_3S^+$: 502.1470; found: 502.1471.




**2r**

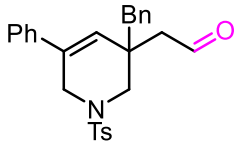
Compound **2r** was obtained in 85% yield (69.6 mg). Colorless oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 9.83 (t, $J$ = 2.0 Hz, 1H), 7.71 (d, $J$ = 8.4 Hz, 2H), 7.36 – 7.28 (m, 7H), 6.12 (s, 1H), 4.08 (dd, $J$ = 15.6, 1.2 Hz, 1H), 3.68 (dd, $J$ = 15.6, 2.0 Hz, 1H), 3.36 (d, $J$ = 11.6 Hz, 1H), 2.90 (d, $J$ = 11.6 Hz, 1H), 2.84 (dd, $J$ = 16.0, 2.4 Hz, 1H), 2.75 (dd, $J$ = 16.0, 2.4 Hz, 1H), 2.44 (s, 3H), 1.60 – 1.51 (m, 2H), 0.71 – 0.61 (m, 1H), 0.54 – 0.46 (m, 2H), 0.13 – 0.03 (m, 2H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 201.6, 144.0, 138.0,

133.1, 132.8, 129.9, 129.4, 128.6, 128.2, 127.7, 125.5, 51.7, 51.1, 46.7, 42.8, 40.4, 21.6, 6.0, 5.3, 4.7. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{24}H_{28}NO_3S^+$: 410.1784; found: 410.1784.



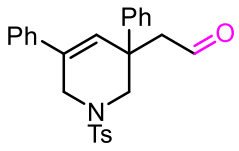

**2s**

Compound **2s** was obtained in 91% yield (69.8 mg). Colorless oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 9.82 (t, *J* = 2.4 Hz, 1H), 7.71 (d, *J* = 8.4 Hz, 2H), 7.37 – 7.27 (m, 7H), 6.02 (s, 1H), 4.08 (dd, *J* = 15.6, 1.2 Hz, 1H), 3.68 (dd, *J* = 15.6, 2.0 Hz, 1H), 3.30 (d, *J* = 11.6 Hz, 1H), 2.78 (d, *J* = 11.6 Hz, 1H), 2.71 (dd, *J* = 16.0, 2.4 Hz, 1H), 2.61 (dd, *J* = 16.0, 2.4 Hz, 1H), 2.44 (s, 3H), 1.71 – 1.59 (m, 2H), 0.92 (t, *J* = 7.2 Hz, 3H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 201.4, 143.9, 138.0, 133.6, 132.9, 129.9, 129.0, 128.6, 128.2, 127.7, 125.5, 51.0, 50.5, 46.7, 39.4, 30.5, 21.6, 8.2. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{22}H_{26}NO_3S^+$: 384.1628; found: 384.1627.




**2t**

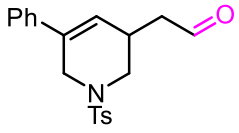
Compound **2t** was obtained in 89% yield (79.3 mg). Colorless oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 9.66 (t, *J* = 2.0 Hz, 1H), 7.63 (d, *J* = 8.0 Hz, 2H), 7.29 – 7.19 (m, 10H), 7.11 (d, *J* = 7.2 Hz, 2H), 5.97 (s, 1H), 3.86 (dd, *J* = 16.0, 1.6 Hz, 1H), 3.89 (dd, *J* = 16.0, 1.6 Hz, 1H), 3.04 – 2.98 (m, 2H), 2.94 (d, *J* = 13.6 Hz, 1H), 2.86 (d, *J* = 13.6 Hz, 1H), 2.56 – 2.46 (m, 2H), 2.37 (s, 3H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 201.4, 144.0, 137.9, 136.2, 133.5, 132.7, 130.6, 129.9, 128.7 (2C), 128.4, 128.2, 127.7, 126.9, 125.5, 51.4, 50.1, 46.8, 43.7, 40.0, 21.6. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{27}H_{28}NO_3S^+$: 446.1784; found: 446.1785.




**2u**

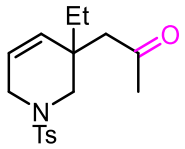
Compound **2u** was obtained in 74% yield (63.9 mg). Colorless oil. **$^1$H NMR** (400 MHz,

$CDCl_3$) δ 9.75 (t, *J* = 2.0 Hz, 1H), 7.63 (d, *J* = 8.0 Hz, 2H), 7.38 – 7.28 (m, 12H), 6.48 (s, 1H), 4.34 (d, *J* = 16.0 Hz, 1H), 3.66 – 3.61 (m, 2H), 3.31 – 3.22 (m, 2H), 2.81 (d, *J* = 11.6 Hz, 1H), 2.40 (s, 3H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 200.5, 144.0, 142.6, 137.8, 134.5, 132.9, 129.9, 129.0, 128.8, 128.4, 128.3, 127.7, 127.4, 126.5, 125.6, 54.9, 52.3, 46.6, 43.1, 21.6. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{26}H_{26}NO_3S^+$: 432.1628; found: 432.1628.



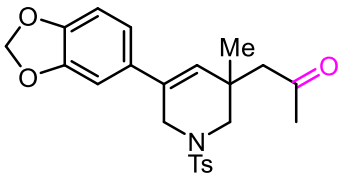

**2v**

Compound **2v** was obtained in 86% yield (61.1 mg). Colorless oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 9.84 (s, 1H), 7.70 (d, *J* = 8.0 Hz, 2H), 7.34 – 7.27 (m, 7H), 6.03 – 6.02 (m, 1H), 4.15 (d, *J* = 16.0 Hz, 1H), 3.67 (d, *J* = 16.0 Hz, 1H), 3.24 (dd, *J* = 12.8, 5.2 Hz, 1H), 3.04 – 3.01 (m, 2H), 2.82 (dd, *J* = 18.0, 6.8 Hz, 1H), 2.68 (dd, *J* = 18.0, 7.0 Hz, 1H), 2.43 (s, 3H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 200.5, 143.8, 138.1, 134.5, 133.2, 129.8, 128.6, 128.1, 127.7, 125.4, 125.1, 47.2, 46.9, 46.6, 30.0, 21.5. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{20}H_{22}NO_3S^+$: 356.1315; found: 356.1317.



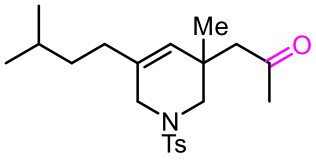

**2w**

Compound **2w** was obtained in 82% yield (52.7 mg). White solid (mp 63–65 °C). **$^1$H NMR** (400 MHz, $CDCl_3$) δ 7.59 (d, *J* = 8.4 Hz, 2H), 7.26 (d, *J* = 8.0 Hz, 2H), 5.69 – 5.66 (m, 1H), 5.54 – 5.50 (m, 1H), 3.70 – 3.64 (m, 1H), 3.25 (d, *J* = 11.6 Hz, 1H), 3.19 (dt, *J* = 16.0, 2.4 Hz, 1H), 2.66 (d, *J* = 16.8 Hz, 1H), 2.55 (d, *J* = 16.8 Hz, 1H), 2.48 (d, *J* = 11.6 Hz, 1H), 2.36 (s, 3H), 2.06 (s, 3H), 1.57 – 1.48 (m, 2H), 0.73 (t, *J* = 7.6 Hz, 3H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 207.6, 143.6, 133.1 (2C), 129.7, 127.6, 121.5, 51.1, 48.9, 45.0, 38.7, 31.8, 28.8, 21.5, 8.2. The spectroscopic data is consistent with the reported values in the literature (*ACS Catal.* **2025**, *15,* 72−80).



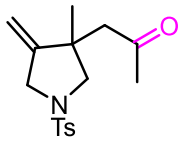

**2x**

Compound **2x** was obtained in 84% yield (71.8 mg). Colorless oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 7.70 (d, *J* = 8.4 Hz, 2H), 7.34 (d, *J* = 8.0 Hz, 2H), 6.78 – 6.73 (m, 3H), 5.96 – 5.94 (m, 3H), 4.09 (d, *J* = 15.6 Hz, 1H), 3.48 (dd, *J* = 15.6, 2.0 Hz, 1H), 3.43 (d, *J* = 11.6 Hz, 1H), 2.83 (d, *J* = 16.8 Hz, 1H), 2.63 (d, *J* = 16.8 Hz, 1H), 2.47 (d, *J* = 11.6 Hz, 1H), 2.42 (s, 3H), 2.13 (s, 3H), 1.20 (s, 3H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 207.4, 147.9, 147.4, 143.8, 133.0, 132.4, 131.3, 130.1, 129.8, 127.6, 118.9, 108.2, 106.0, 101.2, 53.2, 51.8, 46.7, 35.9, 31.8, 23.8, 21.6. The spectroscopic data is consistent with the reported values in the literature (*ACS Catal.* **2025**, *15,* 72−80).




**2y**

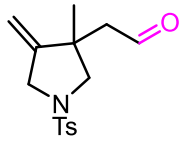
Compound **2y** was obtained in 86% yield (64.9 mg). Colorless oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 7.65 (d, *J* = 8.0 Hz, 2H), 7.32 (d, *J* = 8.0 Hz, 2H), 5.38 (s, 1H), 3.61 (d, *J* = 15.6 Hz, 1H), 3.32 (d, *J* = 11.2 Hz, 1H), 3.09 (d, *J* = 15.6 Hz, 1H), 2.69 (d, *J* = 16.4 Hz, 1H), 2.50 (d, *J* = 16.4 Hz, 1H), 2.41 (s, 3H), 2.36 (d, *J* = 11.2 Hz, 1H), 2.10 (s, 3H), 1.89 – 1.85 (m, 2H), 1.50 – 1.40 (m, 1H), 1.23 – 1.18 (m, 2H), 1.08 (s, 3H), 0.83 (dd, *J* = 6.8, 1.2 Hz, 6H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 207.7, 143.6, 133.1, 132.9, 129.7, 127.8, 127.6, 53.5, 51.8, 47.4, 36.8, 35.4, 32.3, 31.9, 27.8, 23.9, 22.5, 22.4, 21.5. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{21}H_{32}NO_3S^+$: 378.2097; found: 378.2098.




**2z**

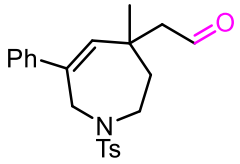
Compound **2z** was obtained in 72% yield (44.3 mg). Colorless oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 7.70 (d, *J* = 8.0 Hz, 2H), 7.33 (d, *J* = 8.0 Hz, 2H), 4.90 (t, *J* = 1.6 Hz, 1H), 4.83 (t, *J* = 2.0 Hz, 1H), 3.90 – 3.80 (m, 2H), 3.32 (d, *J* = 9.6 Hz, 1H), 3.12 (d, *J* = 9.6

Hz, 1H), 2.61 (d, *J* = 17.2 Hz, 1H), 2.49 – 2.43 (m, 4H), 2.07 (s, 3H), 1.15 (s, 3H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 206.4, 152.3, 143.7, 132.6, 129.7, 127.9, 106.0, 58.6, 51.7, 50.8, 43.6, 31.5, 23.8, 21.6. The spectroscopic data is consistent with the reported values in the literature (*ACS Catal.* **2025**, *15,* 72−80).



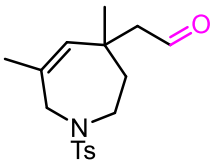

**2aa**

Compound **2aa** was obtained in 78% yield (45.8 mg). Colorless oil. **$^{1}$H NMR** (400 MHz, $CDCl_3$) δ 9.65 (t, *J* = 2.0 Hz, 1H), 7.69 (d, *J* = 8.0 Hz, 2H), 7.33 (d, *J* = 8.0 Hz, 2H), 4.97 (t, *J* = 2.0 Hz, 1H), 4.88 (t, *J* = 2.0 Hz, 1H), 3.91 (dt, *J* = 14.4, 2.4 Hz, 1H), 3.83 (dt, *J* = 14.4, 2.4 Hz, 1H), 3.30 (d, *J* = 9.6 Hz, 1H), 3.07 (d, *J* = 9.6 Hz, 1H), 2.56 (dd, *J* = 16.4, 2.4 Hz, 1H), 2.47 – 2.41 (m, 4H), 1.18 (s, 3H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 200.5, 150.9, 143.9, 132.4, 129.8, 127.8, 107.0, 58.83, 51.7, 51.5, 43.4, 24.0, 21.6. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{15}H_{20}NO_3S^+$: 294.1158; found: 294.1158.



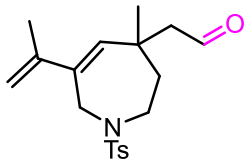

**2ab**

Compound **2ab** was obtained in 90% yield (69.0 mg). Colorless oil. **$^{1}$H NMR** (400 MHz, $CDCl_3$) δ 9.82 (t, *J* = 2.4 Hz, 1H), 7.68 (d, *J* = 8.4 Hz, 2H), 7.39 – 7.28 (m, 7H), 5.65 (s, 1H), 4.29 (d, *J* = 16.8 Hz, 1H), 4.13 (d, *J* = 16.9 Hz, 1H), 3.50 – 3.43 (m, 1H), 3.38 – 3.32 (m, 1H), 2.66 – 2.58 (m, 2H), 2.42 (s, 3H), 2.08 – 2.01 (m, 1H), 1.91 – 1.84 (m, 1H), 1.28 (s, 3H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 201.9, 143.5, 142.2, 138.6, 137.8, 135.2, 129.8, 128.5, 127.6, 127.2, 126.7, 54.3, 47.8, 44.6, 38.8, 35.7, 27.6, 21.6. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{22}H_{26}NO_3S^+$: 384.1628; found: 384.1626.



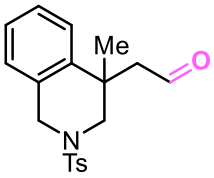

**2ac**

Compound **2ac** was obtained in 92% yield (59.1 mg). Colorless oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 9.76 (t, *J* = 2.8 Hz, 1H), 7.65 (d, *J* = 8.0 Hz, 2H), 7.30 (d, *J* = 8.0 Hz, 2H), 5.28 (s, 1H), 3.76 (d, *J* = 16.8 Hz, 1H), 3.59 (d, *J* = 16.8 Hz, 1H), 3.43 – 3.36 (m, 1H), 3.26 – 3.20 (m, 1H), 2.56 – 2.47 (m, 2H), 2.42 (s, 3H), 1.93 – 1.87 (m, 1H), 1.79 – 1.72 (m, 4H), 1.16 (s, 3H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 202.5, 143.4, 135.2, 134.1, 133.4, 129.7, 127.2, 54.4, 48.4, 44.6, 38.0, 36.4, 27.9, 24.2, 21.5. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{17}H_{24}NO_3S^+$: 322.1471; found: 322.1470.




**2ad**

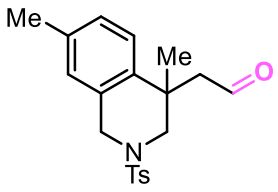
Compound **2ad** was obtained in 84% yield (58.4 mg). Colorless oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 9.76 (t, *J* = 2.4 Hz, 1H), 7.67 (d, *J* = 8.4 Hz, 2H), 7.31 (d, *J* = 8.0 Hz, 2H), 5.61 (s, 1H), 5.02 (s, 1H), 4.97 (s, 1H), 4.15 (d, *J* = 16.4 Hz, 1H), 3.93 (d, *J* = 16.4 Hz, 1H), 3.46 – 3.40 (m, 1H), 3.29 – 3.23 (m, 1H), 2.58 (d, *J* = 2.4 Hz, 2H), 2.42 (s, 3H), 1.98 – 1.92 (m, 1H), 1.89 (s, 3H), 1.81 – 1.74 (m, 1H), 1.22 (s, 3H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 201.9, 143.4, 143.1, 137.6, 136.0, 135.2, 129.7, 127.2, 112.6, 54.2, 44.8, 44.6, 38.4, 35.6, 27.8, 21.8, 21.5. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{19}H_{26}NO_3S^+$: 348.1628; found: 348.1628.




**2ae**

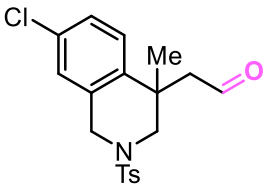
Compound **2ae** was obtained in 91% yield (62.5 mg). Colorless oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 9.66 – 9.95 (m, 1H), 7.75 (d, *J* = 8.0 Hz, 2H), 7.37 (d, *J* = 8.0 Hz, 2H), 7.30 – 7.28 (m, 1H), 7.24 – 7.16 (m, 2H), 7.06 – 7.04 (m, 1H), 4.43 (d, *J* = 14.8 Hz, 1H), 4.06 (d, *J* = 14.8 Hz, 1H), 3.59 (dd, *J* = 12.0, 0.8 Hz, 1H), 2.89 (dd, *J* = 15.6, 2.0 Hz, 1H), 2.83 (d, *J* = 11.8 Hz, 1H), 2.72 (dd, J = 15.6, 3.2 Hz, 1H), 2.44 (s, 3H), 1.45 (s, 3H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 201.3, 144.0, 139.7, 132.7, 130.8, 129.9, 127.8, 127.5, 127.0, 126.7, 126.0, 53.9, 53.8, 48.5, 37.8, 25.8, 21.6. **HRMS** (ESI) m/z: $[M+H]^+$

calcd for $C_{19}H_{22}NO_3S^+$: 344.1315; found: 344.1315.



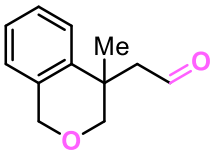

**2af**

Compound **2af** was obtained in 92% yield (65.8 mg). Colorless oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 9.64 (t, *J* = 2.4 Hz, 1H), 7.73 (d, *J* = 8.0 Hz, 2H), 7.35 (d, *J* = 8.0 Hz, 2H), 7.15 (d, *J* = 8.0 Hz, 1H), 7.03 (d, *J* = 8.0 Hz, 1H), 6.85 (s, 1H), 4.38 (d, *J* = 14.8 Hz, 1H), 4.00 (d, *J* = 14.8 Hz, 1H), 3.55 (d, *J* = 11.6 Hz, 1H), 2.85 (dd, *J* = 15.6, 2.1 Hz, 1H), 2.79 (d, *J* = 11.6 Hz, 1H), 2.69 (dd, *J* = 15.6, 3.2 Hz, 1H), 2.43 (s, 3H), 2.27 (s, 3H), 1.41 (s, 3H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 201.5, 144.0, 136.7, 136.6, 132.8, 130.6, 129.9, 128.3, 127.8, 127.1, 125.9, 54.1, 53.8, 48.4, 37.5, 25.8, 21.6, 20.9. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{20}H_{24}NO_3S^+$: 358.1471; found: 358.1472.




**2ag**

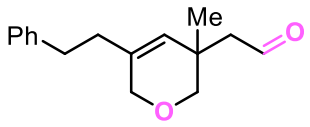
Compound **2ag** was obtained in 81% yield (61.2 mg). Colorless oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 9.65 (t, *J* = 2.4 Hz, 1H), 7.72 (d, *J* = 8.4 Hz, 2H), 7.36 (d, *J* = 8.1 Hz, 2H), 7.22 – 7.17 (m, 2H), 7.04 (s, 1H), 4.38 (d, *J* = 14.8 Hz, 1H), 4.01 (d, *J* = 14.8 Hz, 1H), 3.57 (d, *J* = 12.0 Hz, 1H), 2.88 (dd, *J* = 15.6, 2.0 Hz, 1H), 2.79 (d, *J* = 12.0 Hz, 1H), 2.70 (dd, *J* = 15.6, 2.4 Hz, 1H), 2.44 (s, 3H), 1.42 (s, 3H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 200.7, 144.2, 138.4, 132.7, 132.7, 132.6, 130.0, 127.8, 127.7, 127.6, 126.5, 53.7, 53.5, 48.1, 37.6, 25.7, 21.6. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{19}H_{21}ClNO_3S^+$: 378.0925; found: 378.0923.




**2ah**

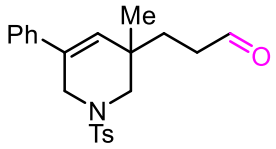
Compound **2ah** was obtained in 83% yield (31.6 mg). Colorless oil. **$^1$H NMR** (400

MHz, $CDCl_3$) δ 9.53 – 9.52 (m, 1H), 7.27 (d, *J* = 7.6 Hz, 1H), 7.20 – 7.16 (m, 1H), 7.15 – 7.11 (m, 1H), 6.92 (dd, *J* = 7.6, 0.8 Hz, 1H), 4.79 – 4.71 (m, 2H), 3.86 (d, *J* = 11.6 Hz, 1H), 3.56 (d, *J* = 11.6 Hz, 1H), 2.66 (dd, *J* = 15.2, 2.0 Hz, 1H), 2.55 (dd, *J* = 15.2, 3.2 Hz, 1H), 1.29 (s, 3H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 202.1, 139.5, 133.8, 127.2, 126.7, 125.8, 124.4, 75.0, 68.9, 54.8, 36.4, 24.3. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{12}H_{15}O_2^+$: 191.1067; found: 191.1066.



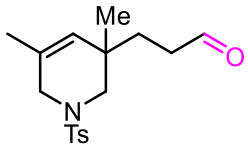

**2ah'**

Compound **2ah'** was obtained in 79% yield (38.6 mg). Colorless oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 9.67 (t, *J* = 2.8 Hz, 1H), 7.32 – 7.28 (m, 2H), 7.23 – 7.17 (m, 3H), 5.41 (d, *J* = 1.2 Hz, 1H), 4.07 – 3.98 (m, 2H), 3.65 (dd, *J* = 11.2, 0.8 Hz, 1H), 3.34 (d, *J* = 11.2 Hz, 1H), 2.81 – 2.69 (m, 2H), 2.45 (dd, *J* = 14.8, 3.2 Hz, 1H), 2.31 (dd, *J* = 14.8, 2.4 Hz, 1H), 2.25 (t, *J* = 8.0 Hz, 2H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 202.7, 141.3, 136.1, 128.4, 128.4, 126.9, 126.1, 74.3, 67.9, 53.3, 34.6, 34.4, 34.1, 24.0. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{16}H_{21}O_2^+$: 245.1536; found: 245.1537.



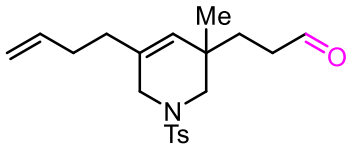

**2ai**

Compound **2ai** was obtained in 82% yield (62.9 mg). Colorless oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 9.78 (t, *J* = 1.2 Hz, 1H), 7.71 (d, *J* = 8.0 Hz, 2H), 7.36 – 7.27 (m, 7H), 5.78 (s, 1H), 4.04 (dd, *J* = 15.6, 1.2 Hz, 1H), 3.67 (dd, *J* = 15.6, 1.8 Hz, 1H), 3.19 (d, *J* = 11.2 Hz, 1H), 2.64 (d, *J* = 11.2 Hz, 1H), 2.60 – 2.54 (m, 2H), 2.43 (s, 3H), 1.92 – 1.80 (m, 2H), 1.10 (s, 3H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 202.1, 143.8, 138.1, 132.9, 132.7, 130.8, 129.8, 128.6, 128.0, 127.7, 125.4, 52.7, 46.4, 39.3, 36.0, 31.9, 24.8, 21.6. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{22}H_{26}NO_3S^+$: 384.1628; found: 384.1629.



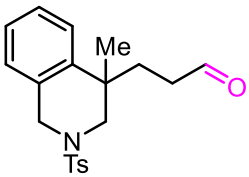

**2aj**

Compound **2aj** was obtained in 80% yield (51.4 mg). Colorless oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 9.75 (t, *J* = 1.6 Hz, 1H), 7.66 (d, *J* = 8.0 Hz, 2H), 7.34 (d, *J* = 8.0 Hz, 2H), 5.16 (s, 1H), 3.50 (d, *J* = 15.6 Hz, 1H), 3.17 (d, *J* = 15.6 Hz, 1H), 3.07 (d, *J* = 11.2 Hz, 1H), 2.52 – 2.45 (m, 3H), 2.43 (s, 3H), 1.80 – 1.68 (m, 2H), 1.63 (s, 3H), 0.97 (s, 3H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 202.4, 143.6, 132.9, 129.8, 129.2, 128.6, 127.7, 52.9, 48.2, 39.3, 35.4, 31.9, 24.8, 21.6, 20.4. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{17}H_{24}NO_3S^+$: 322.1471; found: 322.1470.




**2ak**

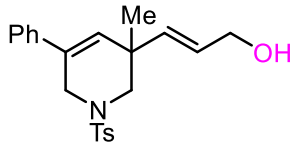
Compound **2ak** was obtained in 76% yield (55.0 mg). Colorless oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 9.75 (t, *J* = 1.6 Hz, 1H), 7.66 (d, *J* = 8.0 Hz, 2H), 7.34 (d, *J* = 8.0 Hz, 2H), 5.77 – 5.67 (m, 1H), 5.17 (s, 1H), 5.00 – 4.93 (m, 2H), 3.53 (d, *J* = 15.6 Hz, 1H), 3.20 (d, *J* = 15.6 Hz, 1H), 3.06 (d, *J* = 11.2 Hz, 1H), 2.51 – 2.45 (m, 3H), 2.43 (s, 3H), 2.15 – 2.10 (m, 2H), 2.03 – 1.99 (m, 2H), 1.80 – 1.67 (m, 2H), 0.97 (s, 3H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 202.4, 143.7, 137.5, 132.9, 132.5, 129.8, 128.4, 127.7, 115.3, 53.0, 47.2, 39.3, 35.4, 33.7, 32.0, 31.8, 25.0, 21.6. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{20}H_{28}NO_3S^+$: 362.1784; found: 362.1784.




**2al**

Compound **2al** was obtained in 73% yield (52.2 mg). Colorless oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 9.69 (s, 1H), 7.73 (d, *J* = 8.0 Hz, 2H), 7.36 (d, *J* = 8.0 Hz, 2H), 7.25 – 7.13 (m, 3H), 7.02 (d, *J* = 7.6 Hz, 1H), 4.42 (d, *J* = 14.4 Hz, 1H), 3.96 (d, *J* = 14.4 Hz, 1H), 3.39 (d, *J* = 11.6 Hz, 1H), 2.67 (d, *J* = 11.6 Hz, 1H), 2.57 – 2.48 (m, 1H), 2.43 – 2.35

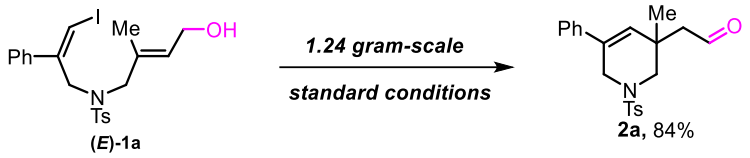
(m, 4H), 2.16 – 2.09 (m, 1H), 1.99 – 1.91 (m, 1H), 1.29 (s, 3H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 202.0, 144.0, 140.6, 132.6, 130.9, 129.9, 127.8, 127.3, 126.6, 126.5, 126.0, 53.5, 48.4, 39.5, 37.5, 33.4, 25.9, 21.6. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{20}H_{24}NO_3S^+$: 358.1471; found: 358.1472.



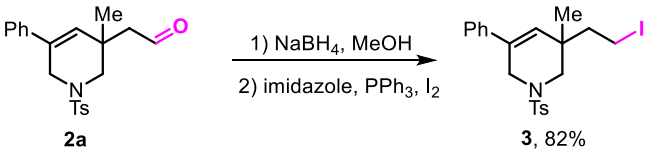

**2a'**

Compound **2a'** was obtained in 58% yield (44.5 mg). Colorless oil. **$^{1}$H NMR** (400 MHz, $CDCl_3$) δ 7.70 (d, *J* = 8.0 Hz, 2H), 7.34 – 7.27 (m, 7H), 5.83 (t, *J* = 2.0 Hz, 1H), 5.79 – 5.67 (m, 2H), 4.14 (d, *J* = 4.8 Hz, 2H), 3.97 (dd, *J* = 15.6, 1.6 Hz, 1H), 3.79 (dd, *J* = 15.6, 1.6 Hz, 1H), 3.15 (d, *J* = 11.6 Hz, 1H), 2.83 (d, *J* = 11.6 Hz, 1H), 2.42 (s, 3H), 1.24 (s, 3H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 143.7, 138.2, 136.6, 133.3, 132.3, 130.1, 129.8, 128.9, 128.6, 128.0, 127.7, 125.4, 63.5, 53.4, 46.3, 38.9, 24.7, 21.6. **HRMS** (ESI) m/z: $[M+Na]^+$ calcd for $C_{22}H_{25}NNaO_3S^+$: 406.1447; found: 406.1446.

## 5. Synthetic Applications



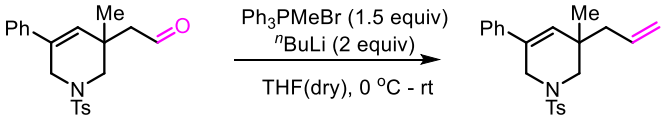

**Gram-scale reaction:** In an 100 mL Schlenk tube, the mixture of vinyl iodide−alkenol substrate **(*E*)-1a** (4.0 mmol, 1.99 g), $Pd(OAc)_2$ (0.2 mmol, 183.1 mg), bpy (0.4 mmol, 62.5 mg) and $K_2CO_3$ (12.0 mmol, 1.66 g) were dissolved in DMF (30 mL). The tube was stirred at 80 °C in oil bath for 18 h. Upon completion, the mixture was cooled to room temperature and was washed with water (40 mL), brine (40 mL). The resulting mixture was extracted with EtOAc (3 × 20 mL) and the organic phase was dried with $Na_2SO_4$. The solvents were removed under reduced pressure and the crude reaction mixture was purified by chromatography on silica gel (petroleum ether/ethyl acetate = 5/1) to afford the product **2** (84%, 1.24 g).




In an 25 mL Schlenk tube, a solution of compound **2a** (0.2 mmol, 73.9 mg) in MeOH (2.0 mL) at 0 °C was slowly added $NaBH_4$ (0.5 mmol, 18.9 mg), Then, the reaction mixture was warmed up to room temperature and further stirred for 30 min. After completion, the solution was quenched by saturated NaCl solution and extracted with EtOAc. The combined organic layers were dried with $Na_2SO_4$ and concentrated under reduced pressure. The obtained crude product was used in the next step without further purification.

To a solution of the crude product in DCM (3 mL) at 0 °C was added imidazole (0.24 mmol, 16.3 mg), $PPh_3$ (0.22 mmol, 57.8 mg) and $I_2$ (0.22 mmol, 55.8 mg) sequentially. Then, the reaction mixture was warmed up to room temperature and further stirred for 1 h. After completion, the solution was quenched by saturated $Na_2S_2O_3$ solution and extracted with DCM. The combined organic layers were dried with $Na_2SO_4$ and concentrated under reduced pressure. the crude reaction mixture was purified by chromatography on silica gel (petroleum ether/ethyl acetate) to afford the compound **3**

in 82% yield (78.9 mg). Pale red solid (mp 115 – 117 °C). **$^1$H NMR** (400 MHz, $CDCl_3$) δ 7.71 (d, *J* = 8.4 Hz, 2H), 7.36 – 7.28 (m, 7H), 5.80 (t, *J* = 1.6 Hz, 1H), 4.04 (dd, *J* = 15.6, 1.2 Hz, 1H), 3.65 (dd, *J* = 15.6, 1.6 Hz, 1H), 3.31 – 3.15 (m, 3H), 2.61 (d, *J* = 11.6 Hz, 1H), 2.44 (s, 3H), 2.28 – 2.13 (m, 2H), 1.11 (s, 3H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 144.0, 138.2, 133.2, 132.9, 130.2, 130.0, 128.8, 128.3, 127.9, 125.6, 52.5, 46.6, 45.6, 39.2, 24.8, 21.8, -0.0. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{21}H_{25}INO_2S^+$: 482.0645; found: 482.0644.

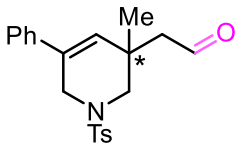


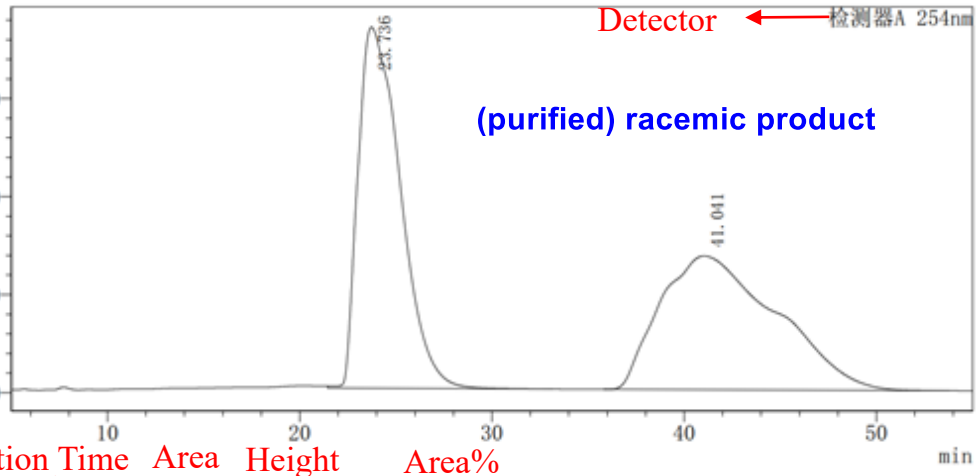
**2a** **4**, 90%

Under $N_2$ atmosphere, a solution of $Ph_3PMeBr$ (0.3 mmol, 108.0 mg) in THF was added $^n$BuLi (0.6 mmol, 0.3 mL, 2.0 M in hexane) at 0 °C for 30 min, then **2a** (0.2 mmol, 73.9 mg) dissolved in THF was added and the reaction mixture stirred at room temperature for 6 h. Upon completion, the mixture was quenched by saturated aq. $NH_4Cl$ and extracted with EtOAc. The organic layers were combined, dried over $Na_2SO_4$, concentrated under reduce pressure. The residue was purified by chromatography on silica gel to afford the desired product **4** in 90% yield (66.2 mg). Colorless oil. **$^1$H NMR** (400 MHz, $CDCl_3$) δ 7.64 (d, *J* = 8.4 Hz, 2H), 7.28 – 7.19 (m, 7H), 5.80 – 5.70 (m, 2H), 5.06 – 5.02 (m, 2H), 3.83 (dd, *J* = 15.6, 1.6 Hz, 1H), 3.73 (dd, *J* = 15.6, 1.6 Hz, 1H), 2.97 (d, *J* = 11.2 Hz, 1H), 2.70 (d, *J* = 11.2 Hz, 1H), 2.36 (s, 3H), 2.17 (d, *J* = 7.2 Hz, 2H), 1.03 (s, 3H). **$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 143.6, 138.4, 133.6, 133.2, 131.9, 131.6, 129.8, 128.5, 127.8, 127.7, 125.4, 118.6, 52.6, 46.5, 44.0, 36.7, 24.1, 21.6. **HRMS** (ESI) m/z: $[M+H]^+$ calcd for $C_{22}H_{26}NO_2S^+$: 368.1679; found: 368.1678.

## 6. HPLC Chromatograms

**2a:** AYH *i*-PrOH/hexane = 25/75, v = 1.0 mL/min, λ = 254 nm




Retention Time Area Height Area%

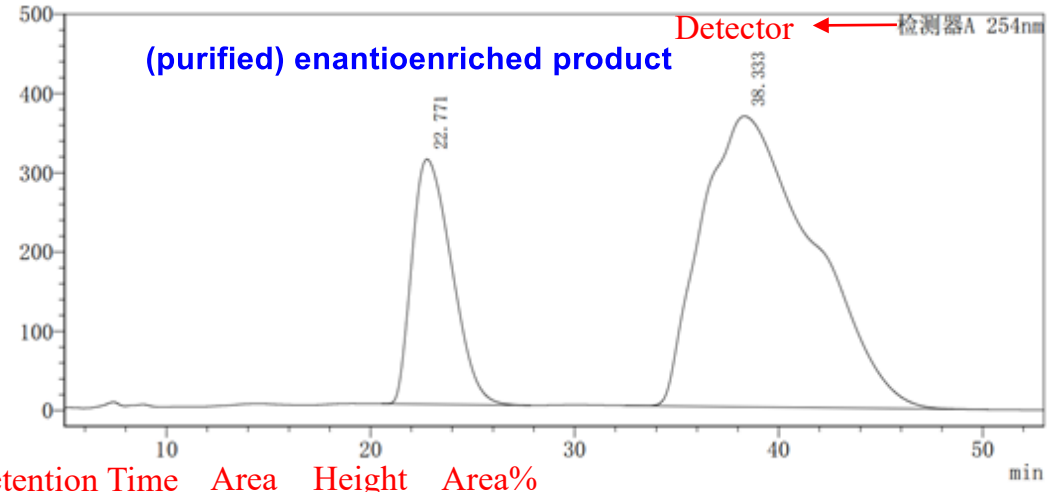
〈峰表〉

检测器A 254nm

| 峰号 | 保留时间 | 面积 | 高度 | 面积% |
|---|---|---|---|---|
| 1 | 23.736 | 140683722 | 920437 | 49.498 |
| 2 | 41.041 | 143539173 | 341100 | 50.502 |
| 总计 | | 284222895 | 1261537 | 100.000 |

Peak

Total




Retention Time Area Height Area%

〈峰表〉

检测器A 254nm

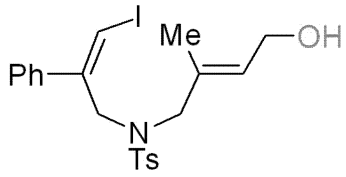
| 峰号 | 保留时间 | 面积 | 高度 | 面积% |
|---|---|---|---|---|
| 1 | 22.771 | 41912842 | 309289 | 23.143 |
| 2 | 38.333 | 139194021 | 366723 | 76.857 |
| 总计 | | 181106864 | 676012 | 100.000 |

Peak

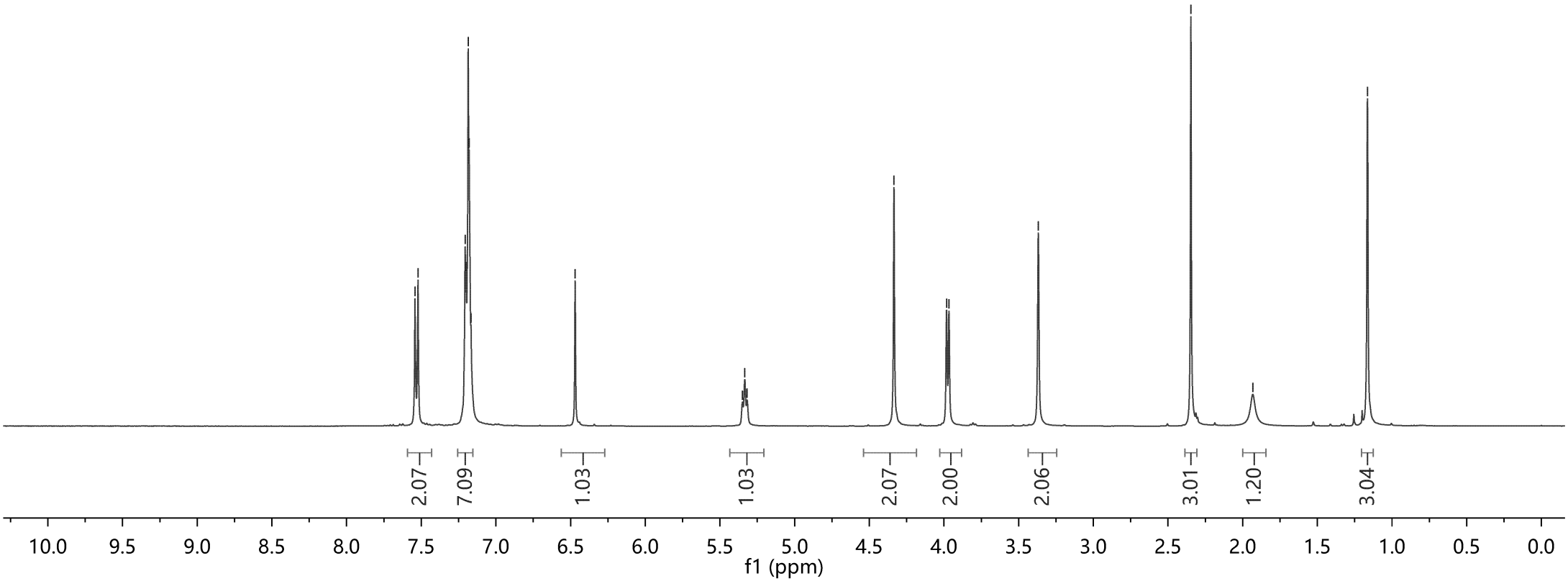
Total

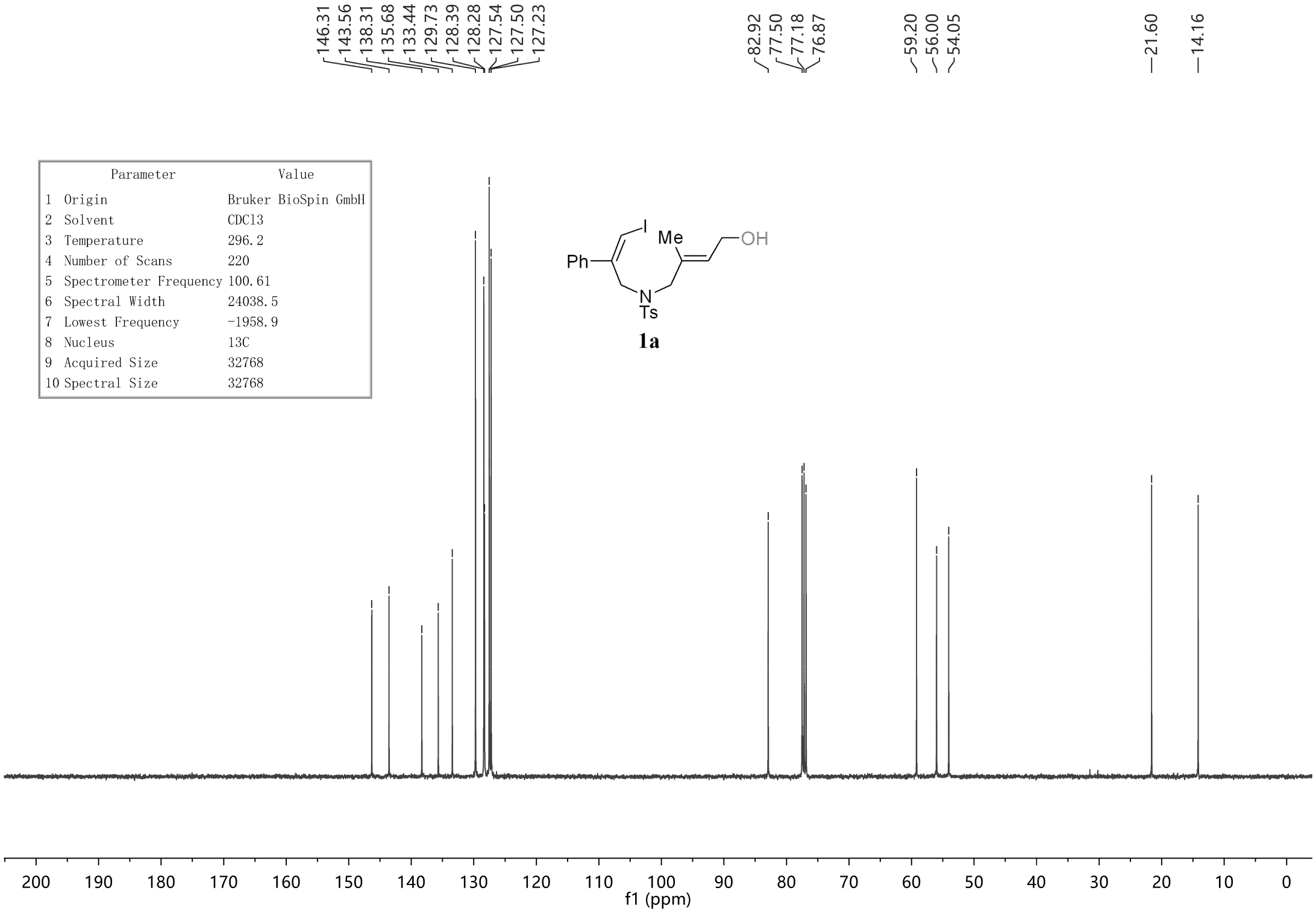
## 7. $^{1}$H and $^{13}$C NMR Spectra

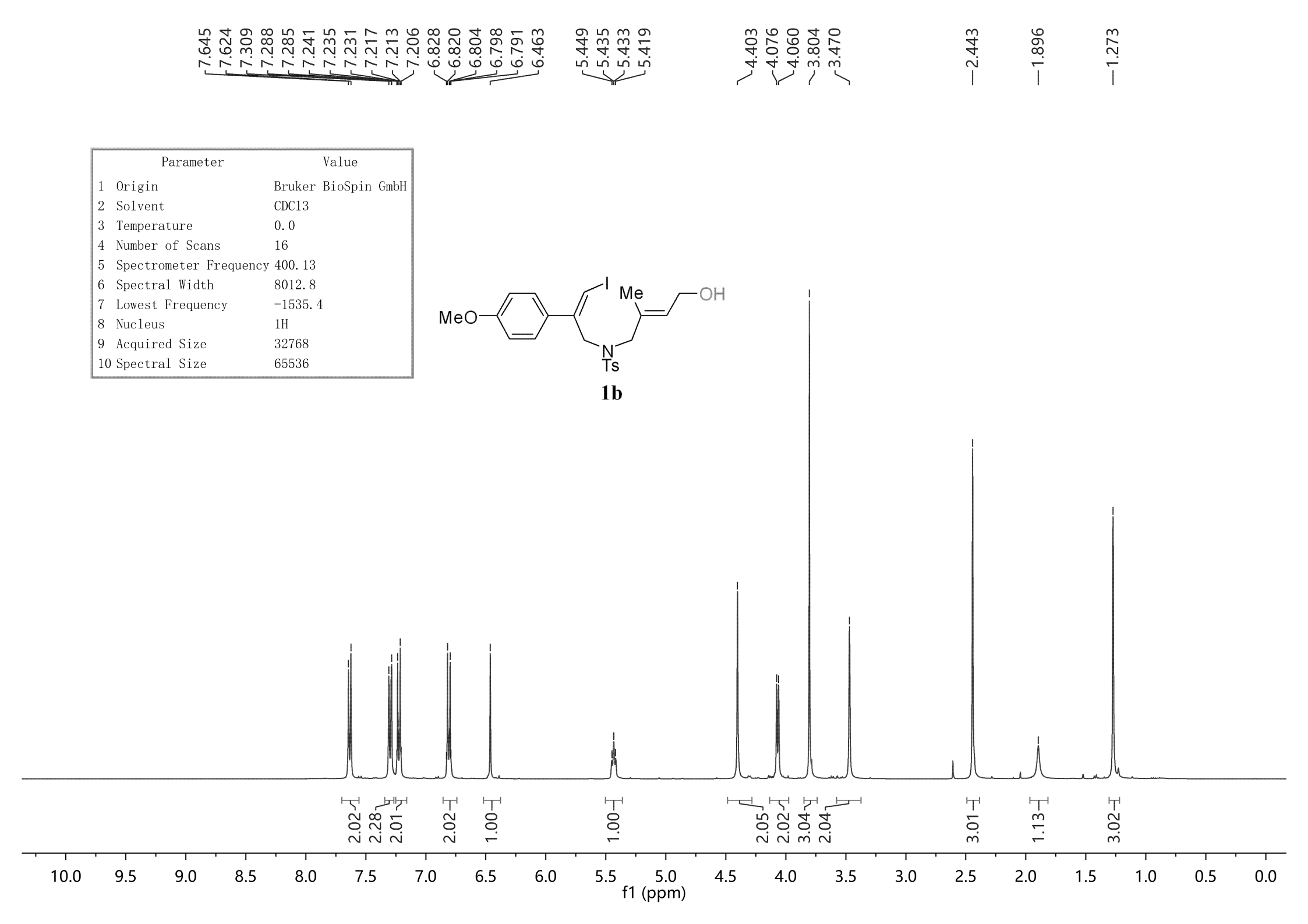

| | Parameter | Value |
|---|---|---|
| 1 | Origin | Bruker BioSpin GmbH |
| 2 | Solvent | CDCl3 |
| 3 | Temperature | 295.8 |
| 4 | Number of Scans | 16 |
| 5 | Spectrometer Frequency | 400.13 |
| 6 | Spectral Width | 8012.8 |
| 7 | Lowest Frequency | -1574.3 |
| 8 | Nucleus | 1H |
| 9 | Acquired Size | 32768 |
| 10 | Spectral Size | 65536 |

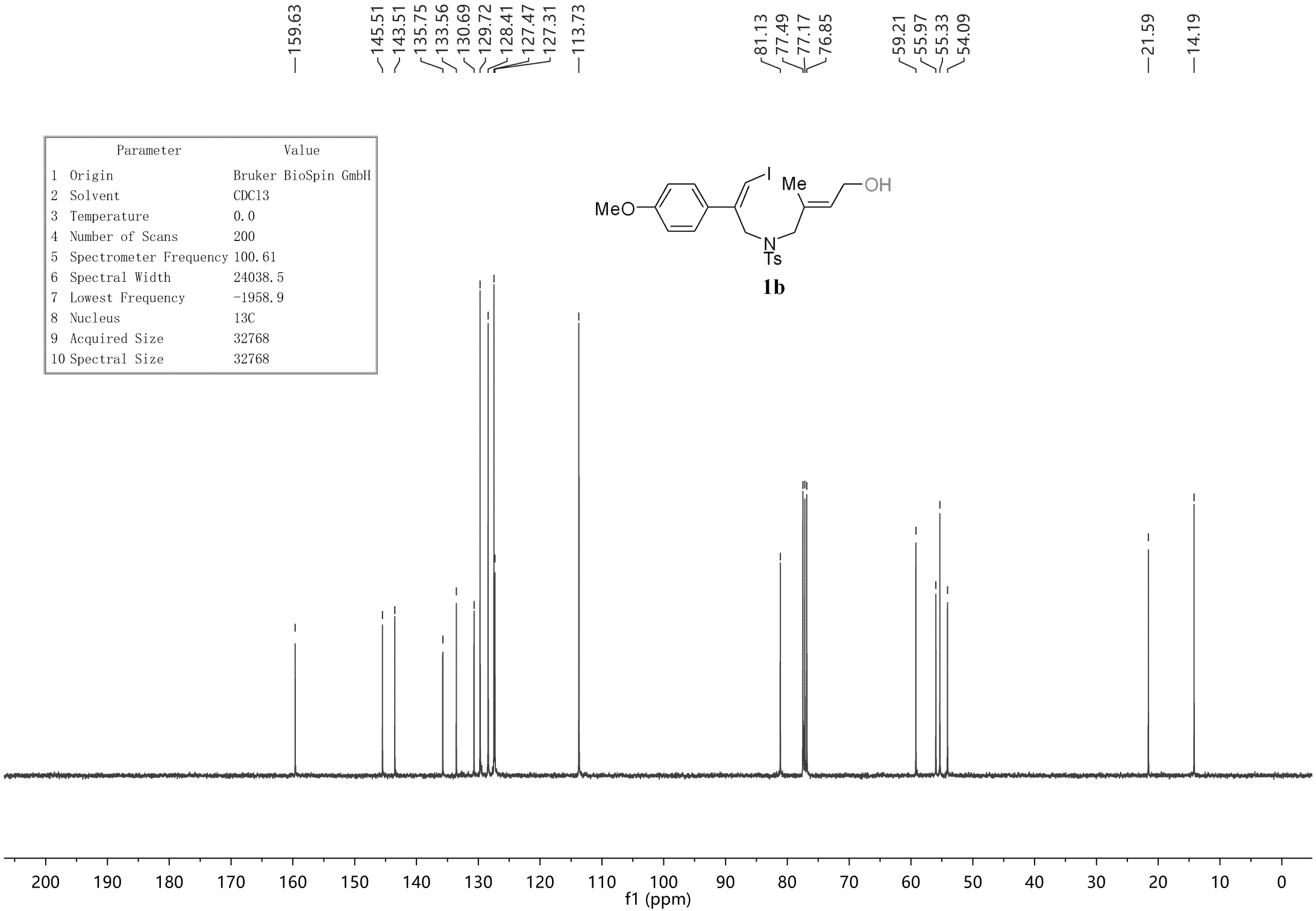


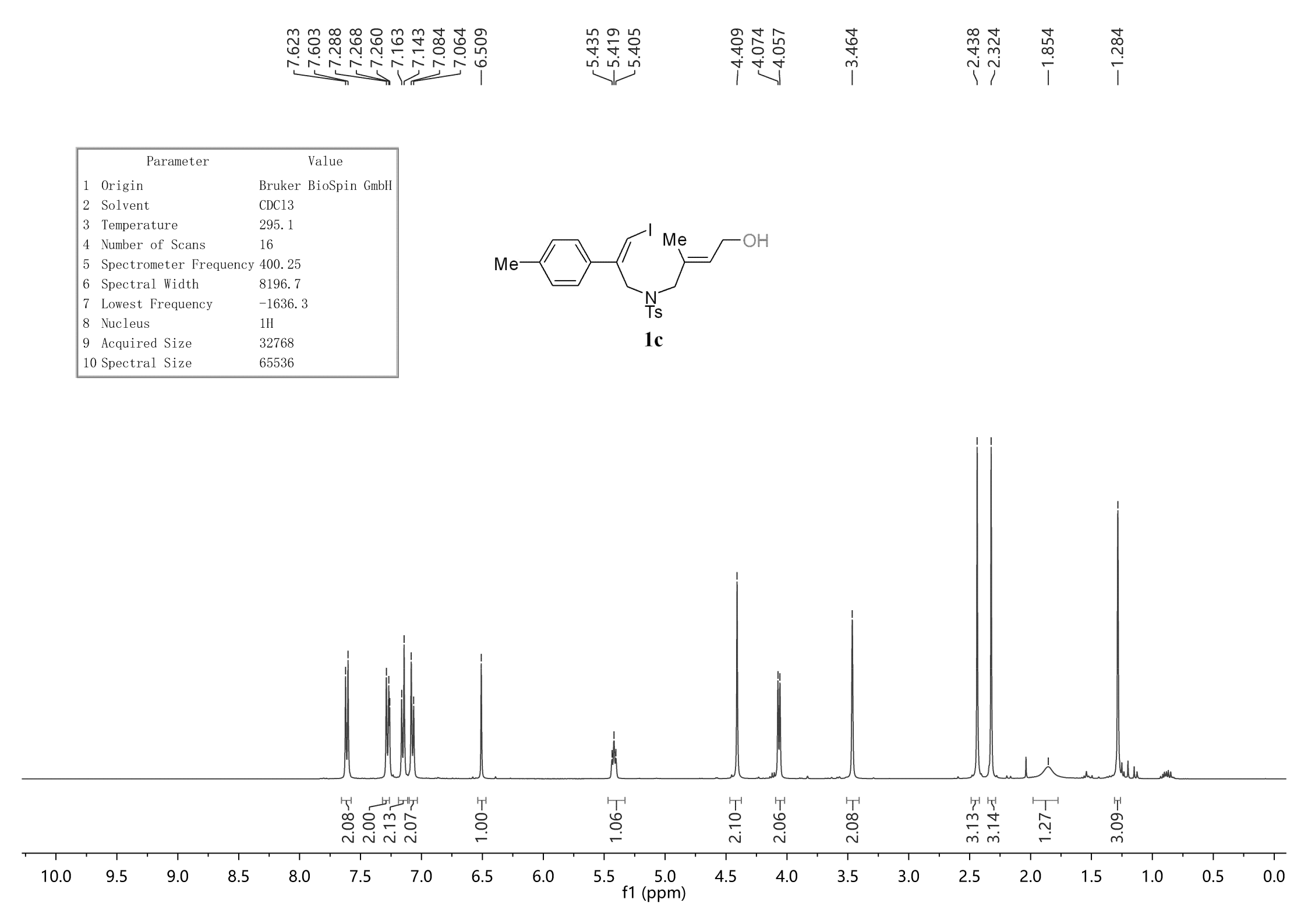

**1a**

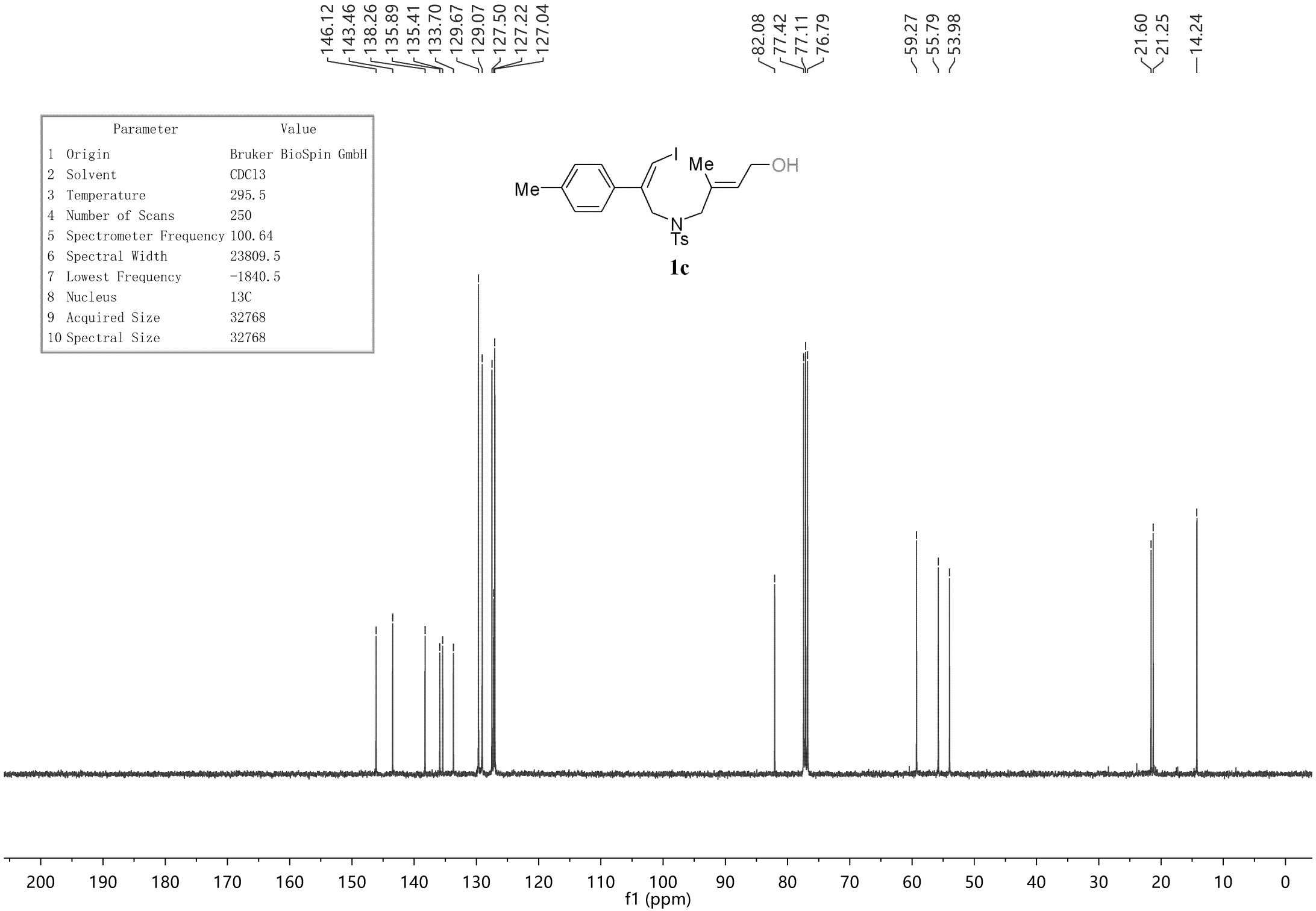



146.31
143.56
138.31
135.68
133.44
129.73
128.39
128.28
127.54
127.50
127.23
82.92
77.50
77.18
76.87
59.20
56.00
54.05
21.60
14.16
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 296.2
4 Number of Scans 220
5 Spectrometer Frequency 100.61
6 Spectral Width 24038.5
7 Lowest Frequency -1958.9
8 Nucleus 13C
9 Acquired Size 32768
10 Spectral Size 32768
I
Me
OH
Ph
N
Ts
1a
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)


7.645
7.624
7.309
7.288
7.285
7.241
7.235
7.231
7.217
7.213
7.206
6.828
6.820
6.804
6.798
6.791
6.463
5.449
5.435
5.433
5.419
4.403
4.076
4.060
3.804
3.470
2.443
1.896
1.273
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 0.0
4 Number of Scans 16
5 Spectrometer Frequency 400.13
6 Spectral Width 8012.8
7 Lowest Frequency -1535.4
8 Nucleus 1H
9 Acquired Size 32768
10 Spectral Size 65536
MeO
I
Me
OH
N
Ts
1b
2.02
2.28
2.01
2.02
1.00
1.00
2.05
2.02
3.04
2.04
3.01
1.13
3.02
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)


159.63
145.51
143.51
135.75
133.56
130.69
129.72
128.41
127.47
127.31
113.73
81.13
77.49
77.17
76.85
59.21
55.97
55.33
54.09
21.59
14.19
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 0.0
4 Number of Scans 200
5 Spectrometer Frequency 100.61
6 Spectral Width 24038.5
7 Lowest Frequency -1958.9
8 Nucleus 13C
9 Acquired Size 32768
10 Spectral Size 32768
I
Me
OH
MeO
N
Ts
1b
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

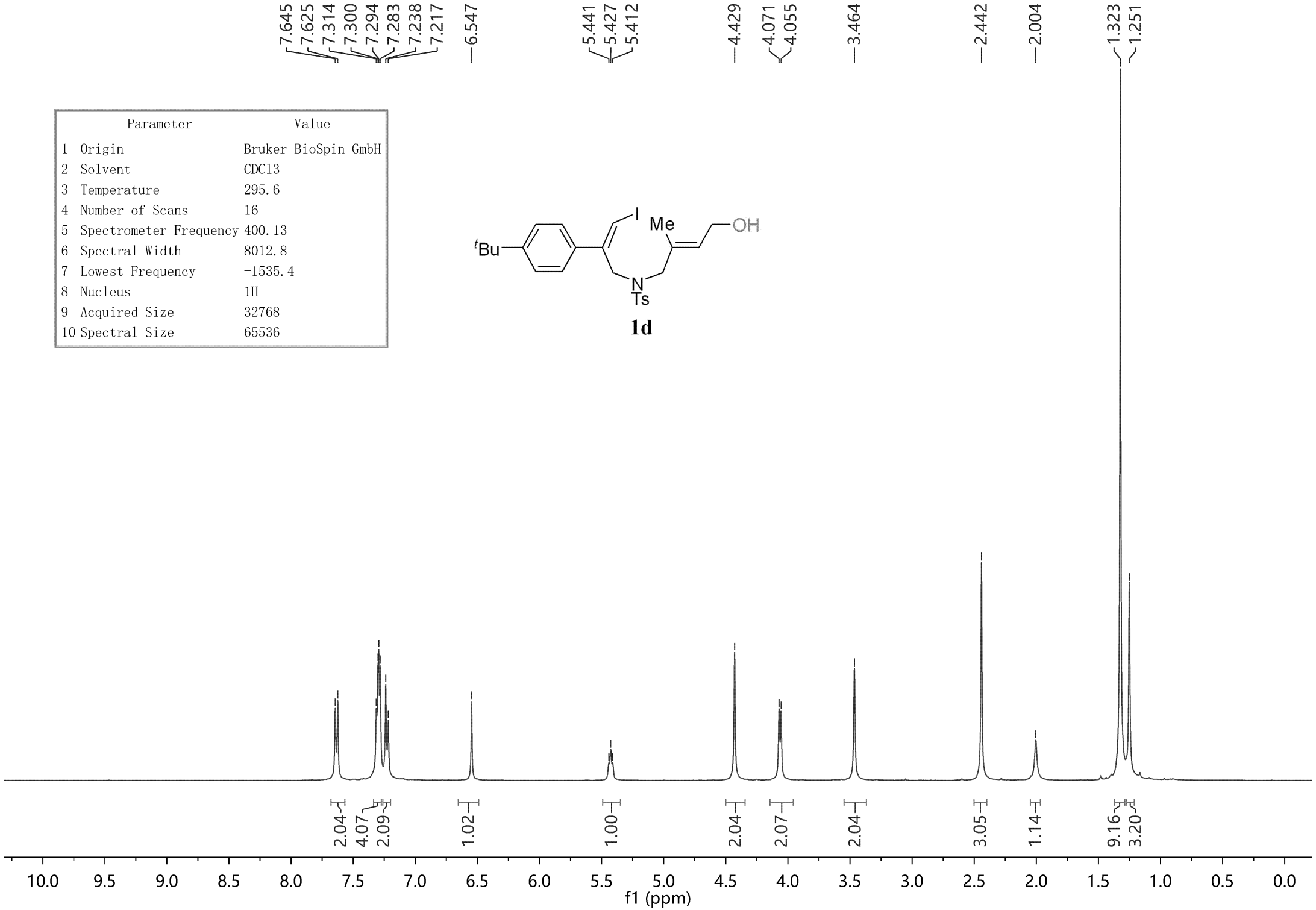

7.623
7.603
7.288
7.268
7.260
7.163
7.143
7.084
7.064
6.509
5.435
5.419
5.405
4.409
4.074
4.057
3.464
2.438
2.324
1.854
1.284
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 295.1
4 Number of Scans 16
5 Spectrometer Frequency 400.25
6 Spectral Width 8196.7
7 Lowest Frequency -1636.3
8 Nucleus 1H
9 Acquired Size 32768
10 Spectral Size 65536
I
Me
OH
Me
N
Ts
1c
2.08
2.00
2.13
2.07
1.00
1.06
2.10
2.06
2.08
3.13
3.14
1.27
3.09
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)

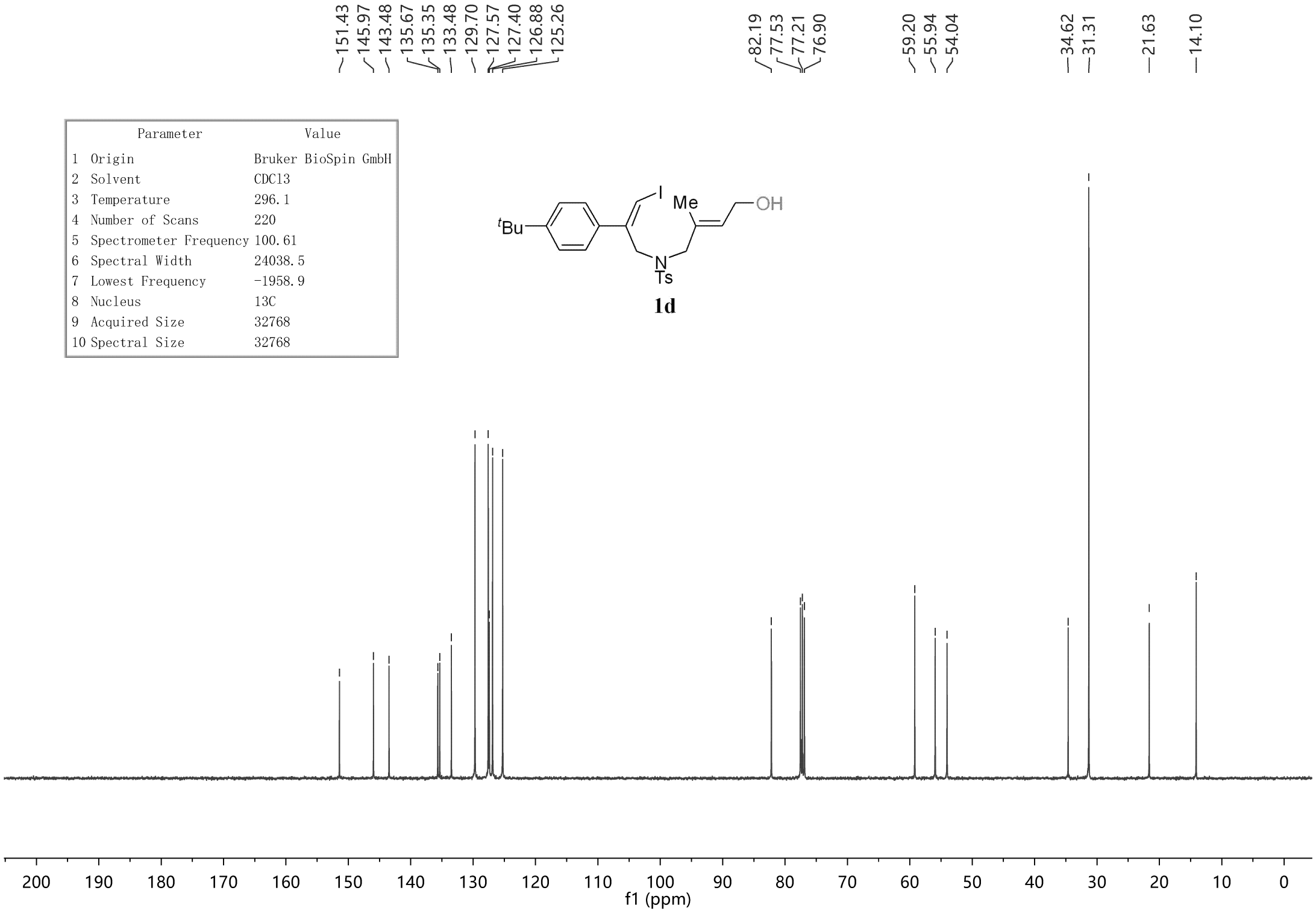

146.12
143.46
138.26
135.89
135.41
133.70
129.67
129.07
127.50
127.22
127.04
82.08
77.42
77.11
76.79
59.27
55.79
53.98
21.60
21.25
14.24
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 295.5
4 Number of Scans 250
5 Spectrometer Frequency 100.64
6 Spectral Width 23809.5
7 Lowest Frequency -1840.5
8 Nucleus 13C
9 Acquired Size 32768
10 Spectral Size 32768
I
Me
OH
Me
N
Ts
1c
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

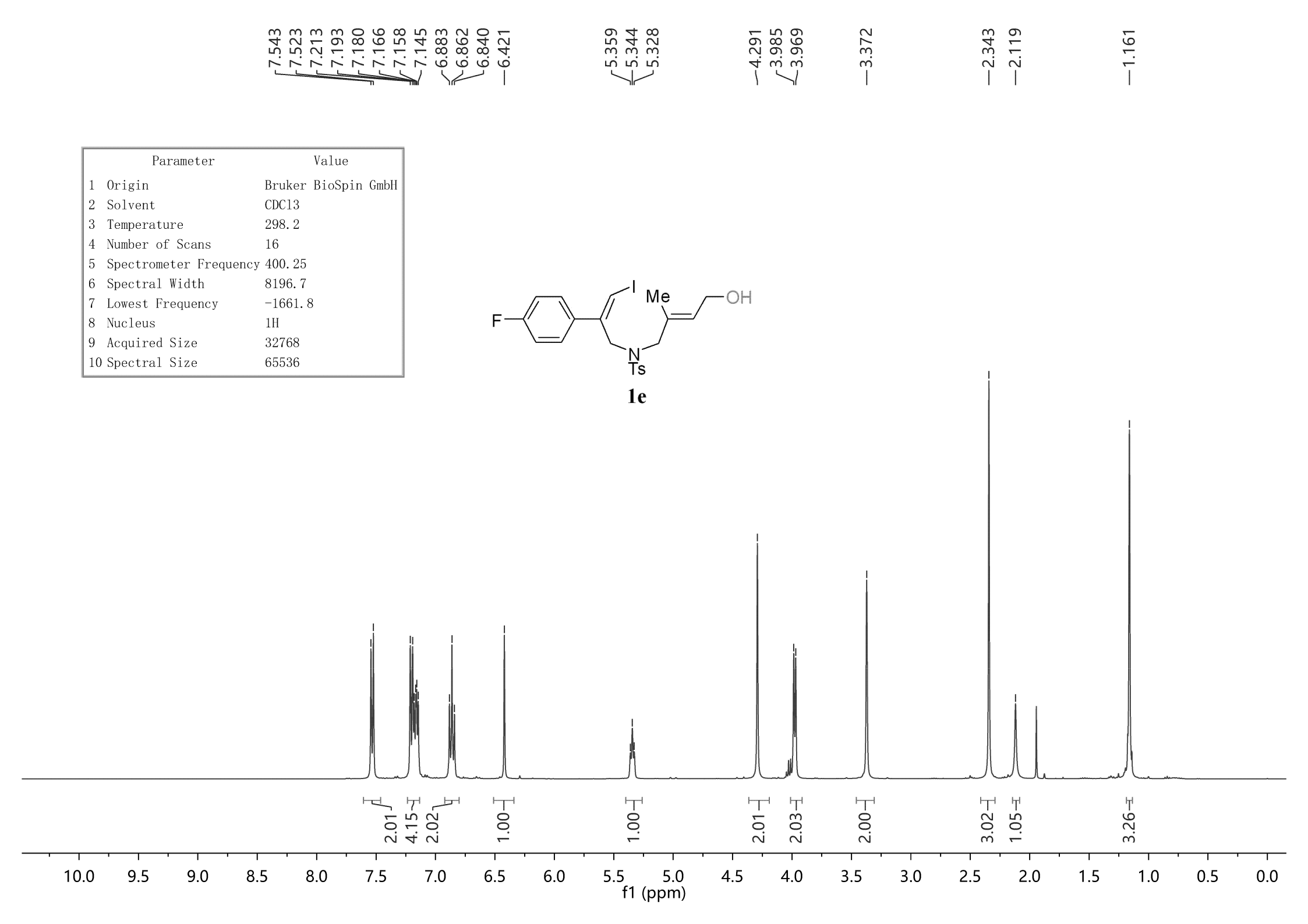
| Parameter | Value |
|---|---|
| 1 Origin | Bruker BioSpin GmbH |
| 2 Solvent | CDCl3 |
| 3 Temperature | 295.6 |
| 4 Number of Scans | 16 |
| 5 Spectrometer Frequency | 400.13 |
| 6 Spectral Width | 8012.8 |
| 7 Lowest Frequency | -1535.4 |
| 8 Nucleus | 1H |
| 9 Acquired Size | 32768 |
| 10 Spectral Size | 65536 |

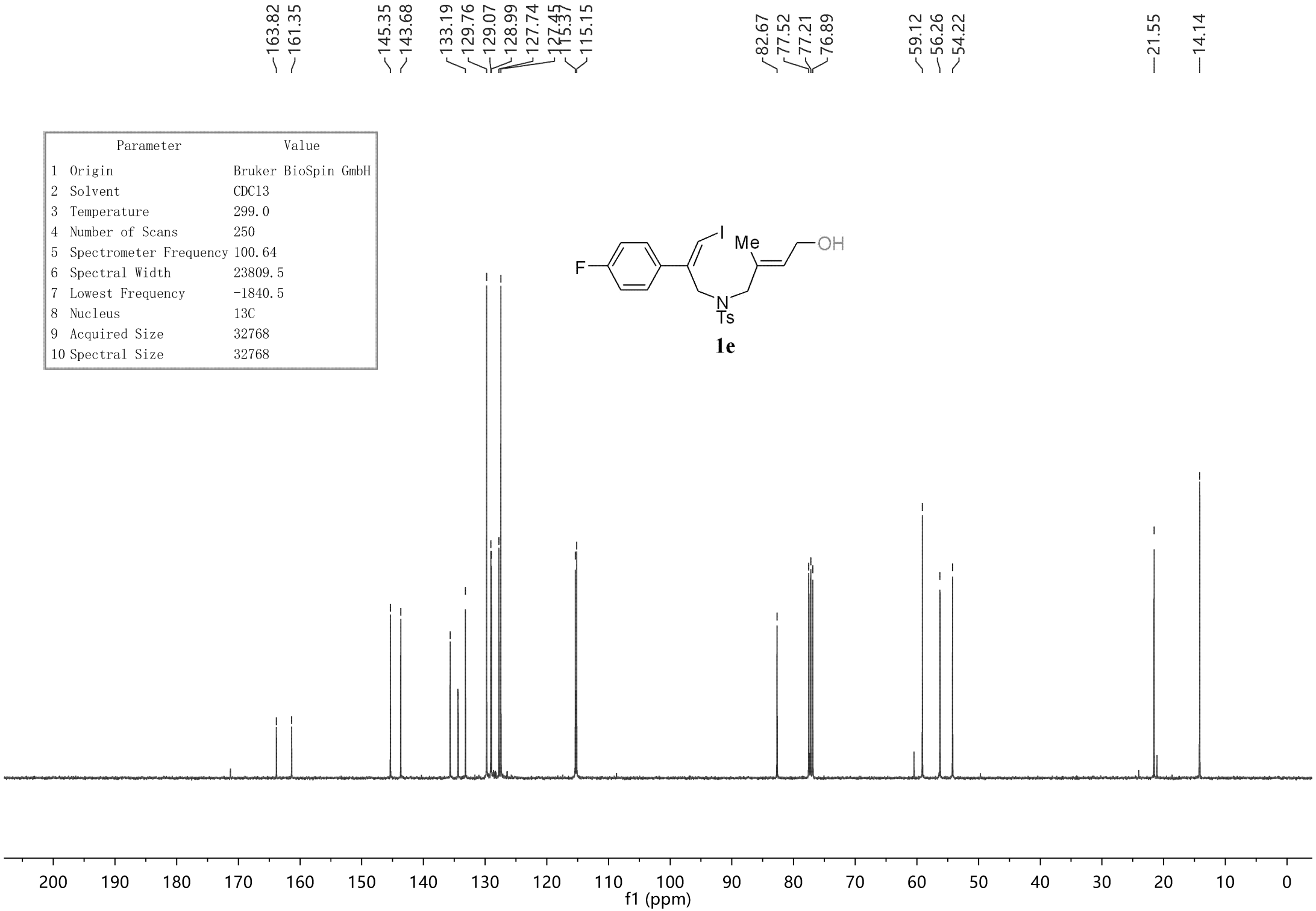



**1d**




151.43
145.97
143.48
135.67
135.35
133.48
129.70
127.57
127.40
126.88
125.26
82.19
77.53
77.21
76.90
59.20
55.94
54.04
34.62
31.31
21.63
14.10
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 296.1
4 Number of Scans 220
5 Spectrometer Frequency 100.61
6 Spectral Width 24038.5
7 Lowest Frequency -1958.9
8 Nucleus 13C
9 Acquired Size 32768
10 Spectral Size 32768
tBu
I
Me
OH
N
Ts
1d
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)


7.543
7.523
7.213
7.193
7.180
7.166
7.158
7.145
6.883
6.862
6.840
6.421
5.359
5.344
5.328
4.291
3.985
3.969
3.372
2.343
2.119
1.161
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.2
4 Number of Scans 16
5 Spectrometer Frequency 400.25
6 Spectral Width 8196.7
7 Lowest Frequency -1661.8
8 Nucleus 1H
9 Acquired Size 32768
10 Spectral Size 65536
F
I
Me
OH
N
Ts
1e
2.01
4.15
2.02
1.00
1.00
2.01
2.03
2.00
3.02
1.05
3.26
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)

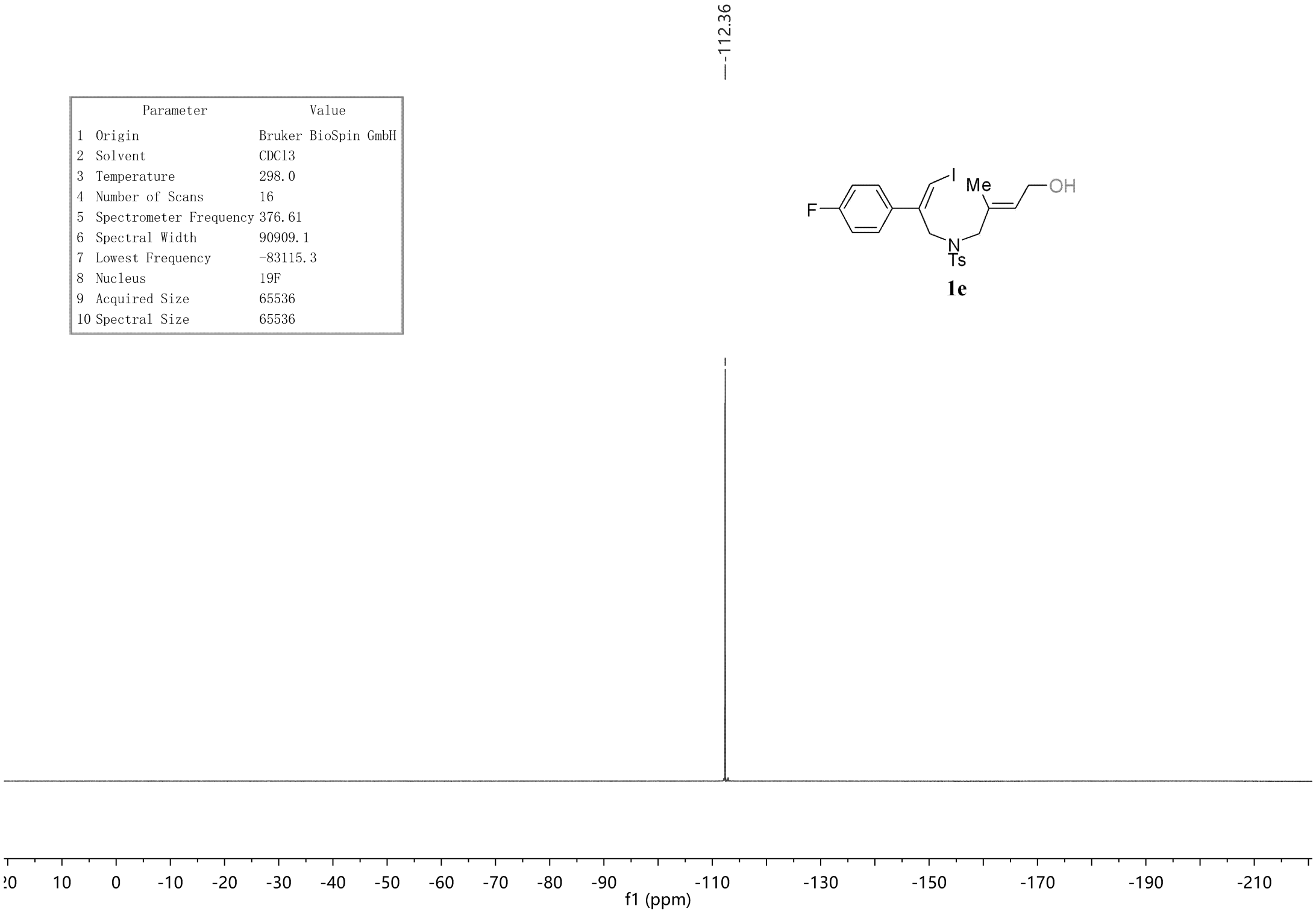



| | Parameter | Value |
|---|---|---|
| 1 | Origin | Bruker BioSpin GmbH |
| 2 | Solvent | CDCl3 |
| 3 | Temperature | 299.0 |
| 4 | Number of Scans | 250 |
| 5 | Spectrometer Frequency | 100.64 |
| 6 | Spectral Width | 23809.5 |
| 7 | Lowest Frequency | -1840.5 |
| 8 | Nucleus | 13C |
| 9 | Acquired Size | 32768 |
| 10 | Spectral Size | 32768 |

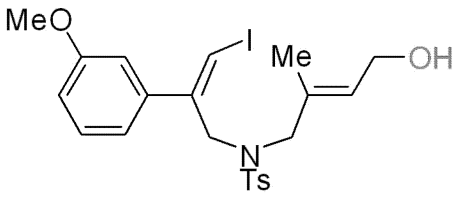
| | Parameter | Value |
|---|---|---|
| 1 | Origin | Bruker BioSpin GmbH |
| 2 | Solvent | CDCl3 |
| 3 | Temperature | 298.0 |
| 4 | Number of Scans | 16 |
| 5 | Spectrometer Frequency | 376.61 |
| 6 | Spectral Width | 90909.1 |
| 7 | Lowest Frequency | -83115.3 |
| 8 | Nucleus | 19F |
| 9 | Acquired Size | 65536 |
| 10 | Spectral Size | 65536 |



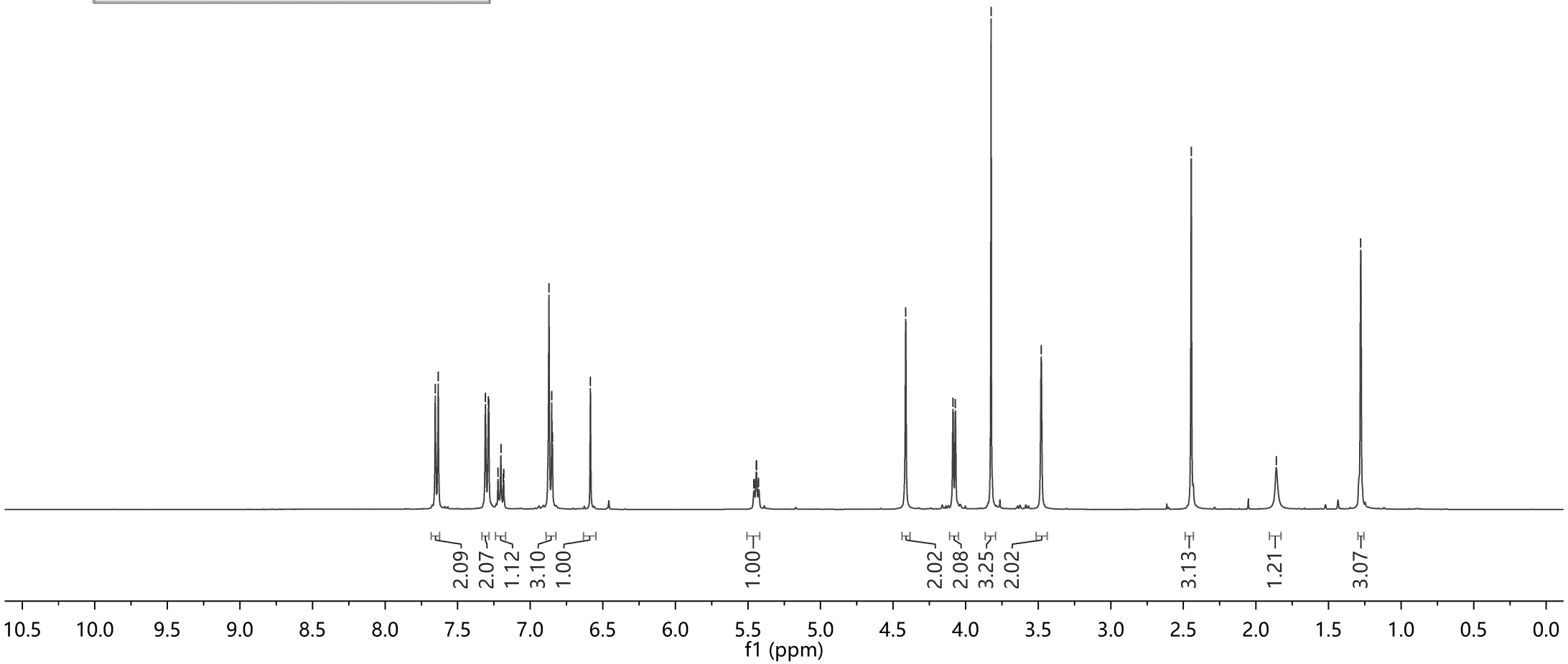

**1e**

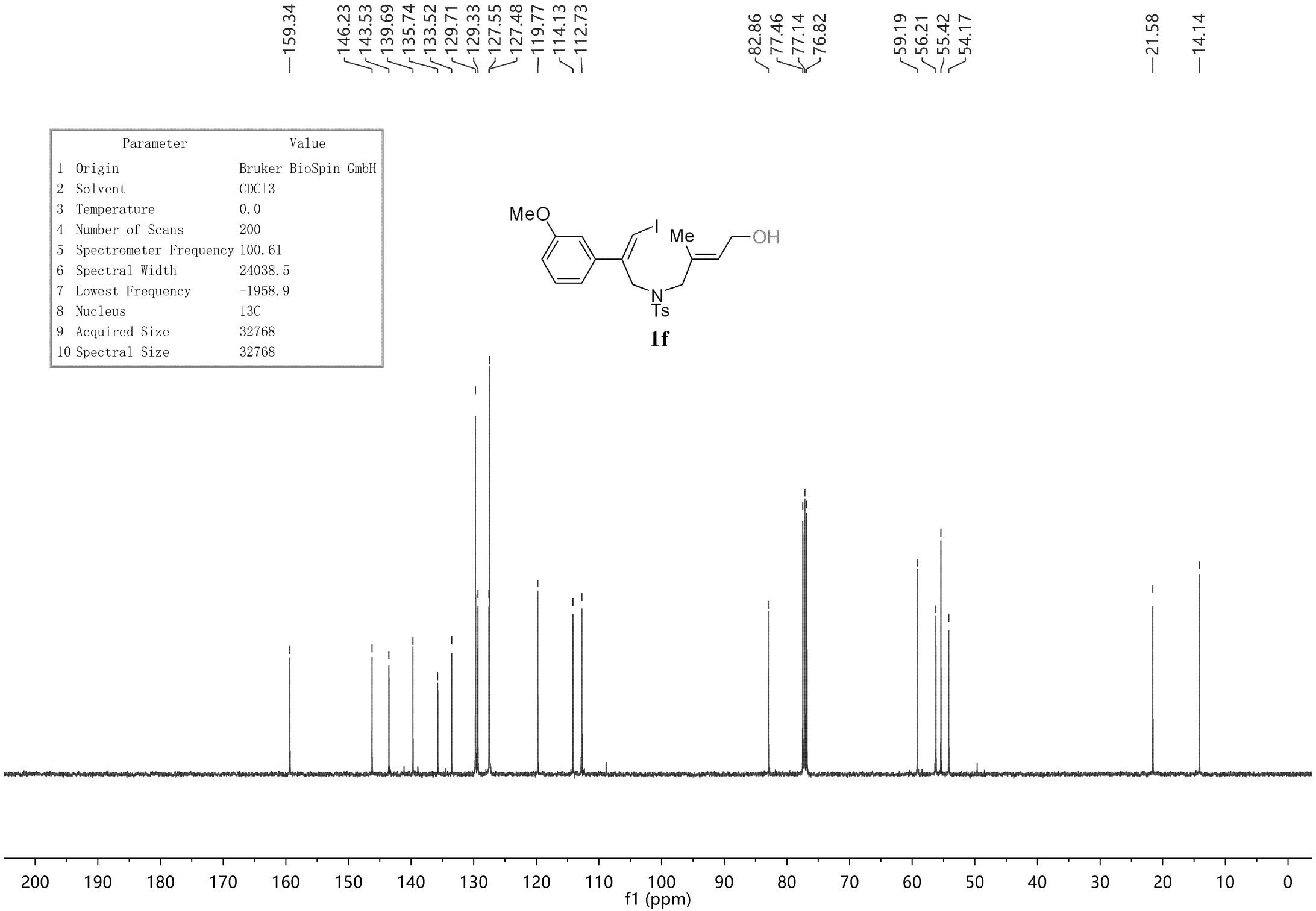


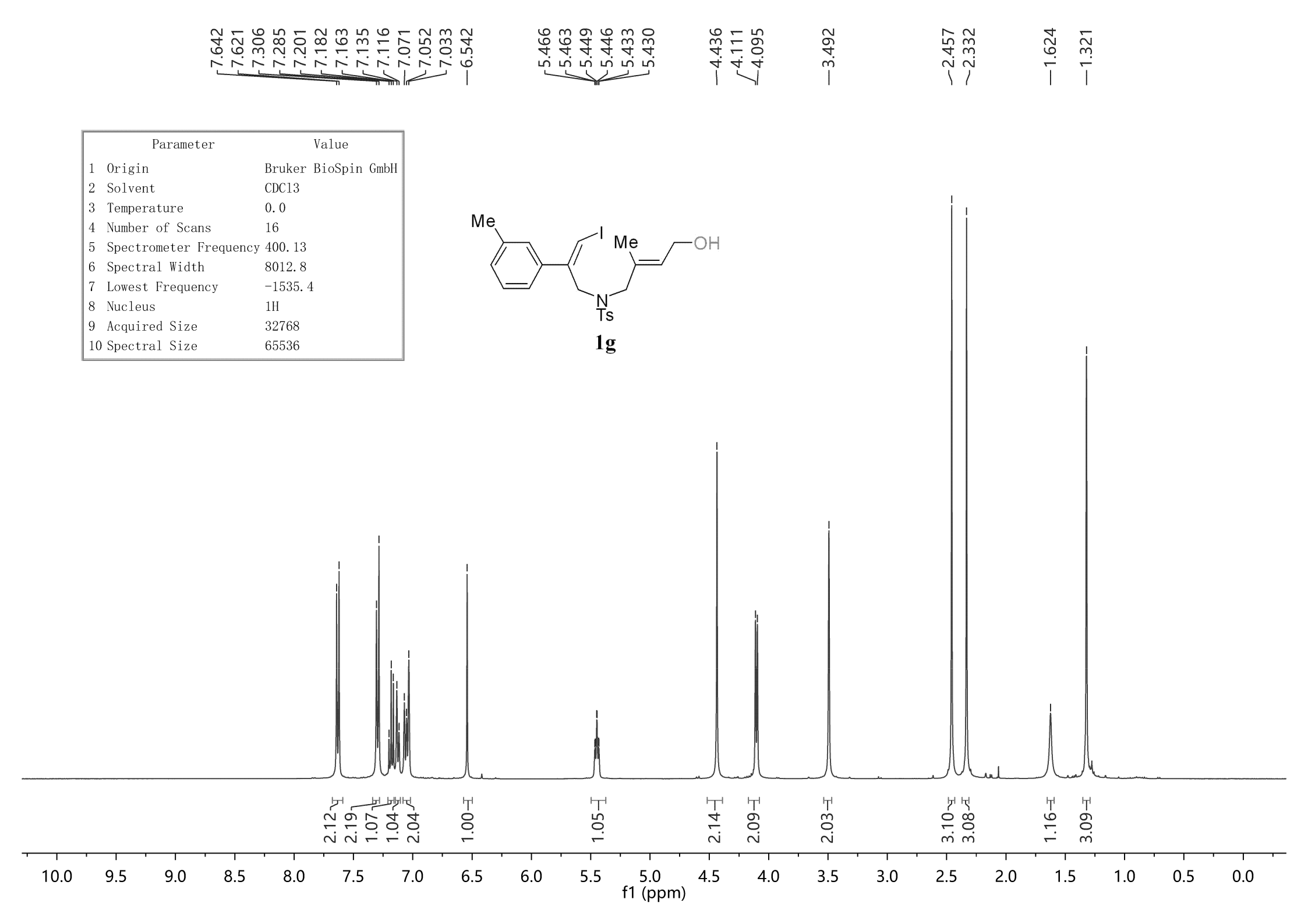
| | Parameter | Value |
|---|---|---|
| 1 | Origin | Bruker BioSpin GmbH |
| 2 | Solvent | CDCl3 |
| 3 | Temperature | 0.0 |
| 4 | Number of Scans | 16 |
| 5 | Spectrometer Frequency | 400.13 |
| 6 | Spectral Width | 8012.8 |
| 7 | Lowest Frequency | -1535.4 |
| 8 | Nucleus | 1H |
| 9 | Acquired Size | 32768 |
| 10 | Spectral Size | 65536 |

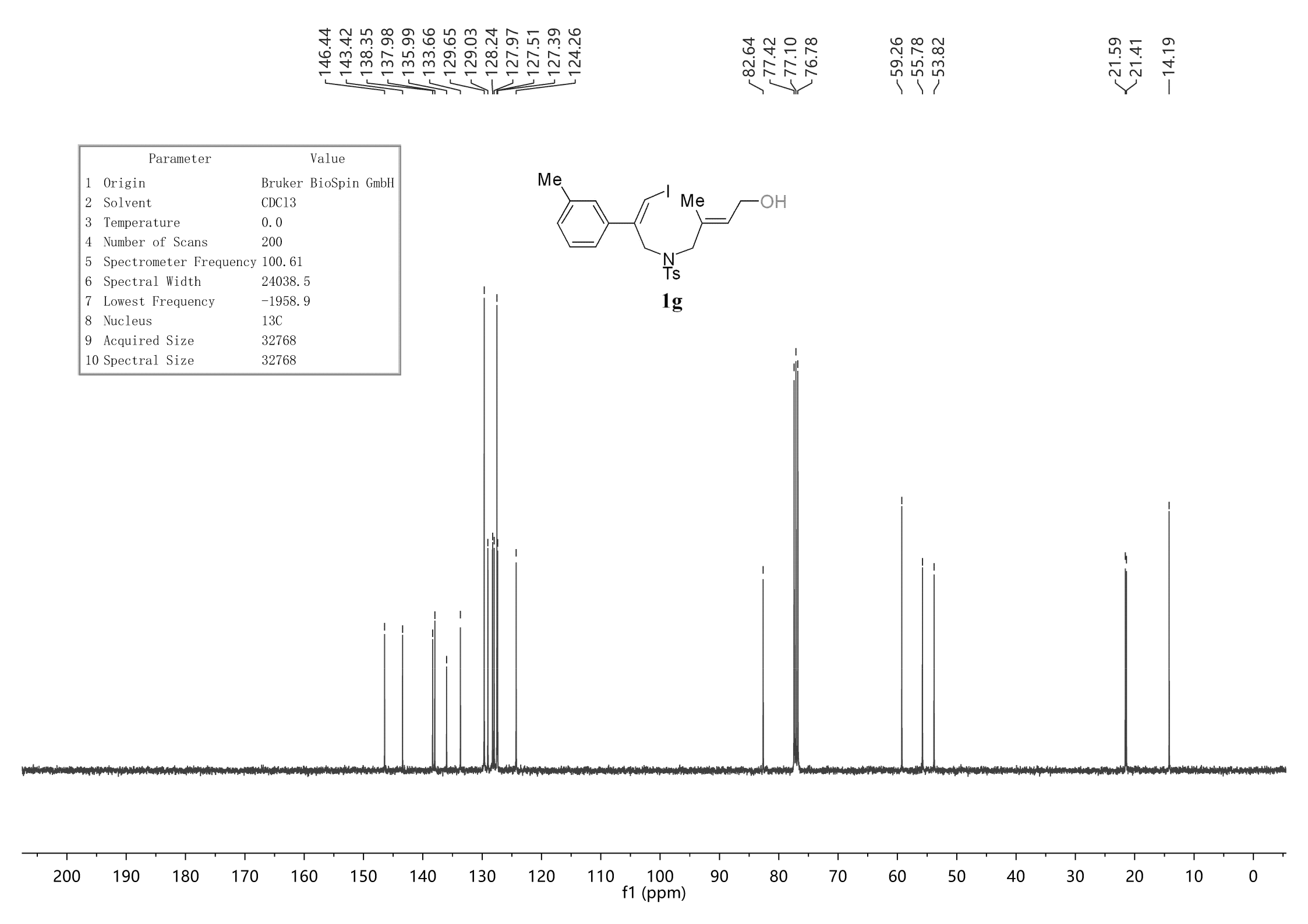


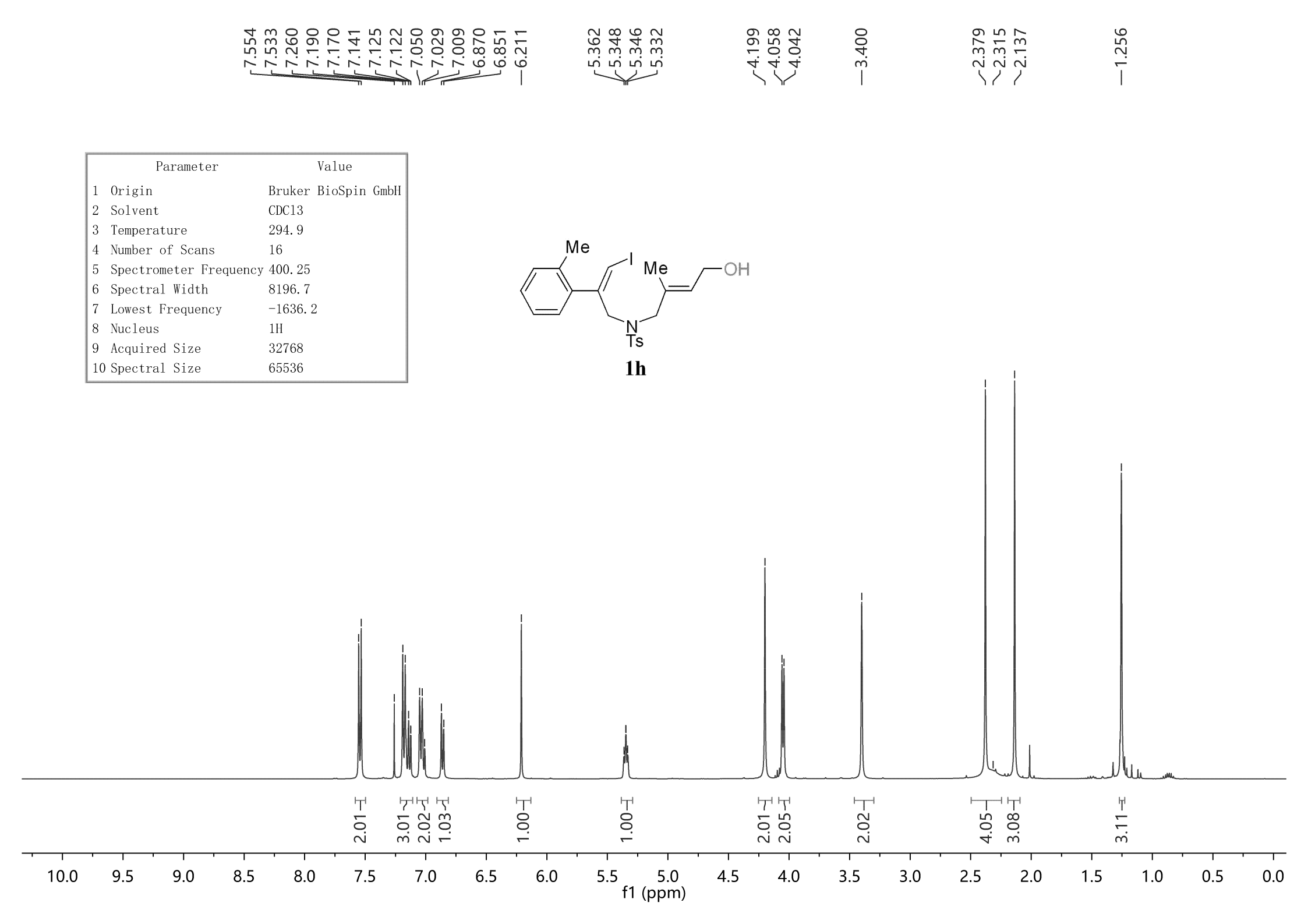

**1f**

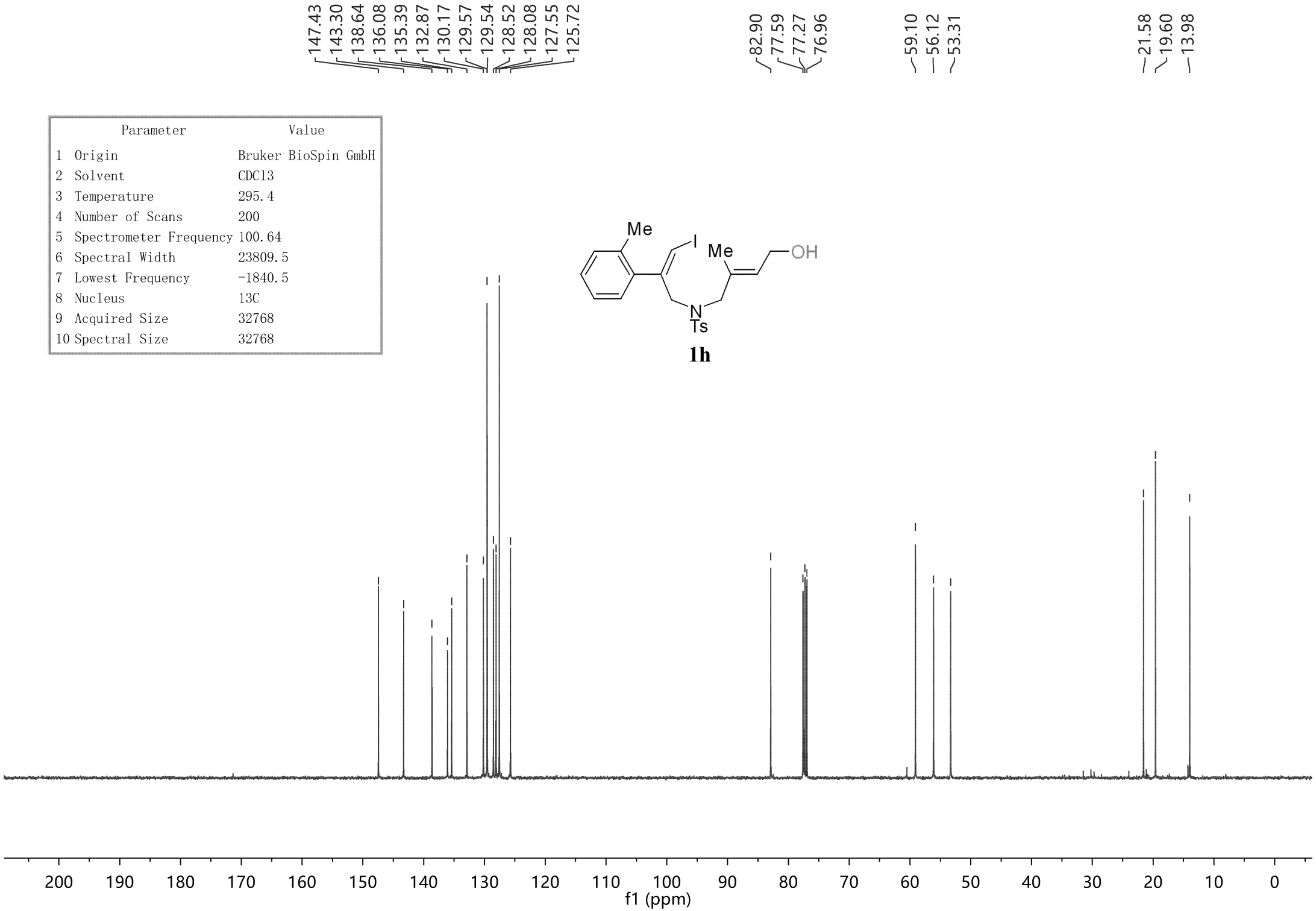



159.34
146.23
143.53
139.69
135.74
133.52
129.71
129.33
127.55
127.48
119.77
114.13
112.73
82.86
77.46
77.14
76.82
59.19
56.21
55.42
54.17
21.58
14.14
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 0.0
4 Number of Scans 200
5 Spectrometer Frequency 100.61
6 Spectral Width 24038.5
7 Lowest Frequency -1958.9
8 Nucleus 13C
9 Acquired Size 32768
10 Spectral Size 32768
MeO
I
Me
OH
N
Ts
1f
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)


7.642
7.621
7.306
7.285
7.201
7.182
7.163
7.135
7.116
7.071
7.052
7.033
6.542
5.466
5.463
5.449
5.446
5.433
5.430
4.436
4.111
4.095
3.492
2.457
2.332
1.624
1.321
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 0.0
4 Number of Scans 16
5 Spectrometer Frequency 400.13
6 Spectral Width 8012.8
7 Lowest Frequency -1535.4
8 Nucleus 1H
9 Acquired Size 32768
10 Spectral Size 65536
Me
I
Me
OH
N
Ts
1g
2.12
2.19
1.07
1.04
2.04
1.00
1.05
2.14
2.09
2.03
3.10
3.08
1.16
3.09
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)


146.44
143.42
138.35
137.98
135.99
133.66
129.65
129.03
128.24
127.97
127.51
127.39
124.26
82.64
77.42
77.10
76.78
59.26
55.78
53.82
21.59
21.41
14.19
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 0.0
4 Number of Scans 200
5 Spectrometer Frequency 100.61
6 Spectral Width 24038.5
7 Lowest Frequency -1958.9
8 Nucleus 13C
9 Acquired Size 32768
10 Spectral Size 32768
Me
I
Me
OH
N
Ts
1g
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

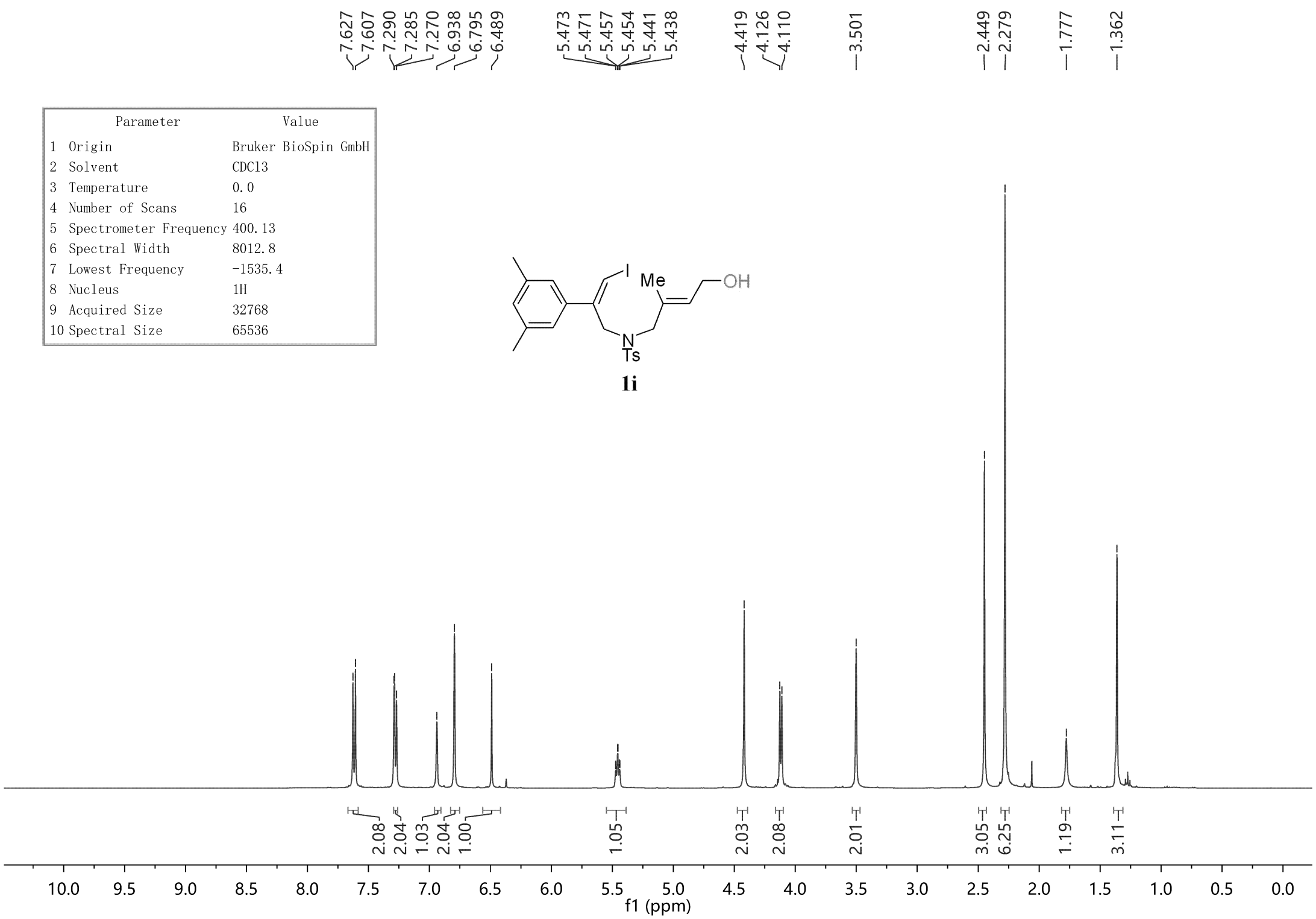

7.554
7.533
7.260
7.190
7.170
7.141
7.125
7.122
7.050
7.029
7.009
6.870
6.851
6.211
5.362
5.348
5.346
5.332
4.199
4.058
4.042
3.400
2.379
2.315
2.137
1.256
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 294.9
4 Number of Scans 16
5 Spectrometer Frequency 400.25
6 Spectral Width 8196.7
7 Lowest Frequency -1636.2
8 Nucleus 1H
9 Acquired Size 32768
10 Spectral Size 65536
Me
I
Me
OH
N
Ts
1h
2.01
3.01
2.02
1.03
1.00
1.00
2.01
2.05
2.02
4.05
3.08
3.11
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

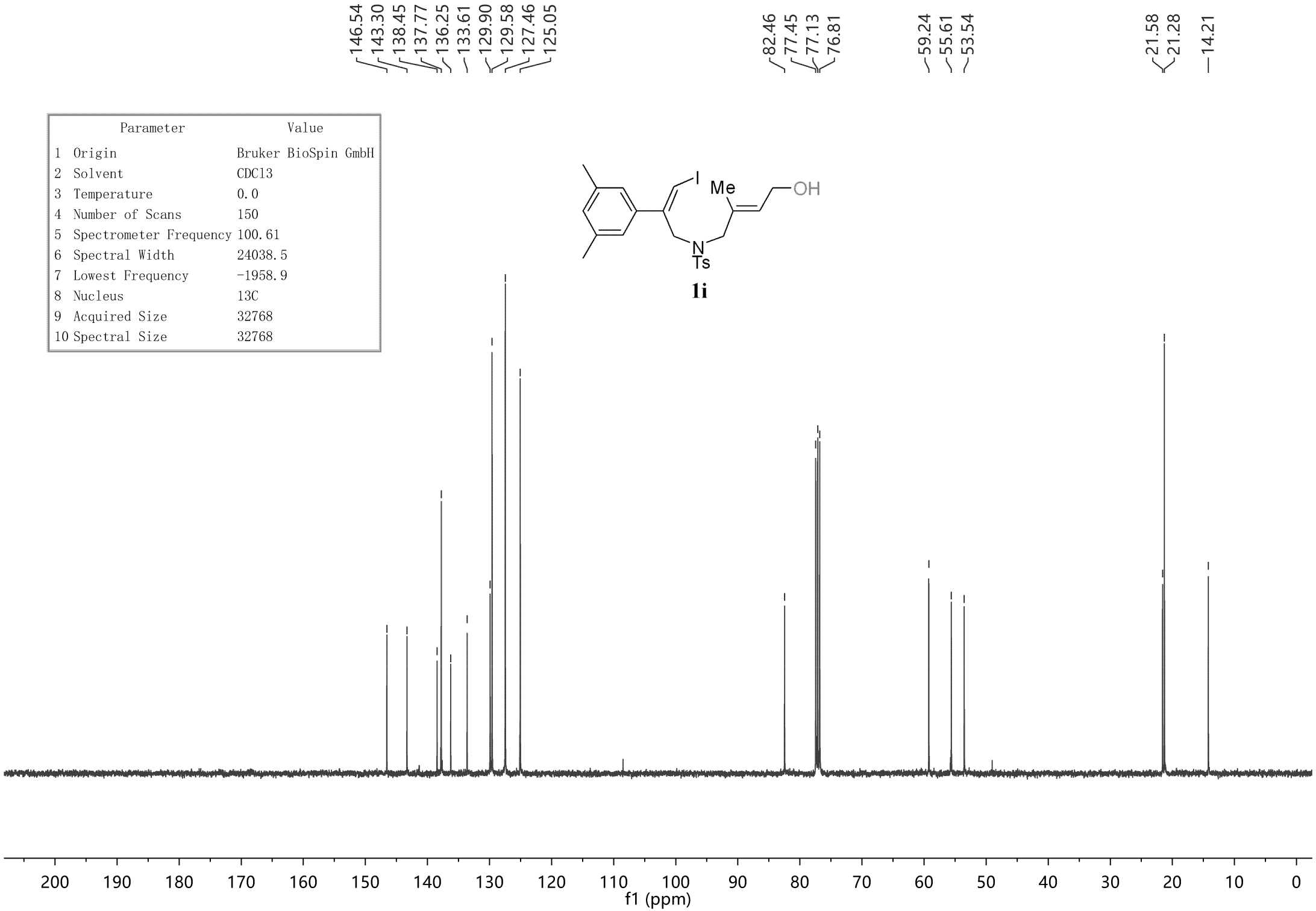

147.43
143.30
138.64
136.08
135.39
132.87
130.17
129.57
129.54
128.52
128.08
127.55
125.72
82.90
77.59
77.27
76.96
59.10
56.12
53.31
21.58
19.60
13.98
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 295.4
4 Number of Scans 200
5 Spectrometer Frequency 100.64
6 Spectral Width 23809.5
7 Lowest Frequency -1840.5
8 Nucleus 13C
9 Acquired Size 32768
10 Spectral Size 32768
Me
I
Me
OH
N
Ts
1h
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

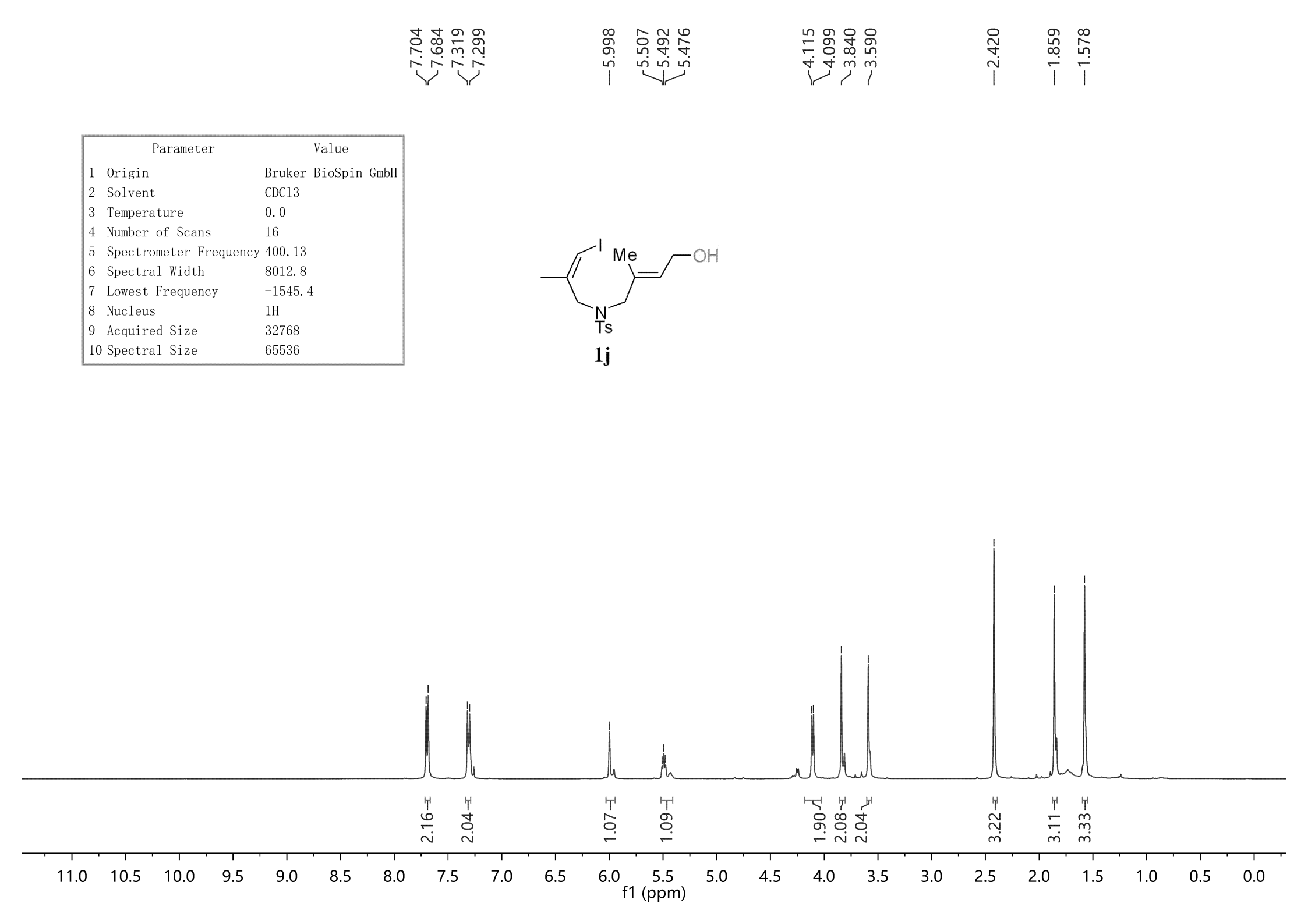
| | Parameter | Value |
|---|---|---|
| 1 | Origin | Bruker BioSpin GmbH |
| 2 | Solvent | CDCl3 |
| 3 | Temperature | 0.0 |
| 4 | Number of Scans | 16 |
| 5 | Spectrometer Frequency | 400.13 |
| 6 | Spectral Width | 8012.8 |
| 7 | Lowest Frequency | -1535.4 |
| 8 | Nucleus | 1H |
| 9 | Acquired Size | 32768 |
| 10 | Spectral Size | 65536 |

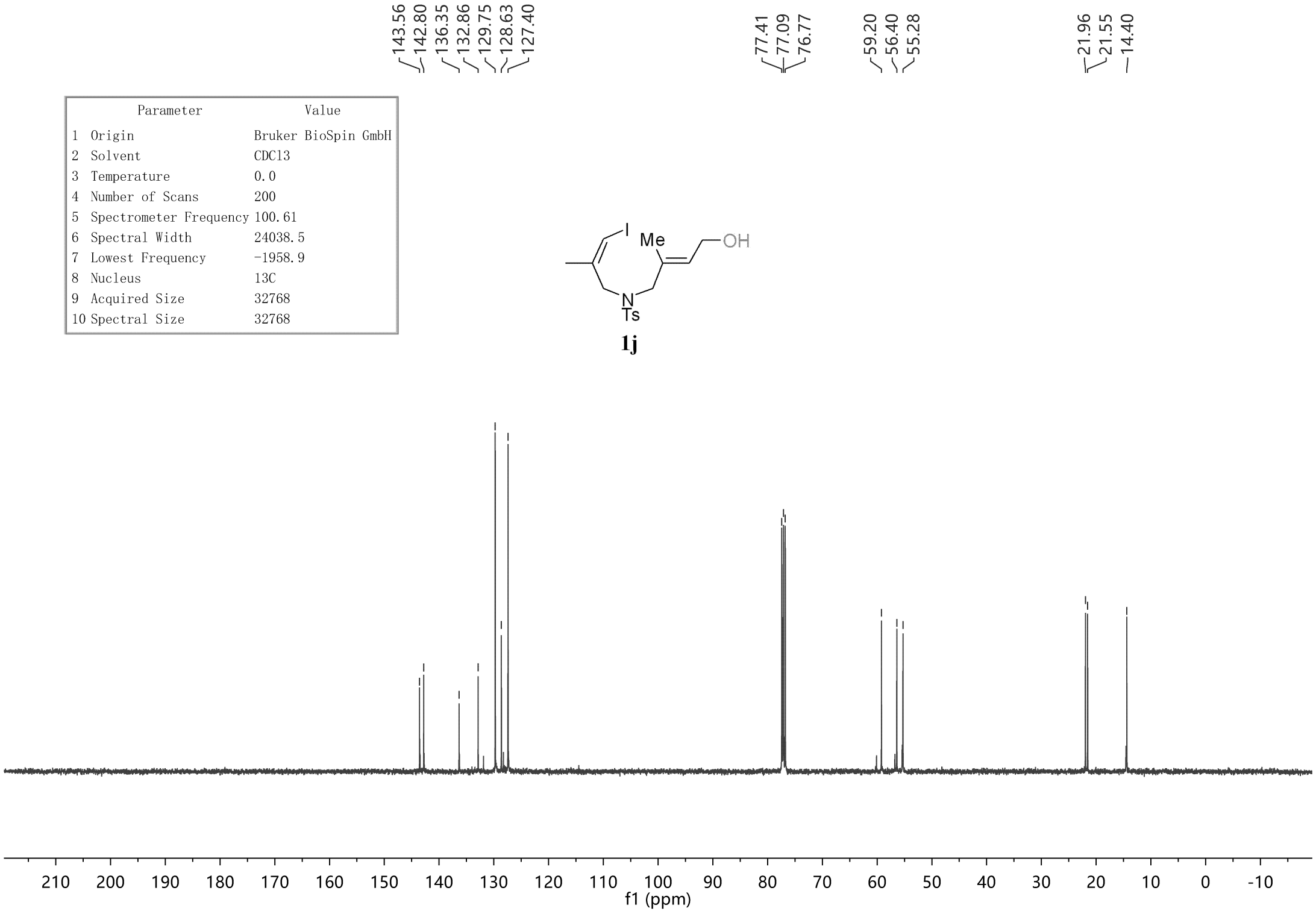



**1i**




146.54
143.30
138.45
137.77
136.25
133.61
129.90
129.58
127.46
125.05
82.46
77.45
77.13
76.81
59.24
55.61
53.54
21.58
21.28
14.21
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 0.0
4 Number of Scans 150
5 Spectrometer Frequency 100.61
6 Spectral Width 24038.5
7 Lowest Frequency -1958.9
8 Nucleus 13C
9 Acquired Size 32768
10 Spectral Size 32768
I
Me
OH
N
Ts
1i
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)


7.704
7.684
7.319
7.299
5.998
5.507
5.492
5.476
4.115
4.099
3.840
3.590
2.420
1.859
1.578
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 0.0
4 Number of Scans 16
5 Spectrometer Frequency 400.13
6 Spectral Width 8012.8
7 Lowest Frequency -1545.4
8 Nucleus 1H
9 Acquired Size 32768
10 Spectral Size 65536
I
Me
OH
N
Ts
1j
2.16
2.04
1.07
1.09
1.90
2.08
2.04
3.22
3.11
3.33
11.0 10.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)

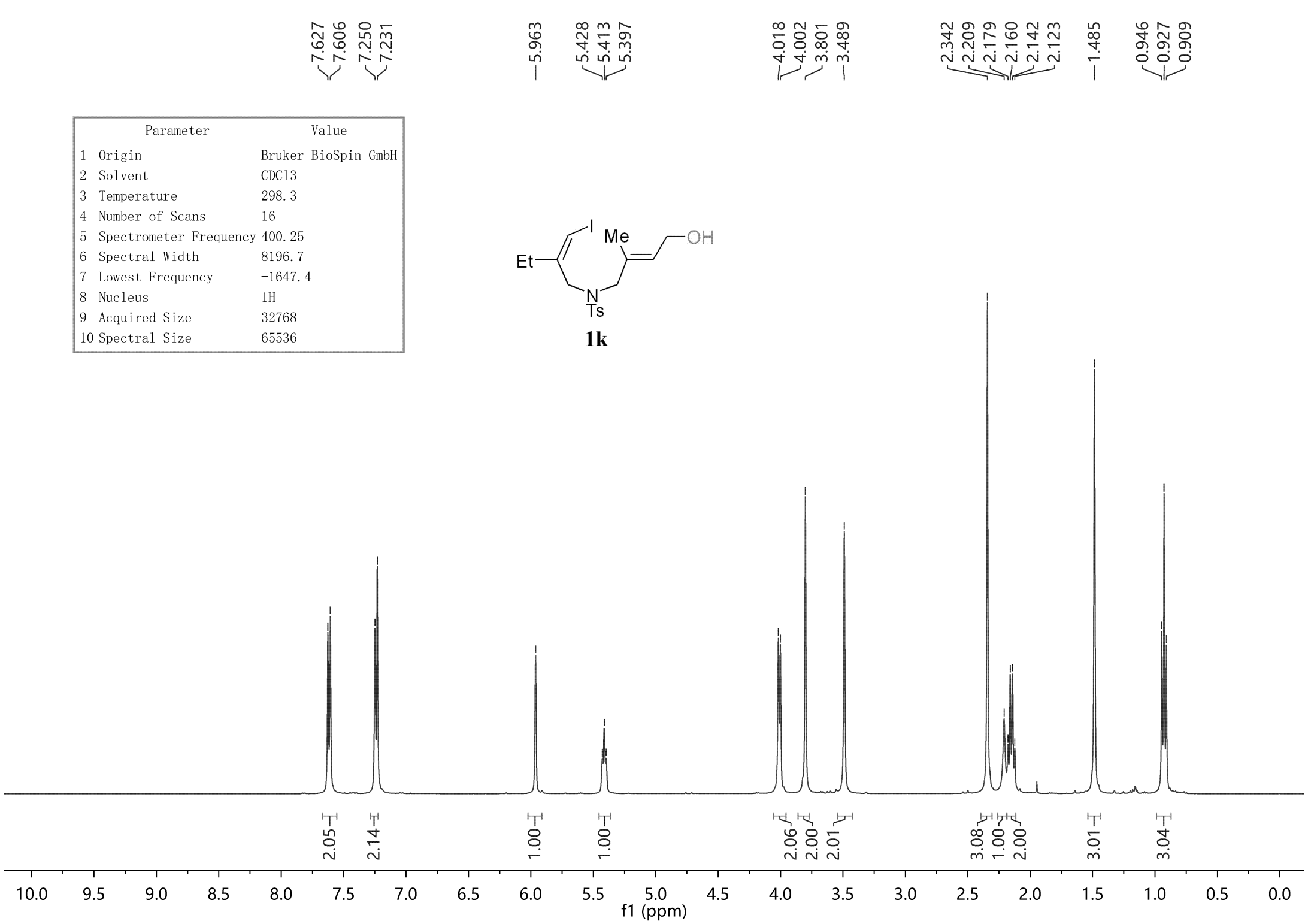


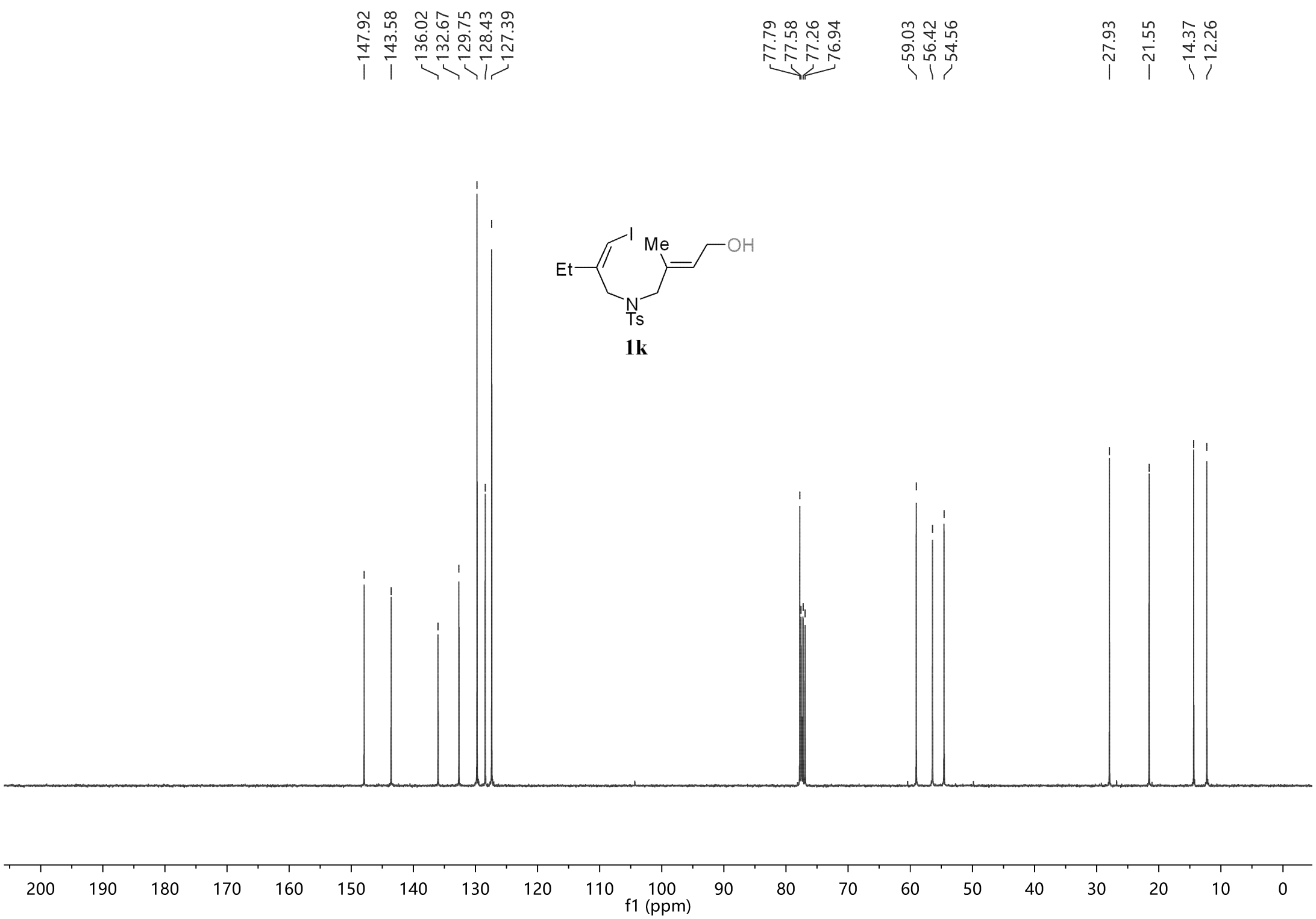

| | Parameter | Value |
|---|---|---|
| 1 | Origin | Bruker BioSpin GmbH |
| 2 | Solvent | CDCl3 |
| 3 | Temperature | 0.0 |
| 4 | Number of Scans | 200 |
| 5 | Spectrometer Frequency | 100.61 |
| 6 | Spectral Width | 24038.5 |
| 7 | Lowest Frequency | -1958.9 |
| 8 | Nucleus | 13C |
| 9 | Acquired Size | 32768 |
| 10 | Spectral Size | 32768 |

| | Parameter | Value |
|---|---|---|
| 1 | Origin | Bruker BioSpin GmbH |
| 2 | Solvent | CDCl3 |
| 3 | Temperature | 298.3 |
| 4 | Number of Scans | 16 |
| 5 | Spectrometer Frequency | 400.25 |
| 6 | Spectral Width | 8196.7 |
| 7 | Lowest Frequency | -1647.4 |
| 8 | Nucleus | 1H |
| 9 | Acquired Size | 32768 |
| 10 | Spectral Size | 65536 |




**1k**

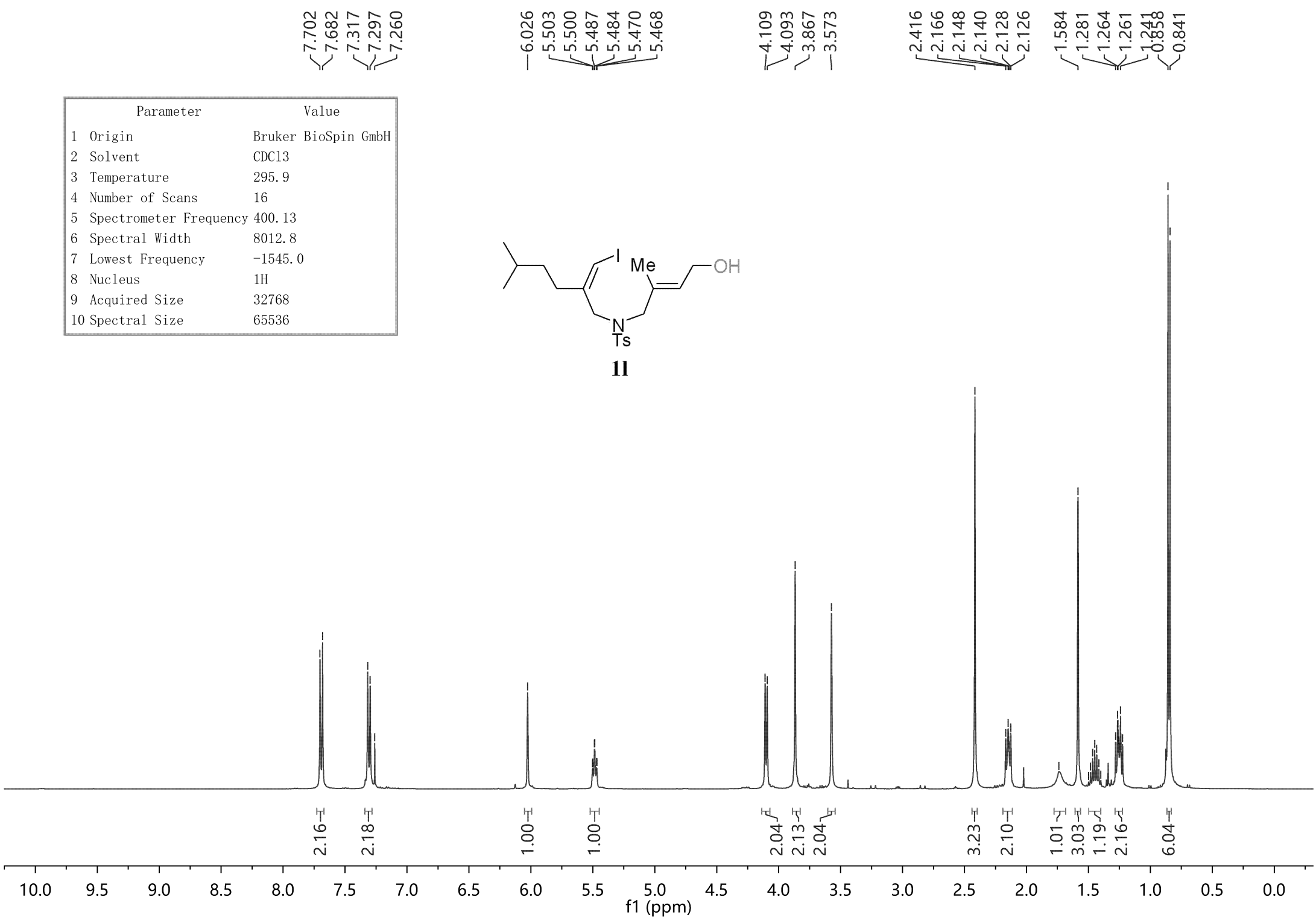


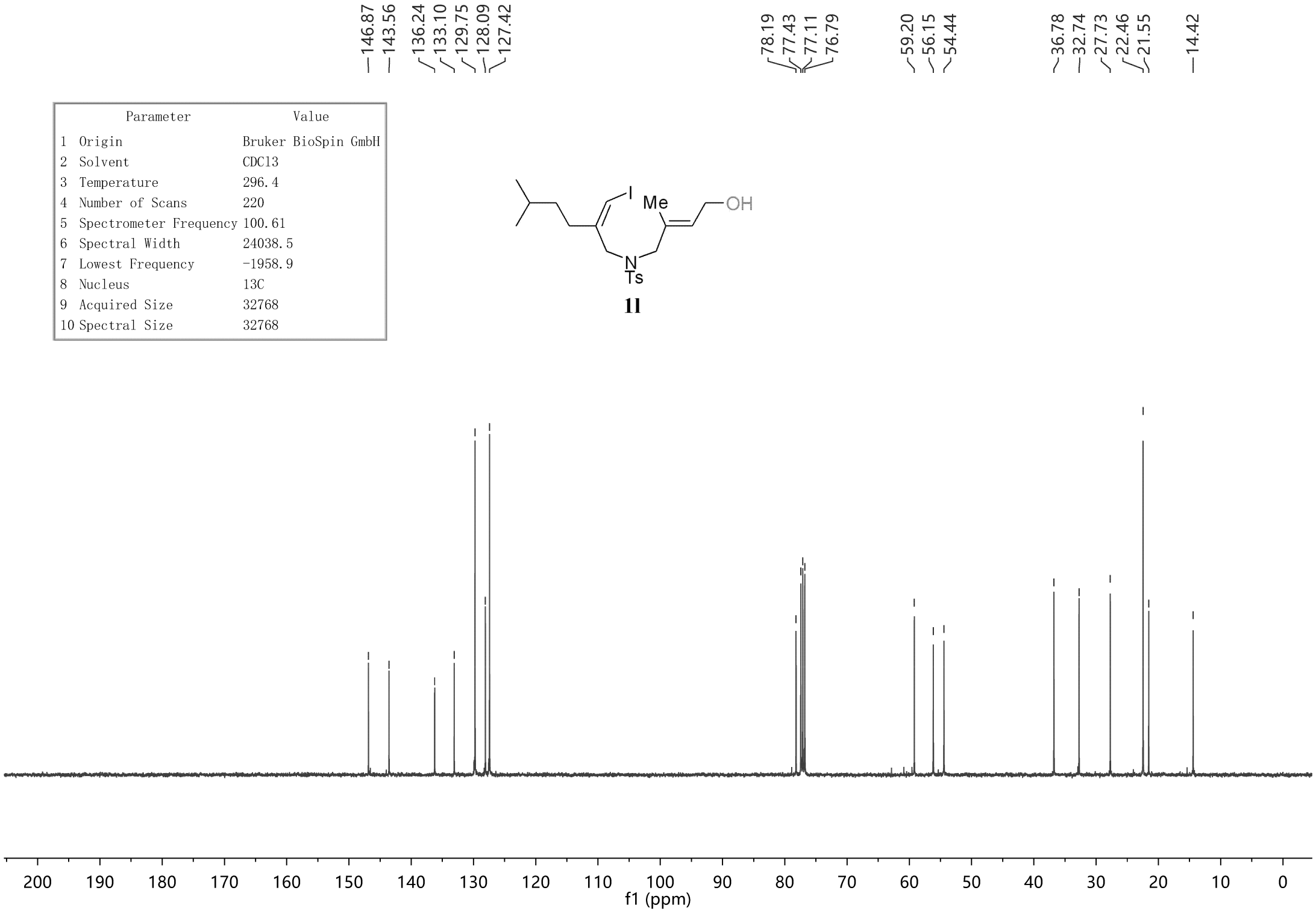

147.92
143.58
136.02
132.67
129.75
128.43
127.39
77.79
77.58
77.26
76.94
59.03
56.42
54.56
27.93
21.55
14.37
12.26
I
Me
OH
Et
N
Ts
1k
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

| | Parameter | Value |
|---|---|---|
| 1 | Origin | Bruker BioSpin GmbH |
| 2 | Solvent | CDCl3 |
| 3 | Temperature | 295.9 |
| 4 | Number of Scans | 16 |
| 5 | Spectrometer Frequency | 400.13 |
| 6 | Spectral Width | 8012.8 |
| 7 | Lowest Frequency | -1545.0 |
| 8 | Nucleus | 1H |
| 9 | Acquired Size | 32768 |
| 10 | Spectral Size | 65536 |



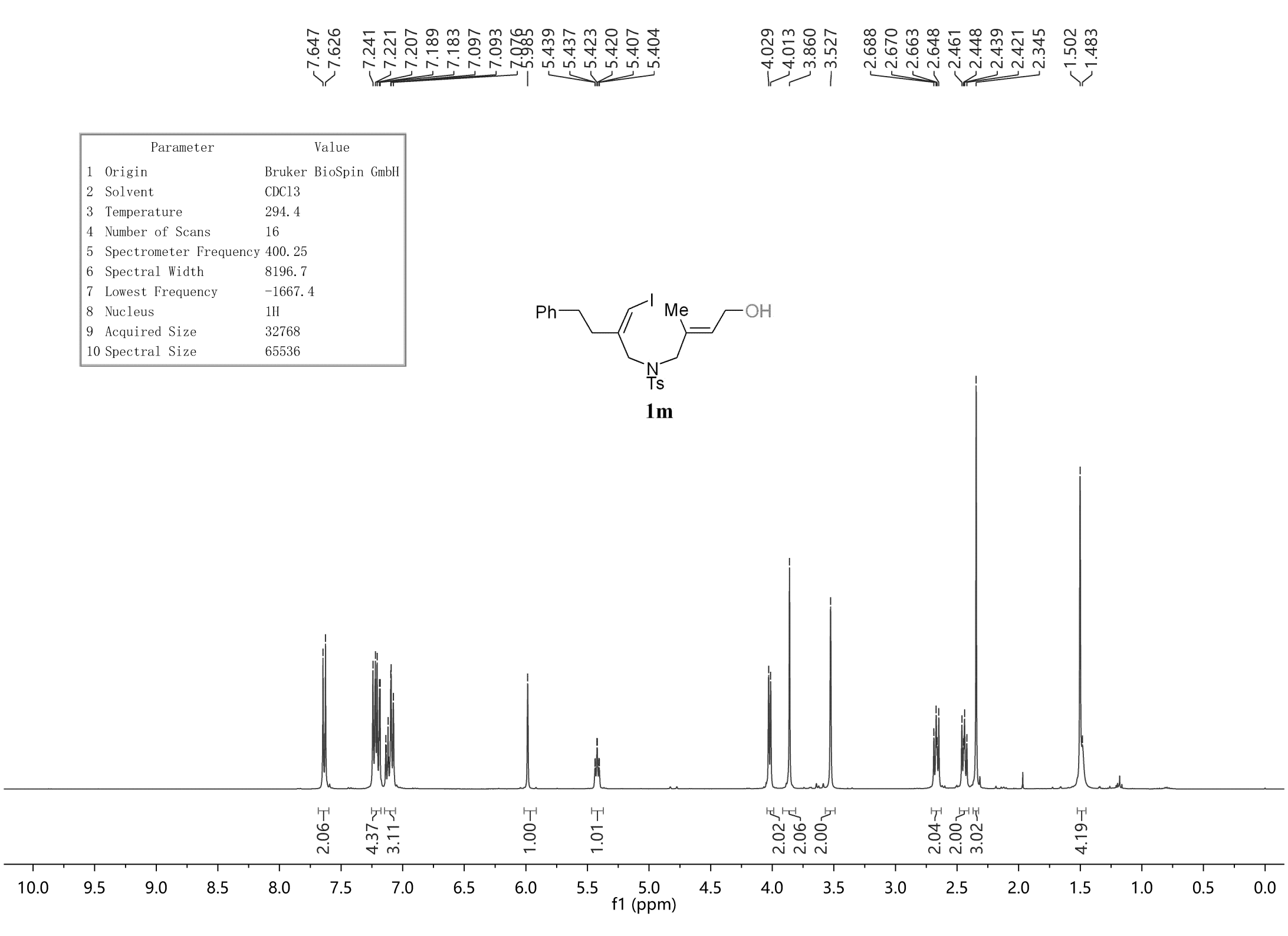

**1l**

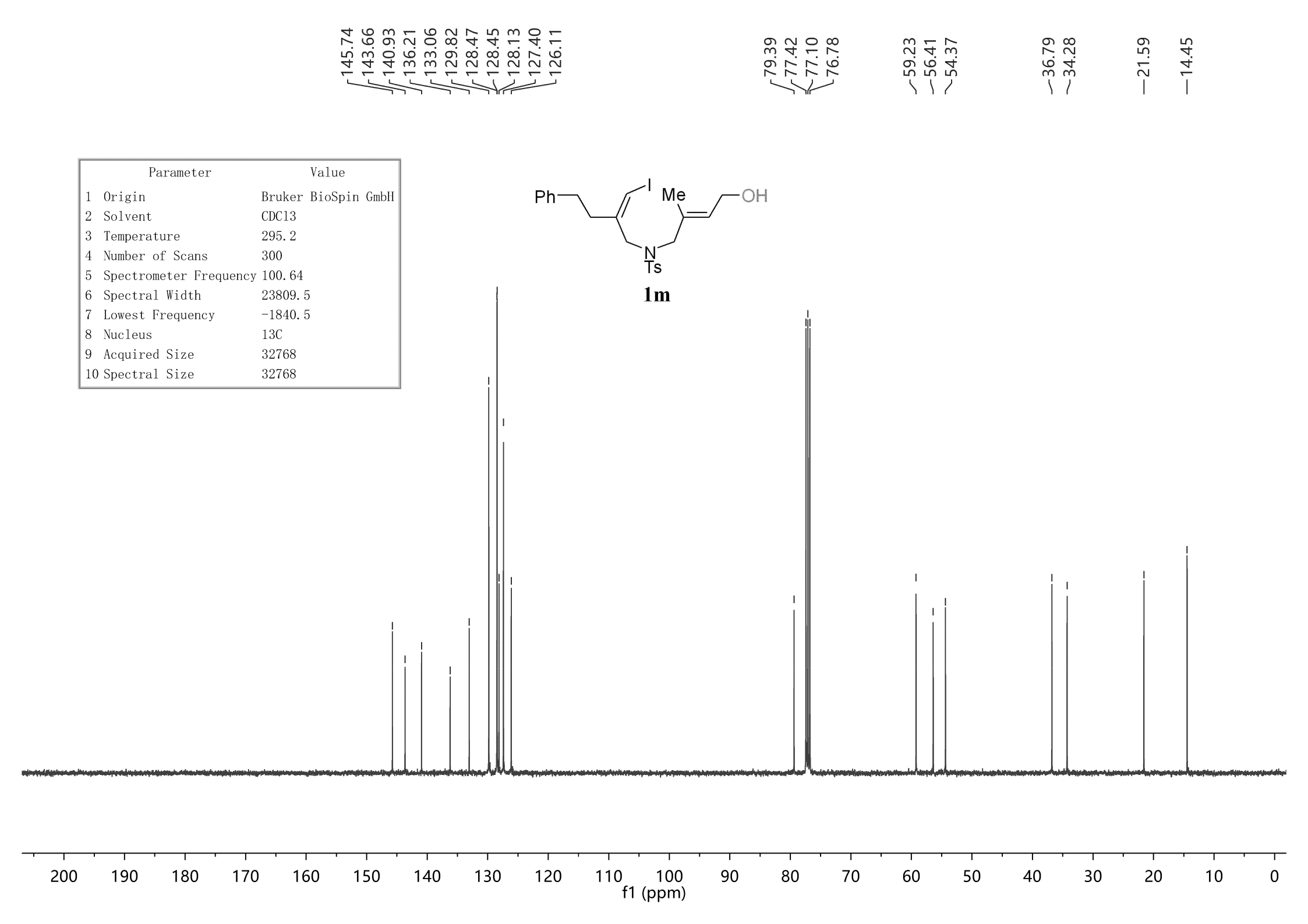





| Parameter | Value |
|---|---|
| 1 Origin | Bruker BioSpin GmbH |
| 2 Solvent | CDCl3 |
| 3 Temperature | 296.4 |
| 4 Number of Scans | 220 |
| 5 Spectrometer Frequency | 100.61 |
| 6 Spectral Width | 24038.5 |
| 7 Lowest Frequency | -1958.9 |
| 8 Nucleus | 13C |
| 9 Acquired Size | 32768 |
| 10 Spectral Size | 32768 |

**1l**

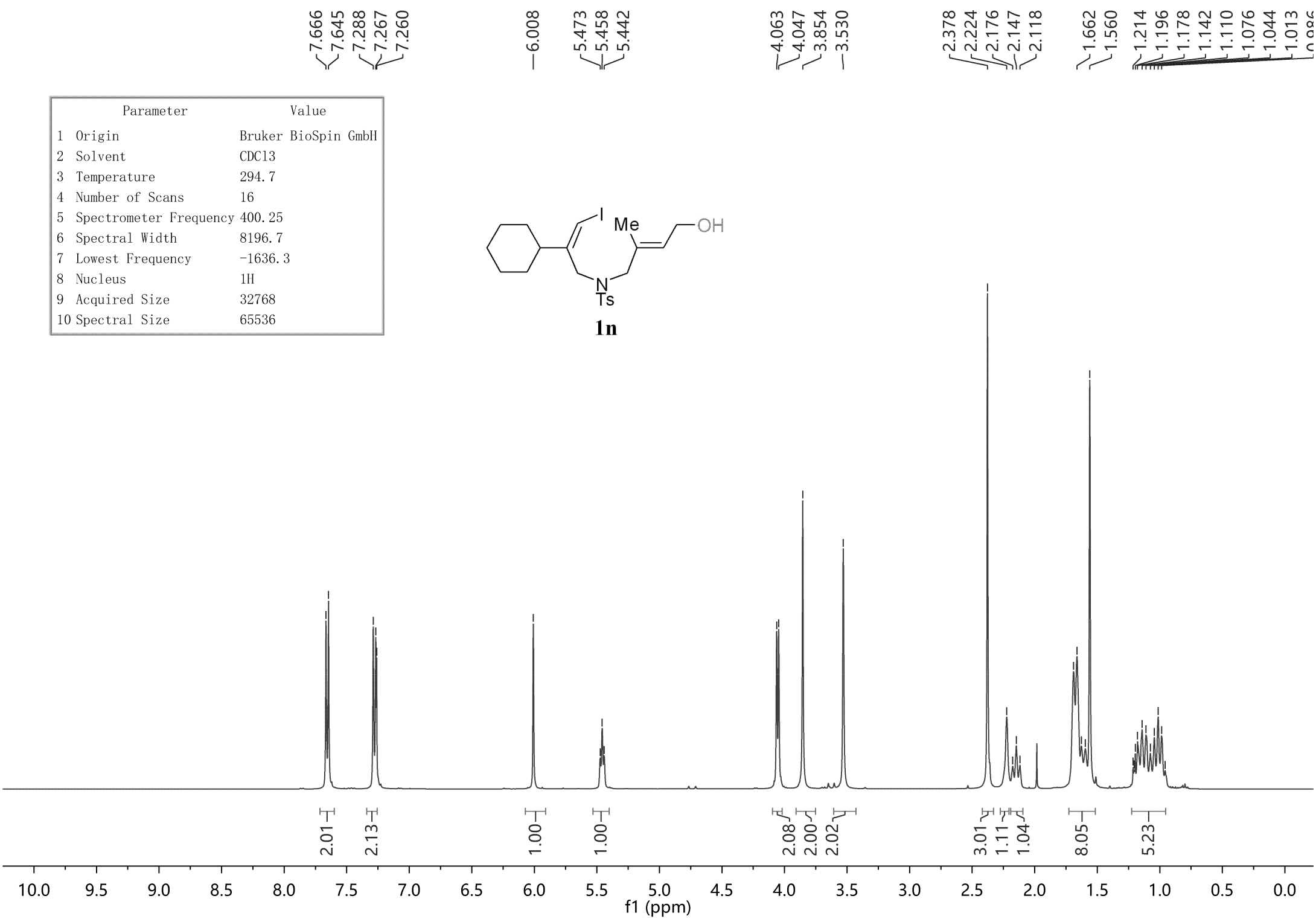

7.647
7.626
7.241
7.221
7.207
7.189
7.183
7.097
7.093
7.076
5.985
5.439
5.437
5.423
5.420
5.407
5.404
4.029
4.013
3.860
3.527
2.688
2.670
2.663
2.648
2.461
2.448
2.439
2.421
2.345
1.502
1.483
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 294.4
4 Number of Scans 16
5 Spectrometer Frequency 400.25
6 Spectral Width 8196.7
7 Lowest Frequency -1667.4
8 Nucleus 1H
9 Acquired Size 32768
10 Spectral Size 65536
Ph
I
Me
OH
N
Ts
1m
2.06
4.37
3.11
1.00
1.01
2.02
2.06
2.00
2.04
2.00
3.02
4.19
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

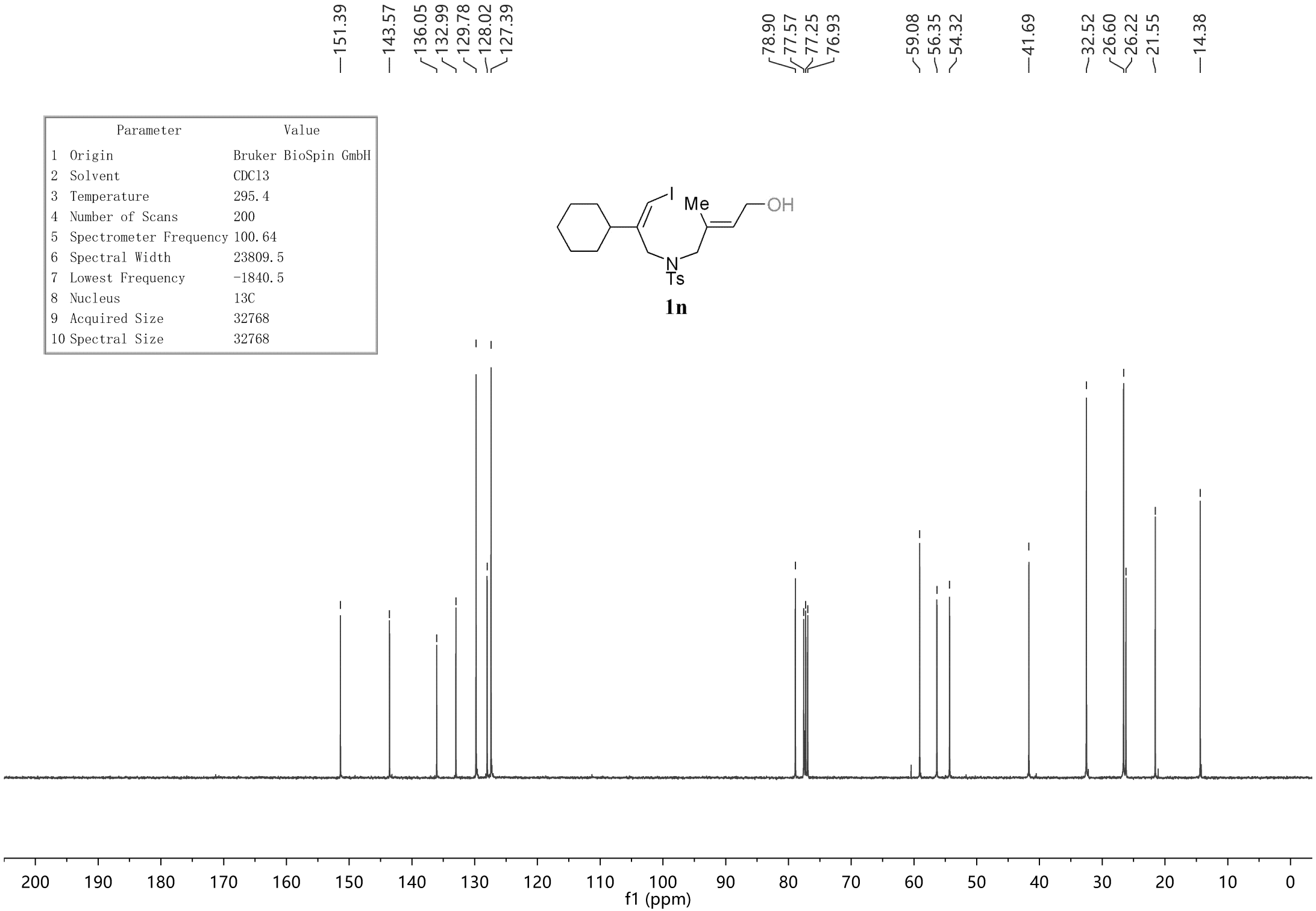

145.74
143.66
140.93
136.21
133.06
129.82
128.47
128.45
128.13
127.40
126.11
79.39
77.42
77.10
76.78
59.23
56.41
54.37
36.79
34.28
21.59
14.45
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 295.2
4 Number of Scans 300
5 Spectrometer Frequency 100.64
6 Spectral Width 23809.5
7 Lowest Frequency -1840.5
8 Nucleus 13C
9 Acquired Size 32768
10 Spectral Size 32768
Ph
I
Me
OH
N
Ts
1m
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

| | Parameter | Value |
|---|---|---|
| 1 | Origin | Bruker BioSpin GmbH |
| 2 | Solvent | CDCl3 |
| 3 | Temperature | 294.7 |
| 4 | Number of Scans | 16 |
| 5 | Spectrometer Frequency | 400.25 |
| 6 | Spectral Width | 8196.7 |
| 7 | Lowest Frequency | -1636.3 |
| 8 | Nucleus | 1H |
| 9 | Acquired Size | 32768 |
| 10 | Spectral Size | 65536 |

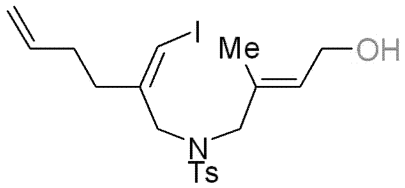



**1n**

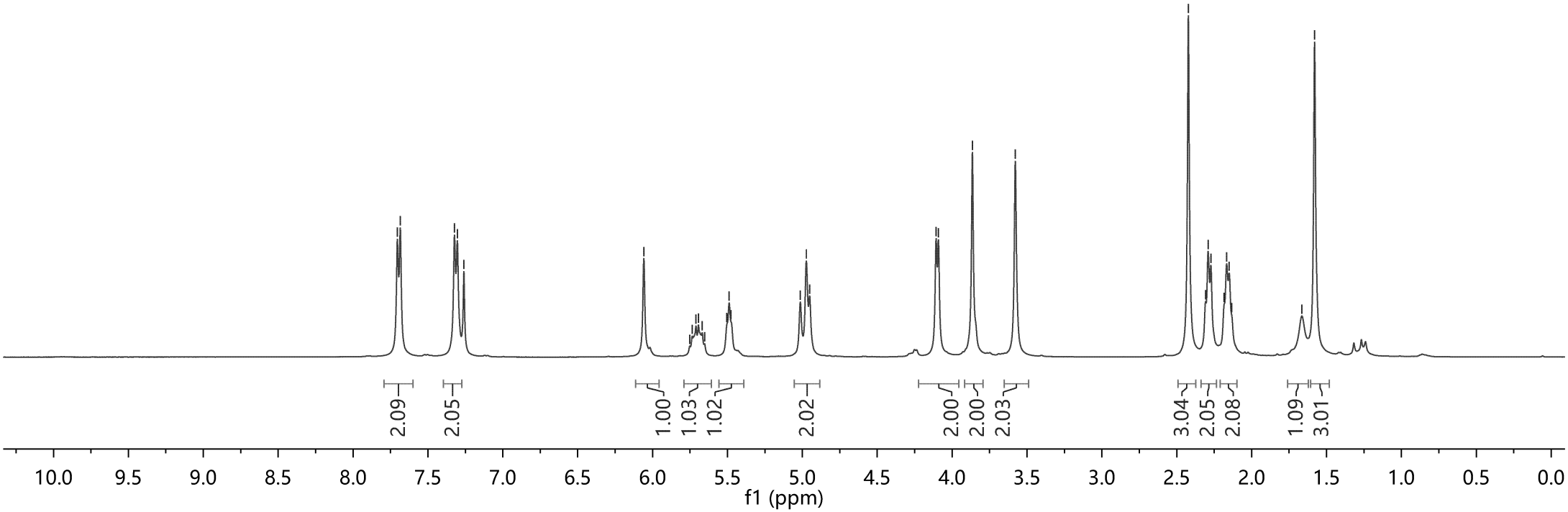


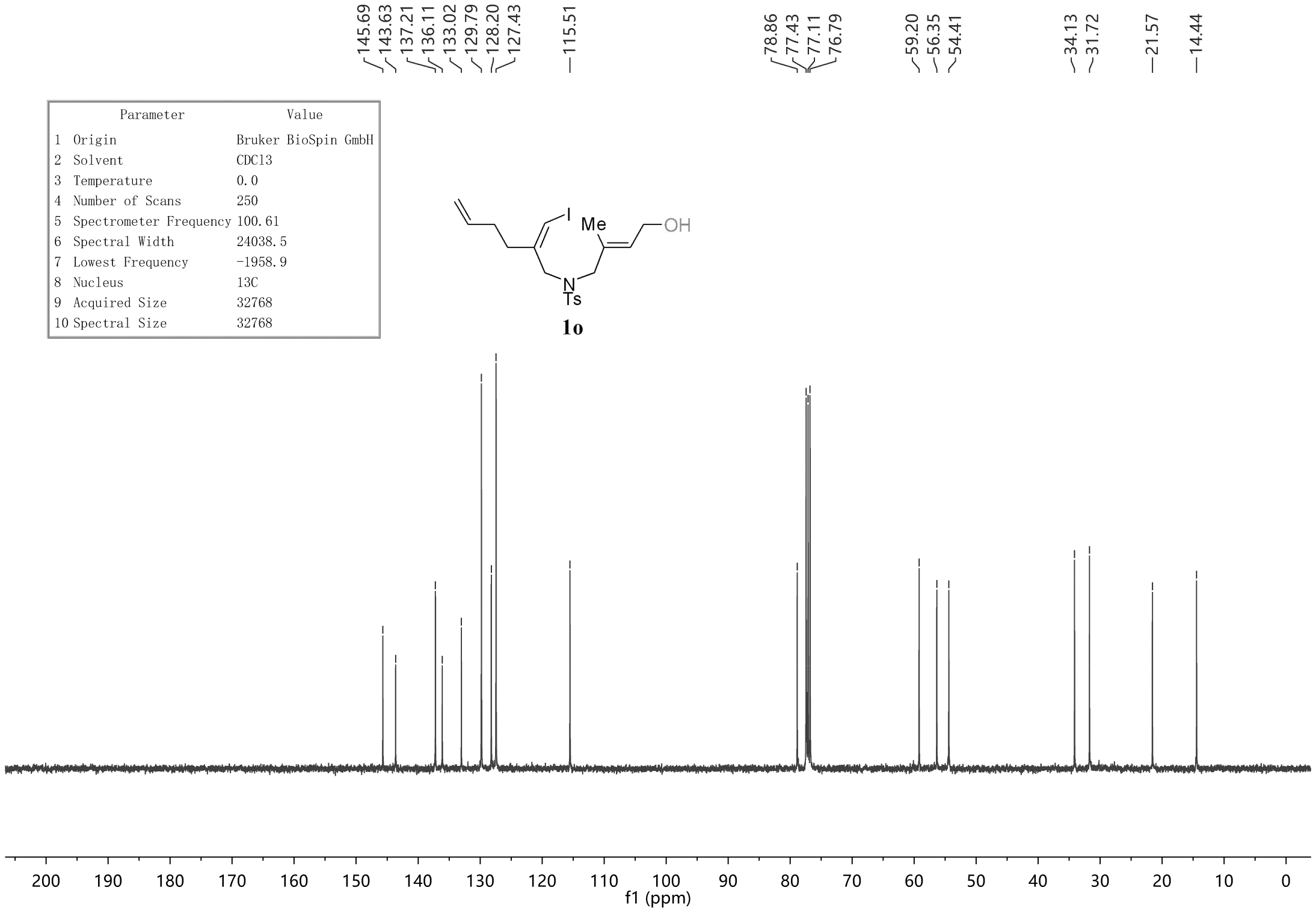

151.39
143.57
136.05
132.99
129.78
128.02
127.39
78.90
77.57
77.25
76.93
59.08
56.35
54.32
41.69
32.52
26.60
26.22
21.55
14.38
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 295.4
4 Number of Scans 200
5 Spectrometer Frequency 100.64
6 Spectral Width 23809.5
7 Lowest Frequency -1840.5
8 Nucleus 13C
9 Acquired Size 32768
10 Spectral Size 32768
I
Me
OH
N
Ts
1n
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)


| | Parameter | Value |
|---|---|---|
| 1 | Origin | Bruker BioSpin GmbH |
| 2 | Solvent | CDCl3 |
| 3 | Temperature | 0.0 |
| 4 | Number of Scans | 16 |
| 5 | Spectrometer Frequency | 400.13 |
| 6 | Spectral Width | 8012.8 |
| 7 | Lowest Frequency | -1545.7 |
| 8 | Nucleus | 1H |
| 9 | Acquired Size | 32768 |
| 10 | Spectral Size | 65536 |




**1o**





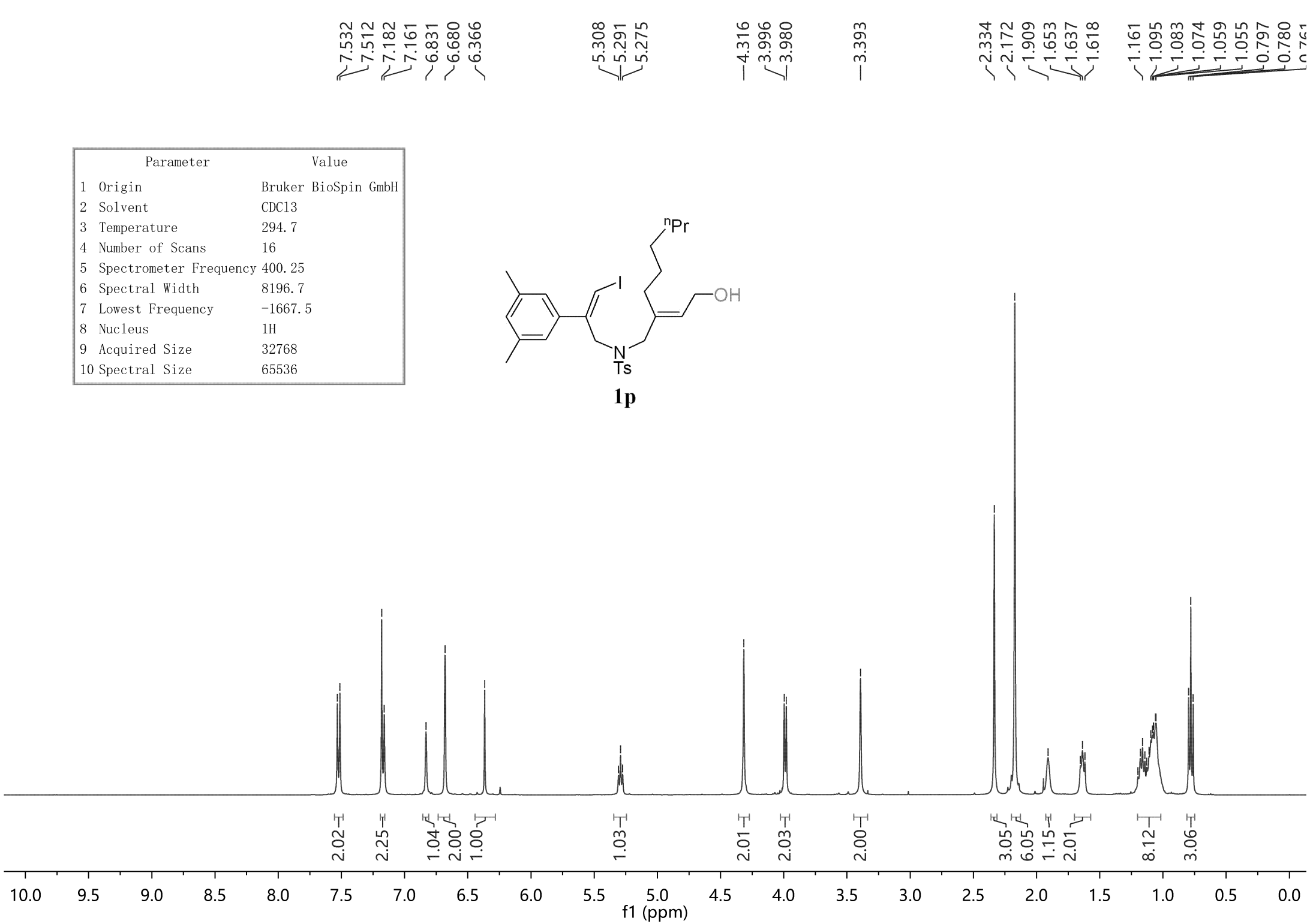

| | Parameter | Value |
|---|---|---|
| 1 | Origin | Bruker BioSpin GmbH |
| 2 | Solvent | CDCl3 |
| 3 | Temperature | 0.0 |
| 4 | Number of Scans | 250 |
| 5 | Spectrometer Frequency | 100.61 |
| 6 | Spectral Width | 24038.5 |
| 7 | Lowest Frequency | -1958.9 |
| 8 | Nucleus | 13C |
| 9 | Acquired Size | 32768 |
| 10 | Spectral Size | 32768 |

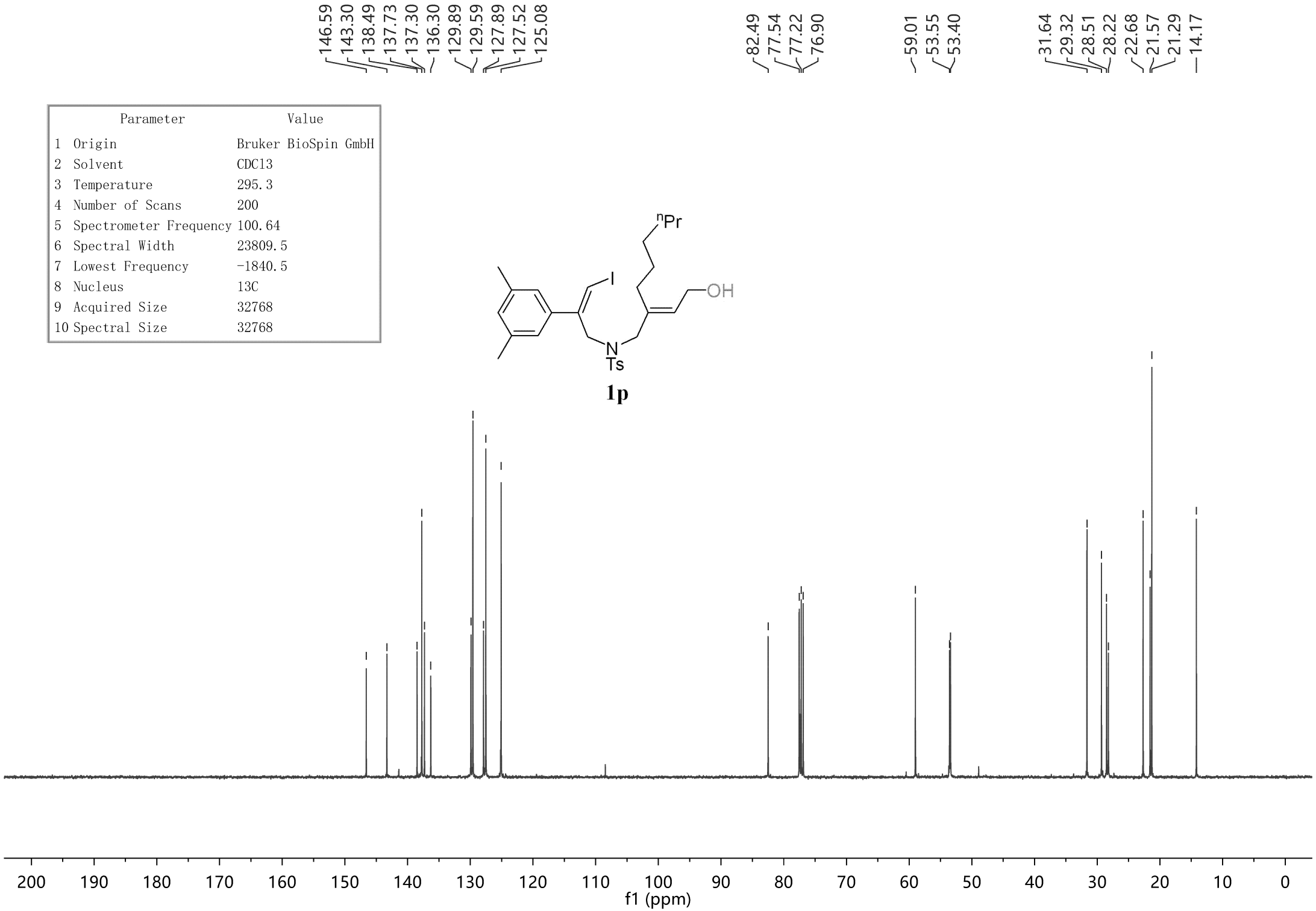
**1o**

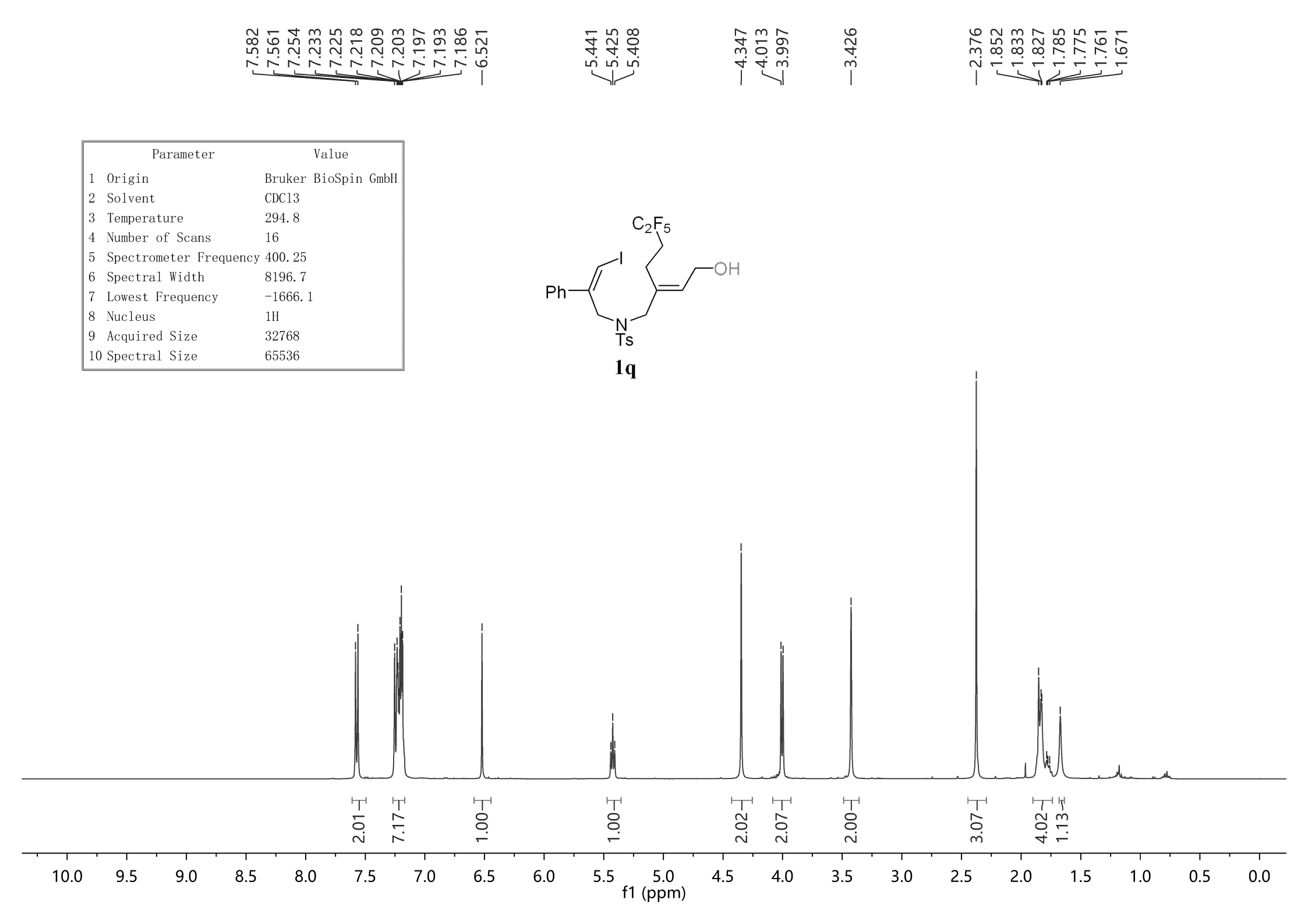
| | Parameter | Value |
|---|---|---|
| 1 | Origin | Bruker BioSpin GmbH |
| 2 | Solvent | CDCl3 |
| 3 | Temperature | 294.7 |
| 4 | Number of Scans | 16 |
| 5 | Spectrometer Frequency | 400.25 |
| 6 | Spectral Width | 8196.7 |
| 7 | Lowest Frequency | -1667.5 |
| 8 | Nucleus | 1H |
| 9 | Acquired Size | 32768 |
| 10 | Spectral Size | 65536 |

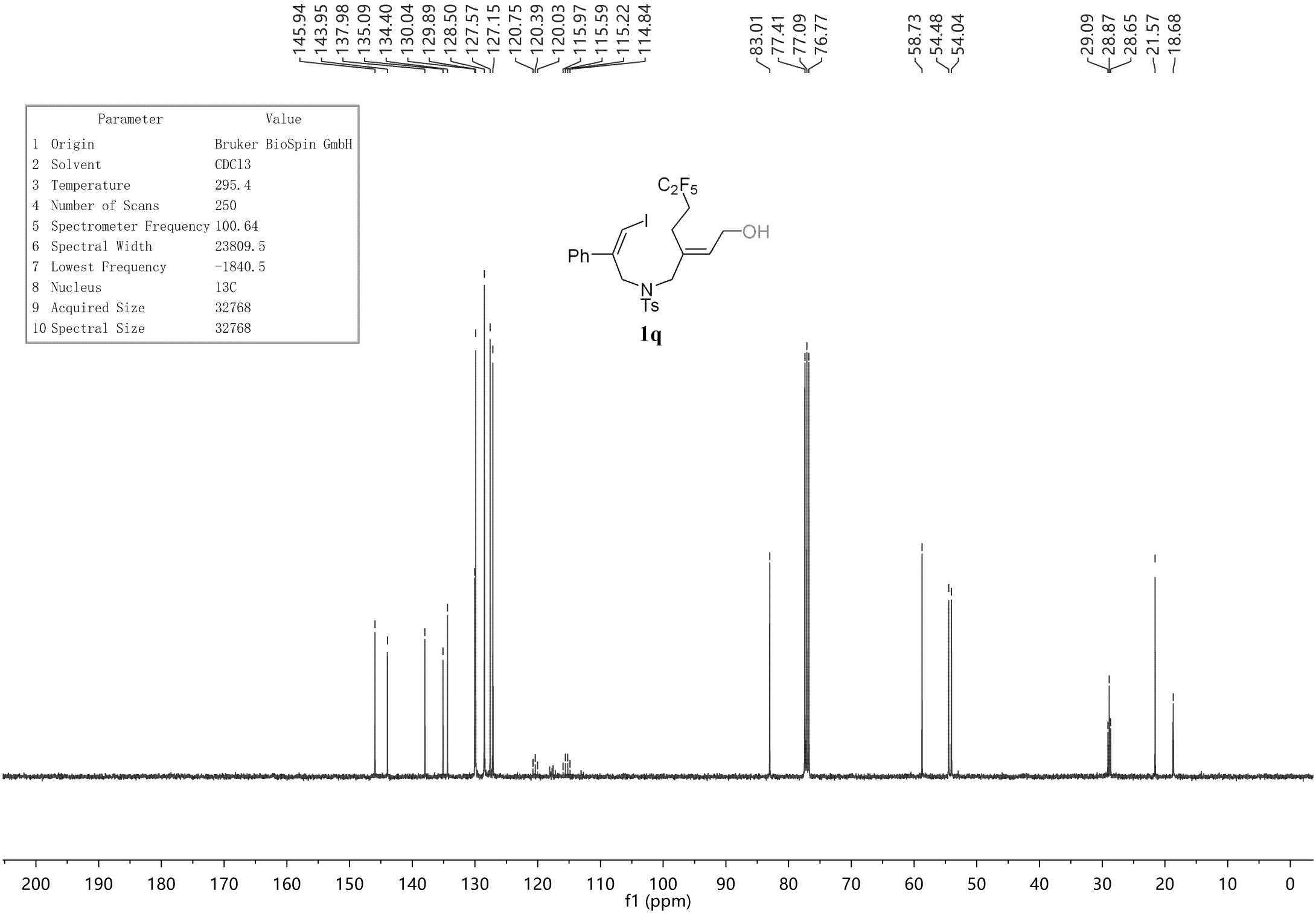



**1p**




146.59
143.30
138.49
137.73
137.30
136.30
129.89
129.59
127.89
127.52
125.08
82.49
77.54
77.22
76.90
59.01
53.55
53.40
31.64
29.32
28.51
28.22
22.68
21.57
21.29
14.17
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 295.3
4 Number of Scans 200
5 Spectrometer Frequency 100.64
6 Spectral Width 23809.5
7 Lowest Frequency -1840.5
8 Nucleus 13C
9 Acquired Size 32768
10 Spectral Size 32768
nPr
I
OH
N
Ts
1p
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

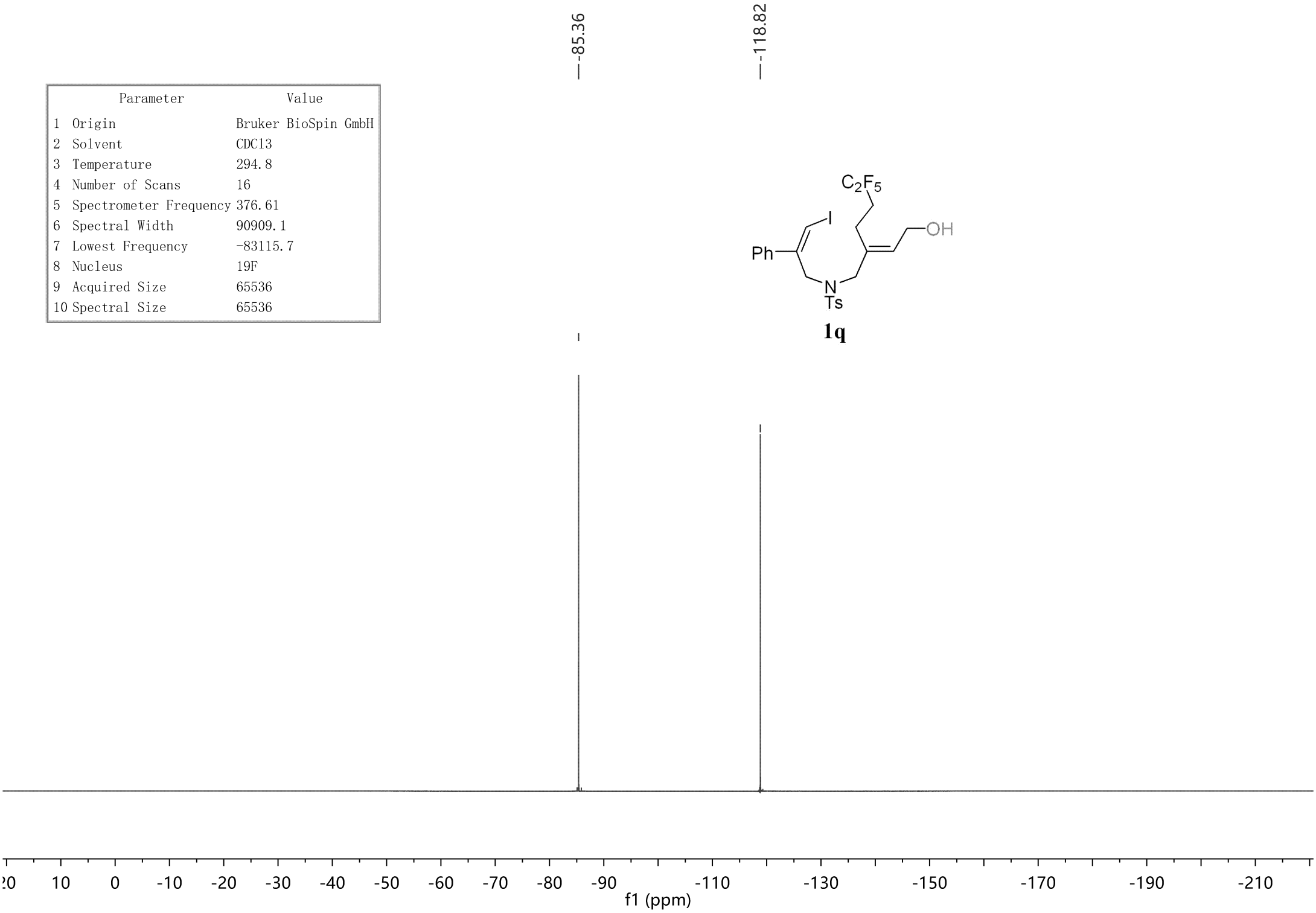

7.582
7.561
7.254
7.233
7.225
7.218
7.209
7.203
7.197
7.193
7.186
6.521
5.441
5.425
5.408
4.347
4.013
3.997
3.426
2.376
1.852
1.833
1.827
1.785
1.775
1.761
1.671
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 294.8
4 Number of Scans 16
5 Spectrometer Frequency 400.25
6 Spectral Width 8196.7
7 Lowest Frequency -1666.1
8 Nucleus 1H
9 Acquired Size 32768
10 Spectral Size 65536
C2F5
I
OH
Ph
N
Ts
1q
2.01
7.17
1.00
1.00
2.02
2.07
2.00
3.07
4.02
1.13
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)

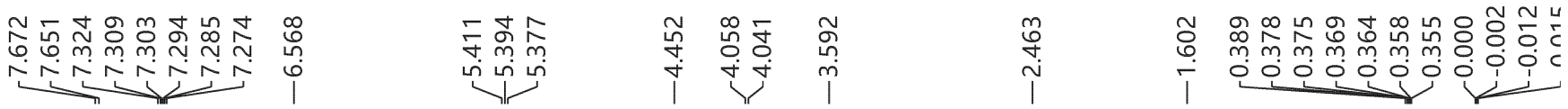

145.94
143.95
137.98
135.09
134.40
130.04
129.89
128.50
127.57
127.15
120.75
120.39
120.03
115.97
115.59
115.22
114.84
83.01
77.41
77.09
76.77
58.73
54.48
54.04
29.09
28.87
28.65
21.57
18.68
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 295.4
4 Number of Scans 250
5 Spectrometer Frequency 100.64
6 Spectral Width 23809.5
7 Lowest Frequency -1840.5
8 Nucleus 13C
9 Acquired Size 32768
10 Spectral Size 32768
C2F5
I
OH
Ph
N
Ts
1q
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

| | Parameter | Value |
|---|---|---|
| 1 | Origin | Bruker BioSpin GmbH |
| 2 | Solvent | CDCl3 |
| 3 | Temperature | 294.8 |
| 4 | Number of Scans | 16 |
| 5 | Spectrometer Frequency | 376.61 |
| 6 | Spectral Width | 90909.1 |
| 7 | Lowest Frequency | -83115.7 |
| 8 | Nucleus | 19F |
| 9 | Acquired Size | 65536 |
| 10 | Spectral Size | 65536 |

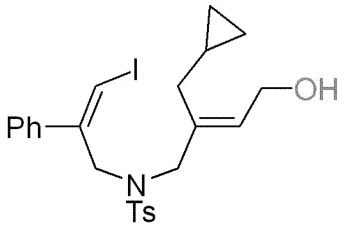



**1q**

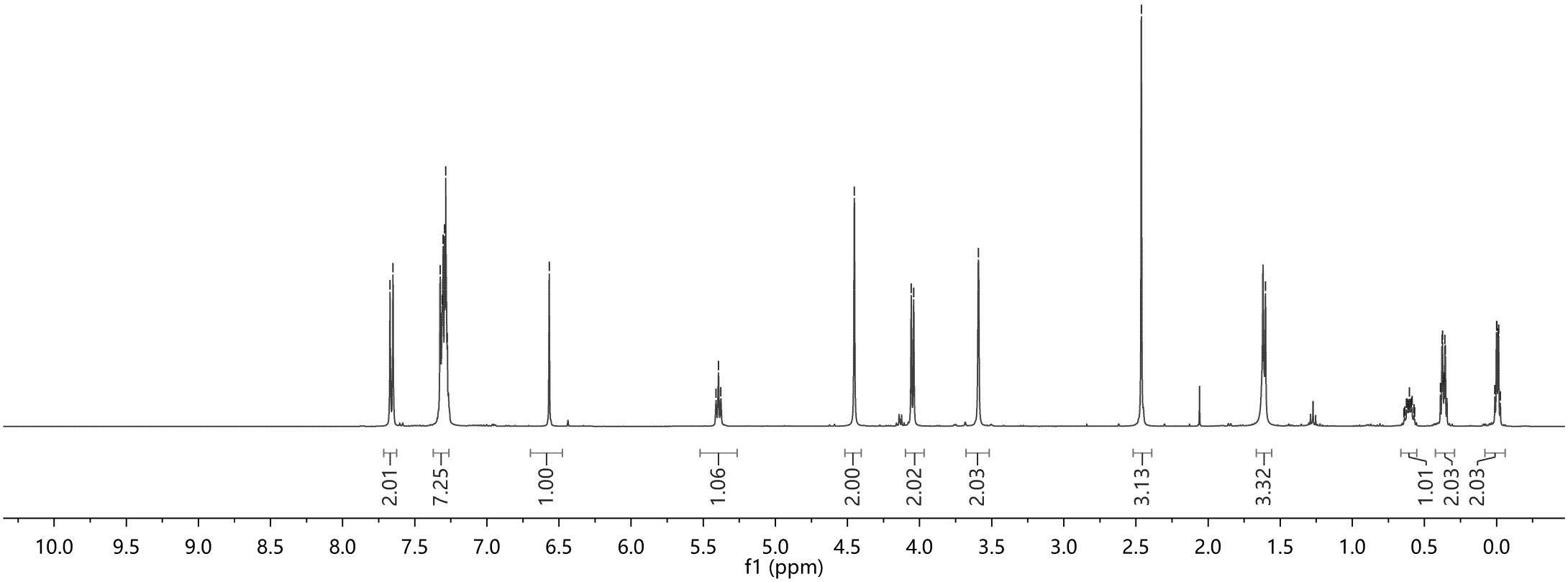


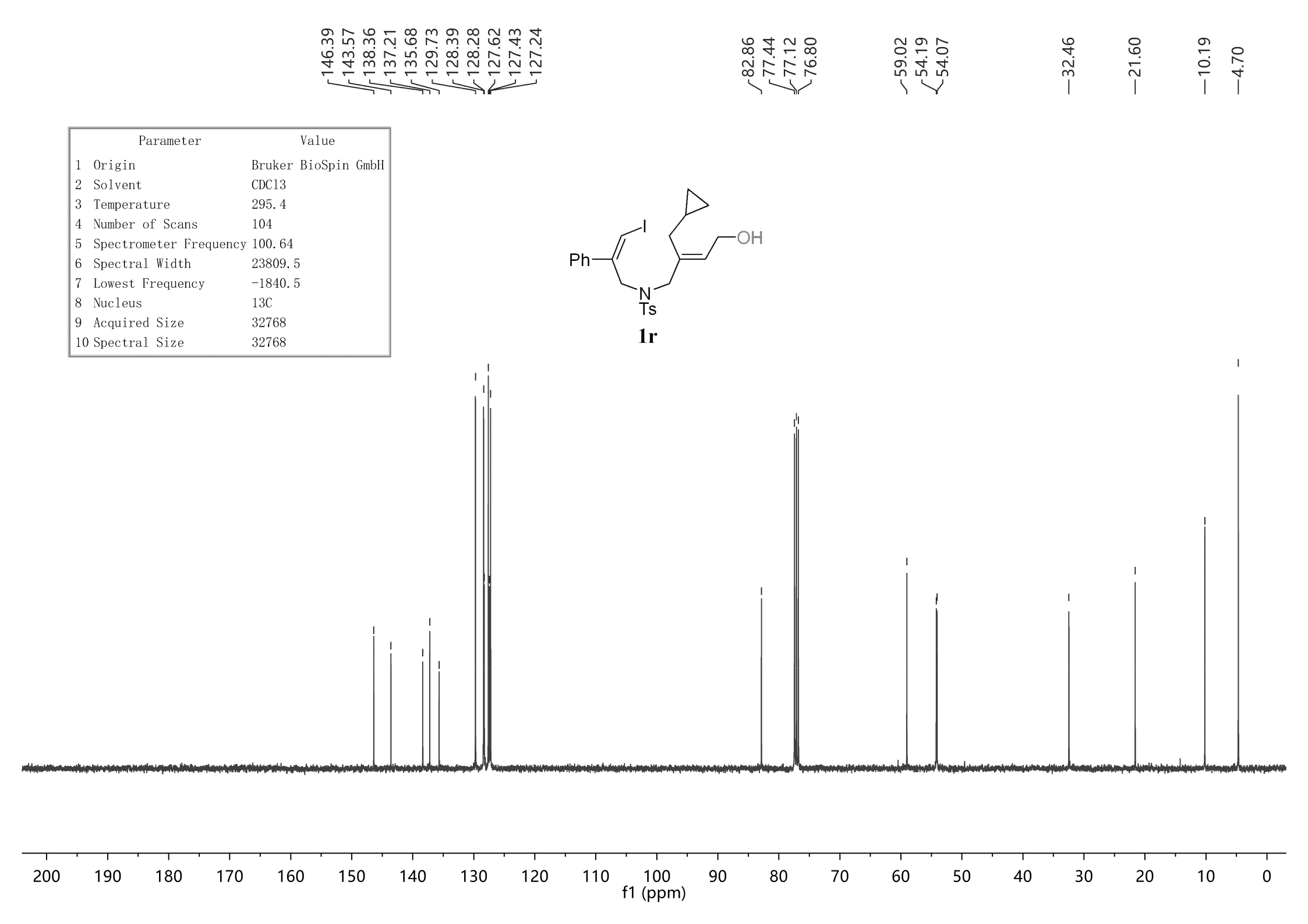


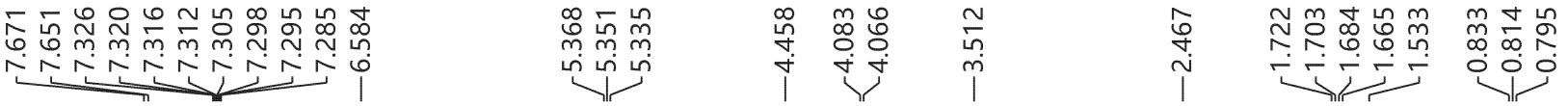

| Parameter | Value |
|---|---|
| 1 Origin | Bruker BioSpin GmbH |
| 2 Solvent | CDCl3 |
| 3 Temperature | 294.7 |
| 4 Number of Scans | 16 |
| 5 Spectrometer Frequency | 400.25 |
| 6 Spectral Width | 8196.7 |
| 7 Lowest Frequency | -1626.3 |
| 8 Nucleus | 1H |
| 9 Acquired Size | 32768 |
| 10 Spectral Size | 65536 |



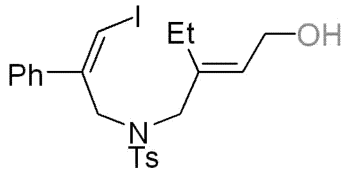

**1r**



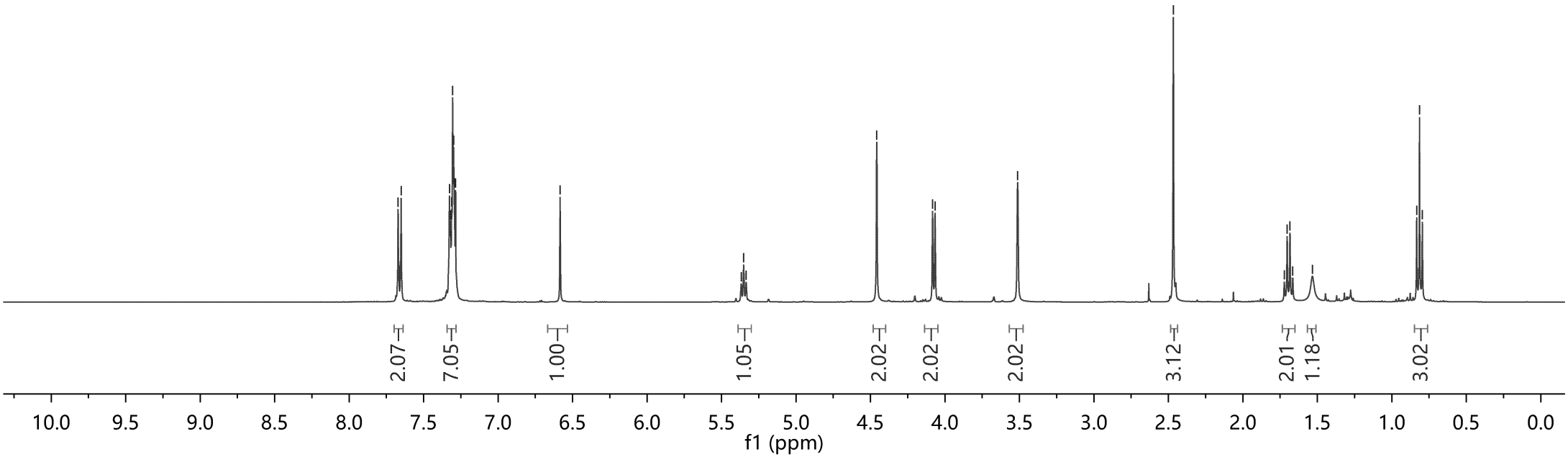

146.39
143.57
138.36
137.21
135.68
129.73
128.39
128.28
127.62
127.43
127.24
82.86
77.44
77.12
76.80
59.02
54.19
54.07
32.46
21.60
10.19
4.70
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 295.4
4 Number of Scans 104
5 Spectrometer Frequency 100.64
6 Spectral Width 23809.5
7 Lowest Frequency -1840.5
8 Nucleus 13C
9 Acquired Size 32768
10 Spectral Size 32768
I
OH
Ph
N
Ts
1r
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

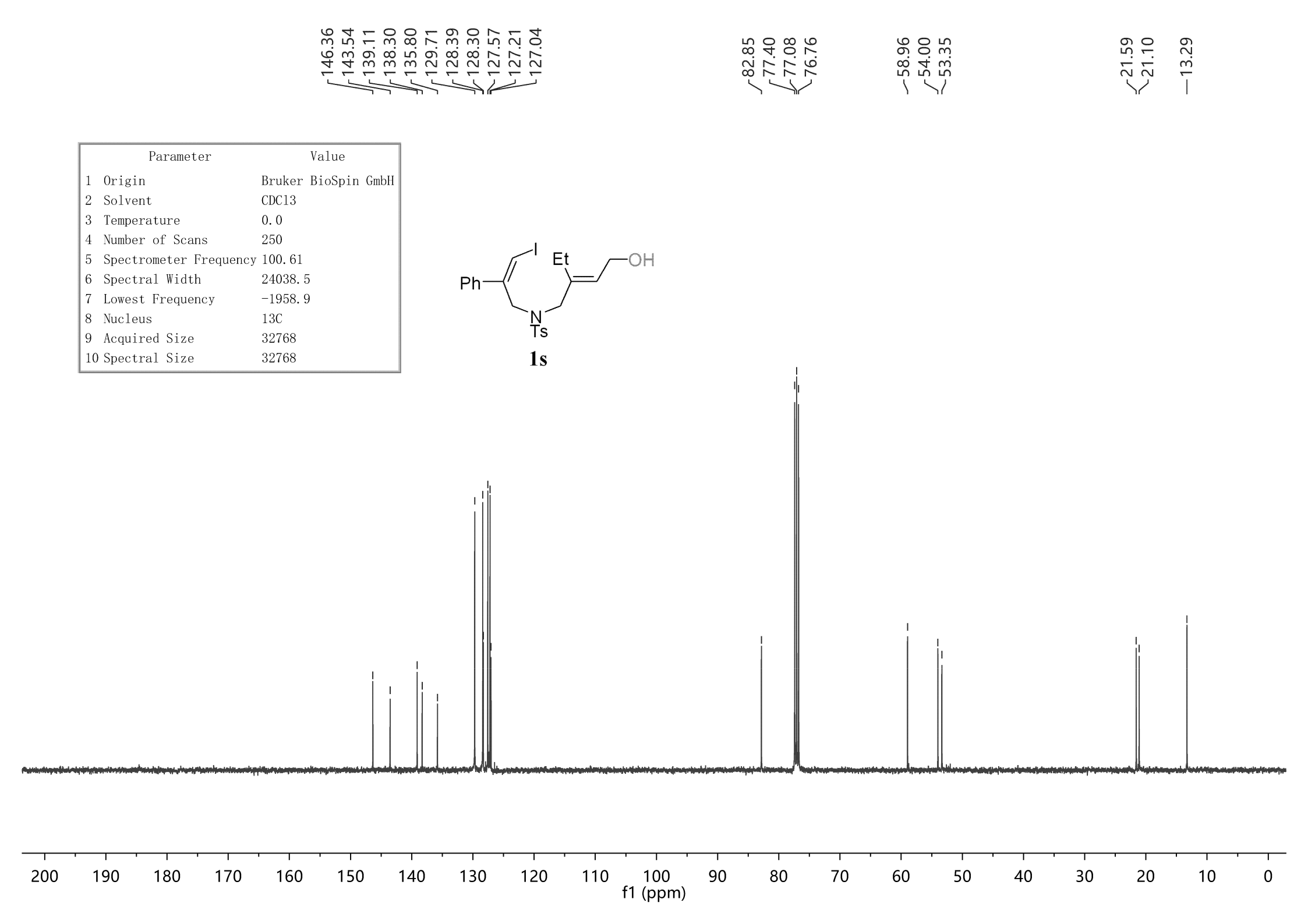


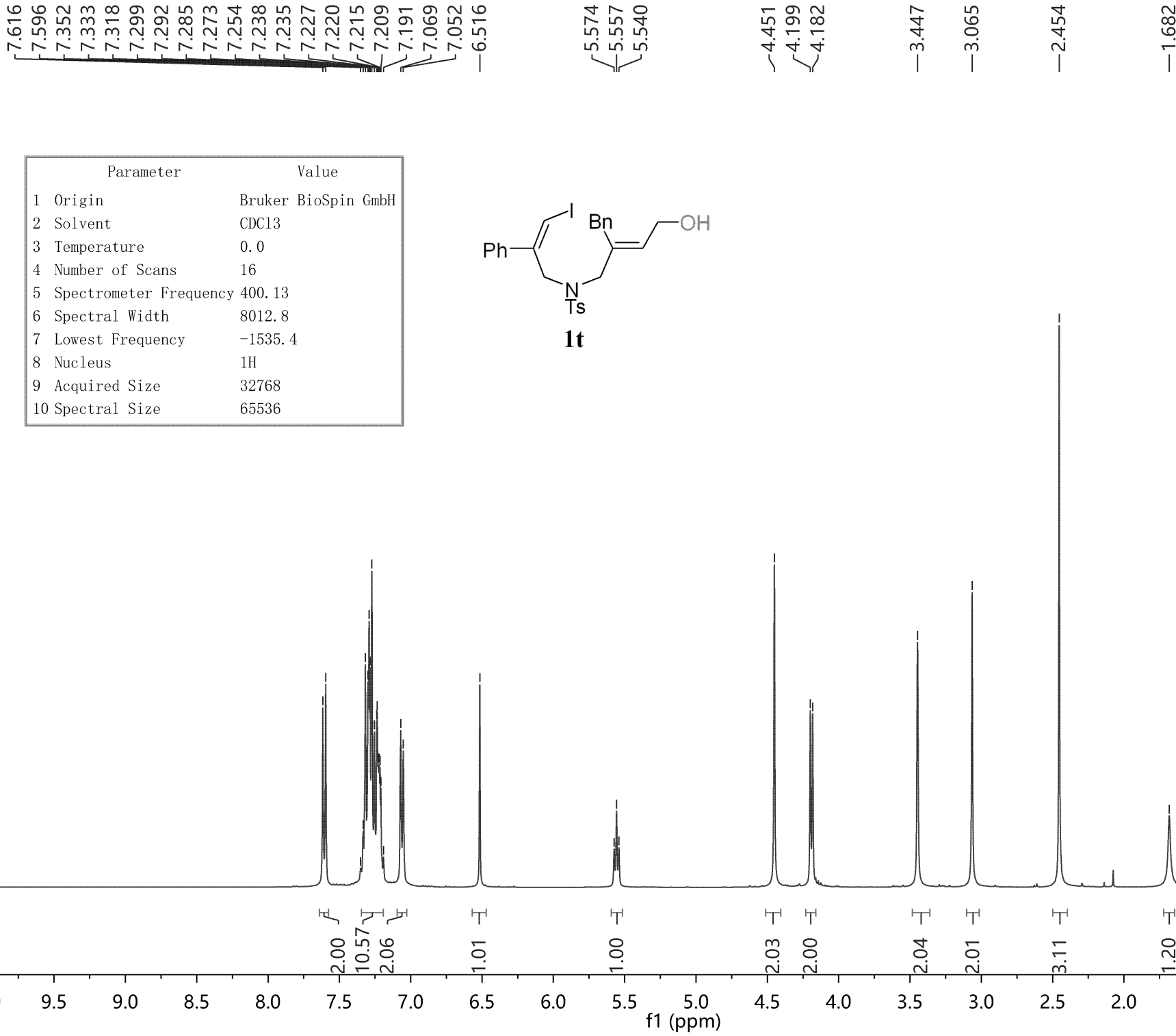

| | Parameter | Value |
|---|---|---|
| 1 | Origin | Bruker BioSpin GmbH |
| 2 | Solvent | CDCl3 |
| 3 | Temperature | 0.0 |
| 4 | Number of Scans | 16 |
| 5 | Spectrometer Frequency | 400.13 |
| 6 | Spectral Width | 8012.8 |
| 7 | Lowest Frequency | -1535.4 |
| 8 | Nucleus | 1H |
| 9 | Acquired Size | 32768 |
| 10 | Spectral Size | 65536 |

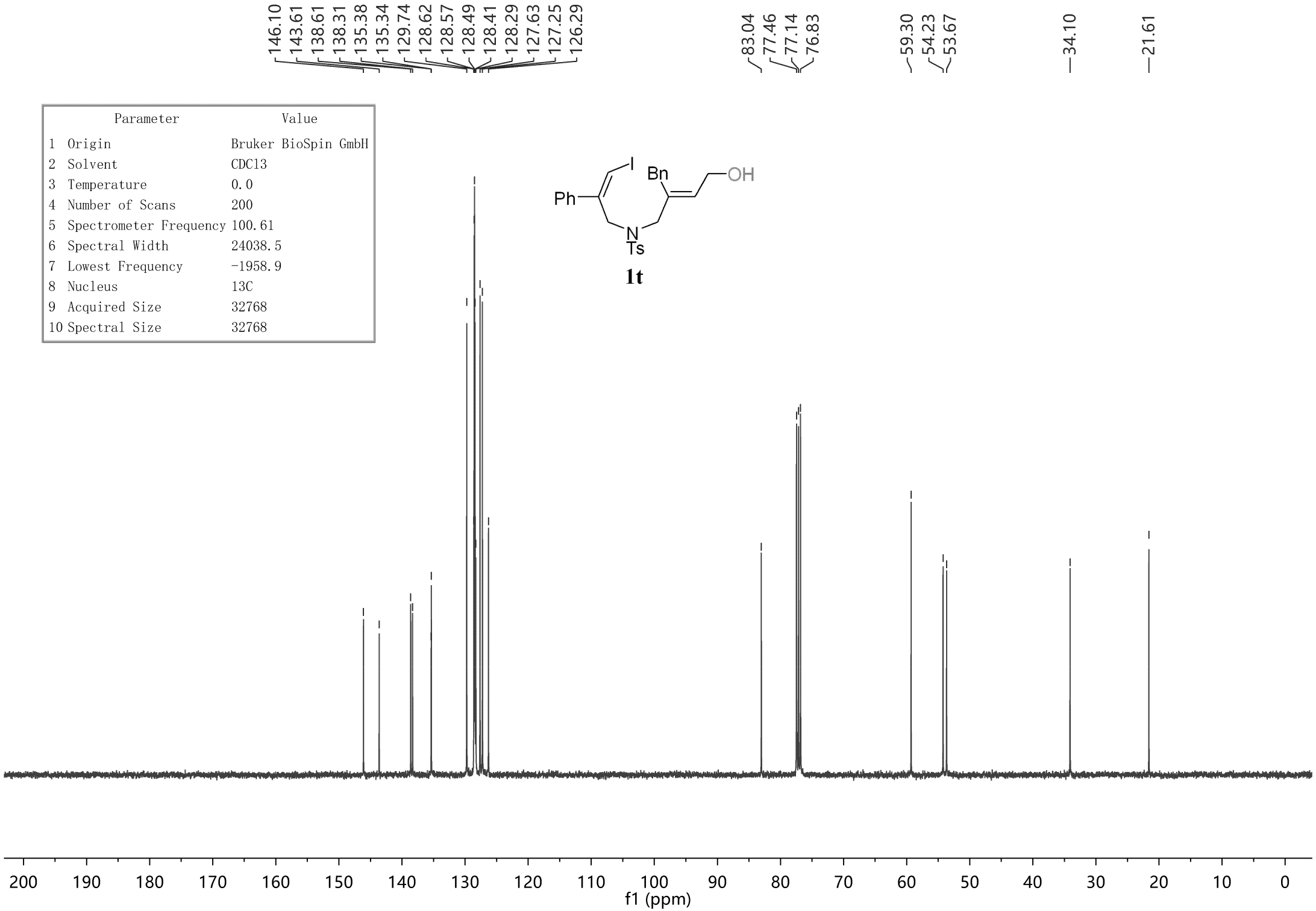



**1s**

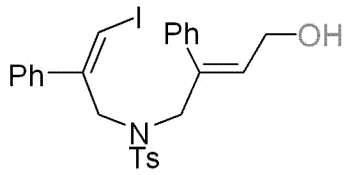



146.36
143.54
139.11
138.30
135.80
129.71
128.39
128.30
127.57
127.21
127.04
82.85
77.40
77.08
76.76
58.96
54.00
53.35
21.59
21.10
13.29
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 0.0
4 Number of Scans 250
5 Spectrometer Frequency 100.61
6 Spectral Width 24038.5
7 Lowest Frequency -1958.9
8 Nucleus 13C
9 Acquired Size 32768
10 Spectral Size 32768
I
Et
OH
Ph
N
Ts
1s
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

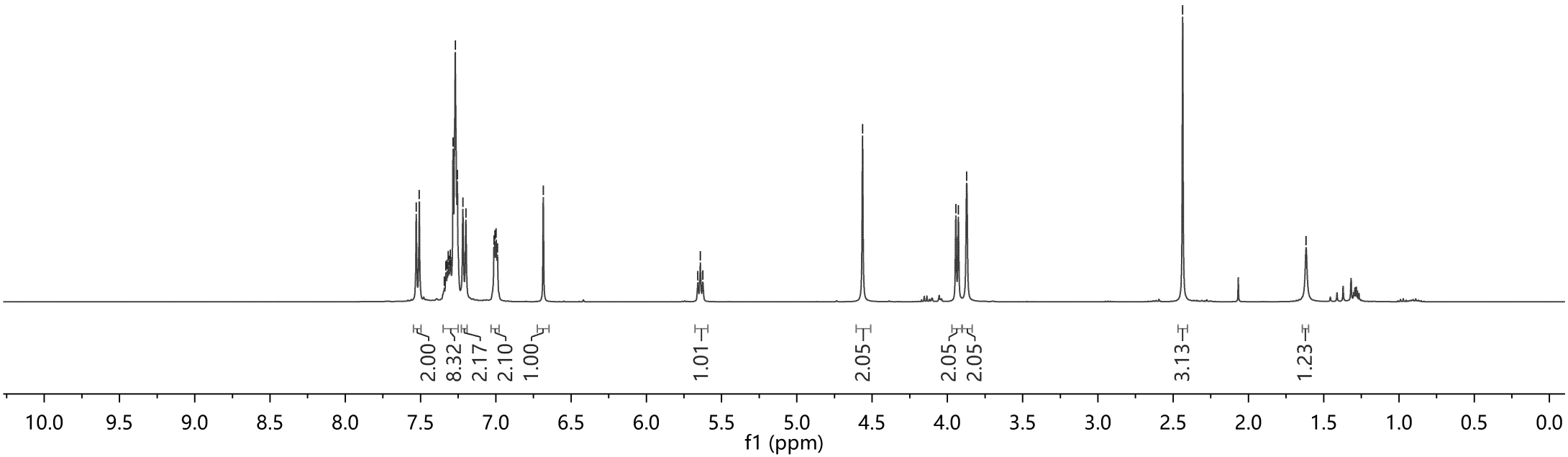

7.616
7.596
7.352
7.333
7.318
7.299
7.292
7.285
7.273
7.254
7.238
7.235
7.227
7.220
7.215
7.209
7.191
7.069
7.052
6.516
5.574
5.557
5.540
4.451
4.199
4.182
3.447
3.065
2.454
1.682
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 0.0
4 Number of Scans 16
5 Spectrometer Frequency 400.13
6 Spectral Width 8012.8
7 Lowest Frequency -1535.4
8 Nucleus 1H
9 Acquired Size 32768
10 Spectral Size 65536
I
Bn
OH
Ph
N
Ts
1t
2.00
10.57
2.06
1.01
1.00
2.03
2.00
2.04
2.01
3.11
1.20
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

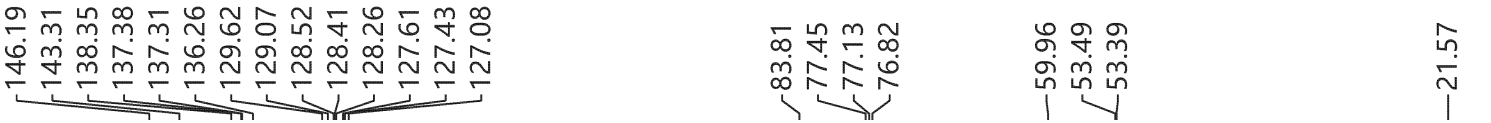

146.10
143.61
138.61
138.31
135.38
135.34
129.74
128.62
128.57
128.49
128.41
128.29
127.63
127.25
126.29
83.04
77.46
77.14
76.83
59.30
54.23
53.67
34.10
21.61
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 0.0
4 Number of Scans 200
5 Spectrometer Frequency 100.61
6 Spectral Width 24038.5
7 Lowest Frequency -1958.9
8 Nucleus 13C
9 Acquired Size 32768
10 Spectral Size 32768
I
Bn
OH
Ph
N
Ts
1t
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)


| | Parameter | Value |
|---|---|---|
| 1 | Origin | Bruker BioSpin GmbH |
| 2 | Solvent | CDCl3 |
| 3 | Temperature | 296.1 |
| 4 | Number of Scans | 16 |
| 5 | Spectrometer Frequency | 400.13 |
| 6 | Spectral Width | 8012.8 |
| 7 | Lowest Frequency | -1535.4 |
| 8 | Nucleus | 1H |
| 9 | Acquired Size | 32768 |
| 10 | Spectral Size | 65536 |

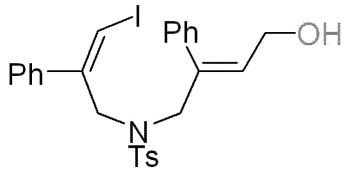



**1u**

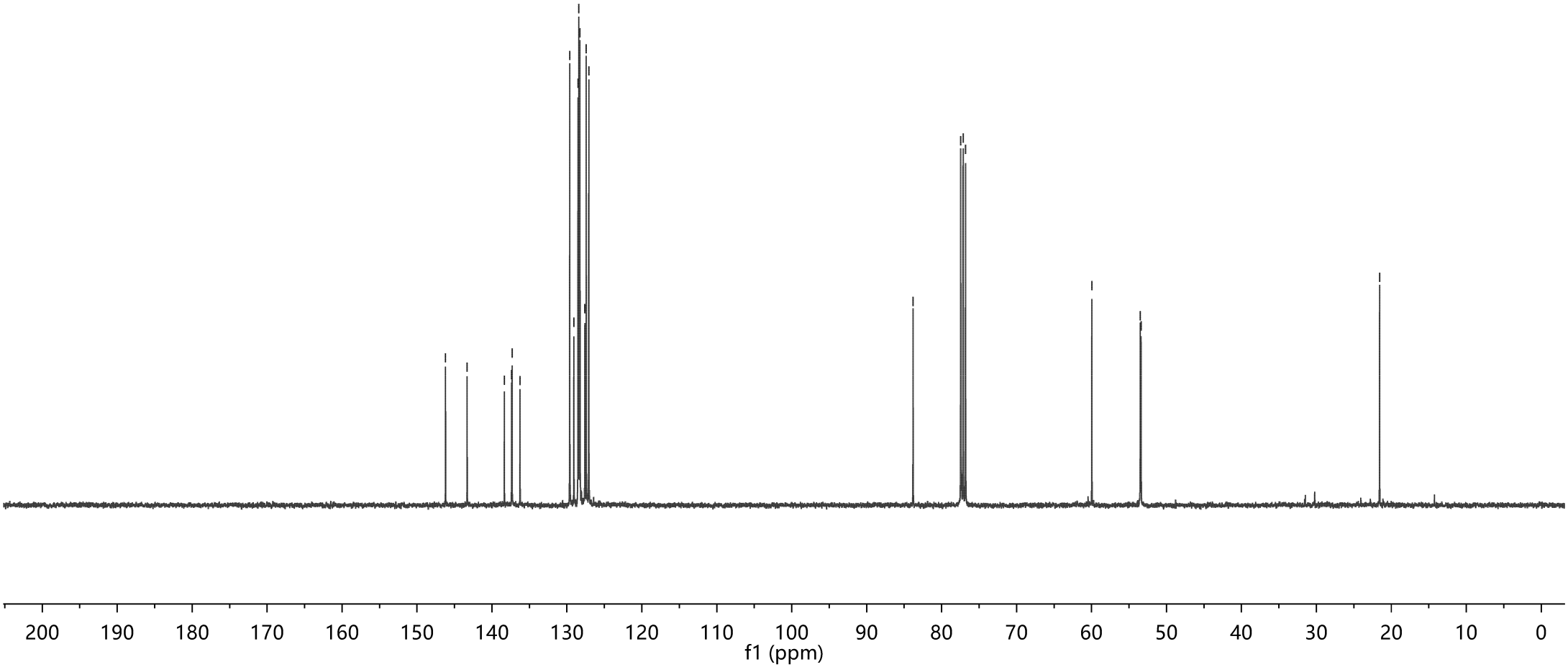





| Parameter | | Value |
|---|---|---|
| 1 | Origin | Bruker BioSpin GmbH |
| 2 | Solvent | CDCl3 |
| 3 | Temperature | 296.1 |
| 4 | Number of Scans | 250 |
| 5 | Spectrometer Frequency | 100.61 |
| 6 | Spectral Width | 24038.5 |
| 7 | Lowest Frequency | -1958.9 |
| 8 | Nucleus | 13C |
| 9 | Acquired Size | 32768 |
| 10 | Spectral Size | 32768 |



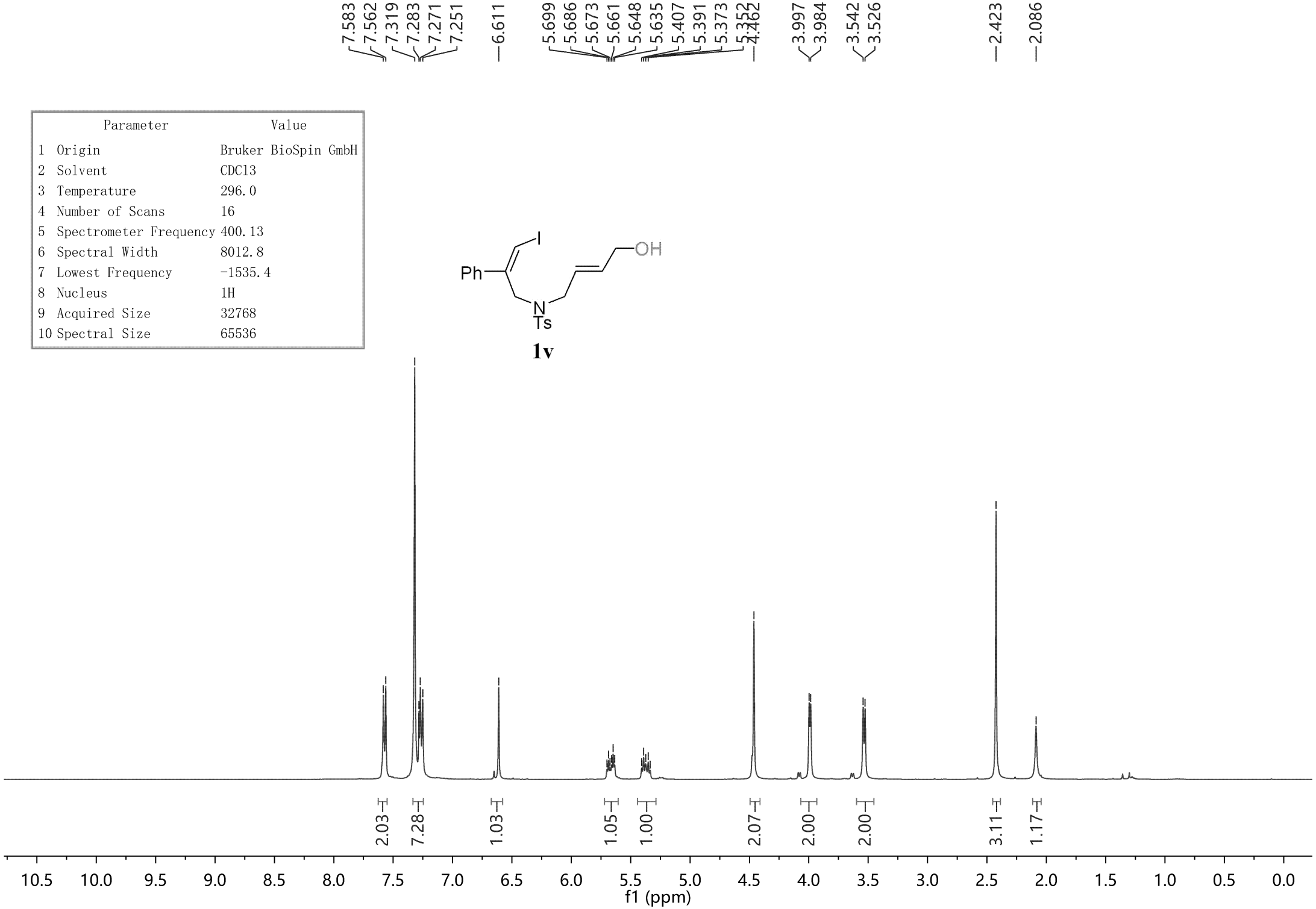

**1u**

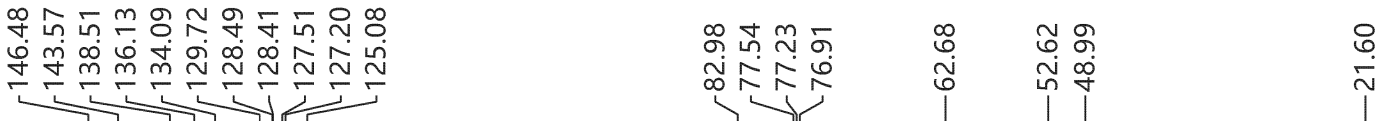


| Parameter | Value |
|---|---|
| 1 Origin | Bruker BioSpin GmbH |
| 2 Solvent | CDCl3 |
| 3 Temperature | 296.0 |
| 4 Number of Scans | 16 |
| 5 Spectrometer Frequency | 400.13 |
| 6 Spectral Width | 8012.8 |
| 7 Lowest Frequency | -1535.4 |
| 8 Nucleus | 1H |
| 9 Acquired Size | 32768 |
| 10 Spectral Size | 65536 |

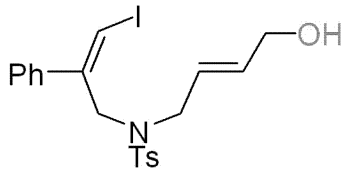



**1v**

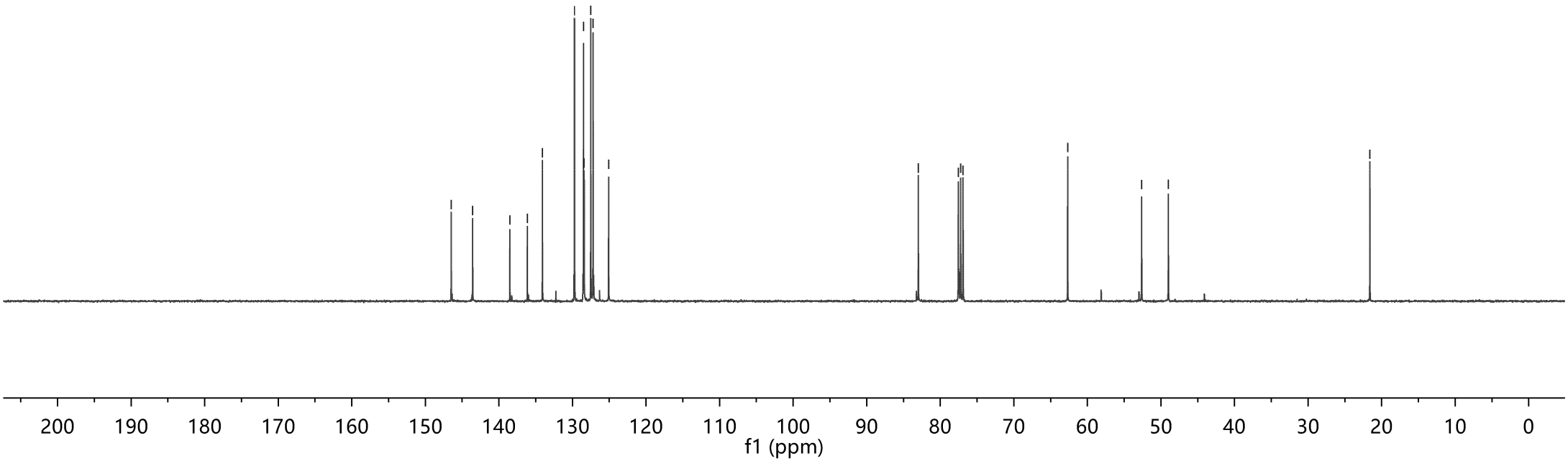




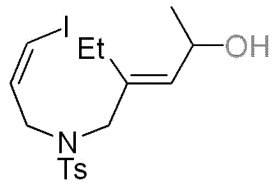

| Parameter | Value |
|---|---|
| 1 Origin | Bruker BioSpin GmbH |
| 2 Solvent | CDCl3 |
| 3 Temperature | 296.5 |
| 4 Number of Scans | 220 |
| 5 Spectrometer Frequency | 100.61 |
| 6 Spectral Width | 24038.5 |
| 7 Lowest Frequency | -1958.9 |
| 8 Nucleus | 13C |
| 9 Acquired Size | 32768 |
| 10 Spectral Size | 32768 |



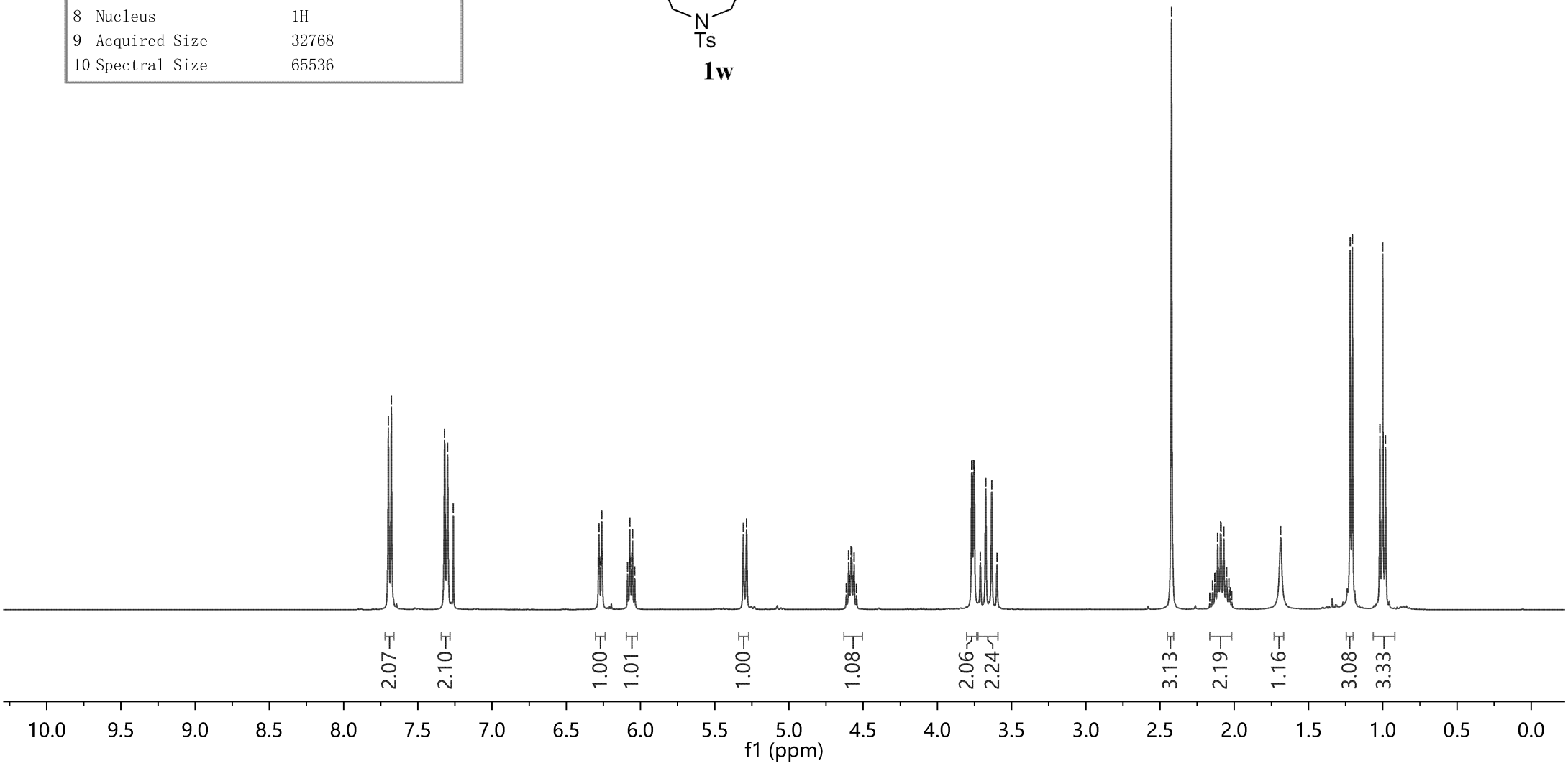

**1v**

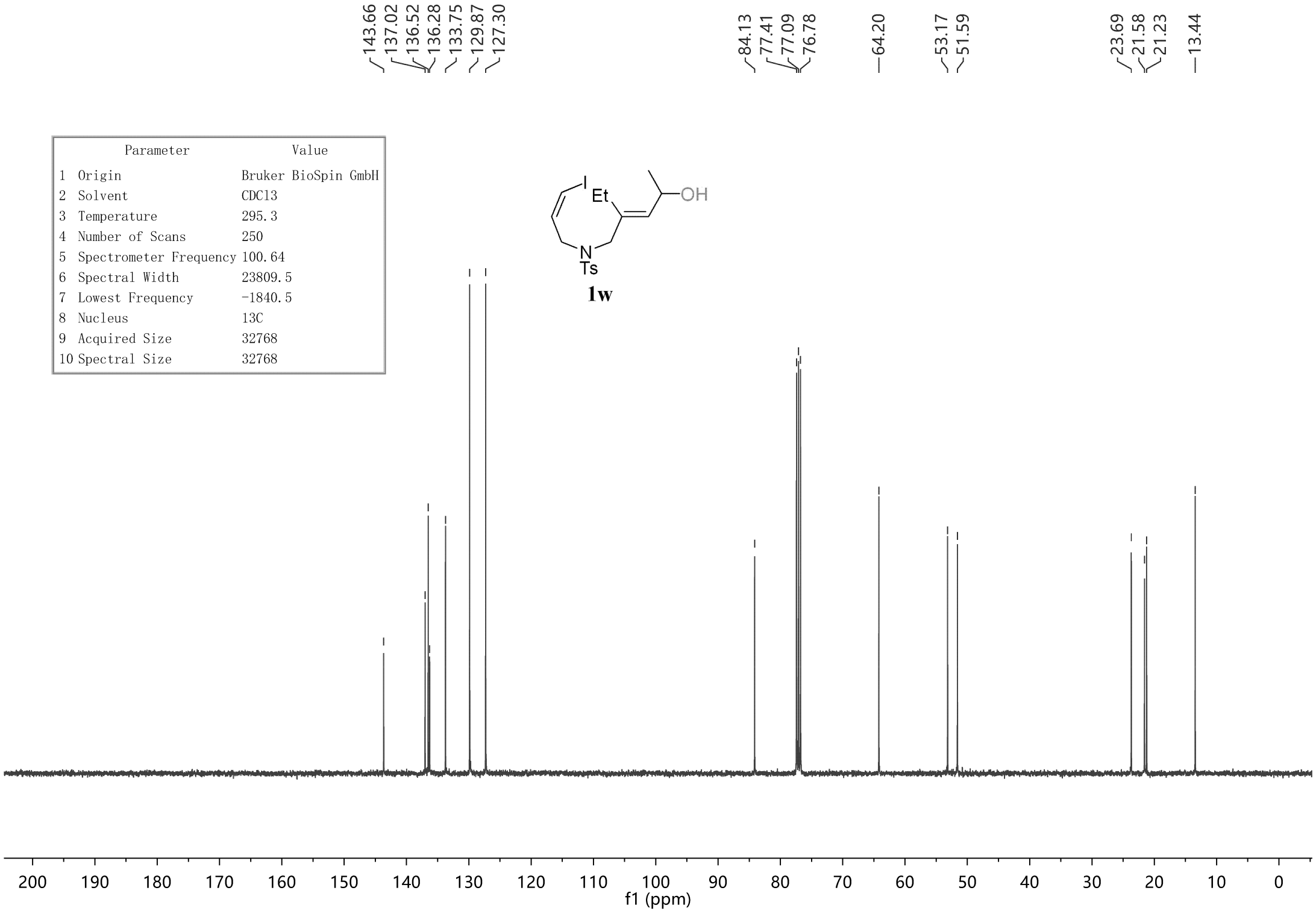


| | Parameter | Value |
|---|---|---|
| 1 | Origin | Bruker BioSpin GmbH |
| 2 | Solvent | CDCl3 |
| 3 | Temperature | 294.6 |
| 4 | Number of Scans | 16 |
| 5 | Spectrometer Frequency | 400.25 |
| 6 | Spectral Width | 8196.7 |
| 7 | Lowest Frequency | -1636.2 |
| 8 | Nucleus | 1H |
| 9 | Acquired Size | 32768 |
| 10 | Spectral Size | 65536 |

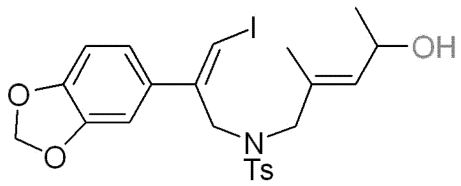



**1w**

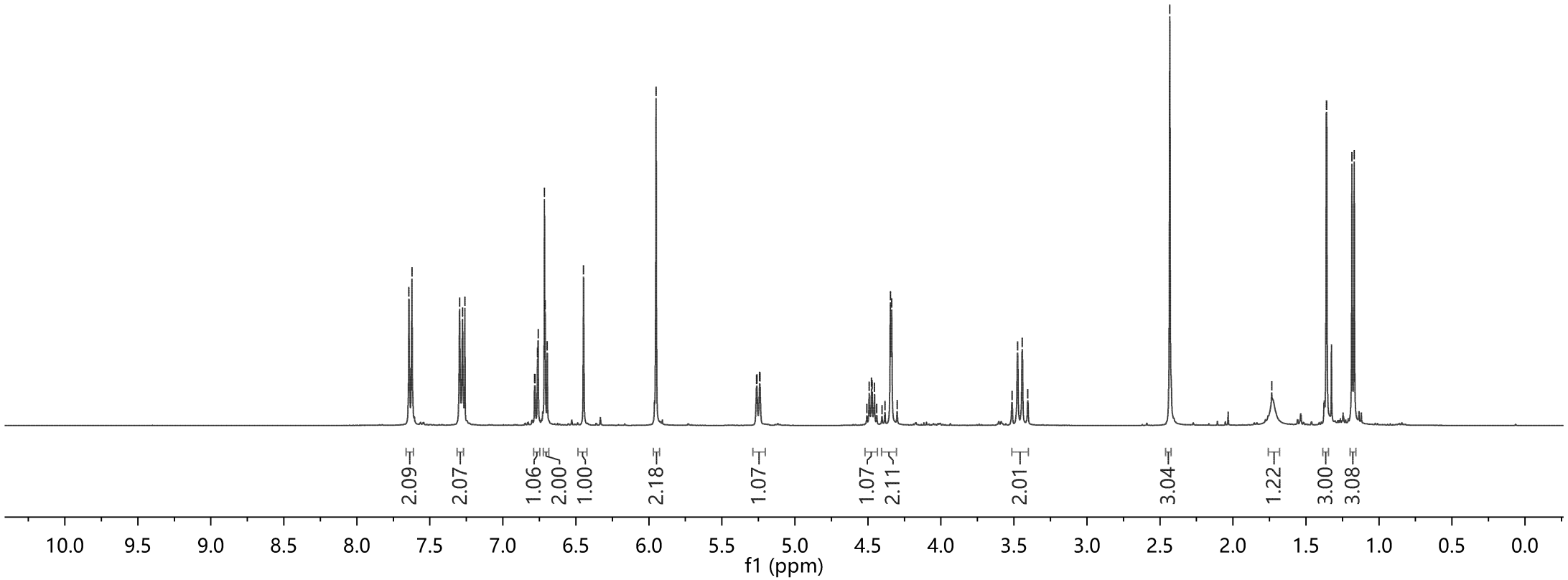


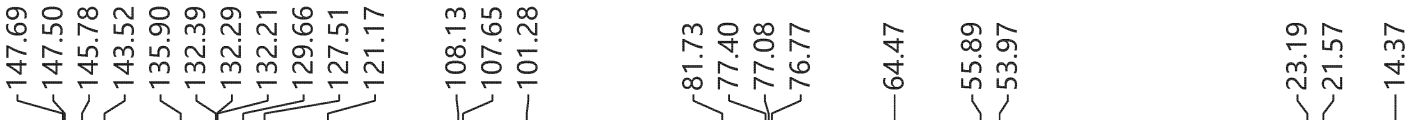

143.66
137.02
136.52
136.28
133.75
129.87
127.30
84.13
77.41
77.09
76.78
64.20
53.17
51.59
23.69
21.58
21.23
13.44
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 295.3
4 Number of Scans 250
5 Spectrometer Frequency 100.64
6 Spectral Width 23809.5
7 Lowest Frequency -1840.5
8 Nucleus 13C
9 Acquired Size 32768
10 Spectral Size 32768
I
Et
OH
N
Ts
1w
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

| Parameter | Value |
|---|---|
| 1 Origin | Bruker BioSpin GmbH |
| 2 Solvent | CDCl3 |
| 3 Temperature | 0.0 |
| 4 Number of Scans | 16 |
| 5 Spectrometer Frequency | 400.13 |
| 6 Spectral Width | 8012.8 |
| 7 Lowest Frequency | -1545.2 |
| 8 Nucleus | 1H |
| 9 Acquired Size | 32768 |
| 10 Spectral Size | 65536 |

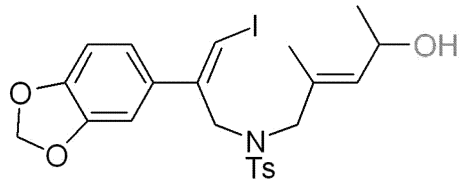



**1x**

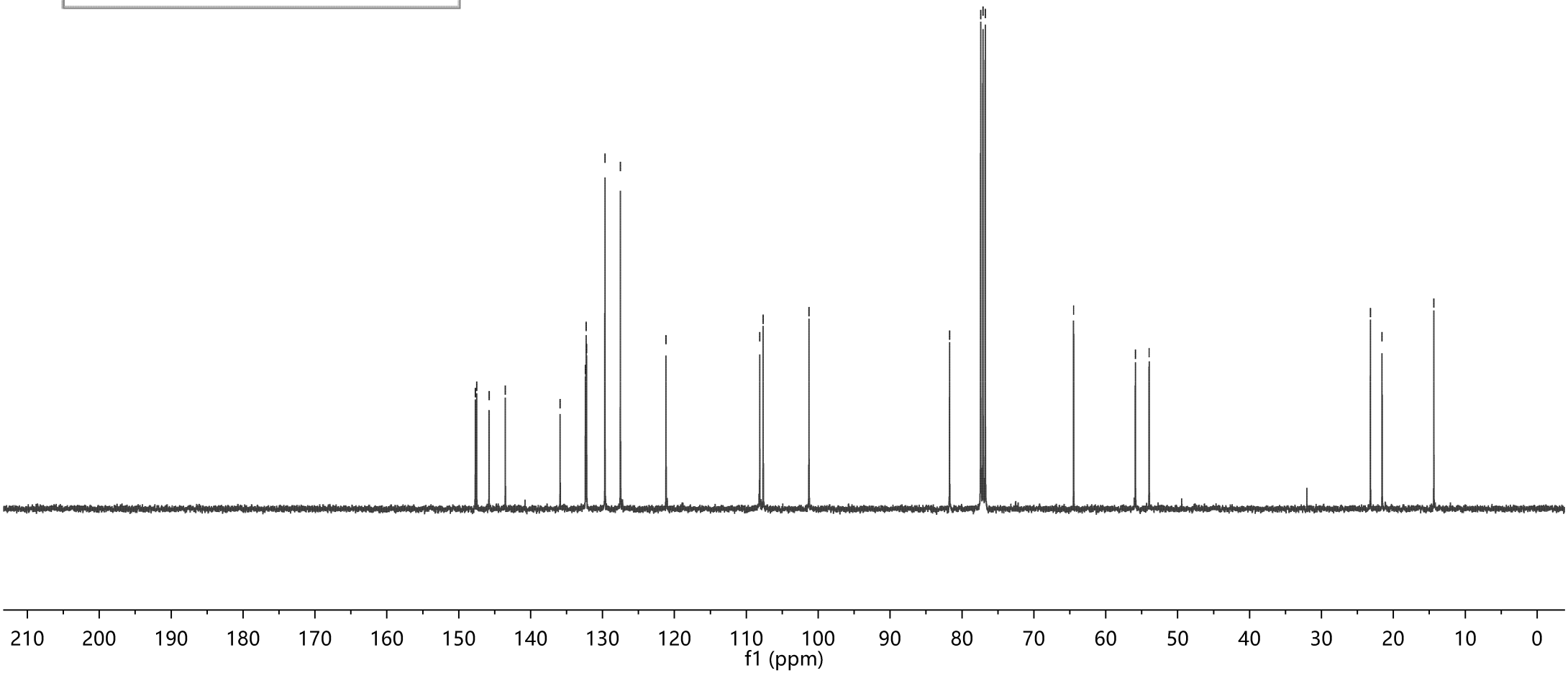





| Parameter | | Value |
|---|---|---|
| 1 | Origin | Bruker BioSpin GmbH |
| 2 | Solvent | CDCl3 |
| 3 | Temperature | 0.0 |
| 4 | Number of Scans | 250 |
| 5 | Spectrometer Frequency | 100.61 |
| 6 | Spectral Width | 24038.5 |
| 7 | Lowest Frequency | -1958.9 |
| 8 | Nucleus | 13C |
| 9 | Acquired Size | 32768 |
| 10 | Spectral Size | 32768 |



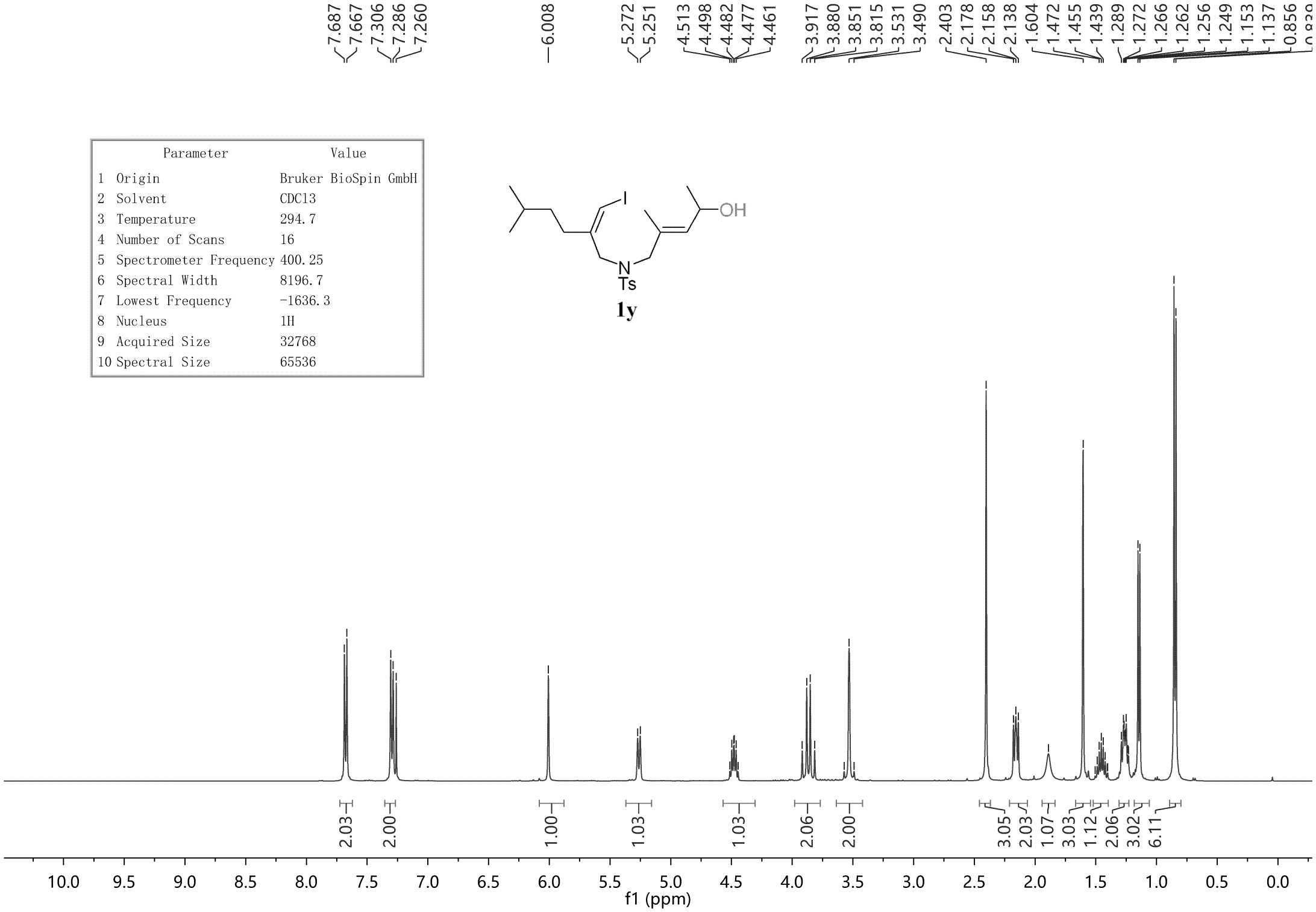

**1x**

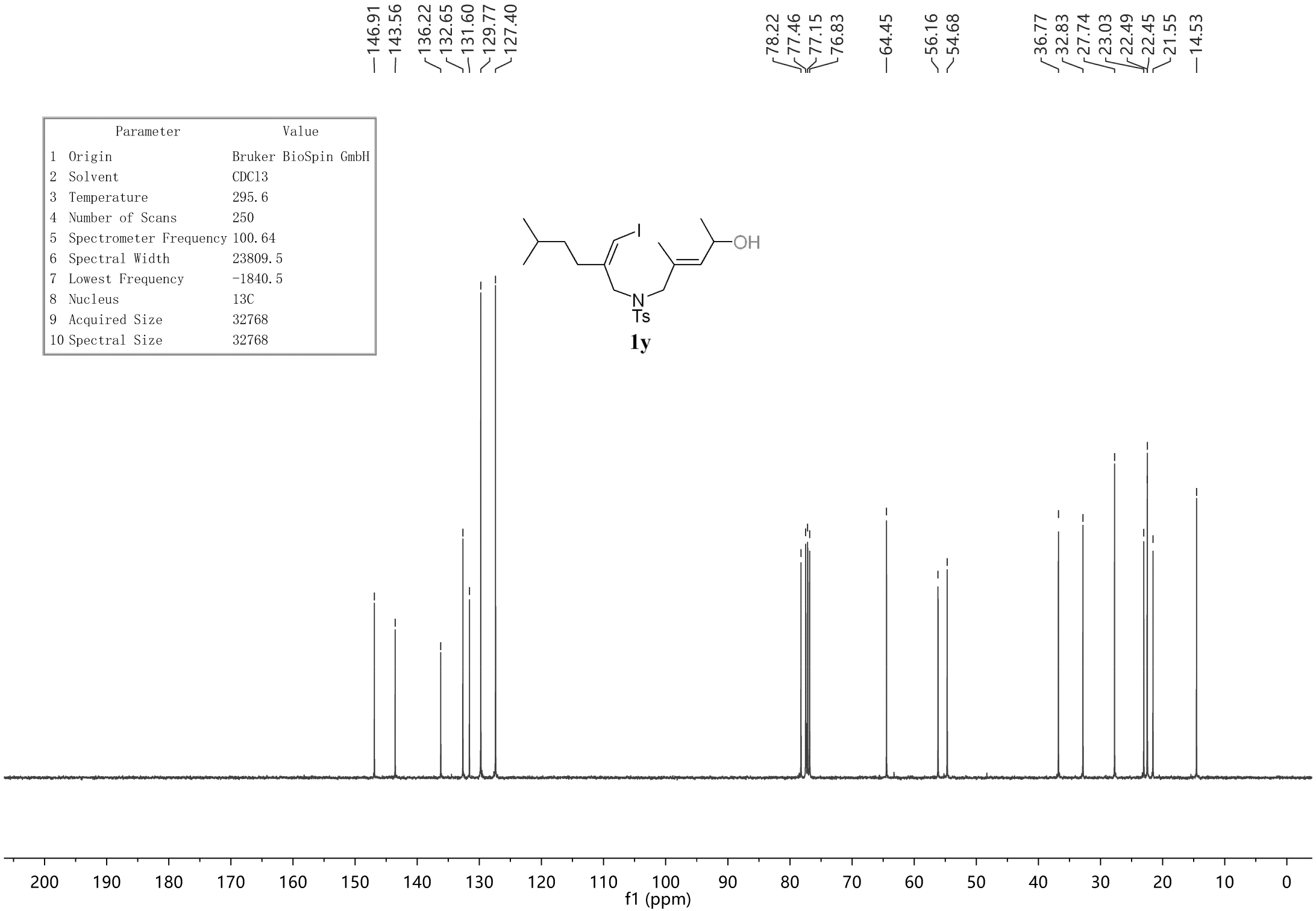


| Parameter | Value |
|---|---|
| 1 Origin | Bruker BioSpin GmbH |
| 2 Solvent | CDCl3 |
| 3 Temperature | 294.7 |
| 4 Number of Scans | 16 |
| 5 Spectrometer Frequency | 400.25 |
| 6 Spectral Width | 8196.7 |
| 7 Lowest Frequency | -1636.3 |
| 8 Nucleus | 1H |
| 9 Acquired Size | 32768 |
| 10 Spectral Size | 65536 |




**1y**



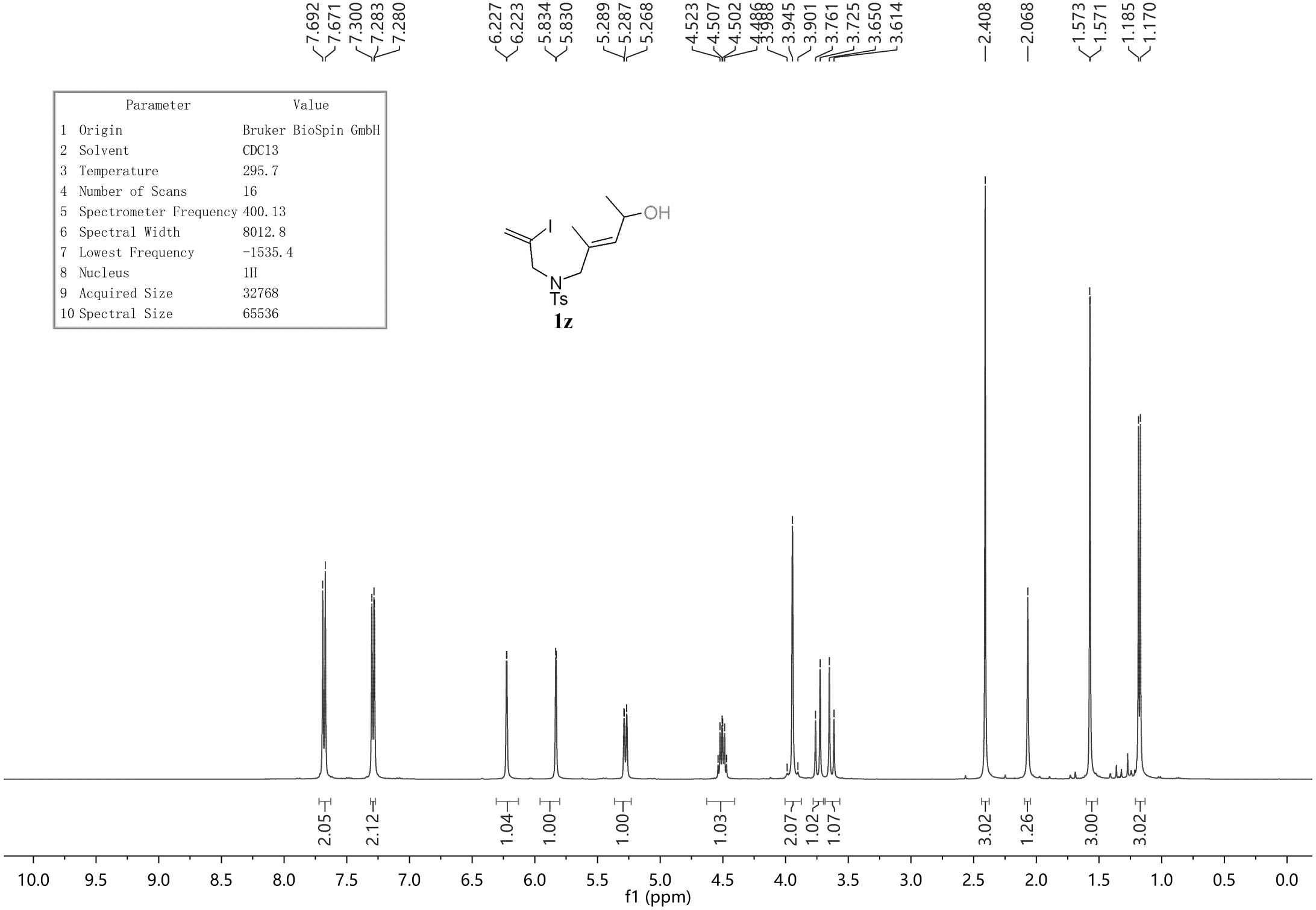


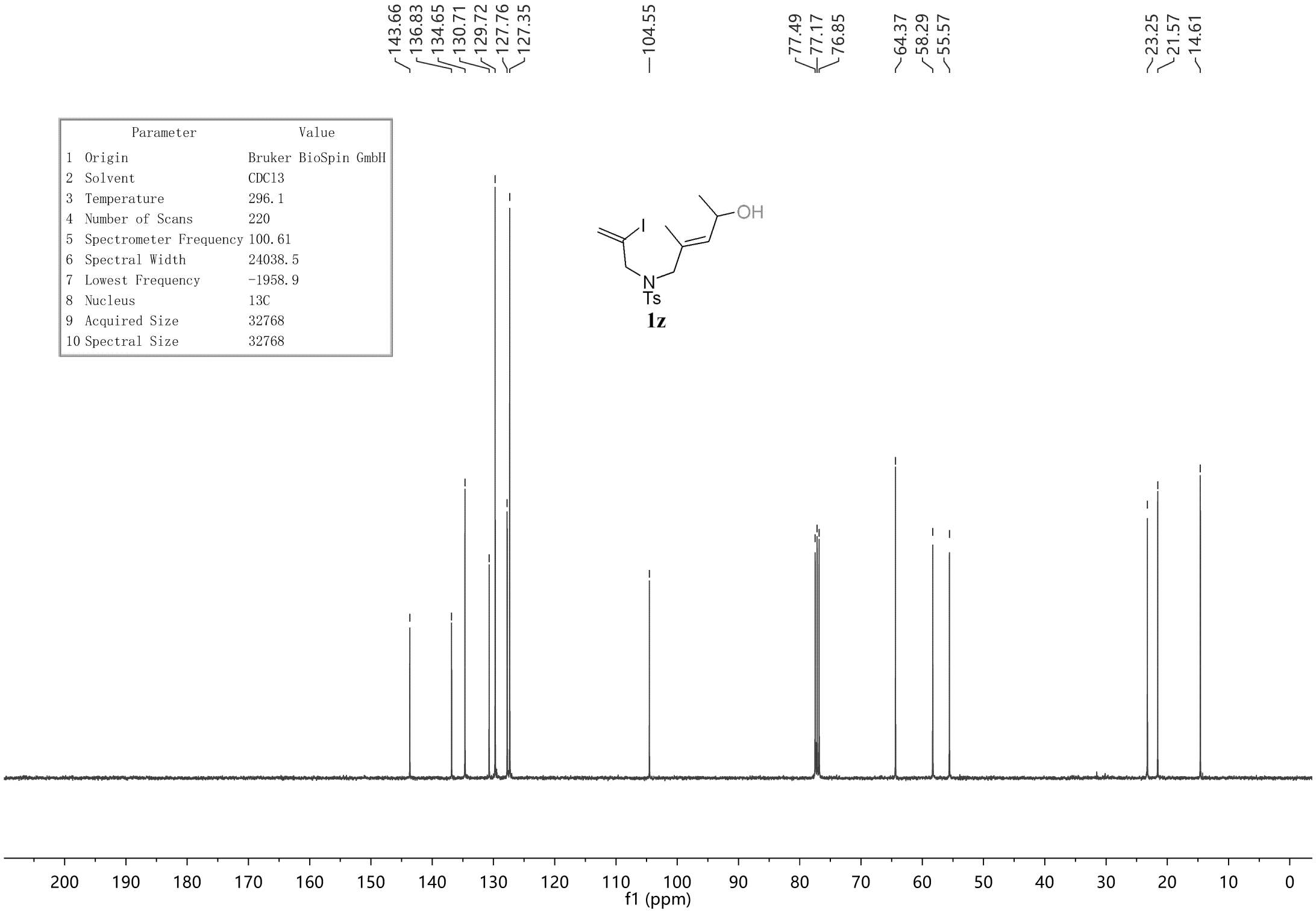

| Parameter | Value |
|---|---|
| 1 Origin | Bruker BioSpin GmbH |
| 2 Solvent | CDCl3 |
| 3 Temperature | 295.6 |
| 4 Number of Scans | 250 |
| 5 Spectrometer Frequency | 100.64 |
| 6 Spectral Width | 23809.5 |
| 7 Lowest Frequency | -1840.5 |
| 8 Nucleus | 13C |
| 9 Acquired Size | 32768 |
| 10 Spectral Size | 32768 |

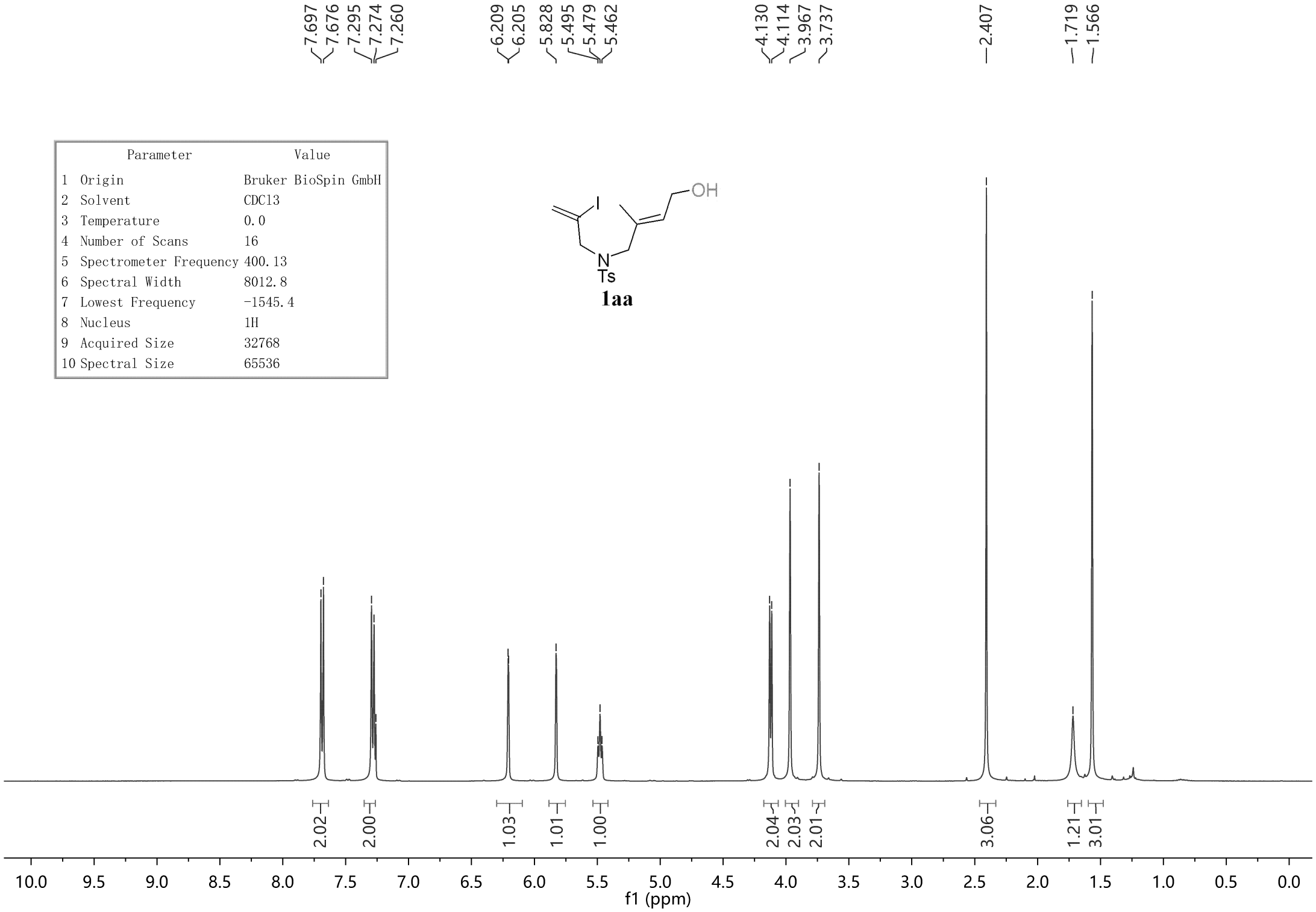
| Parameter | Value |
|---|---|
| 1 Origin | Bruker BioSpin GmbH |
| 2 Solvent | CDCl3 |
| 3 Temperature | 295.7 |
| 4 Number of Scans | 16 |
| 5 Spectrometer Frequency | 400.13 |
| 6 Spectral Width | 8012.8 |
| 7 Lowest Frequency | -1535.4 |
| 8 Nucleus | 1H |
| 9 Acquired Size | 32768 |
| 10 Spectral Size | 65536 |

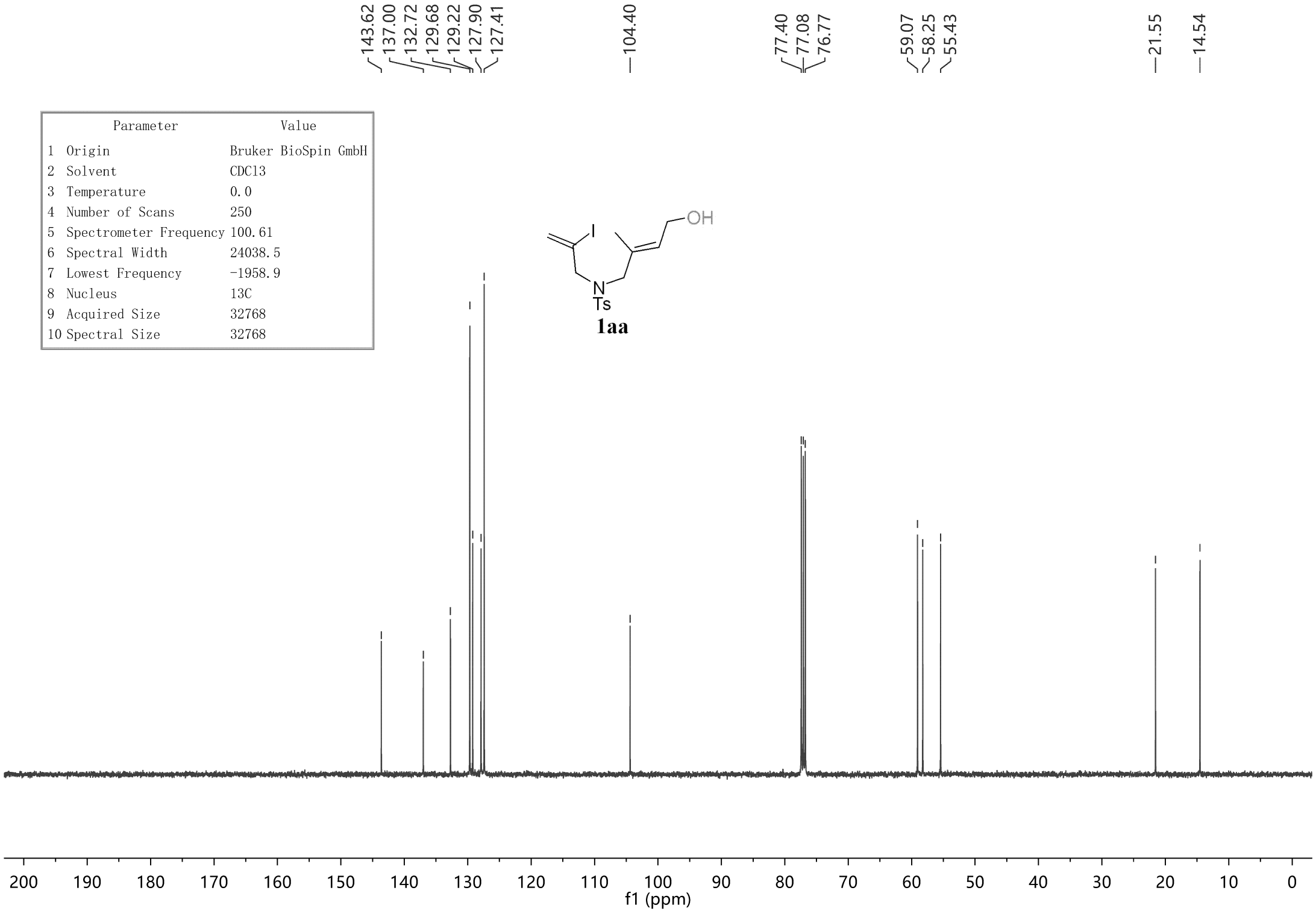



**1z**




143.66
136.83
134.65
130.71
129.72
127.76
127.35
104.55
77.49
77.17
76.85
64.37
58.29
55.57
23.25
21.57
14.61
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 296.1
4 Number of Scans 220
5 Spectrometer Frequency 100.61
6 Spectral Width 24038.5
7 Lowest Frequency -1958.9
8 Nucleus 13C
9 Acquired Size 32768
10 Spectral Size 32768
I
OH
N
Ts
1z
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

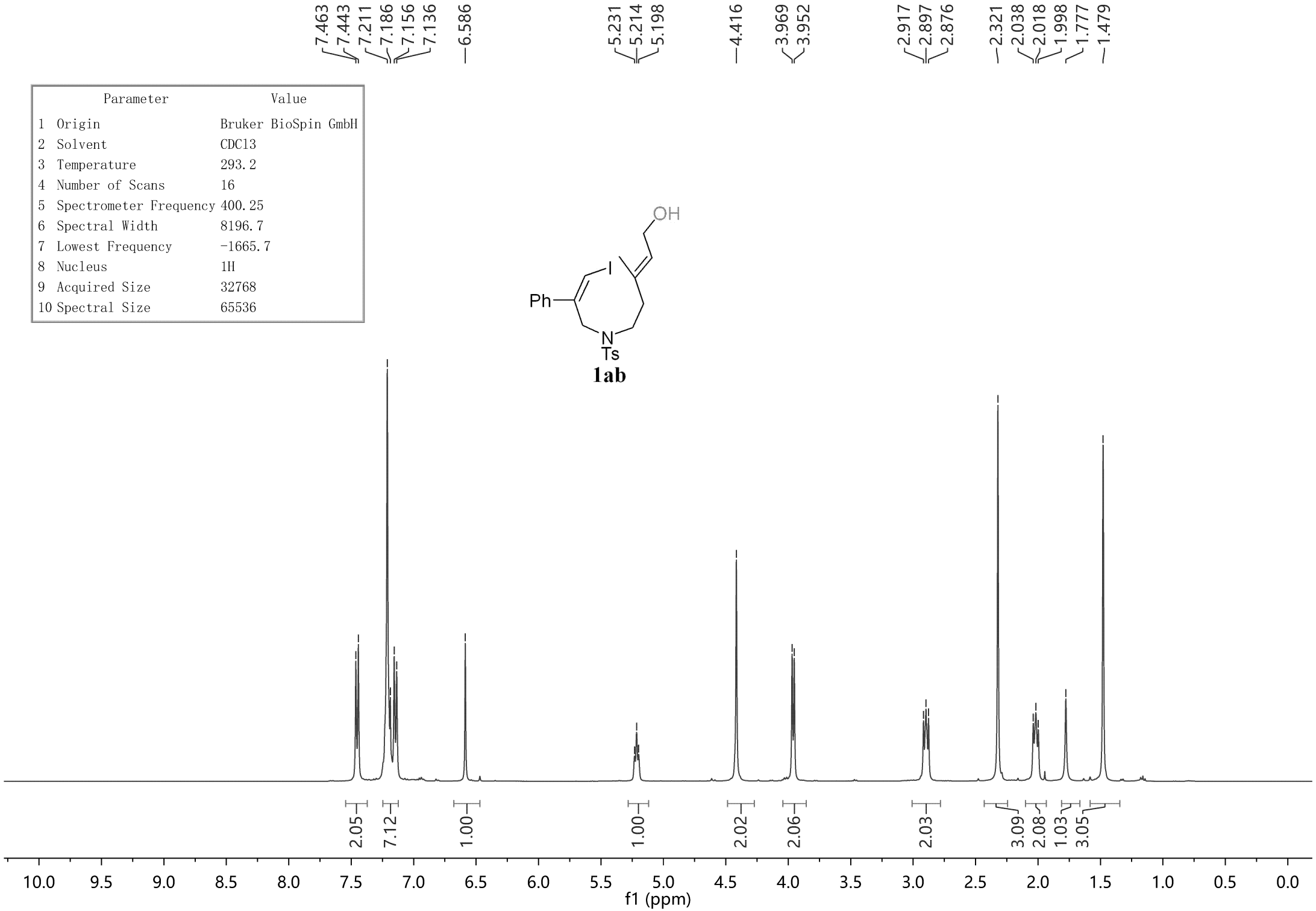

7.697
7.676
7.295
7.274
7.260
6.209
6.205
5.828
5.495
5.479
5.462
4.130
4.114
3.967
3.737
2.407
1.719
1.566
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 0.0
4 Number of Scans 16
5 Spectrometer Frequency 400.13
6 Spectral Width 8012.8
7 Lowest Frequency -1545.4
8 Nucleus 1H
9 Acquired Size 32768
10 Spectral Size 65536
I
OH
N
Ts
1aa
2.02
2.00
1.03
1.01
1.00
2.04
2.03
2.01
3.06
1.21
3.01
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

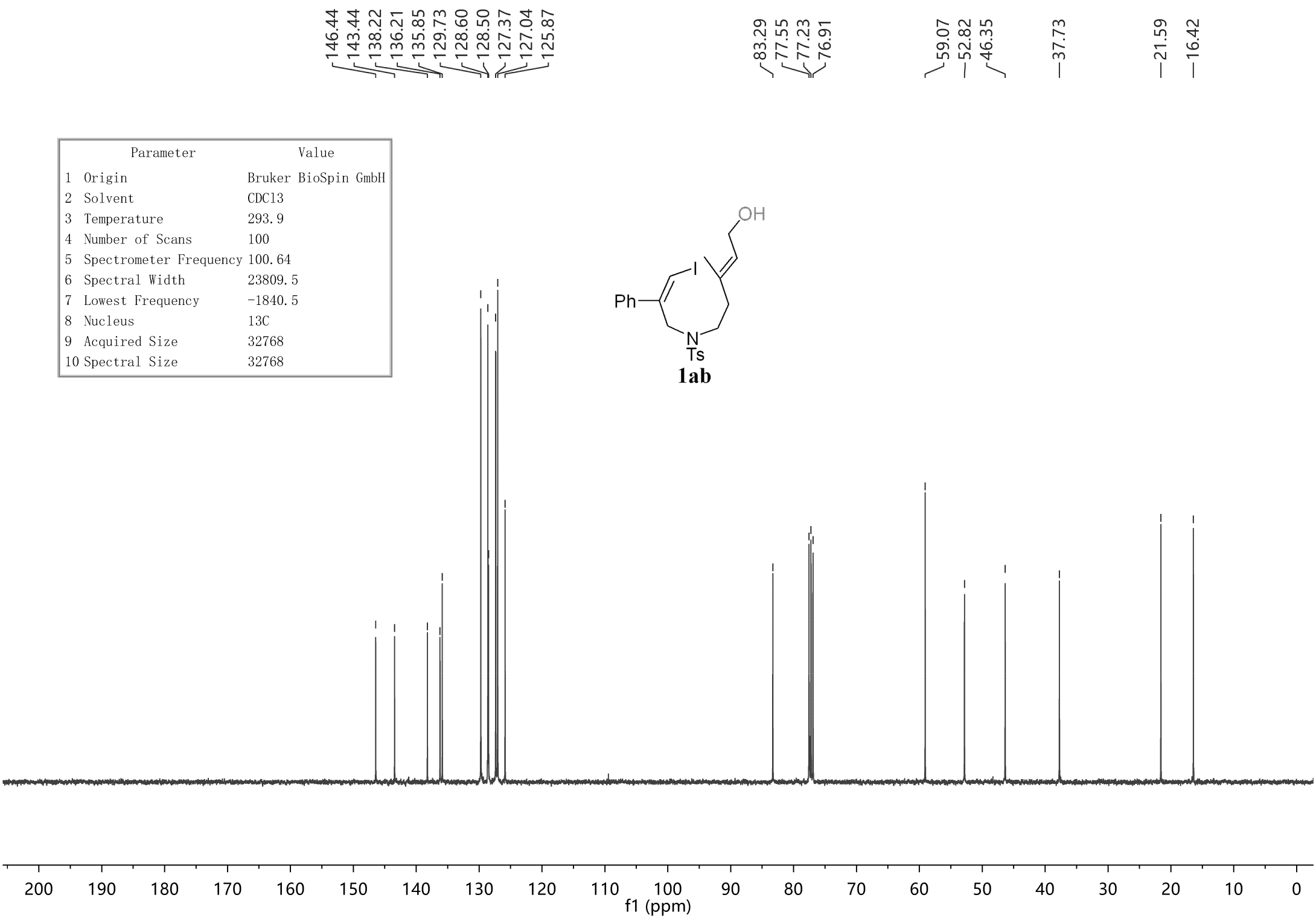

143.62
137.00
132.72
129.68
129.22
127.90
127.41
104.40
77.40
77.08
76.77
59.07
58.25
55.43
21.55
14.54
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 0.0
4 Number of Scans 250
5 Spectrometer Frequency 100.61
6 Spectral Width 24038.5
7 Lowest Frequency -1958.9
8 Nucleus 13C
9 Acquired Size 32768
10 Spectral Size 32768
I
OH
N
Ts
1aa
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

| Parameter | Value |
|---|---|
| 1 Origin | Bruker BioSpin GmbH |
| 2 Solvent | CDCl3 |
| 3 Temperature | 293.2 |
| 4 Number of Scans | 16 |
| 5 Spectrometer Frequency | 400.25 |
| 6 Spectral Width | 8196.7 |
| 7 Lowest Frequency | -1665.7 |
| 8 Nucleus | 1H |
| 9 Acquired Size | 32768 |
| 10 Spectral Size | 65536 |

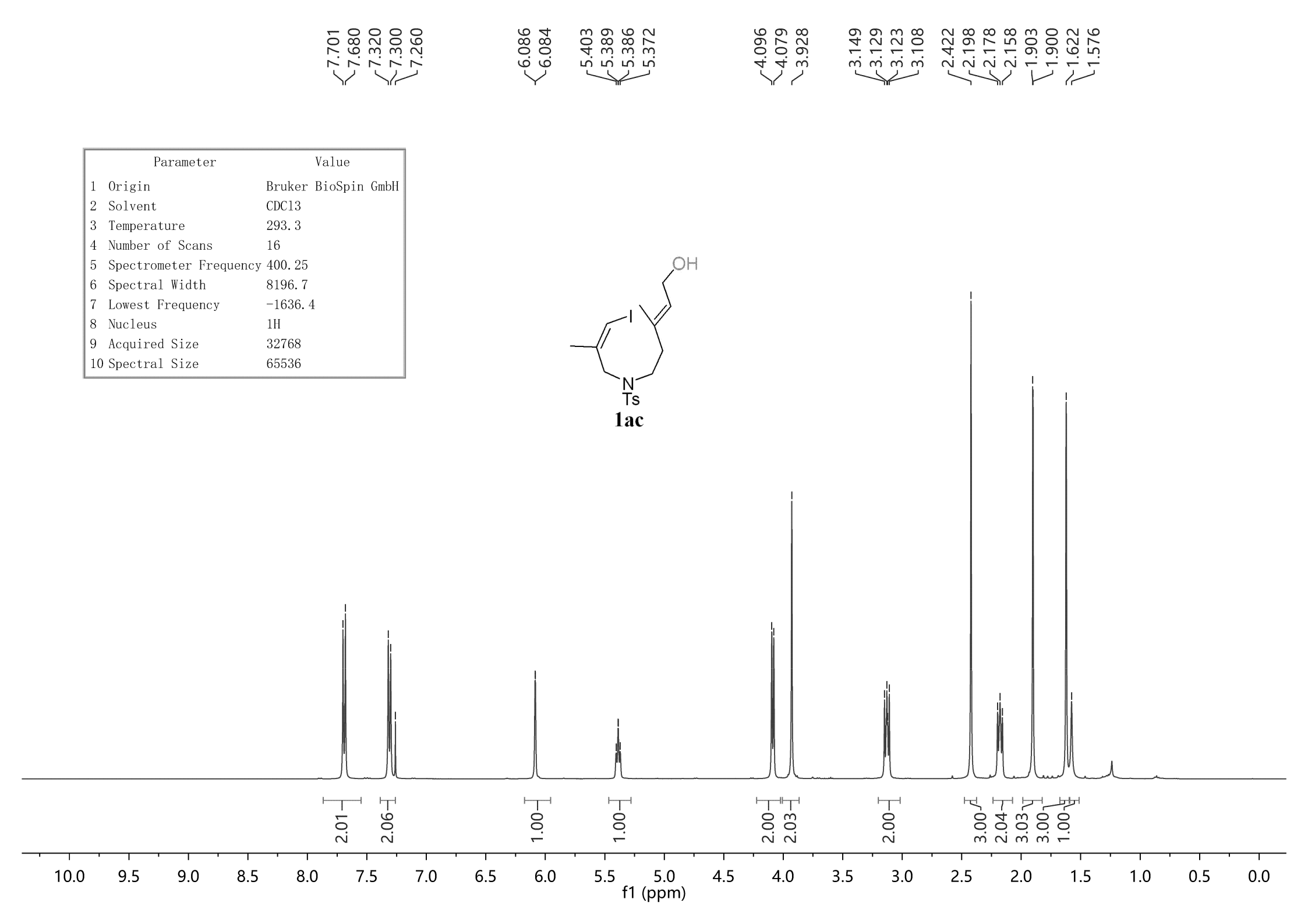


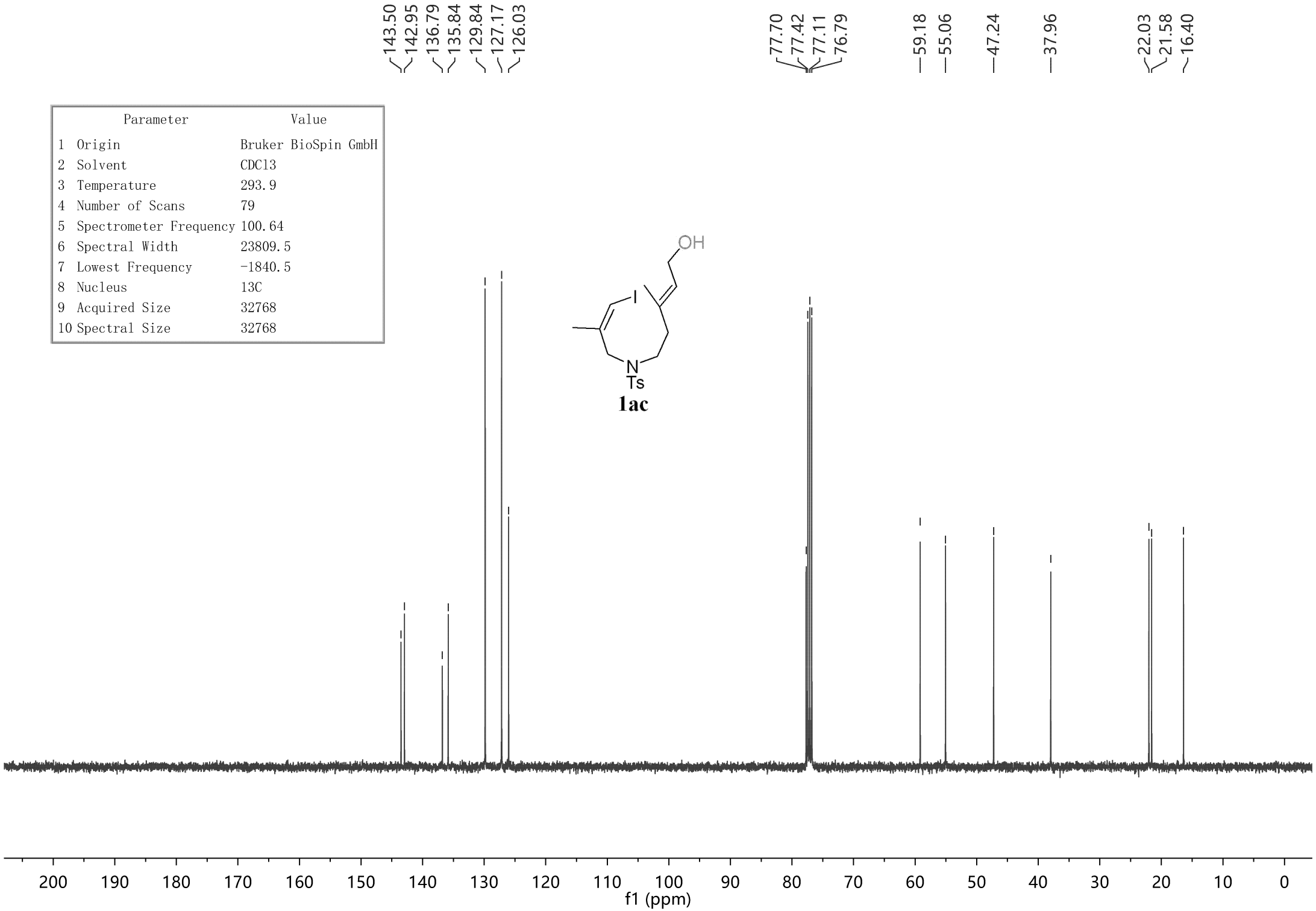

**1ab**

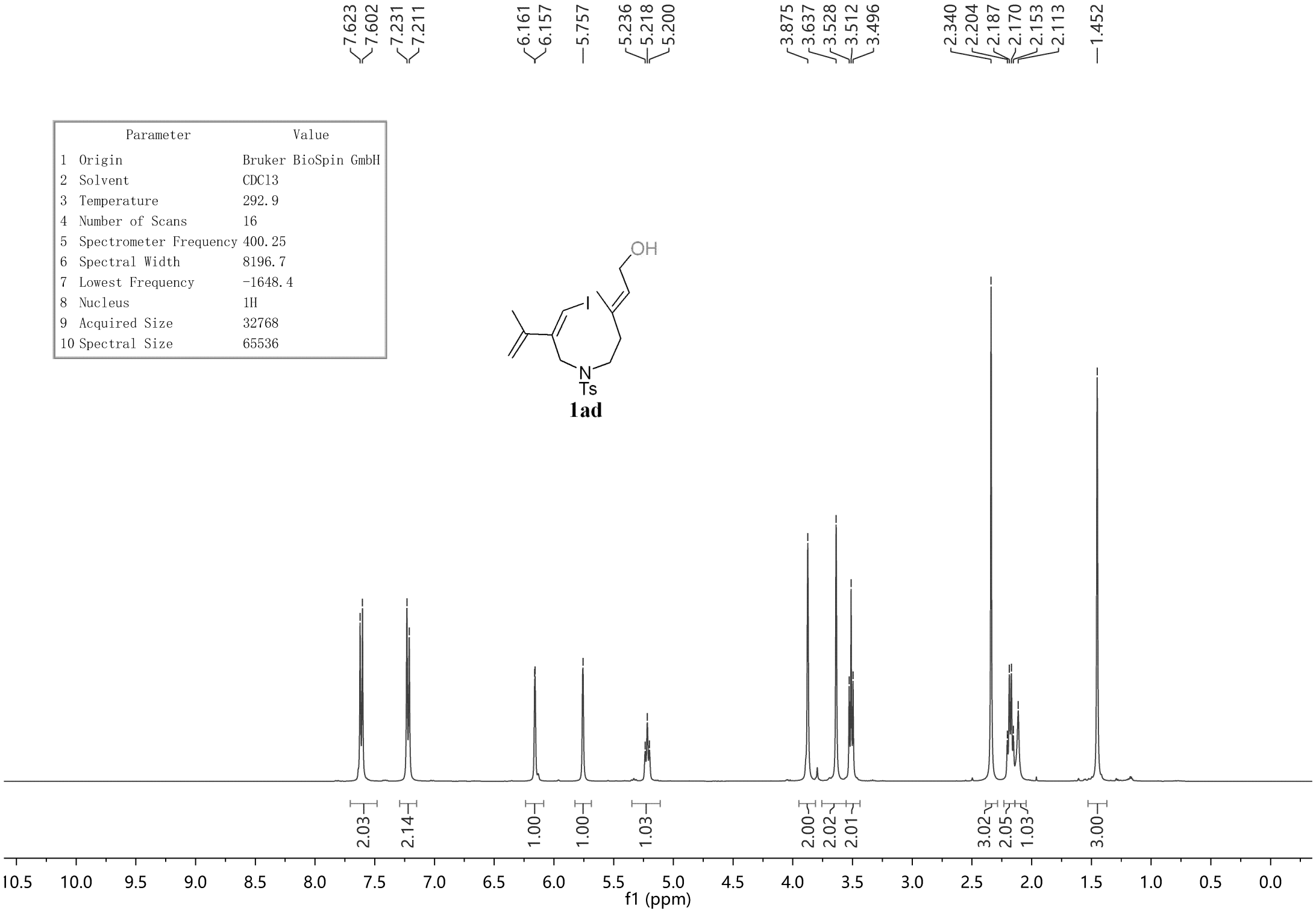




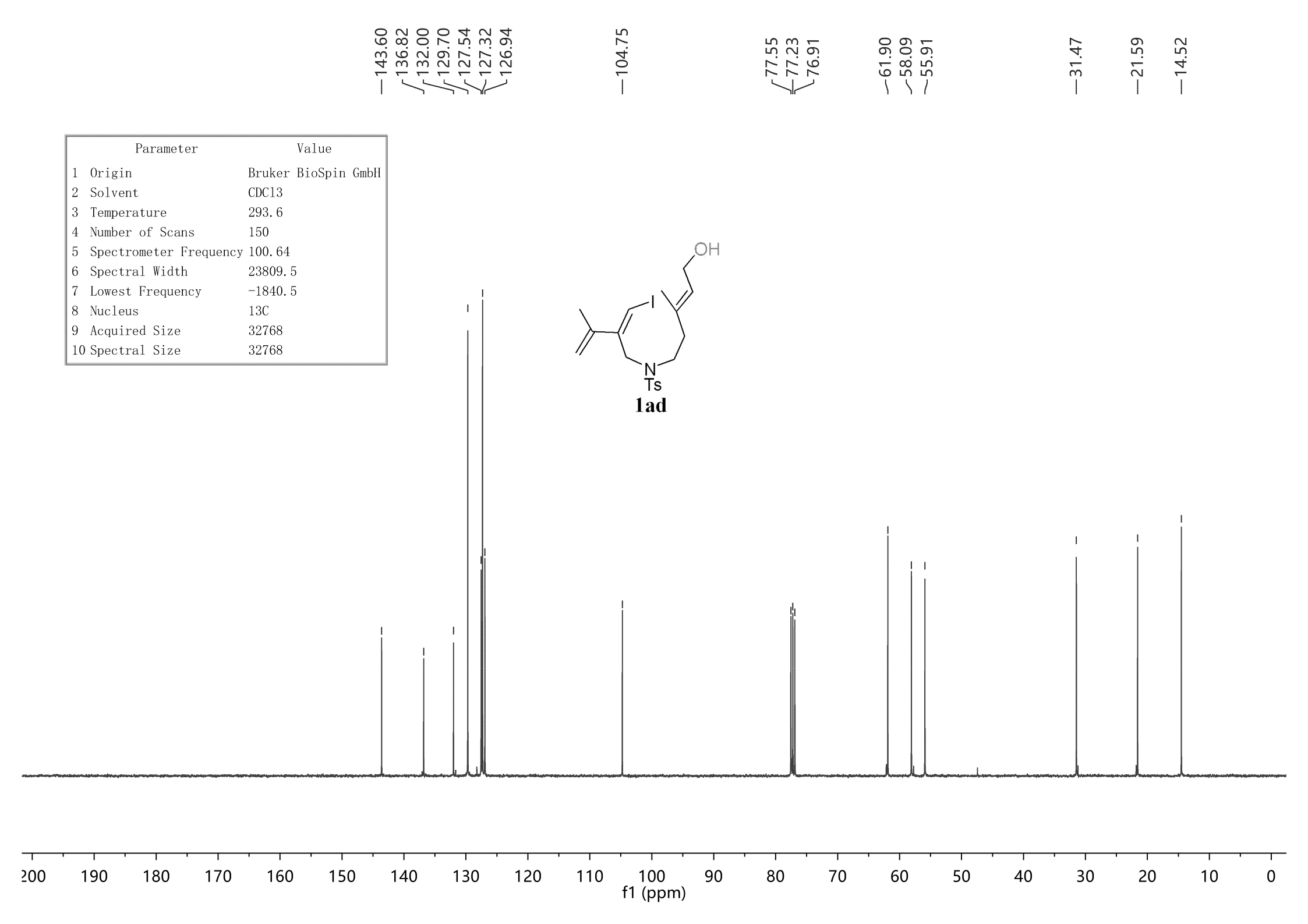

| | Parameter | Value |
|---|---|---|
| 1 | Origin | Bruker BioSpin GmbH |
| 2 | Solvent | CDCl3 |
| 3 | Temperature | 293.9 |
| 4 | Number of Scans | 100 |
| 5 | Spectrometer Frequency | 100.64 |
| 6 | Spectral Width | 23809.5 |
| 7 | Lowest Frequency | -1840.5 |
| 8 | Nucleus | 13C |
| 9 | Acquired Size | 32768 |
| 10 | Spectral Size | 32768 |

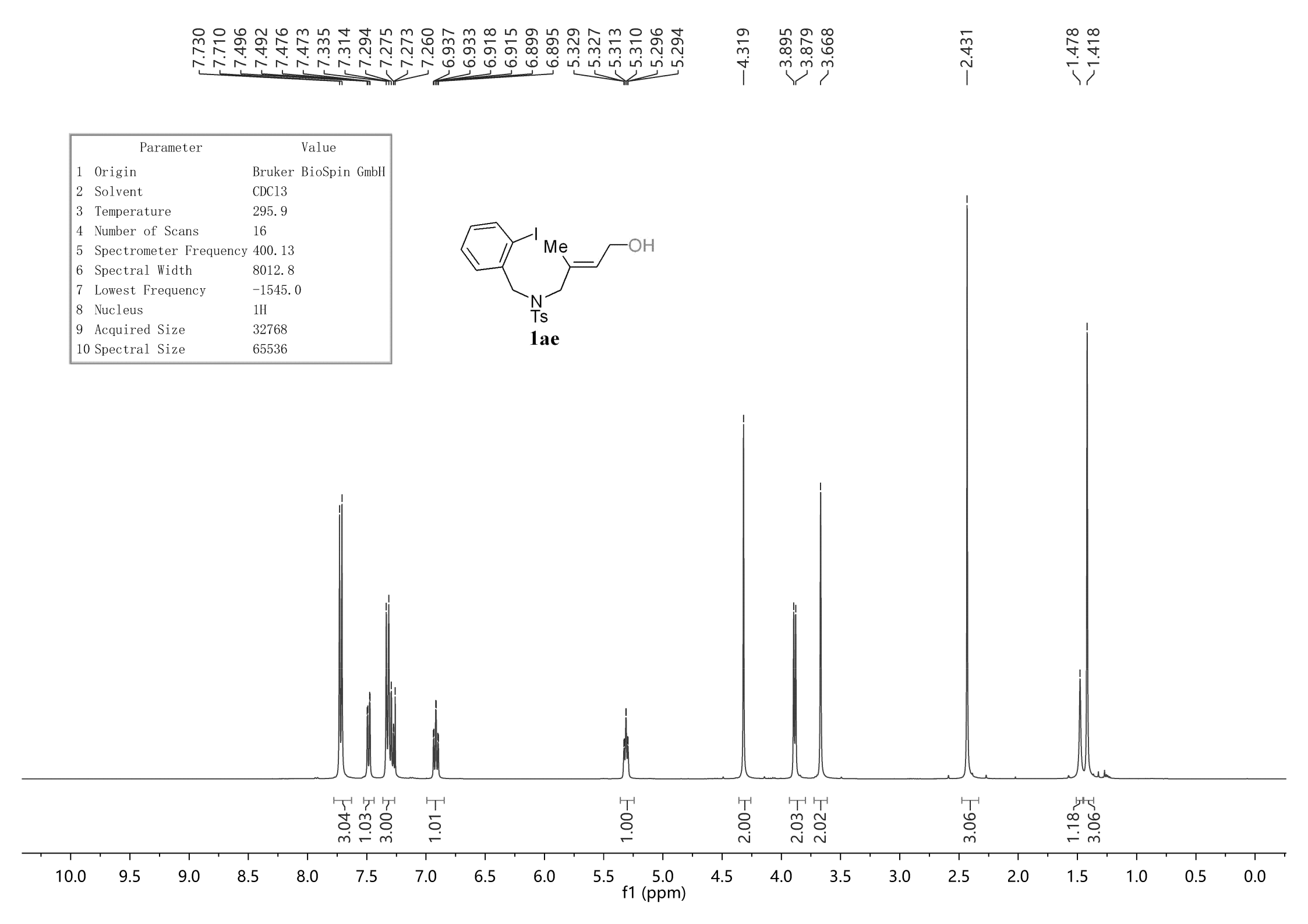

7.701
7.680
7.320
7.300
7.260
6.086
6.084
5.403
5.389
5.386
5.372
4.096
4.079
3.928
3.149
3.129
3.123
3.108
2.422
2.198
2.178
2.158
1.903
1.900
1.622
1.576
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 293.3
4 Number of Scans 16
5 Spectrometer Frequency 400.25
6 Spectral Width 8196.7
7 Lowest Frequency -1636.4
8 Nucleus 1H
9 Acquired Size 32768
10 Spectral Size 65536
OH
I
N
Ts
1ac
2.01
2.06
1.00
1.00
2.00
2.03
2.00
3.00
2.04
3.03
3.00
1.00
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

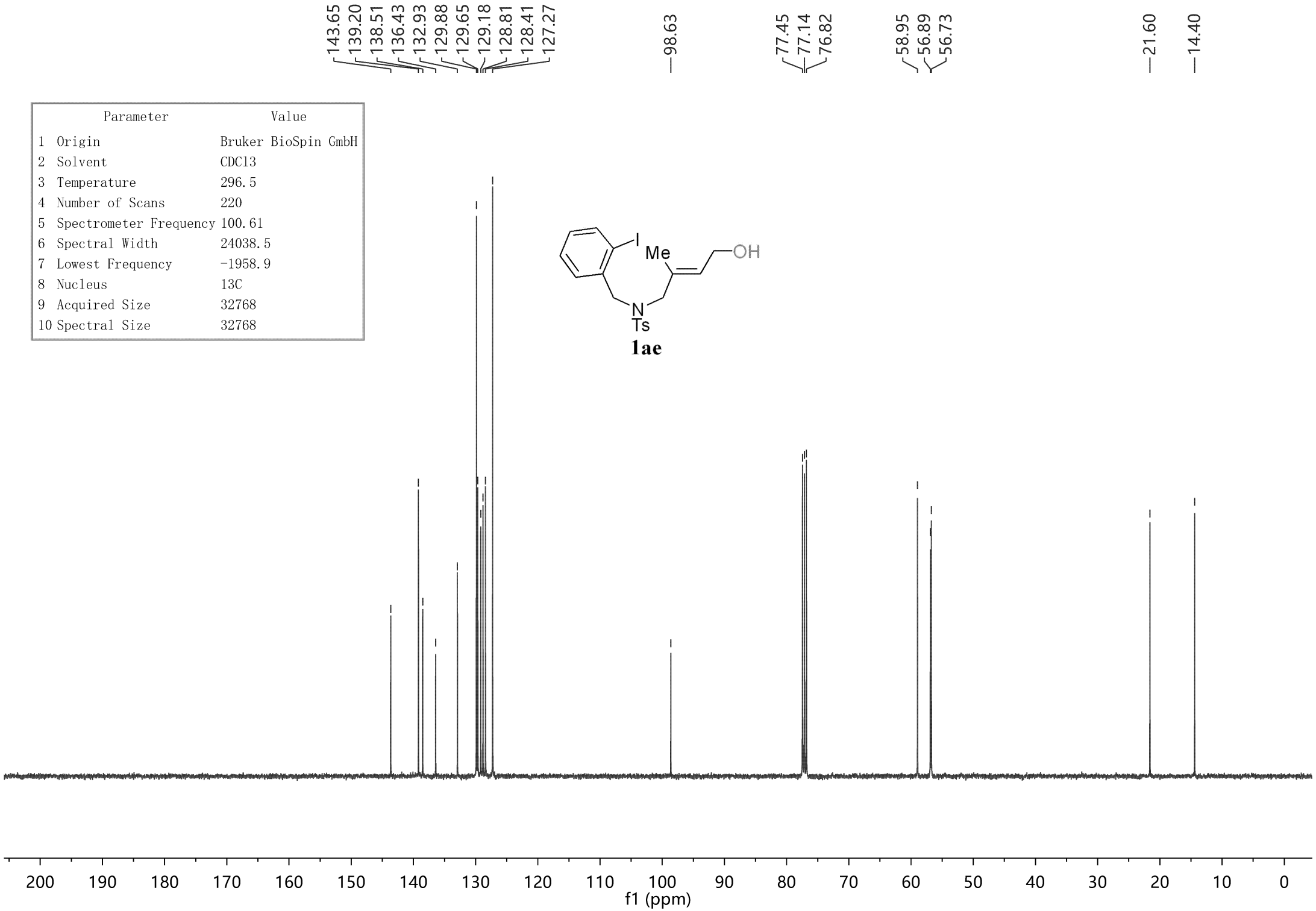

143.50
142.95
136.79
135.84
129.84
127.17
126.03
77.70
77.42
77.11
76.79
59.18
55.06
47.24
37.96
22.03
21.58
16.40
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 293.9
4 Number of Scans 79
5 Spectrometer Frequency 100.64
6 Spectral Width 23809.5
7 Lowest Frequency -1840.5
8 Nucleus 13C
9 Acquired Size 32768
10 Spectral Size 32768
OH
I
N
Ts
1ac
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)




| Parameter | Value |
|---|---|
| 1 Origin | Bruker BioSpin GmbH |
| 2 Solvent | CDCl3 |
| 3 Temperature | 292.9 |
| 4 Number of Scans | 16 |
| 5 Spectrometer Frequency | 400.25 |
| 6 Spectral Width | 8196.7 |
| 7 Lowest Frequency | -1648.4 |
| 8 Nucleus | 1H |
| 9 Acquired Size | 32768 |
| 10 Spectral Size | 65536 |


143.60
136.82
132.00
129.70
127.54
127.32
126.94
104.75
77.55
77.23
76.91
61.90
58.09
55.91
31.47
21.59
14.52
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 293.6
4 Number of Scans 150
5 Spectrometer Frequency 100.64
6 Spectral Width 23809.5
7 Lowest Frequency -1840.5
8 Nucleus 13C
9 Acquired Size 32768
10 Spectral Size 32768
OH
I
N
Ts
1ad
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

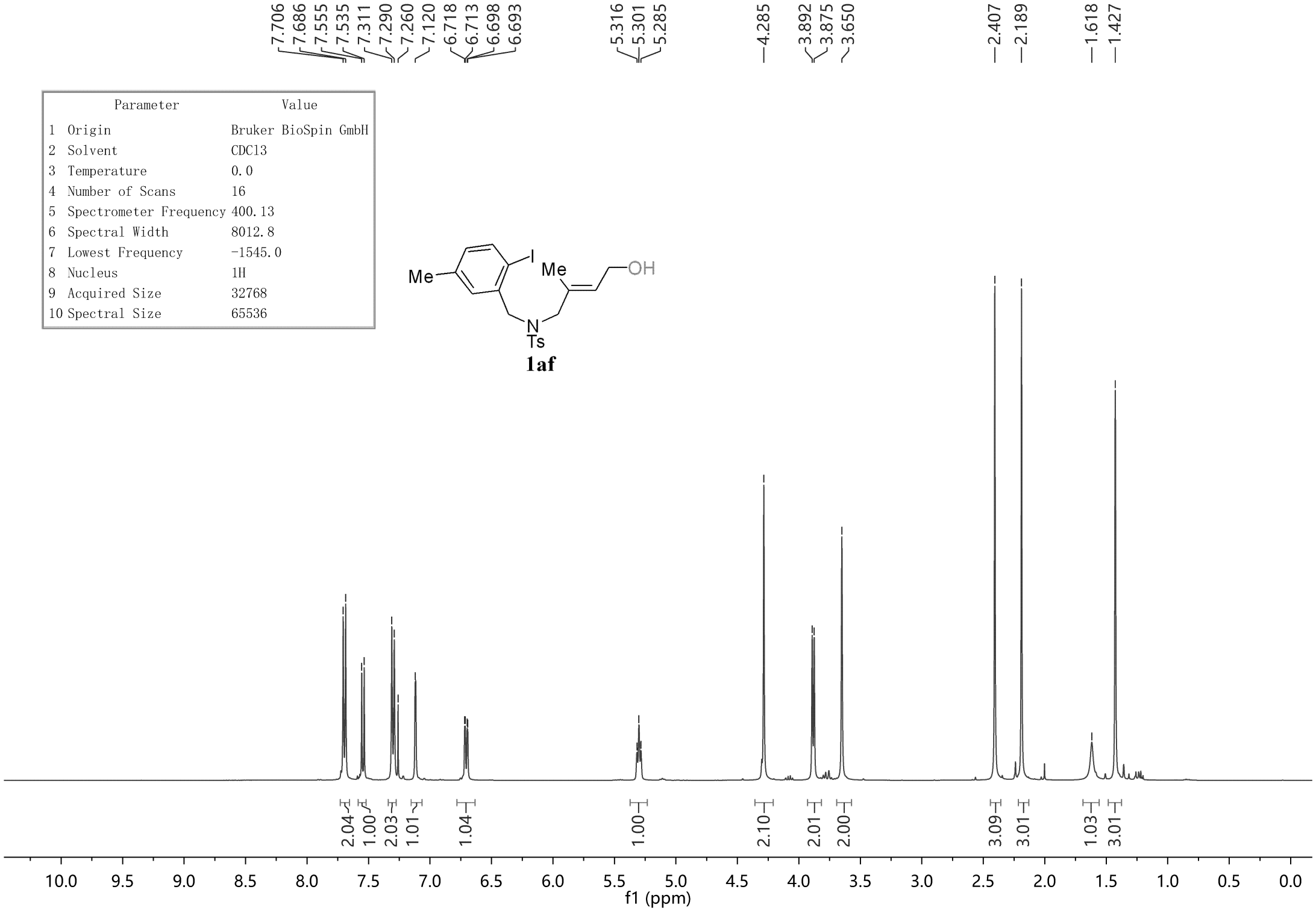

7.730
7.710
7.496
7.492
7.476
7.473
7.335
7.314
7.294
7.275
7.273
7.260
6.937
6.933
6.918
6.915
6.899
6.895
5.329
5.327
5.313
5.310
5.296
5.294
4.319
3.895
3.879
3.668
2.431
1.478
1.418
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 295.9
4 Number of Scans 16
5 Spectrometer Frequency 400.13
6 Spectral Width 8012.8
7 Lowest Frequency -1545.0
8 Nucleus 1H
9 Acquired Size 32768
10 Spectral Size 65536
I
Me
OH
N
Ts
1ae
3.04
1.03
3.00
1.01
1.00
2.00
2.03
2.02
3.06
1.18
3.06
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

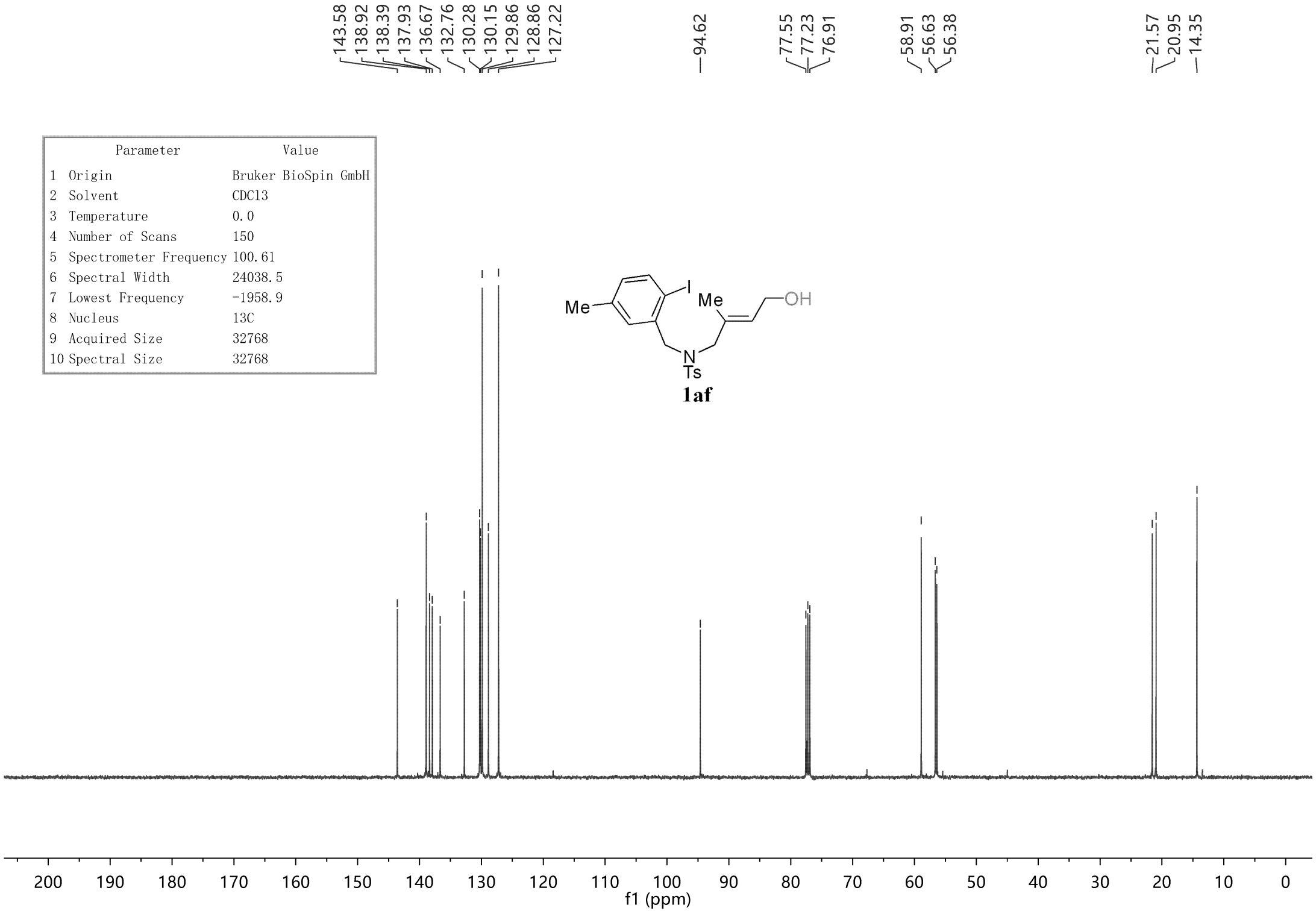

143.65
139.20
138.51
136.43
132.93
129.88
129.65
129.18
128.81
128.41
127.27
98.63
77.45
77.14
76.82
58.95
56.89
56.73
21.60
14.40
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 296.5
4 Number of Scans 220
5 Spectrometer Frequency 100.61
6 Spectral Width 24038.5
7 Lowest Frequency -1958.9
8 Nucleus 13C
9 Acquired Size 32768
10 Spectral Size 32768
I
Me
OH
N
Ts
1ae
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

| Parameter | Value |
|---|---|
| 1 Origin | Bruker BioSpin GmbH |
| 2 Solvent | CDCl3 |
| 3 Temperature | 0.0 |
| 4 Number of Scans | 16 |
| 5 Spectrometer Frequency | 400.13 |
| 6 Spectral Width | 8012.8 |
| 7 Lowest Frequency | -1545.0 |
| 8 Nucleus | 1H |
| 9 Acquired Size | 32768 |
| 10 Spectral Size | 65536 |




**1af**

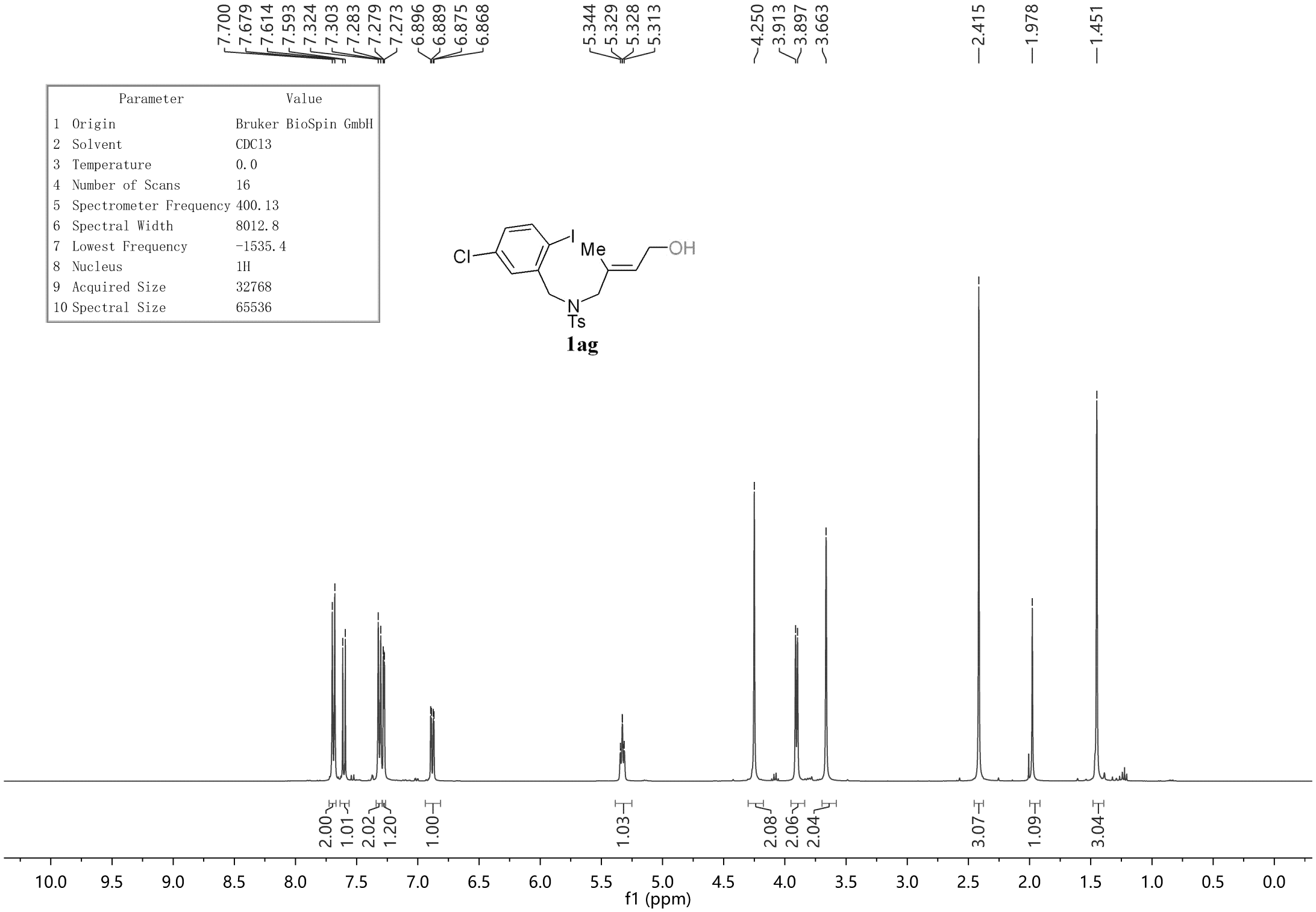


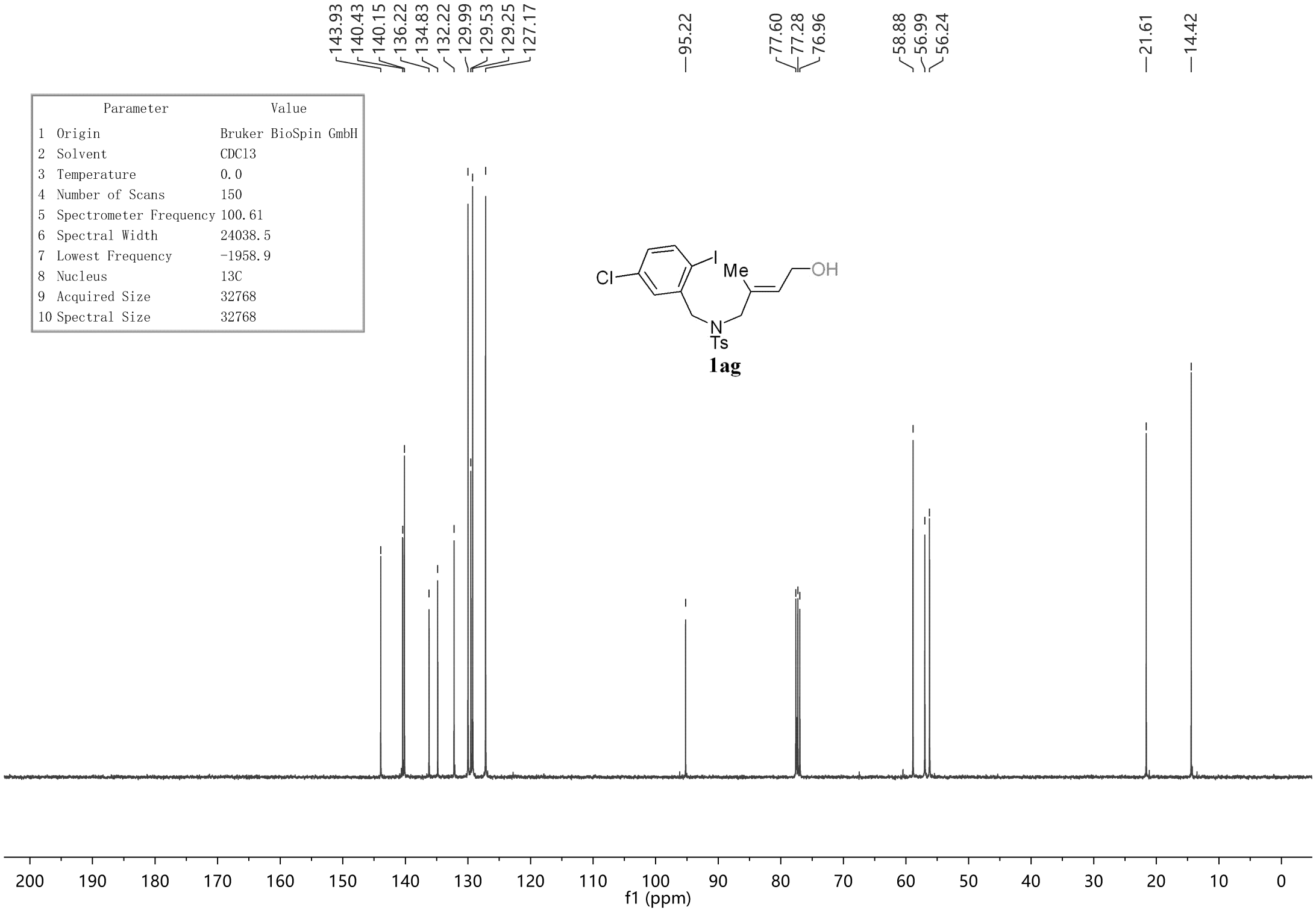

143.58
138.92
138.39
137.93
136.67
132.76
130.28
130.15
129.86
128.86
127.22
94.62
77.55
77.23
76.91
58.91
56.63
56.38
21.57
20.95
14.35
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 0.0
4 Number of Scans 150
5 Spectrometer Frequency 100.61
6 Spectral Width 24038.5
7 Lowest Frequency -1958.9
8 Nucleus 13C
9 Acquired Size 32768
10 Spectral Size 32768
Me
I
Me
OH
N
Ts
1af
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

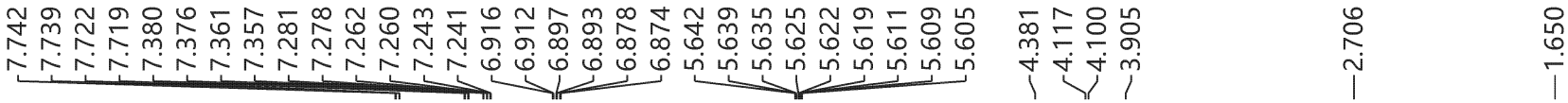
| Parameter | Value |
|---|---|
| 1 Origin | Bruker BioSpin GmbH |
| 2 Solvent | CDCl3 |
| 3 Temperature | 0.0 |
| 4 Number of Scans | 16 |
| 5 Spectrometer Frequency | 400.13 |
| 6 Spectral Width | 8012.8 |
| 7 Lowest Frequency | -1535.4 |
| 8 Nucleus | 1H |
| 9 Acquired Size | 32768 |
| 10 Spectral Size | 65536 |



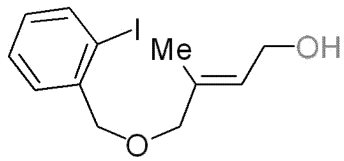

**1ag**



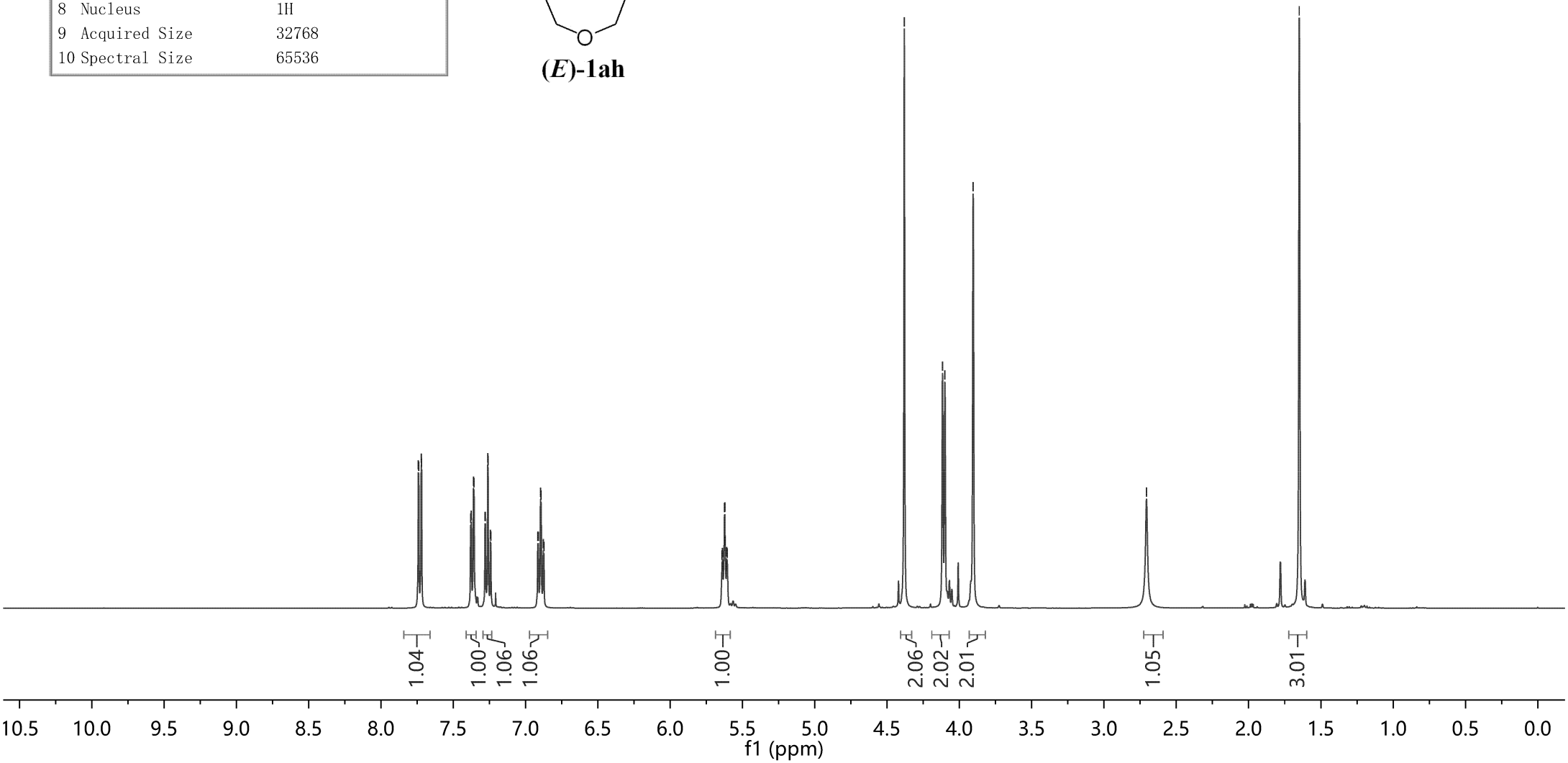

143.93
140.43
140.15
136.22
134.83
132.22
129.99
129.53
129.25
127.17
95.22
77.60
77.28
76.96
58.88
56.99
56.24
21.61
14.42
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDC13
3 Temperature 0.0
4 Number of Scans 150
5 Spectrometer Frequency 100.61
6 Spectral Width 24038.5
7 Lowest Frequency -1958.9
8 Nucleus 13C
9 Acquired Size 32768
10 Spectral Size 32768
Cl
I
Me
OH
N
Ts
1ag
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

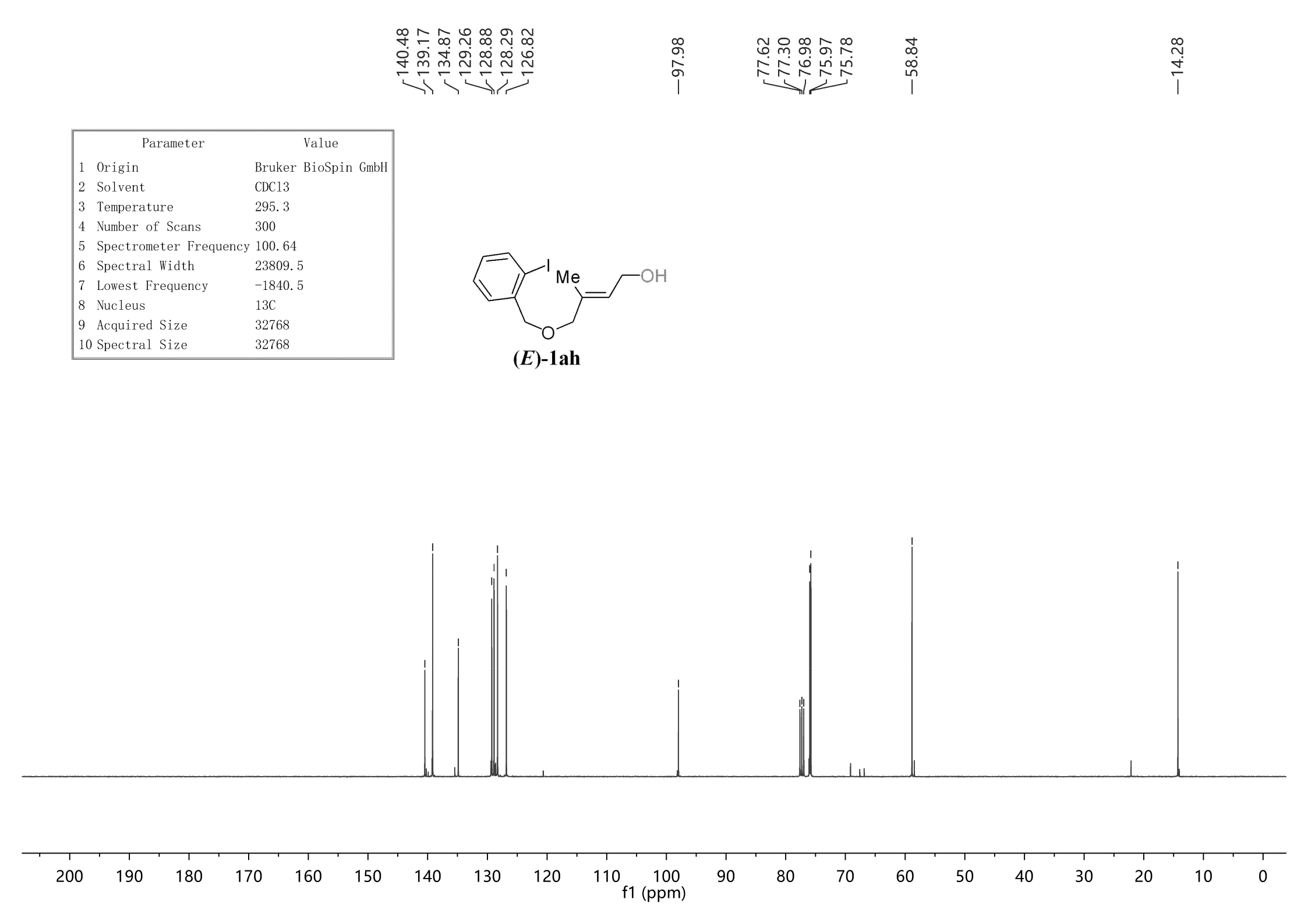



| | Parameter | Value |
|---|---|---|
| 1 | Origin | Bruker BioSpin GmbH |
| 2 | Solvent | CDCl3 |
| 3 | Temperature | 294.3 |
| 4 | Number of Scans | 16 |
| 5 | Spectrometer Frequency | 400.25 |
| 6 | Spectral Width | 8196.7 |
| 7 | Lowest Frequency | -1657.2 |
| 8 | Nucleus | 1H |
| 9 | Acquired Size | 32768 |
| 10 | Spectral Size | 65536 |



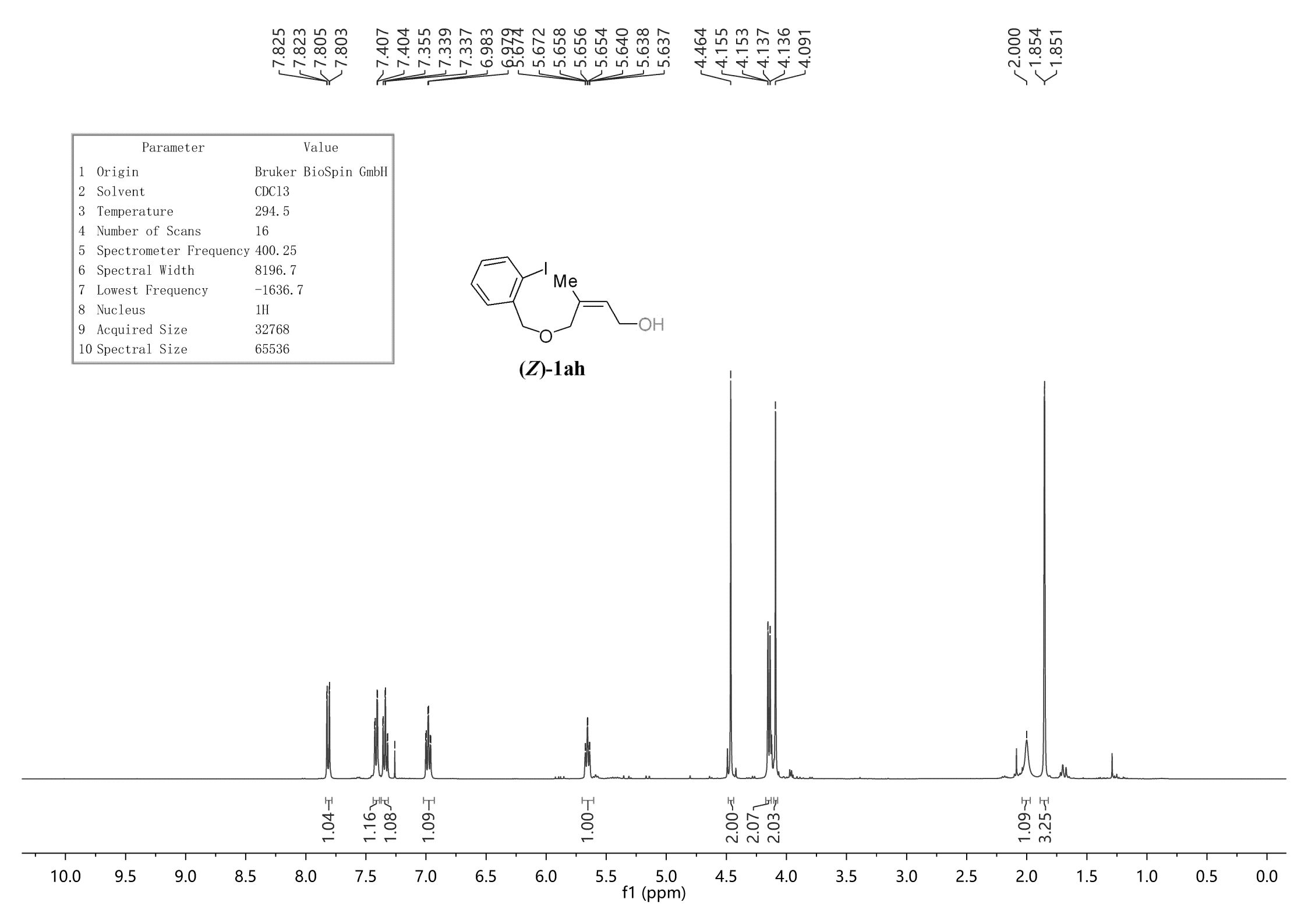

**(*E*)-1ah**

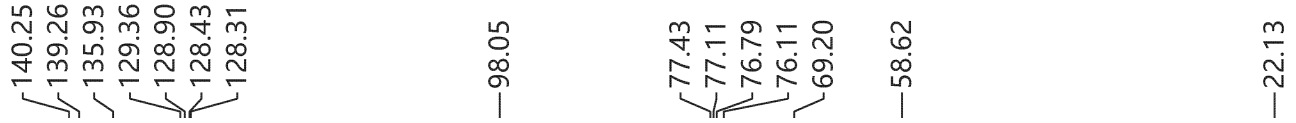




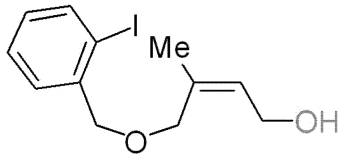

| | Parameter | Value |
|---|---|---|
| 1 | Origin | Bruker BioSpin GmbH |
| 2 | Solvent | CDCl3 |
| 3 | Temperature | 295.3 |
| 4 | Number of Scans | 300 |
| 5 | Spectrometer Frequency | 100.64 |
| 6 | Spectral Width | 23809.5 |
| 7 | Lowest Frequency | -1840.5 |
| 8 | Nucleus | 13C |
| 9 | Acquired Size | 32768 |
| 10 | Spectral Size | 32768 |

**(*E*)-1ah**

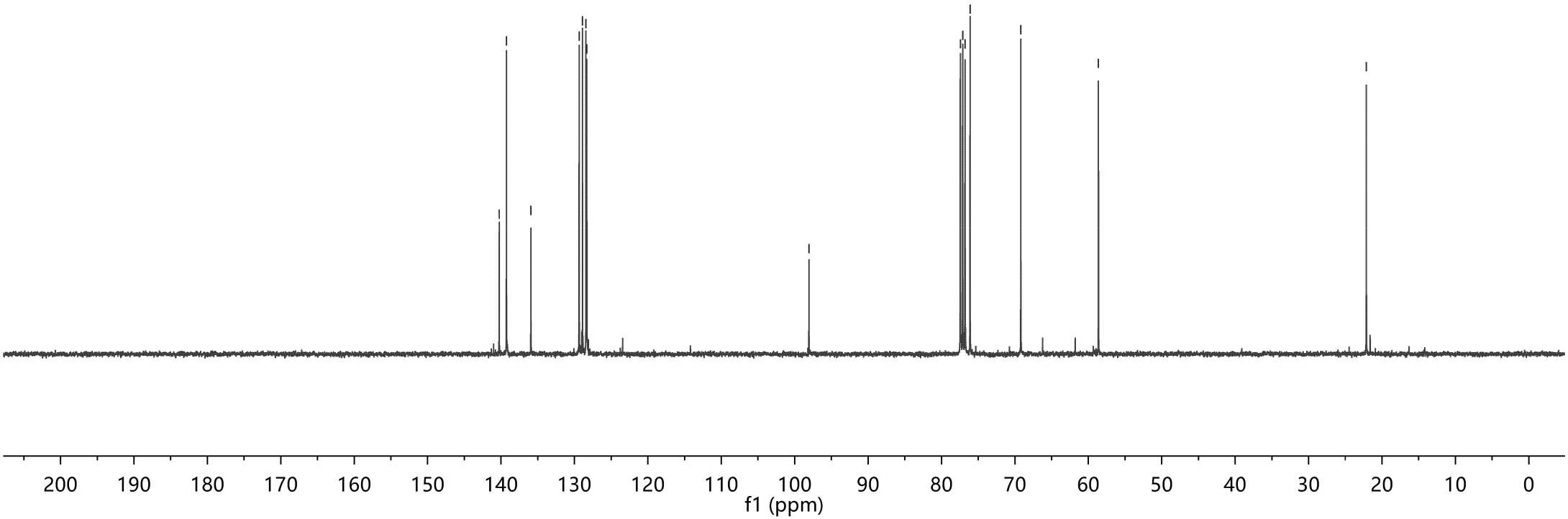

7.825
7.823
7.805
7.803
7.407
7.404
7.355
7.339
7.337
6.983
6.979
6.674
5.672
5.658
5.656
5.654
5.640
5.638
5.637
4.464
4.155
4.153
4.137
4.136
4.091
2.000
1.854
1.851
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 294.5
4 Number of Scans 16
5 Spectrometer Frequency 400.25
6 Spectral Width 8196.7
7 Lowest Frequency -1636.7
8 Nucleus 1H
9 Acquired Size 32768
10 Spectral Size 65536
I
Me
OH
O
(Z)-1ah
1.04
1.16
1.08
1.09
1.00
2.00
2.07
2.03
1.09
3.25
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

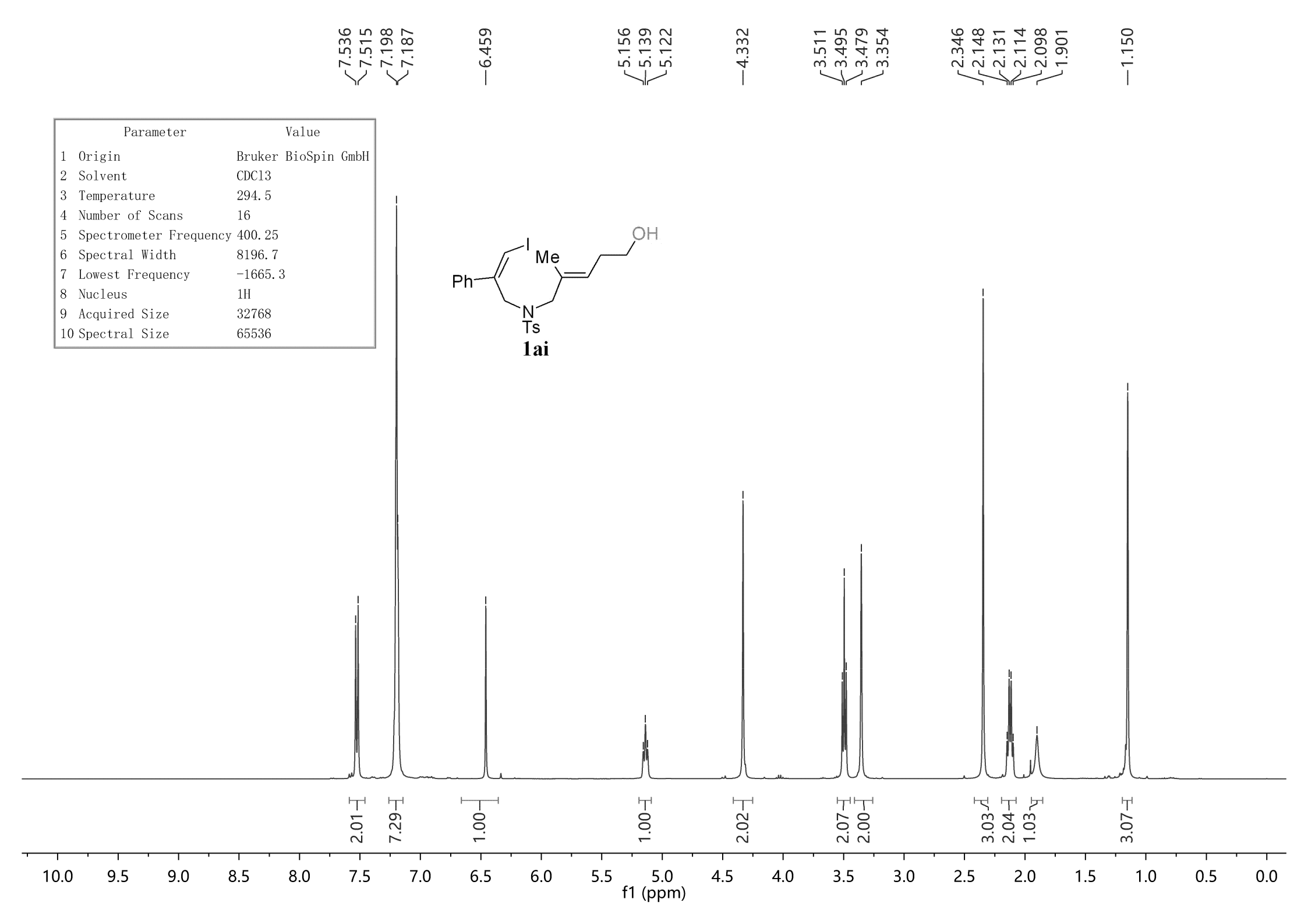


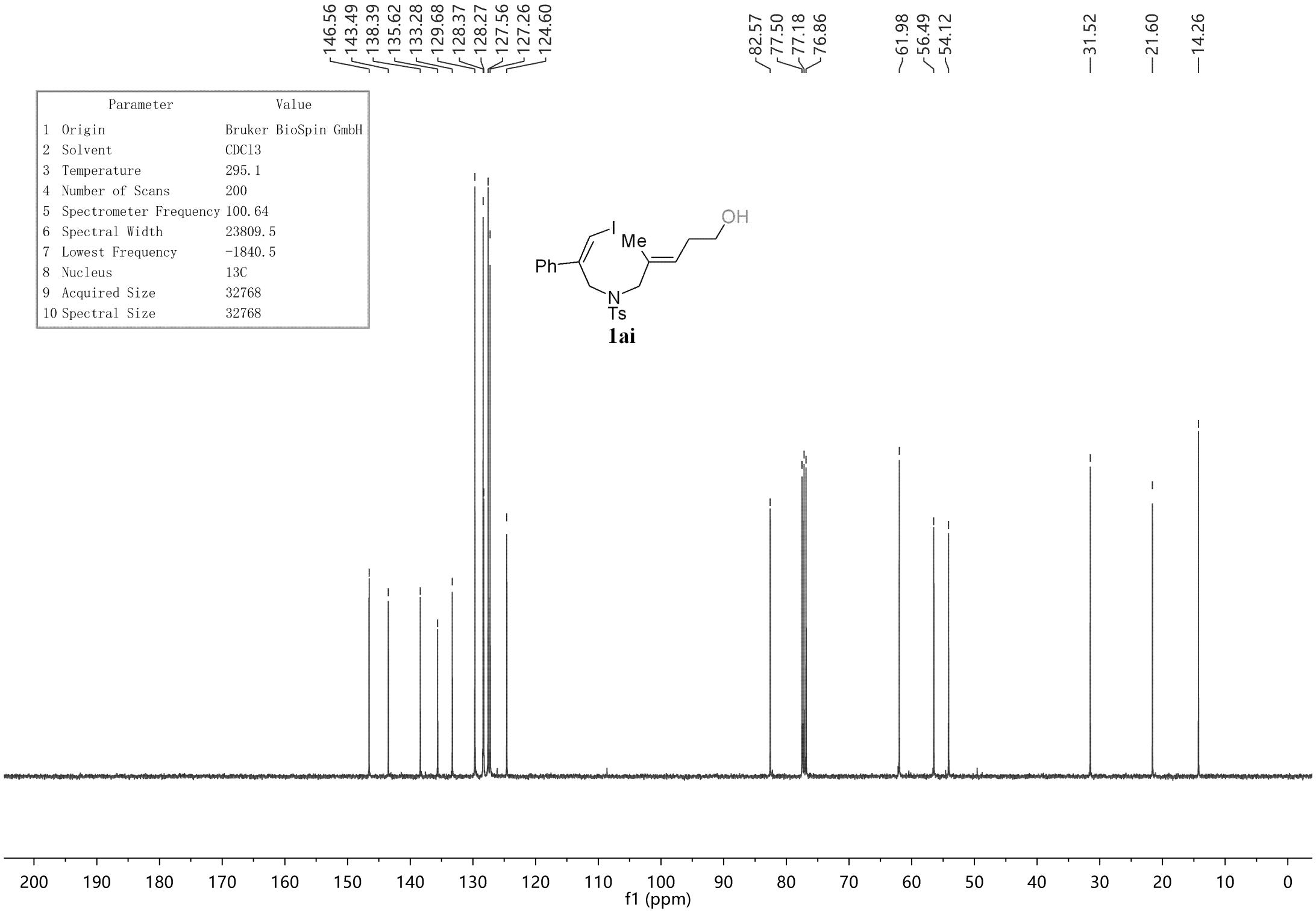

| | Parameter | Value |
|---|---|---|
| 1 | Origin | Bruker BioSpin GmbH |
| 2 | Solvent | CDCl3 |
| 3 | Temperature | 0.0 |
| 4 | Number of Scans | 250 |
| 5 | Spectrometer Frequency | 100.61 |
| 6 | Spectral Width | 24038.5 |
| 7 | Lowest Frequency | -1958.9 |
| 8 | Nucleus | 13C |
| 9 | Acquired Size | 32768 |
| 10 | Spectral Size | 32768 |




**(*Z*)-1ah**



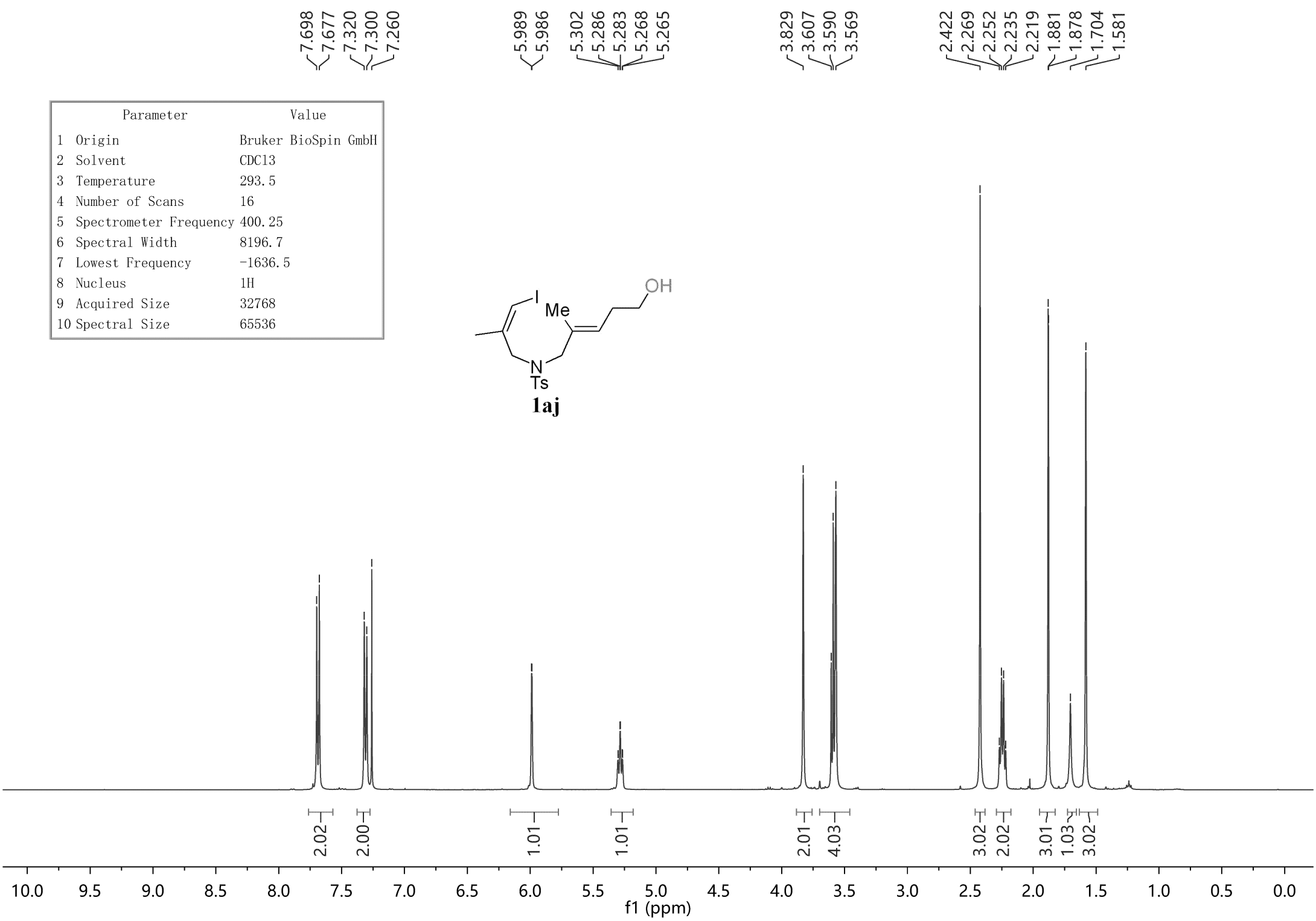

7.536
7.515
7.198
7.187
6.459
5.156
5.139
5.122
4.332
3.511
3.495
3.479
3.354
2.346
2.148
2.131
2.114
2.098
1.901
1.150
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 294.5
4 Number of Scans 16
5 Spectrometer Frequency 400.25
6 Spectral Width 8196.7
7 Lowest Frequency -1665.3
8 Nucleus 1H
9 Acquired Size 32768
10 Spectral Size 65536
I
Me
OH
Ph
N
Ts
1ai
2.01
7.29
1.00
1.00
2.02
2.07
2.00
3.03
2.04
1.03
3.07
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)

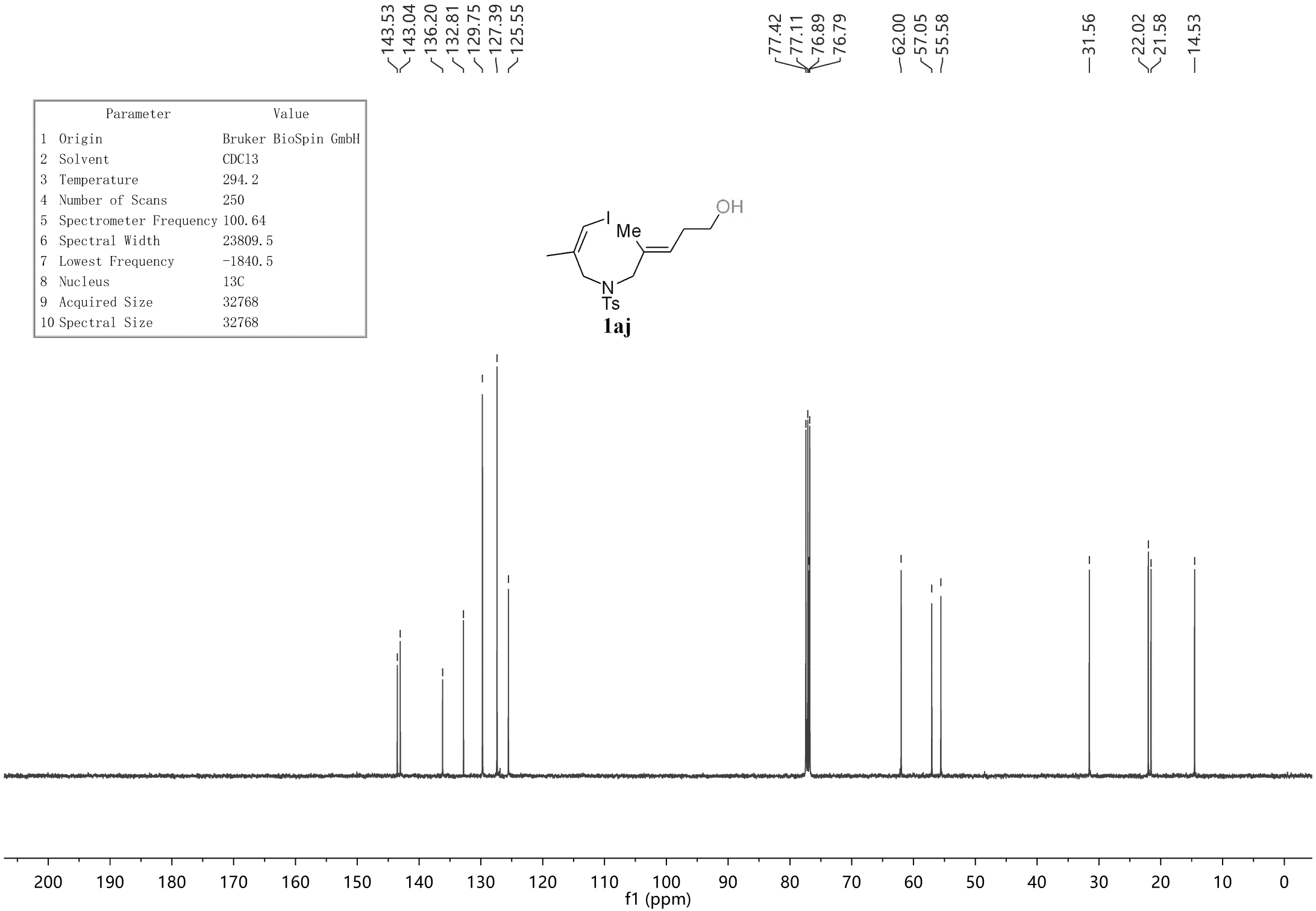

146.56
143.49
138.39
135.62
133.28
129.68
128.37
128.27
127.56
127.26
124.60
82.57
77.50
77.18
76.86
61.98
56.49
54.12
31.52
21.60
14.26
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 295.1
4 Number of Scans 200
5 Spectrometer Frequency 100.64
6 Spectral Width 23809.5
7 Lowest Frequency -1840.5
8 Nucleus 13C
9 Acquired Size 32768
10 Spectral Size 32768
I
Me
OH
Ph
N
Ts
1ai
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

| | Parameter | Value |
|---|---|---|
| 1 | Origin | Bruker BioSpin GmbH |
| 2 | Solvent | CDCl3 |
| 3 | Temperature | 293.5 |
| 4 | Number of Scans | 16 |
| 5 | Spectrometer Frequency | 400.25 |
| 6 | Spectral Width | 8196.7 |
| 7 | Lowest Frequency | -1636.5 |
| 8 | Nucleus | 1H |
| 9 | Acquired Size | 32768 |
| 10 | Spectral Size | 65536 |

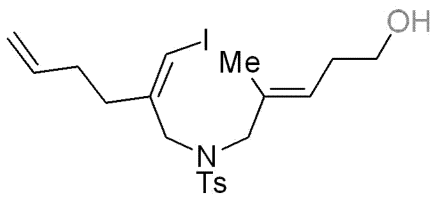



**1aj**

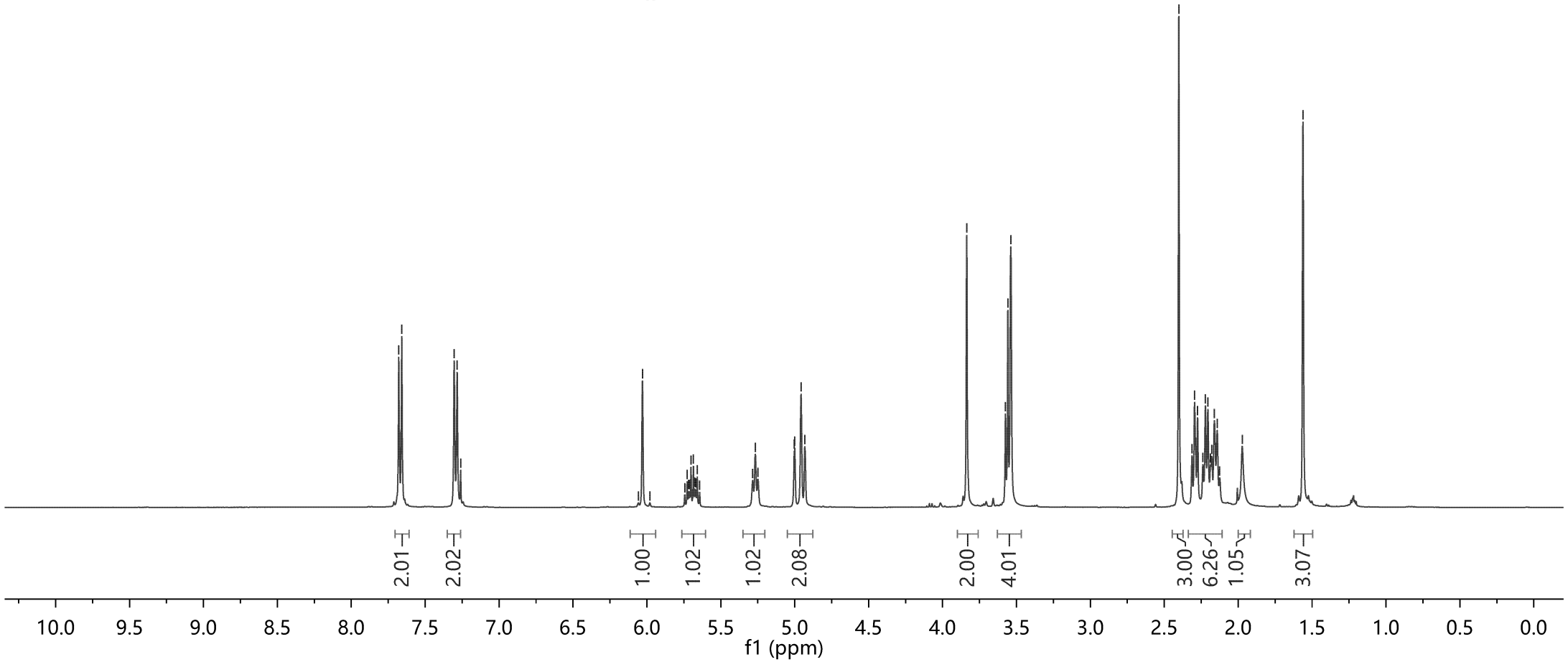


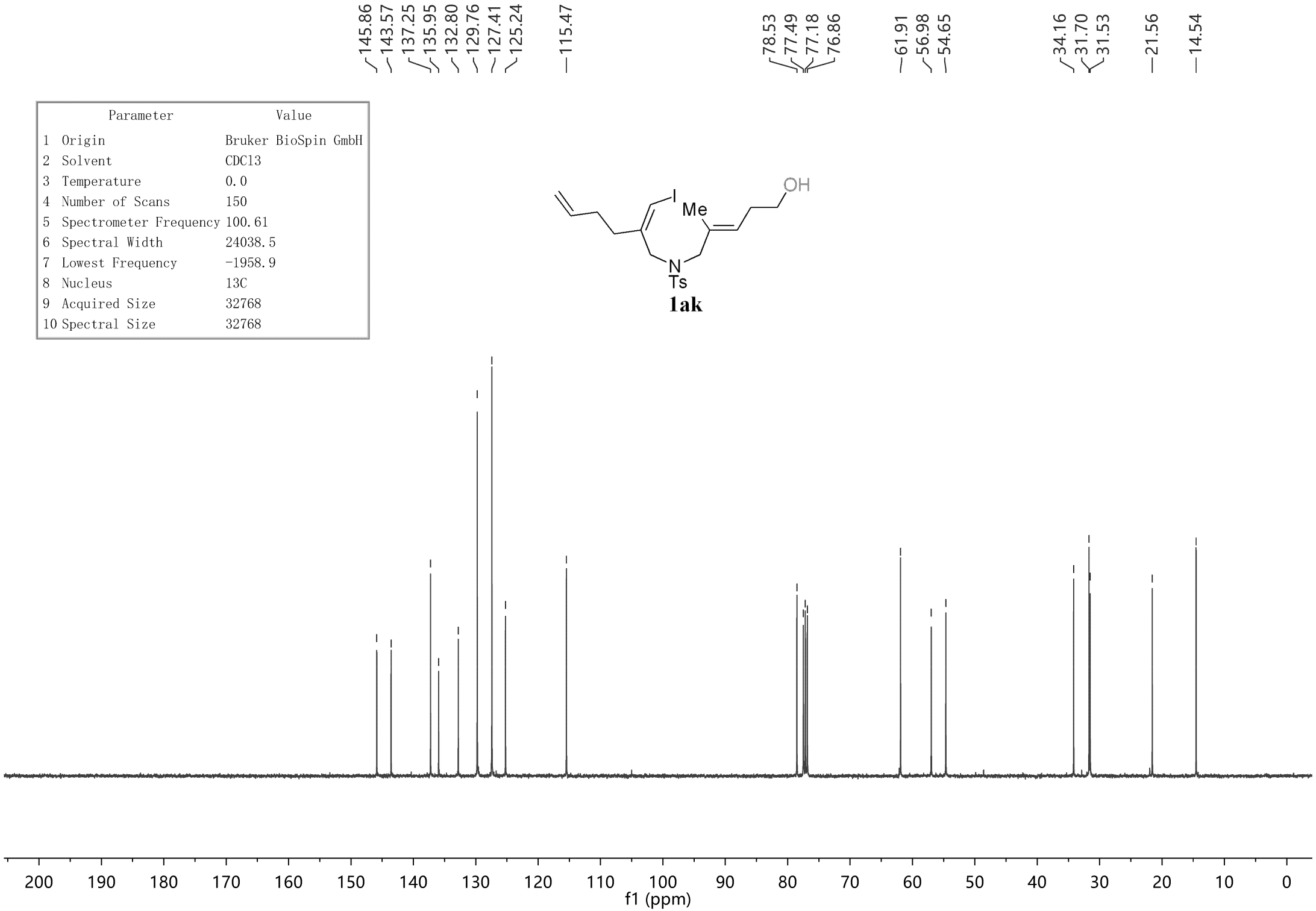

143.53
143.04
136.20
132.81
129.75
127.39
125.55
77.42
77.11
76.89
76.79
62.00
57.05
55.58
31.56
22.02
21.58
14.53
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 294.2
4 Number of Scans 250
5 Spectrometer Frequency 100.64
6 Spectral Width 23809.5
7 Lowest Frequency -1840.5
8 Nucleus 13C
9 Acquired Size 32768
10 Spectral Size 32768
I
Me
OH
N
Ts
1aj
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

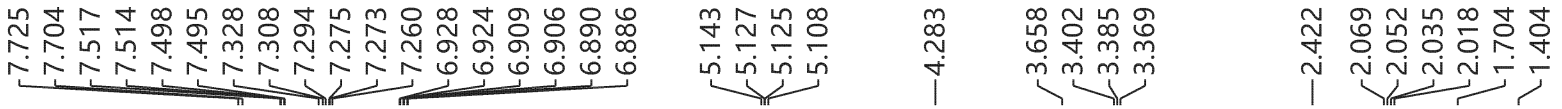
| | Parameter | Value |
|---|---|---|
| 1 | Origin | Bruker BioSpin GmbH |
| 2 | Solvent | CDCl3 |
| 3 | Temperature | 0.0 |
| 4 | Number of Scans | 16 |
| 5 | Spectrometer Frequency | 400.13 |
| 6 | Spectral Width | 8012.8 |
| 7 | Lowest Frequency | -1545.0 |
| 8 | Nucleus | 1H |
| 9 | Acquired Size | 32768 |
| 10 | Spectral Size | 65536 |



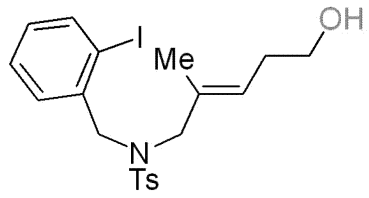

**1ak**



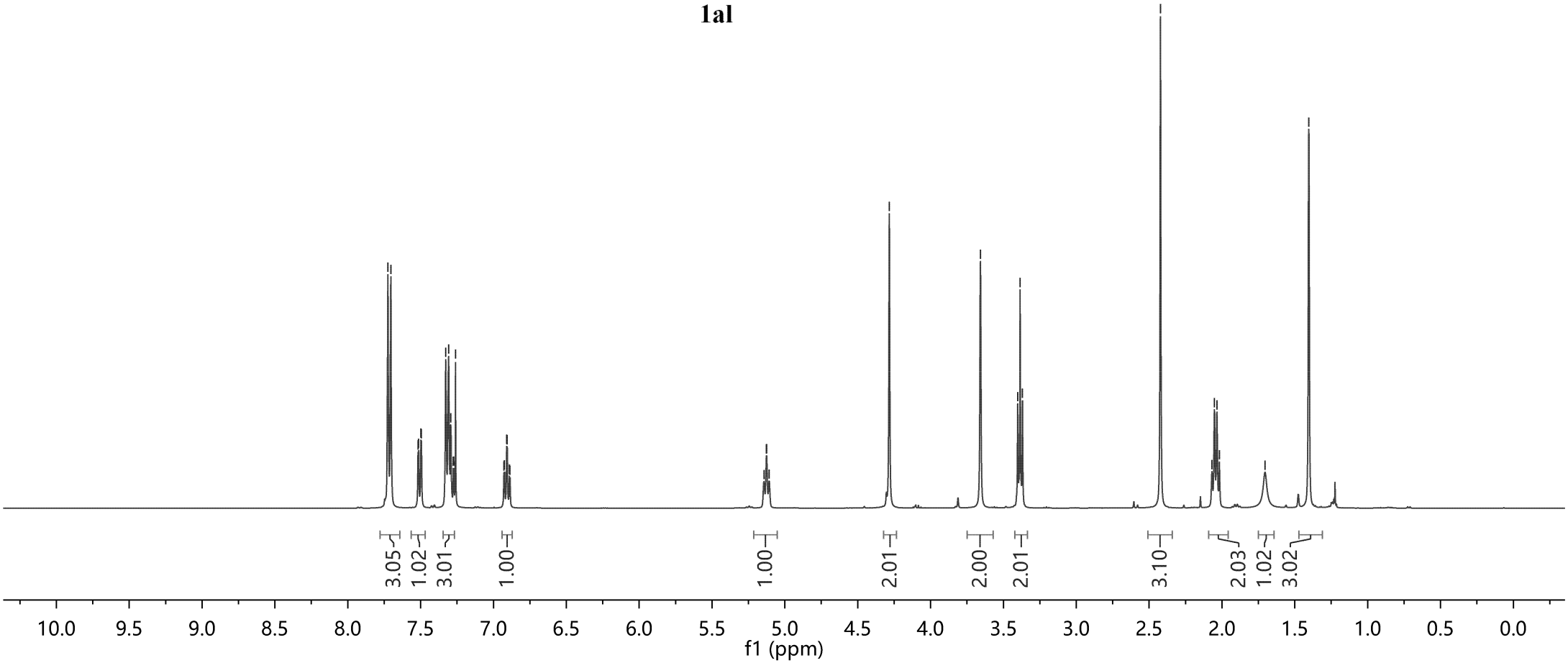

145.86
143.57
137.25
135.95
132.80
129.76
127.41
125.24
115.47
78.53
77.49
77.18
76.86
61.91
56.98
54.65
34.16
31.70
31.53
21.56
14.54
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 0.0
4 Number of Scans 150
5 Spectrometer Frequency 100.61
6 Spectral Width 24038.5
7 Lowest Frequency -1958.9
8 Nucleus 13C
9 Acquired Size 32768
10 Spectral Size 32768
I
Me
OH
N
Ts
1ak
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

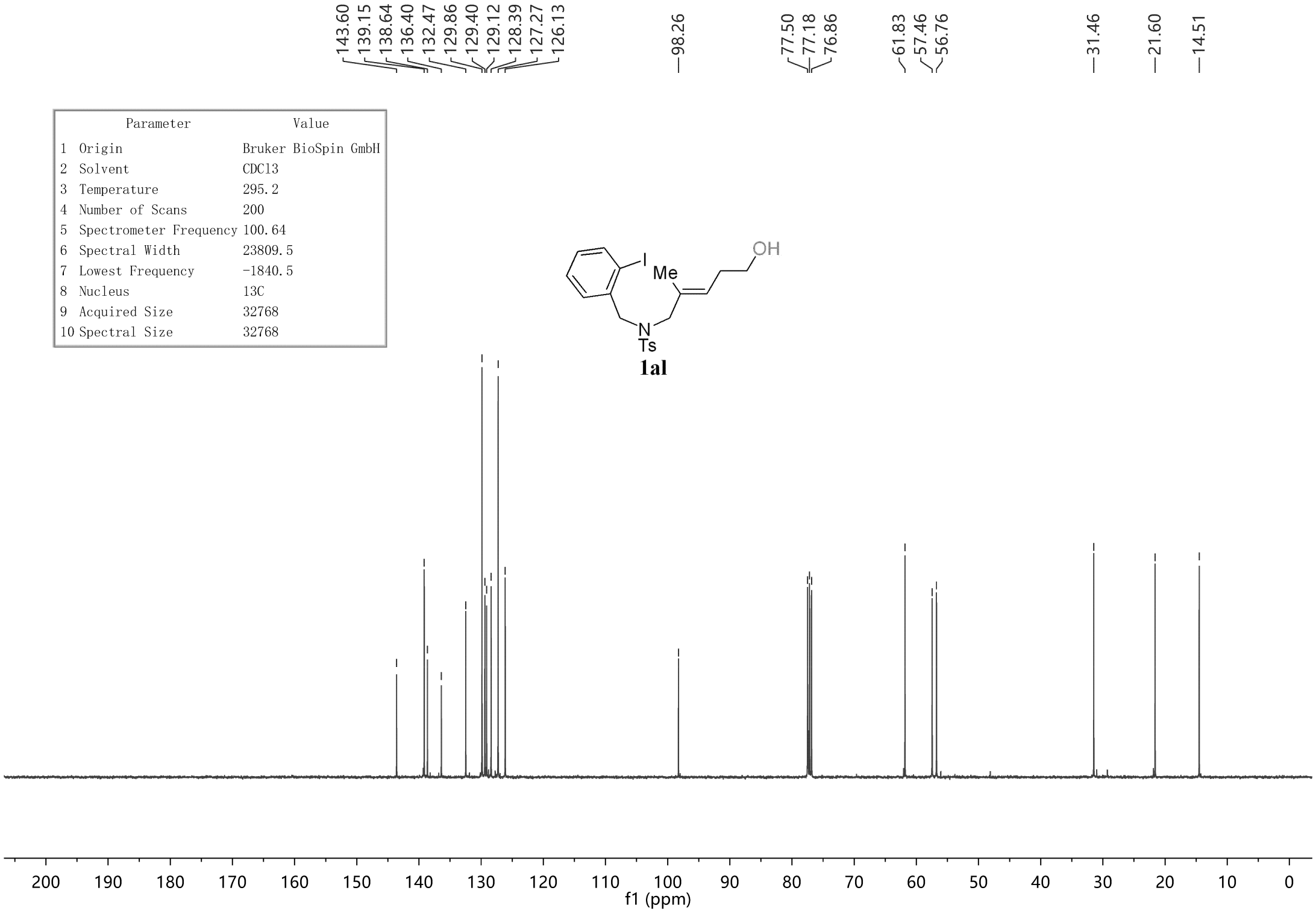


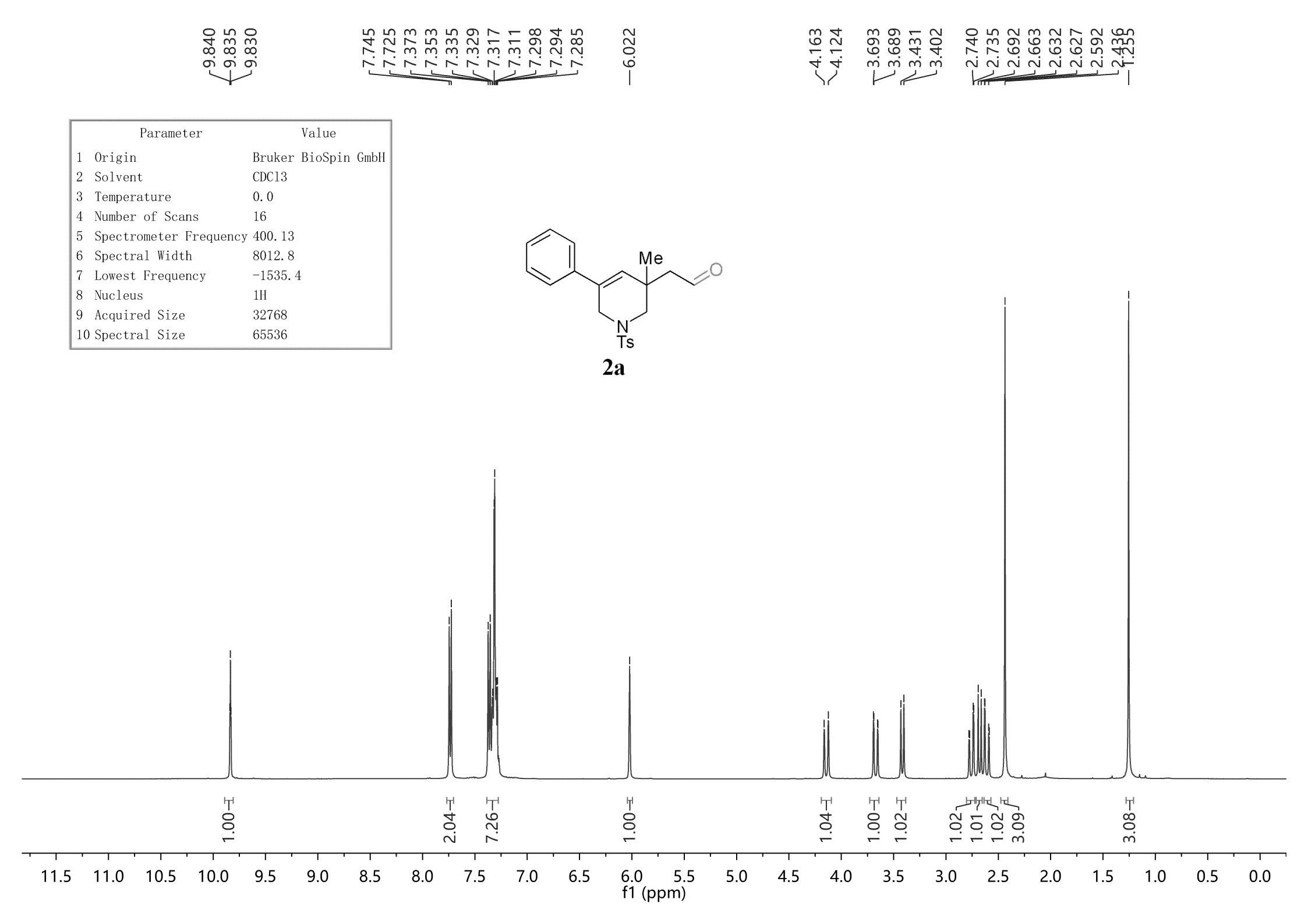

| | Parameter | Value |
|---|---|---|
| 1 | Origin | Bruker BioSpin GmbH |
| 2 | Solvent | CDCl3 |
| 3 | Temperature | 294.4 |
| 4 | Number of Scans | 16 |
| 5 | Spectrometer Frequency | 400.25 |
| 6 | Spectral Width | 8196.7 |
| 7 | Lowest Frequency | -1636.1 |
| 8 | Nucleus | 1H |
| 9 | Acquired Size | 32768 |
| 10 | Spectral Size | 65536 |

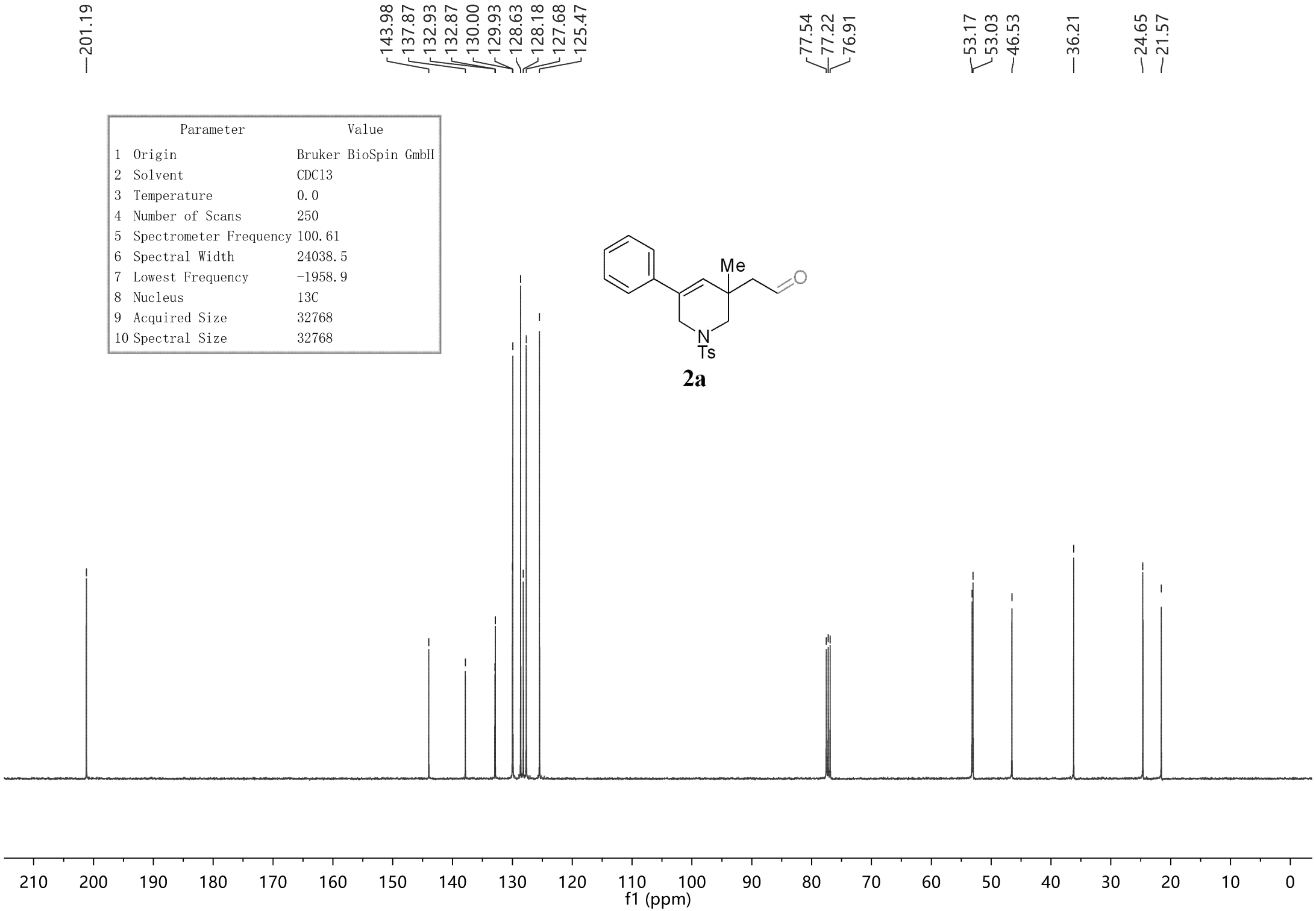



**1al**




143.60
139.15
138.64
136.40
132.47
129.86
129.40
129.12
128.39
127.27
126.13
98.26
77.50
77.18
76.86
61.83
57.46
56.76
31.46
21.60
14.51
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 295.2
4 Number of Scans 200
5 Spectrometer Frequency 100.64
6 Spectral Width 23809.5
7 Lowest Frequency -1840.5
8 Nucleus 13C
9 Acquired Size 32768
10 Spectral Size 32768
I
Me
OH
N
Ts
1al
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

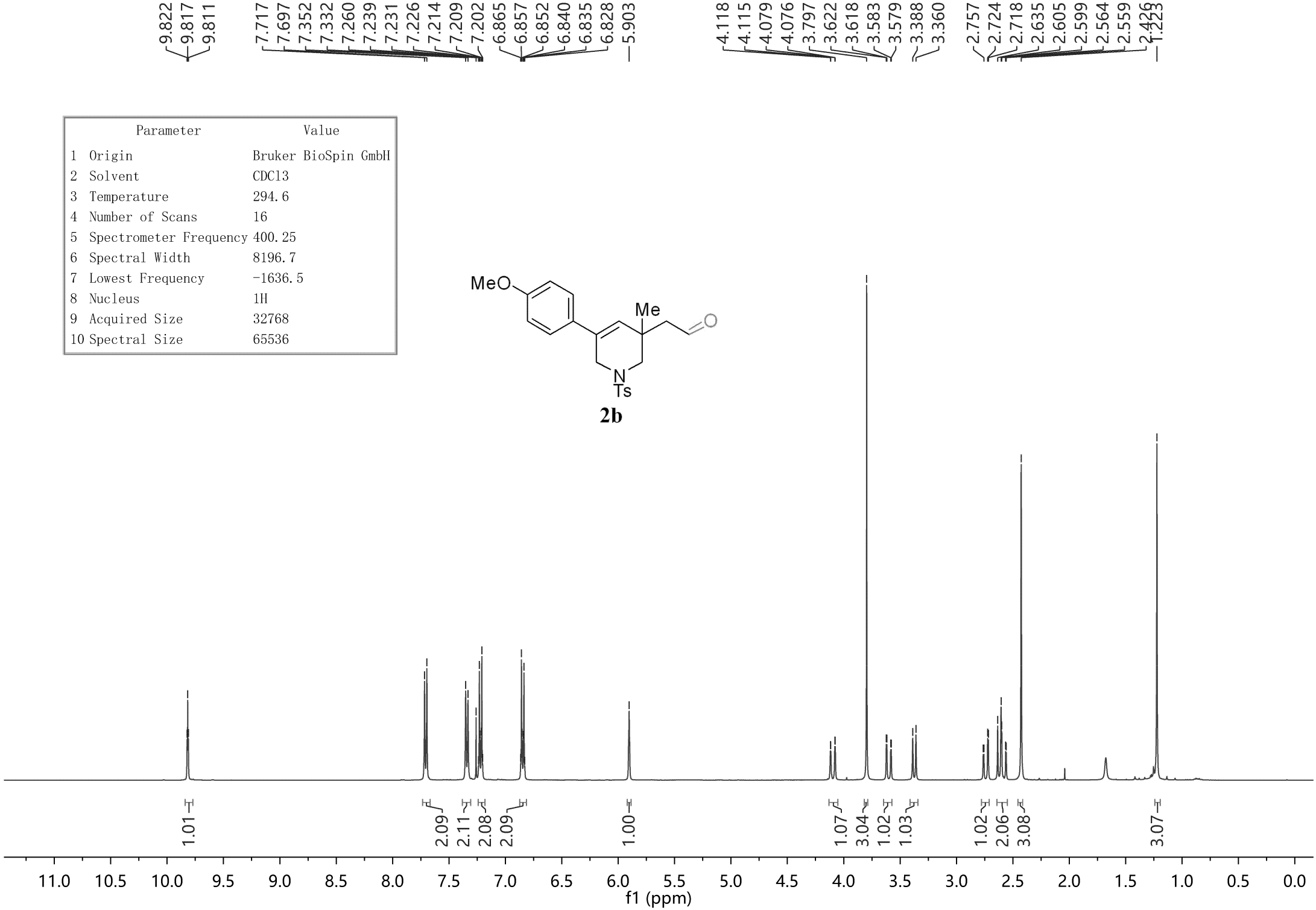

9.840
9.835
9.830
7.745
7.725
7.373
7.353
7.335
7.329
7.317
7.311
7.298
7.294
7.285
6.022
4.163
4.124
3.693
3.689
3.431
3.402
2.740
2.735
2.692
2.663
2.632
2.627
2.592
2.436
1.255
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 0.0
4 Number of Scans 16
5 Spectrometer Frequency 400.13
6 Spectral Width 8012.8
7 Lowest Frequency -1535.4
8 Nucleus 1H
9 Acquired Size 32768
10 Spectral Size 65536
Me
O
N
Ts
2a
1.00
2.04
7.26
1.00
1.04
1.00
1.02
1.02
1.01
1.02
3.09
3.08
11.5 11.0 10.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)

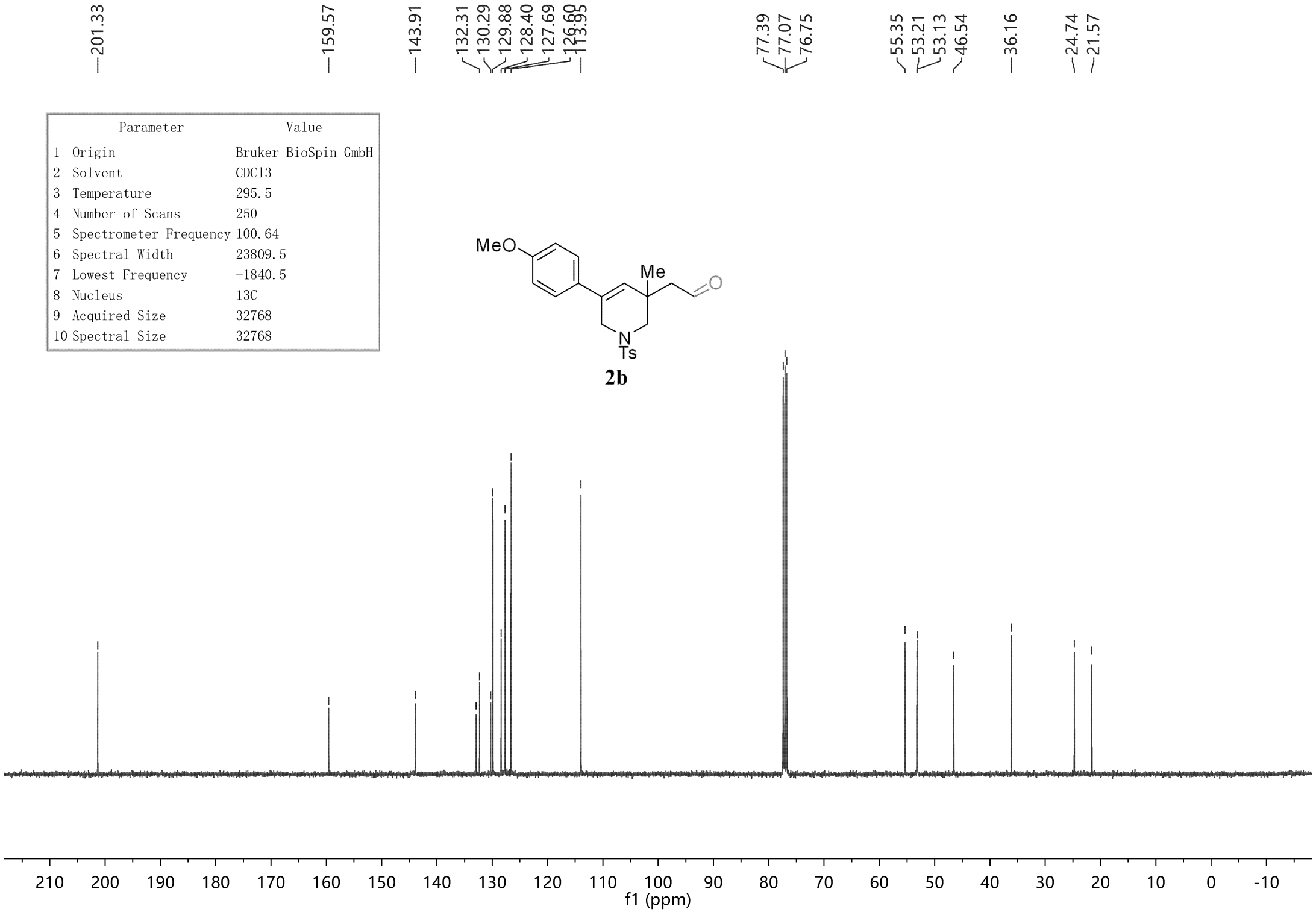

201.19
143.98
137.87
132.93
132.87
130.00
129.93
128.63
128.18
127.68
125.47
77.54
77.22
76.91
53.17
53.03
46.53
36.21
24.65
21.57
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 0.0
4 Number of Scans 250
5 Spectrometer Frequency 100.61
6 Spectral Width 24038.5
7 Lowest Frequency -1958.9
8 Nucleus 13C
9 Acquired Size 32768
10 Spectral Size 32768
Me
O
N
Ts
2a
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

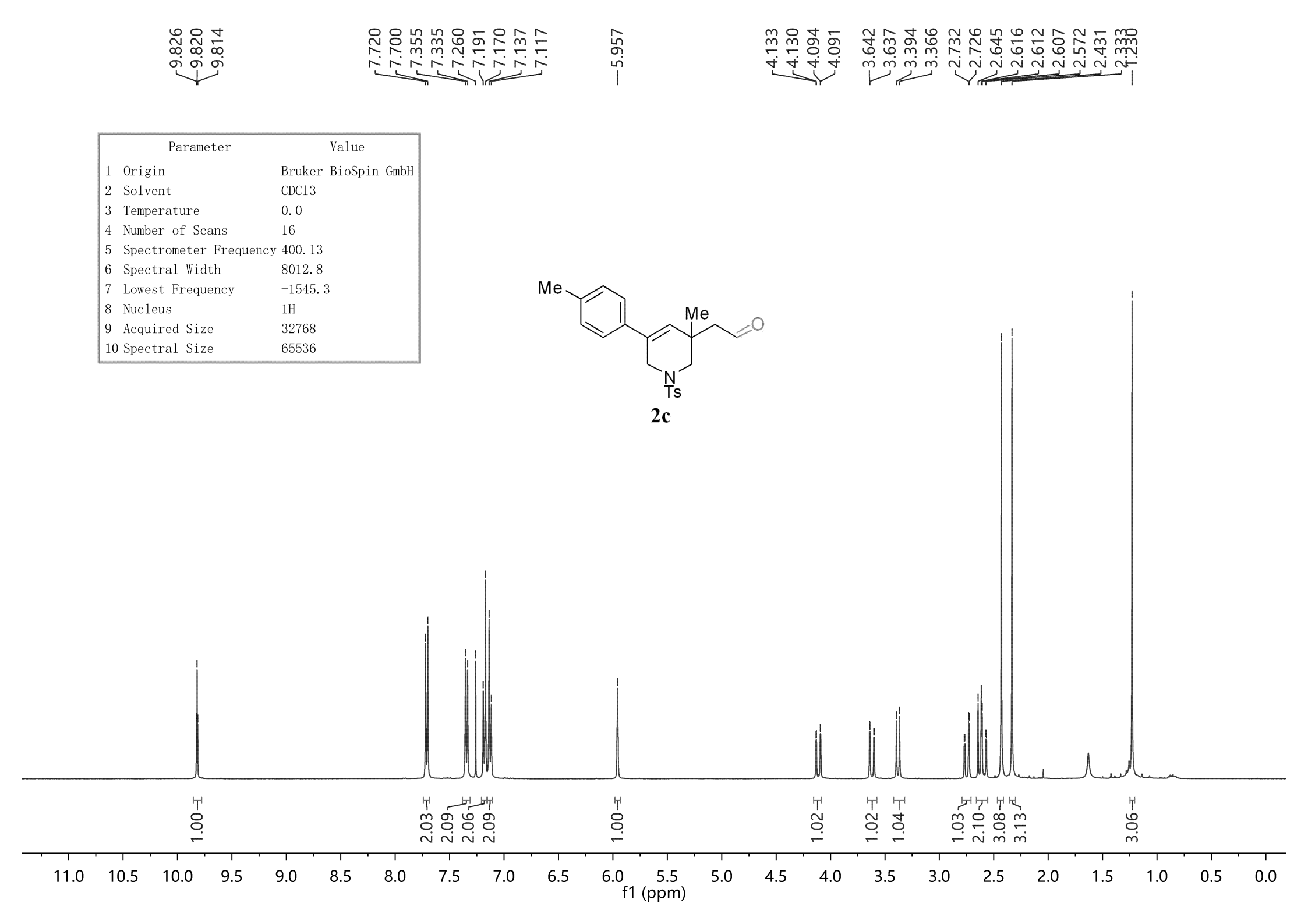
| Parameter | Value |
|---|---|
| 1 Origin | Bruker BioSpin GmbH |
| 2 Solvent | CDCl3 |
| 3 Temperature | 294.6 |
| 4 Number of Scans | 16 |
| 5 Spectrometer Frequency | 400.25 |
| 6 Spectral Width | 8196.7 |
| 7 Lowest Frequency | -1636.5 |
| 8 Nucleus | 1H |
| 9 Acquired Size | 32768 |
| 10 Spectral Size | 65536 |

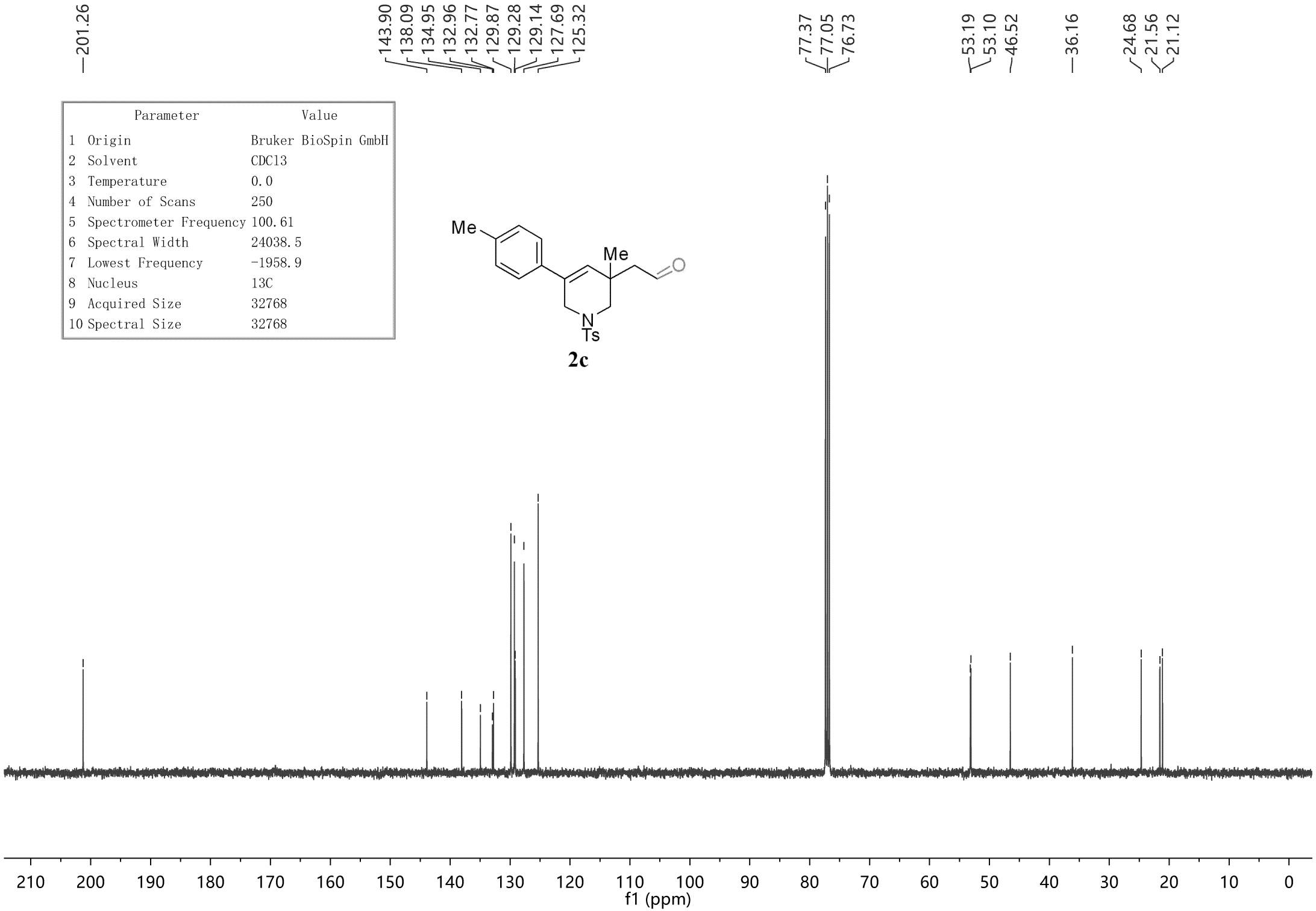



**2b**




201.33
159.57
143.91
132.31
130.29
129.88
128.40
127.69
126.60
113.95
77.39
77.07
76.75
55.35
53.21
53.13
46.54
36.16
24.74
21.57
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 295.5
4 Number of Scans 250
5 Spectrometer Frequency 100.64
6 Spectral Width 23809.5
7 Lowest Frequency -1840.5
8 Nucleus 13C
9 Acquired Size 32768
10 Spectral Size 32768
MeO
Me
O
N
Ts
2b
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

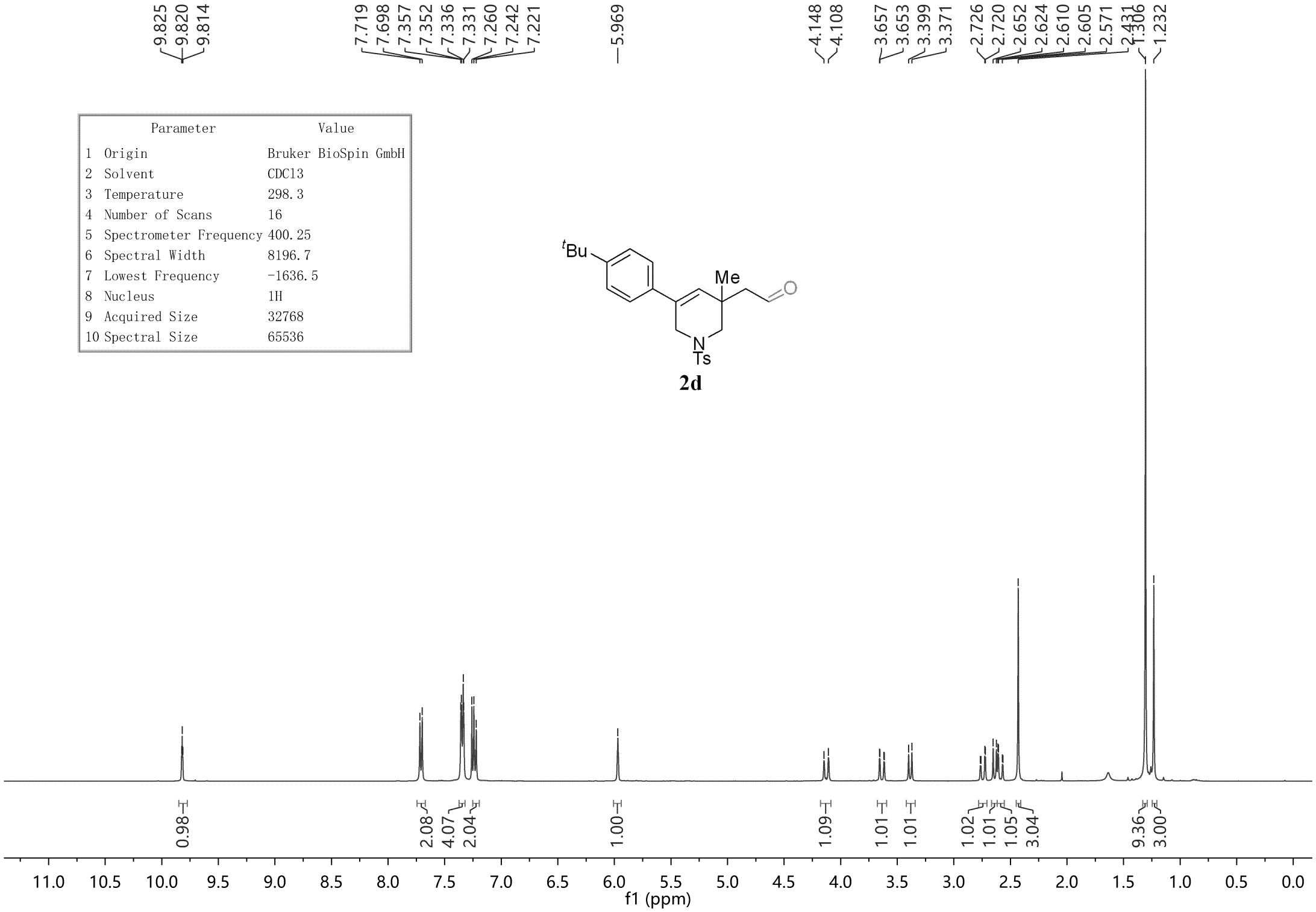

9.826
9.820
9.814
7.720
7.700
7.355
7.335
7.260
7.191
7.170
7.137
7.117
5.957
4.133
4.130
4.094
4.091
3.642
3.637
3.394
3.366
2.732
2.726
2.645
2.616
2.612
2.607
2.572
2.431
2.333
1.230
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 0.0
4 Number of Scans 16
5 Spectrometer Frequency 400.13
6 Spectral Width 8012.8
7 Lowest Frequency -1545.3
8 Nucleus 1H
9 Acquired Size 32768
10 Spectral Size 65536
Me
Me
O
N
Ts
2c
1.00
2.03
2.09
2.06
2.09
1.00
1.02
1.02
1.04
1.03
2.10
3.08
3.13
3.06
11.0 10.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)

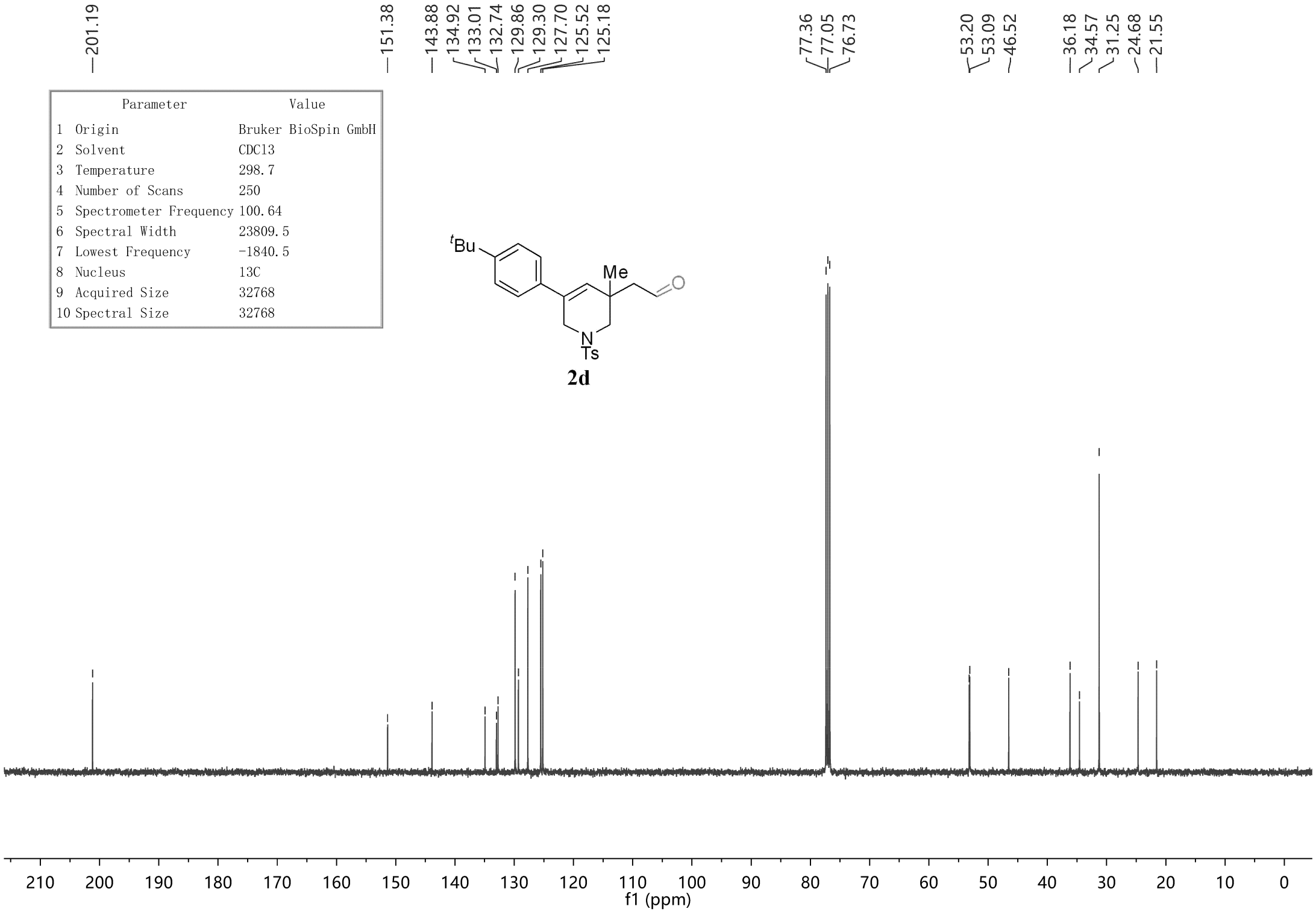

201.26
143.90
138.09
134.95
132.96
132.77
129.87
129.28
129.14
127.69
125.32
77.37
77.05
76.73
53.19
53.10
46.52
36.16
24.68
21.56
21.12
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 0.0
4 Number of Scans 250
5 Spectrometer Frequency 100.61
6 Spectral Width 24038.5
7 Lowest Frequency -1958.9
8 Nucleus 13C
9 Acquired Size 32768
10 Spectral Size 32768
Me
Me
O
N
Ts
2c
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

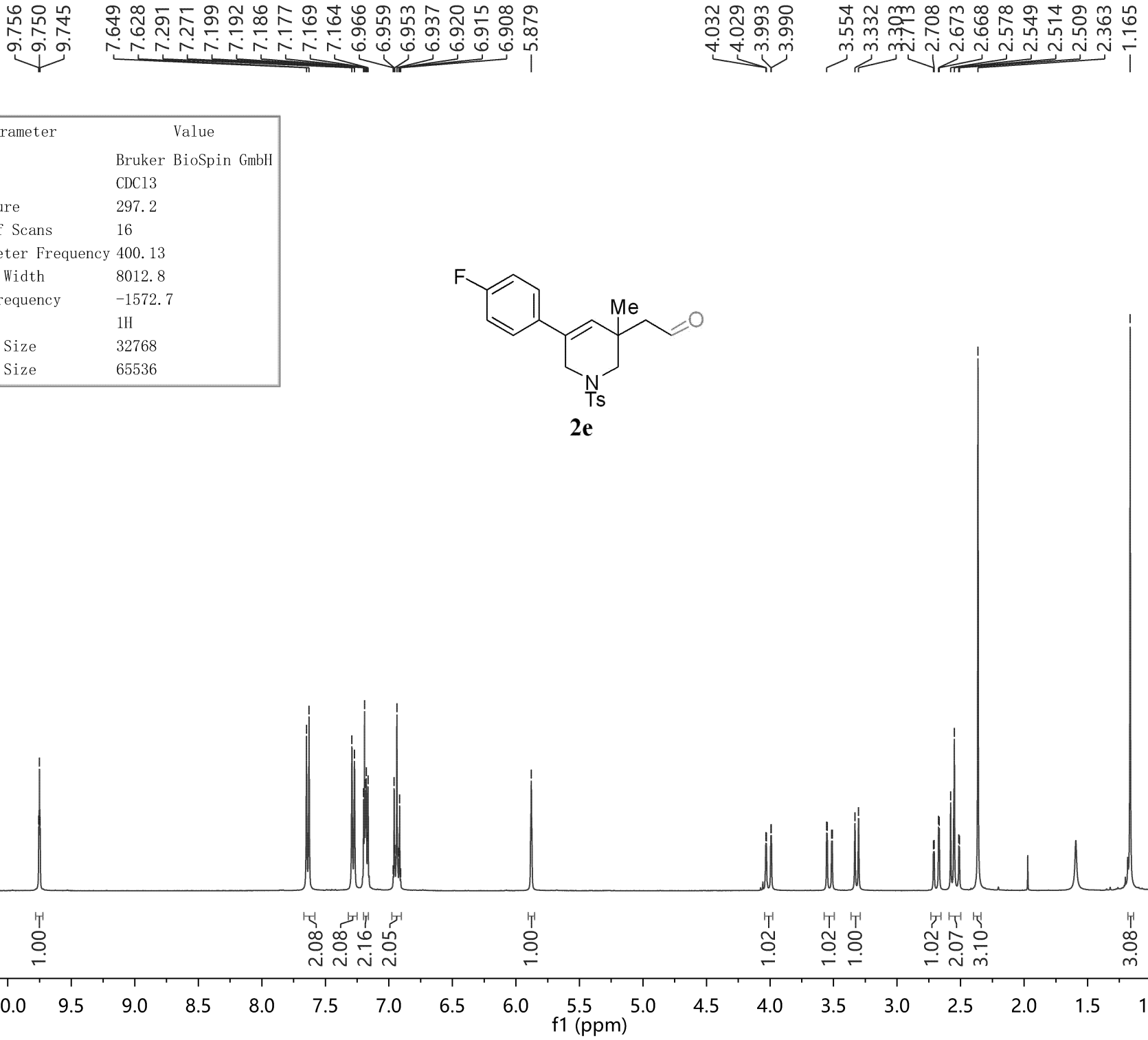
| Parameter | Value |
|---|---|
| 1 Origin | Bruker BioSpin GmbH |
| 2 Solvent | CDCl3 |
| 3 Temperature | 298.3 |
| 4 Number of Scans | 16 |
| 5 Spectrometer Frequency | 400.25 |
| 6 Spectral Width | 8196.7 |
| 7 Lowest Frequency | -1636.5 |
| 8 Nucleus | 1H |
| 9 Acquired Size | 32768 |
| 10 Spectral Size | 65536 |

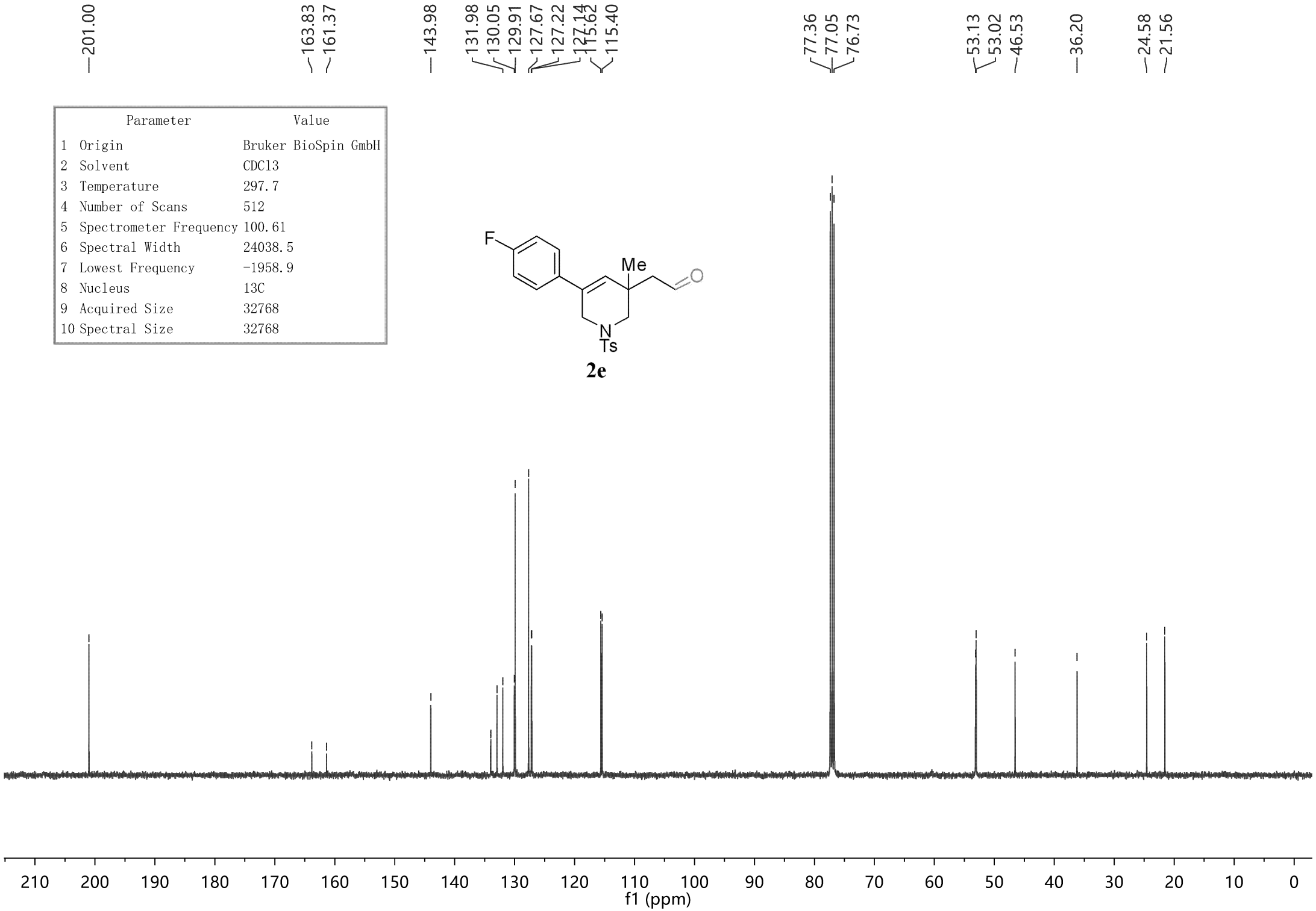



**2d**




201.19
151.38
143.88
134.92
133.01
132.74
129.86
129.30
127.70
125.52
125.18
77.36
77.05
76.73
53.20
53.09
46.52
36.18
34.57
31.25
24.68
21.55
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.7
4 Number of Scans 250
5 Spectrometer Frequency 100.64
6 Spectral Width 23809.5
7 Lowest Frequency -1840.5
8 Nucleus 13C
9 Acquired Size 32768
10 Spectral Size 32768
tBu
Me
O
N
Ts
2d
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

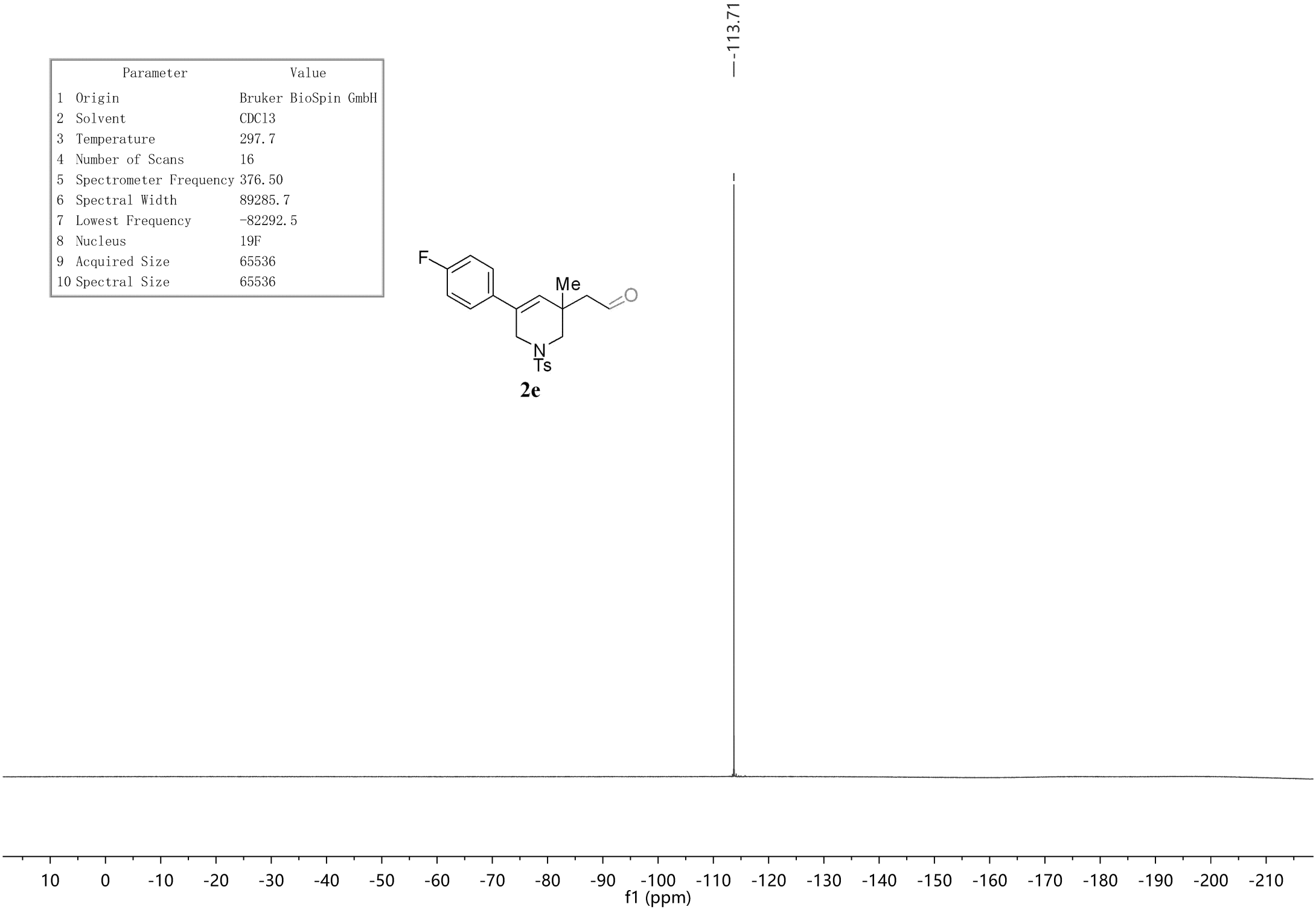

9.756
9.750
9.745
7.649
7.628
7.291
7.271
7.199
7.192
7.186
7.177
7.169
7.164
6.966
6.959
6.953
6.937
6.920
6.915
6.908
5.879
4.032
4.029
3.993
3.990
3.554
3.332
3.303
2.713
2.708
2.673
2.668
2.578
2.549
2.514
2.509
2.363
1.165
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 297.2
4 Number of Scans 16
5 Spectrometer Frequency 400.13
6 Spectral Width 8012.8
7 Lowest Frequency -1572.7
8 Nucleus 1H
9 Acquired Size 32768
10 Spectral Size 65536
F
Me
O
N
Ts
2e
1.00
2.08
2.08
2.16
2.05
1.00
1.02
1.02
1.00
1.02
2.07
3.10
3.08
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

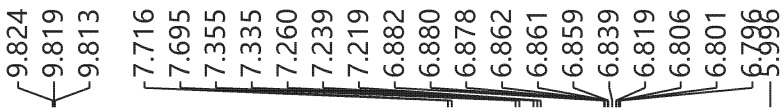

201.00
163.83
161.37
143.98
131.98
130.05
129.91
127.67
127.22
127.14
115.62
115.40
77.36
77.05
76.73
53.13
53.02
46.53
36.20
24.58
21.56
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 297.7
4 Number of Scans 512
5 Spectrometer Frequency 100.61
6 Spectral Width 24038.5
7 Lowest Frequency -1958.9
8 Nucleus 13C
9 Acquired Size 32768
10 Spectral Size 32768
F
Me
O
N
Ts
2e
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

| | Parameter | Value |
|---|---|---|
| 1 | Origin | Bruker BioSpin GmbH |
| 2 | Solvent | CDCl3 |
| 3 | Temperature | 297.7 |
| 4 | Number of Scans | 16 |
| 5 | Spectrometer Frequency | 376.50 |
| 6 | Spectral Width | 89285.7 |
| 7 | Lowest Frequency | -82292.5 |
| 8 | Nucleus | 19F |
| 9 | Acquired Size | 65536 |
| 10 | Spectral Size | 65536 |



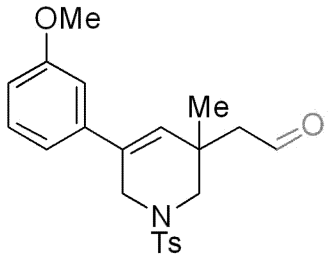

**2e**



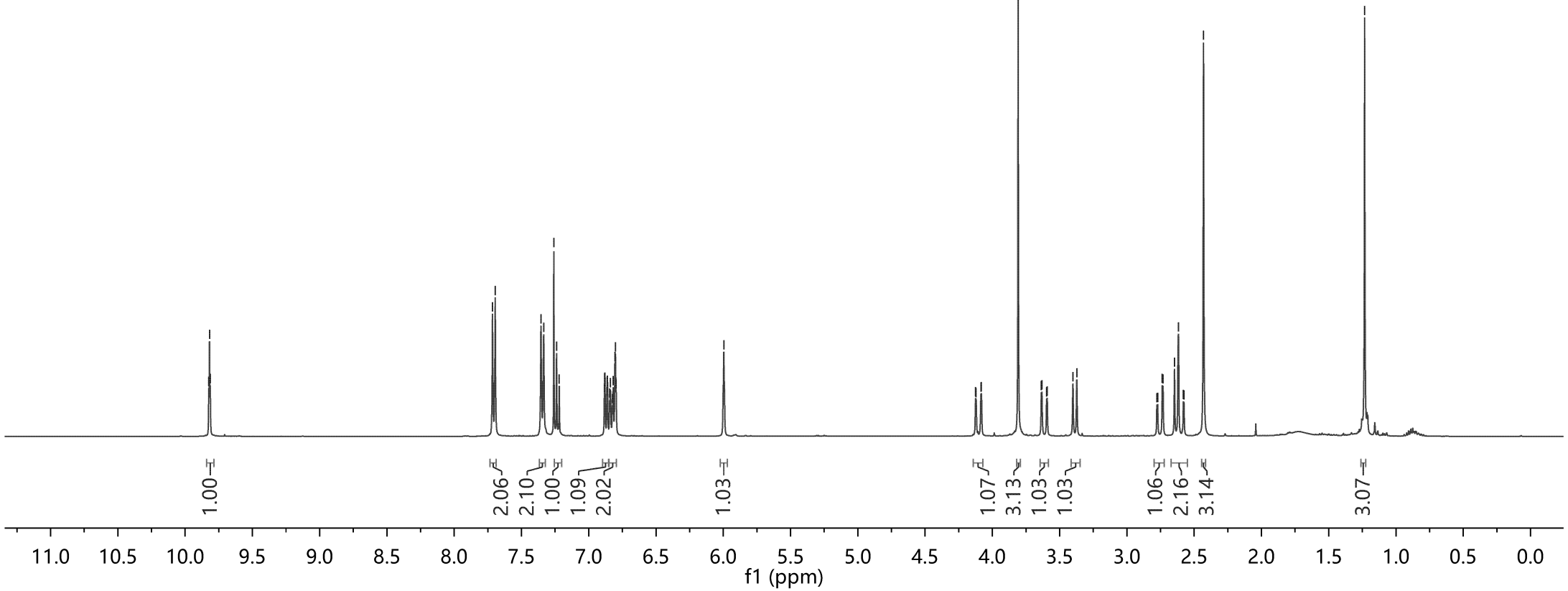


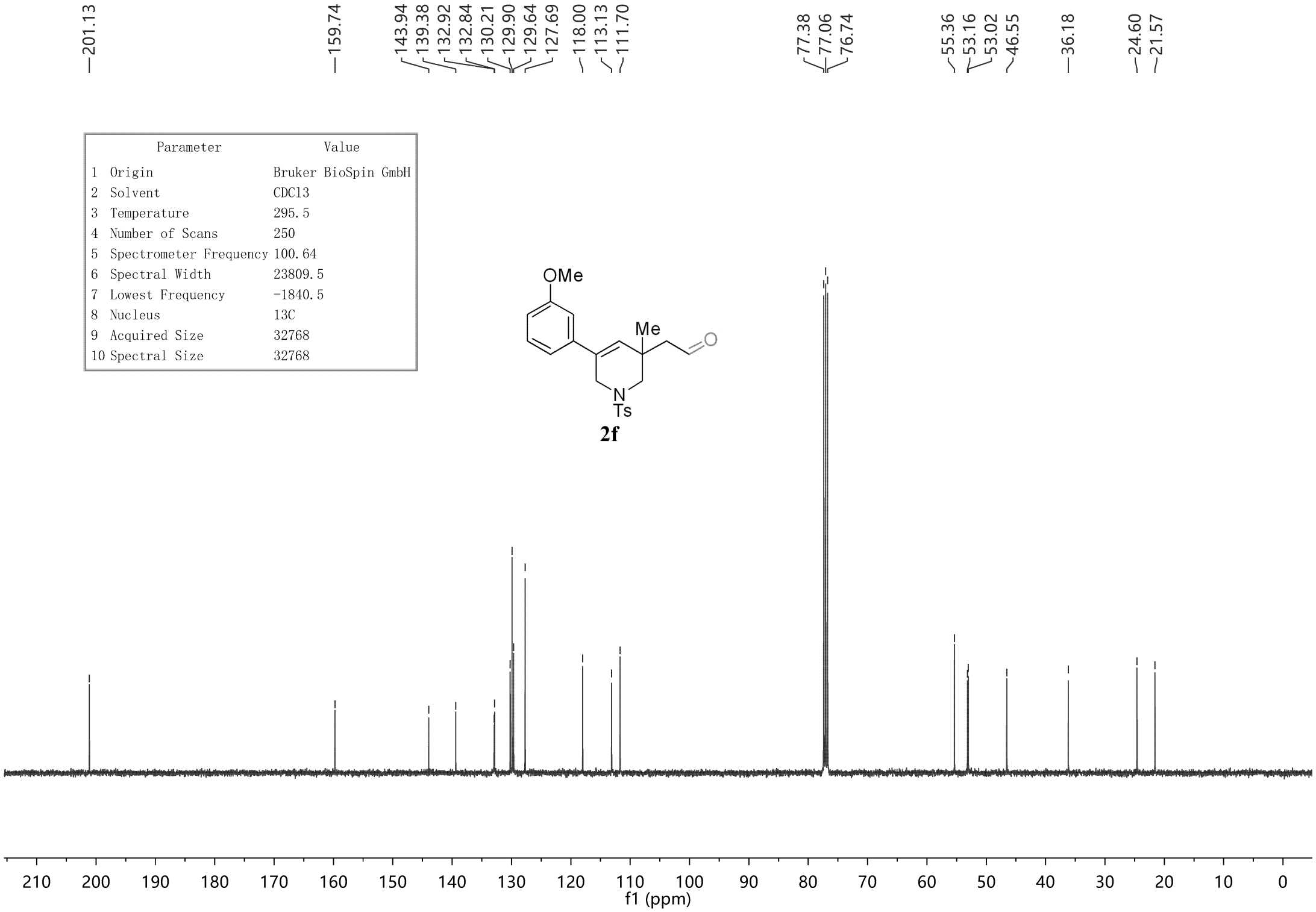


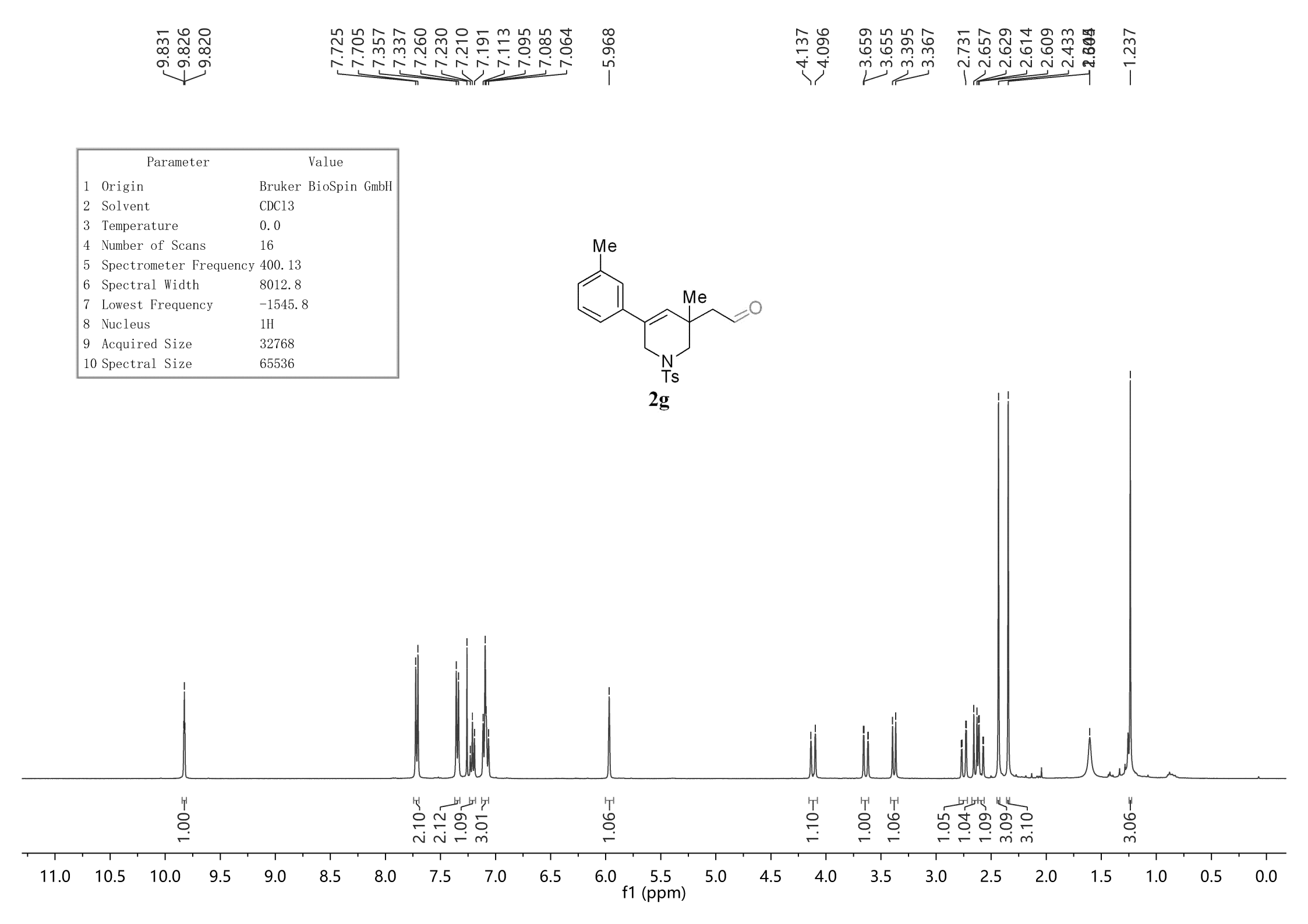
| Parameter | Value |
|---|---|
| 1 Origin | Bruker BioSpin GmbH |
| 2 Solvent | CDCl3 |
| 3 Temperature | 294.6 |
| 4 Number of Scans | 16 |
| 5 Spectrometer Frequency | 400.25 |
| 6 Spectral Width | 8196.7 |
| 7 Lowest Frequency | -1636.7 |
| 8 Nucleus | 1H |
| 9 Acquired Size | 32768 |
| 10 Spectral Size | 65536 |

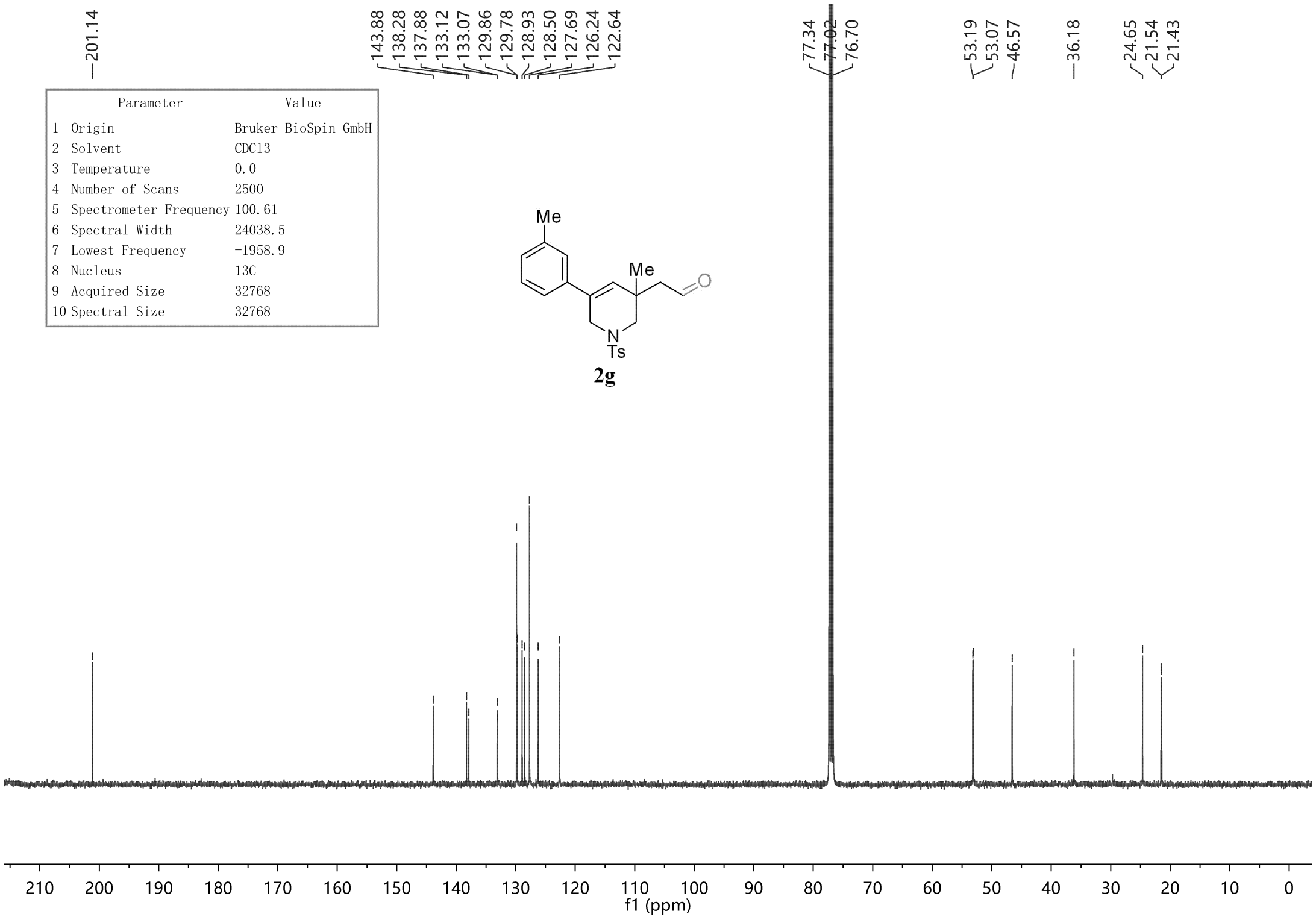


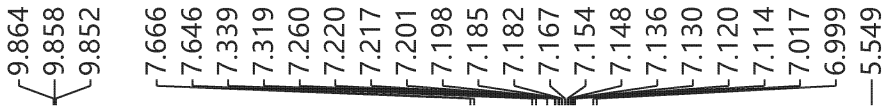

**2f**



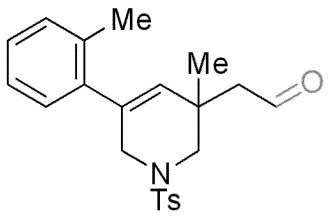

201.13
159.74
143.94
139.38
132.92
132.84
130.21
129.90
129.64
127.69
118.00
113.13
111.70
77.38
77.06
76.74
55.36
53.16
53.02
46.55
36.18
24.60
21.57
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 295.5
4 Number of Scans 250
5 Spectrometer Frequency 100.64
6 Spectral Width 23809.5
7 Lowest Frequency -1840.5
8 Nucleus 13C
9 Acquired Size 32768
10 Spectral Size 32768
OMe
Me
O
N
Ts
2f
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)


9.831
9.826
9.820
7.725
7.705
7.357
7.337
7.260
7.230
7.210
7.191
7.113
7.095
7.085
7.064
5.968
4.137
4.096
3.659
3.655
3.395
3.367
2.731
2.657
2.629
2.614
2.609
2.433
1.237
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 0.0
4 Number of Scans 16
5 Spectrometer Frequency 400.13
6 Spectral Width 8012.8
7 Lowest Frequency -1545.8
8 Nucleus 1H
9 Acquired Size 32768
10 Spectral Size 65536
Me
Me
N
Ts
O
2g
1.00
2.10
2.12
1.09
3.01
1.06
1.10
1.00
1.06
1.05
1.04
1.09
3.09
3.10
3.06
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

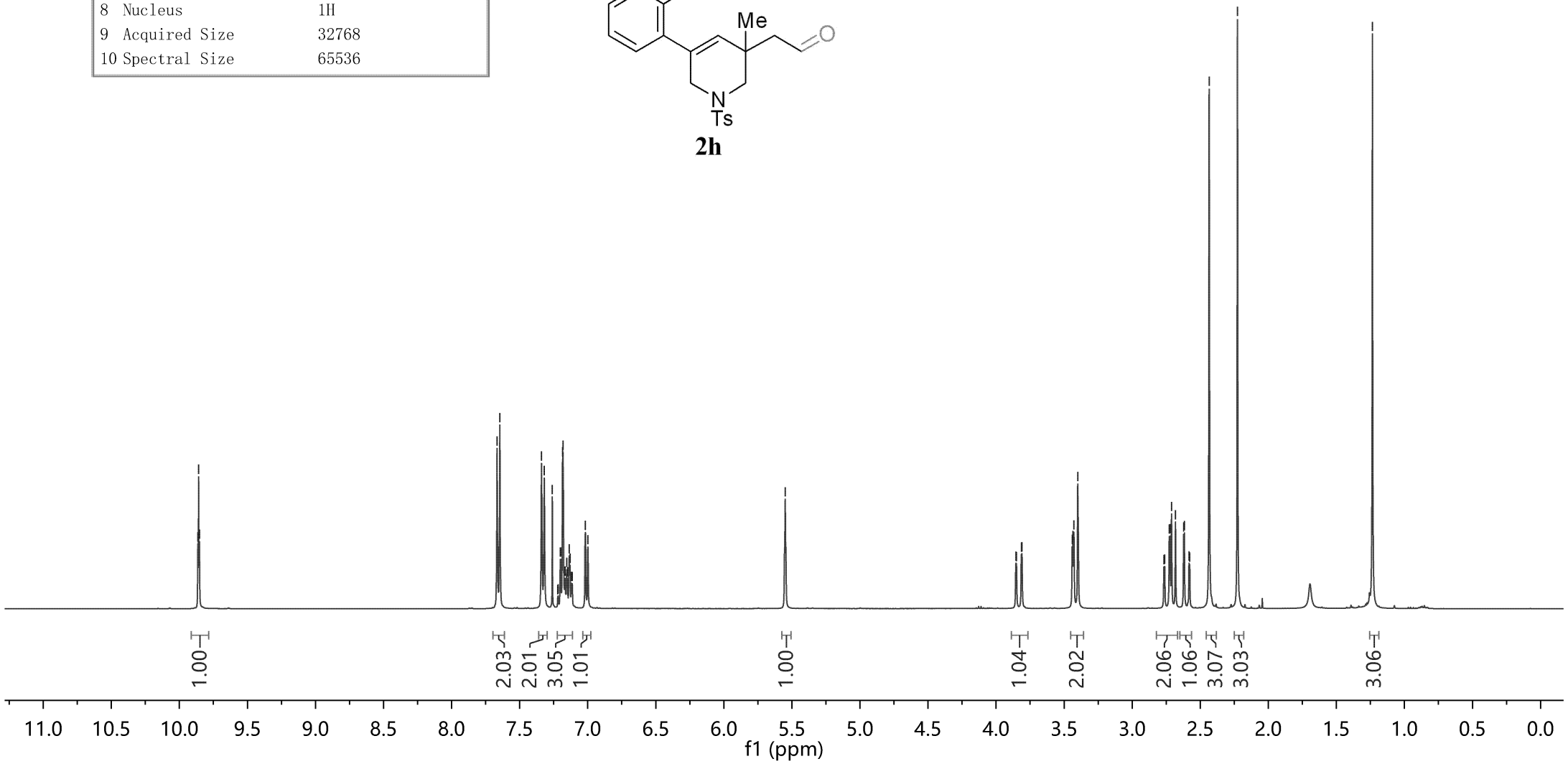

201.14
143.88
138.28
137.88
133.12
133.07
129.86
129.78
128.93
128.50
127.69
126.24
122.64
77.34
77.02
76.70
53.19
53.07
46.57
36.18
24.65
21.54
21.43
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 0.0
4 Number of Scans 2500
5 Spectrometer Frequency 100.61
6 Spectral Width 24038.5
7 Lowest Frequency -1958.9
8 Nucleus 13C
9 Acquired Size 32768
10 Spectral Size 32768
Me
Me
O
N
Ts
2g
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

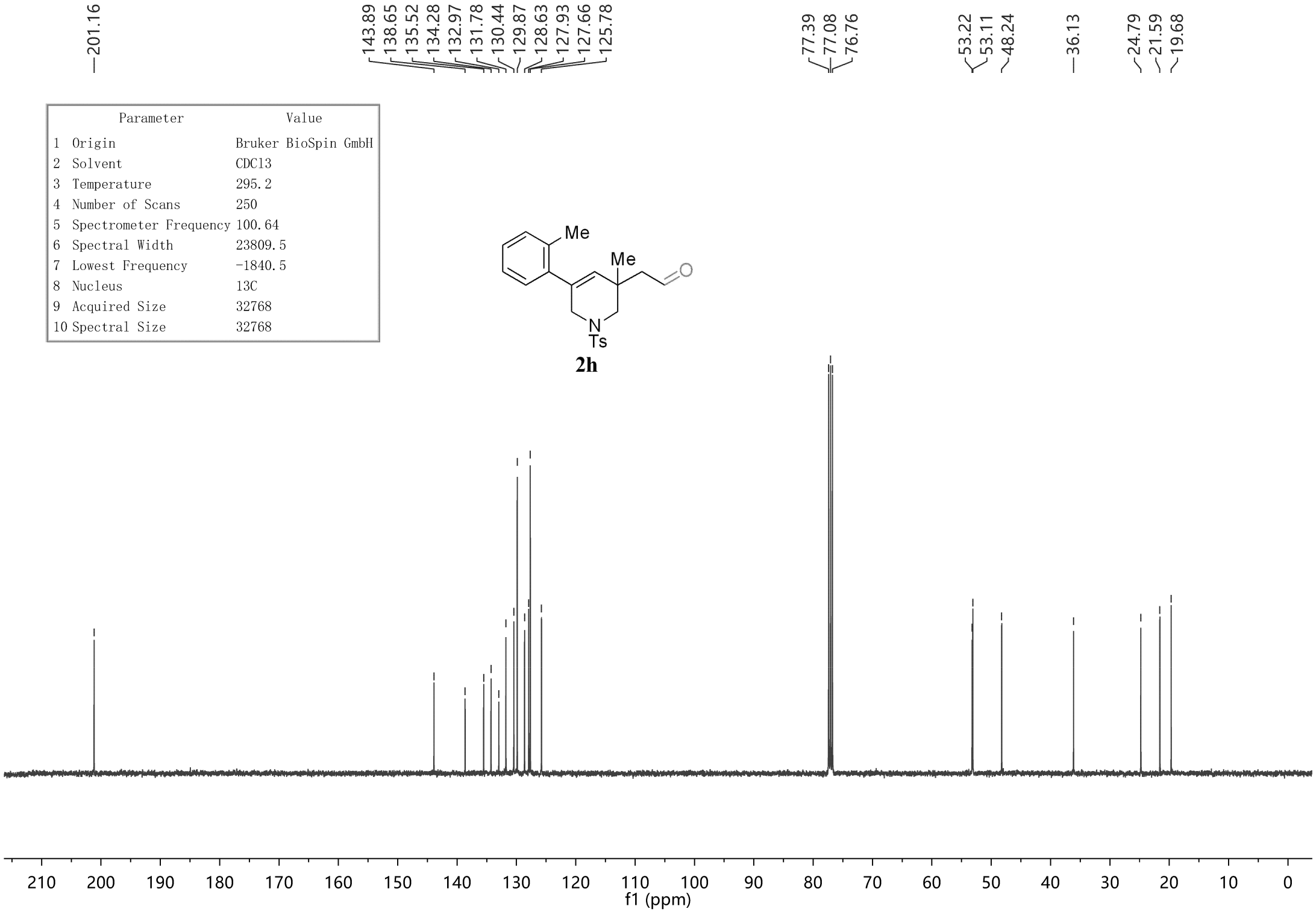



| | Parameter | Value |
|---|---|---|
| 1 | Origin | Bruker BioSpin GmbH |
| 2 | Solvent | CDCl3 |
| 3 | Temperature | 294.6 |
| 4 | Number of Scans | 16 |
| 5 | Spectrometer Frequency | 400.25 |
| 6 | Spectral Width | 8196.7 |
| 7 | Lowest Frequency | -1636.6 |
| 8 | Nucleus | 1H |
| 9 | Acquired Size | 32768 |
| 10 | Spectral Size | 65536 |



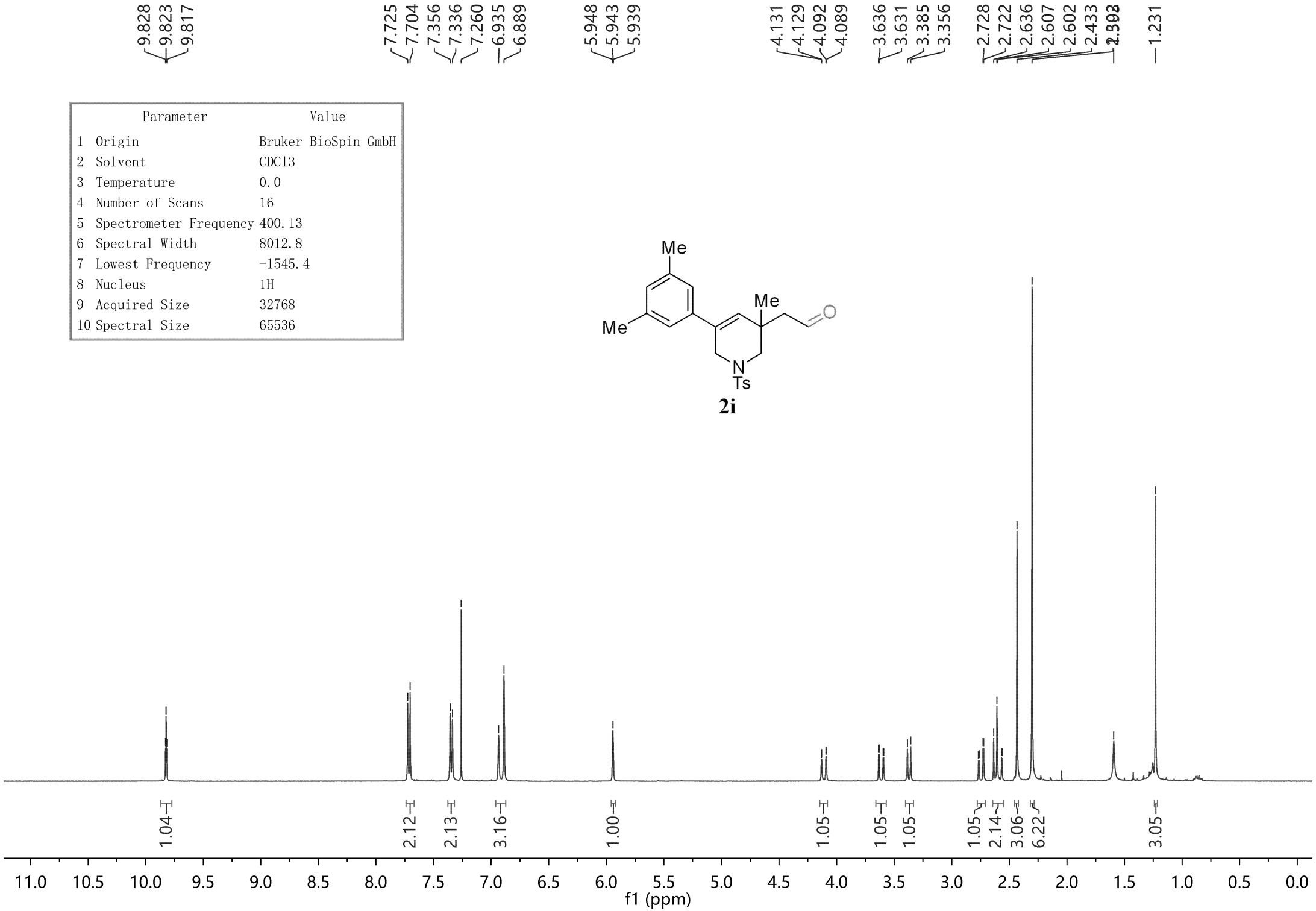

**2h**

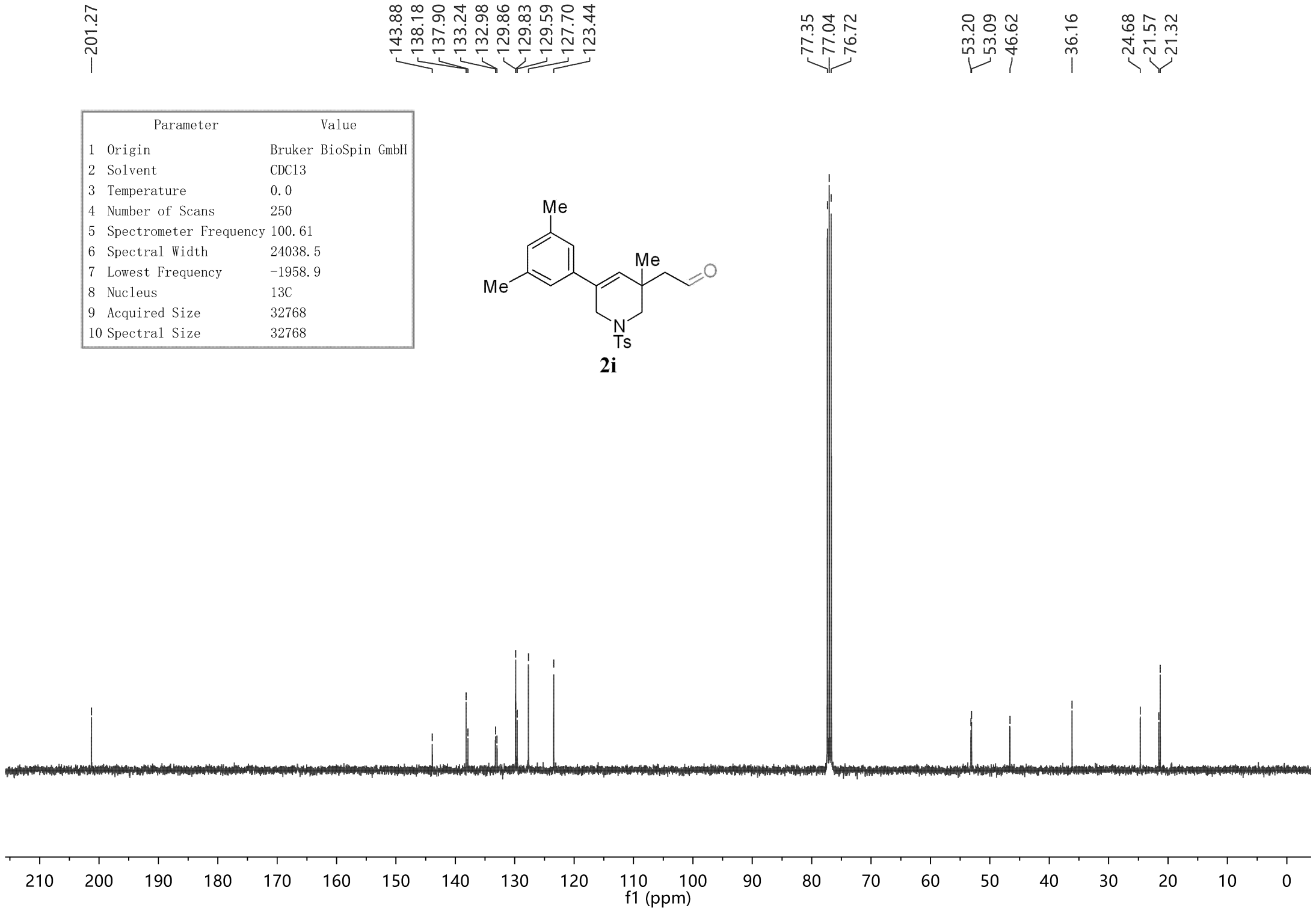




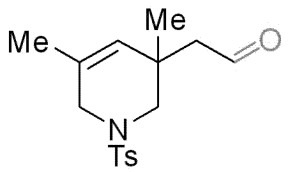

| | Parameter | Value |
|---|---|---|
| 1 | Origin | Bruker BioSpin GmbH |
| 2 | Solvent | CDCl3 |
| 3 | Temperature | 295.2 |
| 4 | Number of Scans | 250 |
| 5 | Spectrometer Frequency | 100.64 |
| 6 | Spectral Width | 23809.5 |
| 7 | Lowest Frequency | -1840.5 |
| 8 | Nucleus | 13C |
| 9 | Acquired Size | 32768 |
| 10 | Spectral Size | 32768 |

**2h**

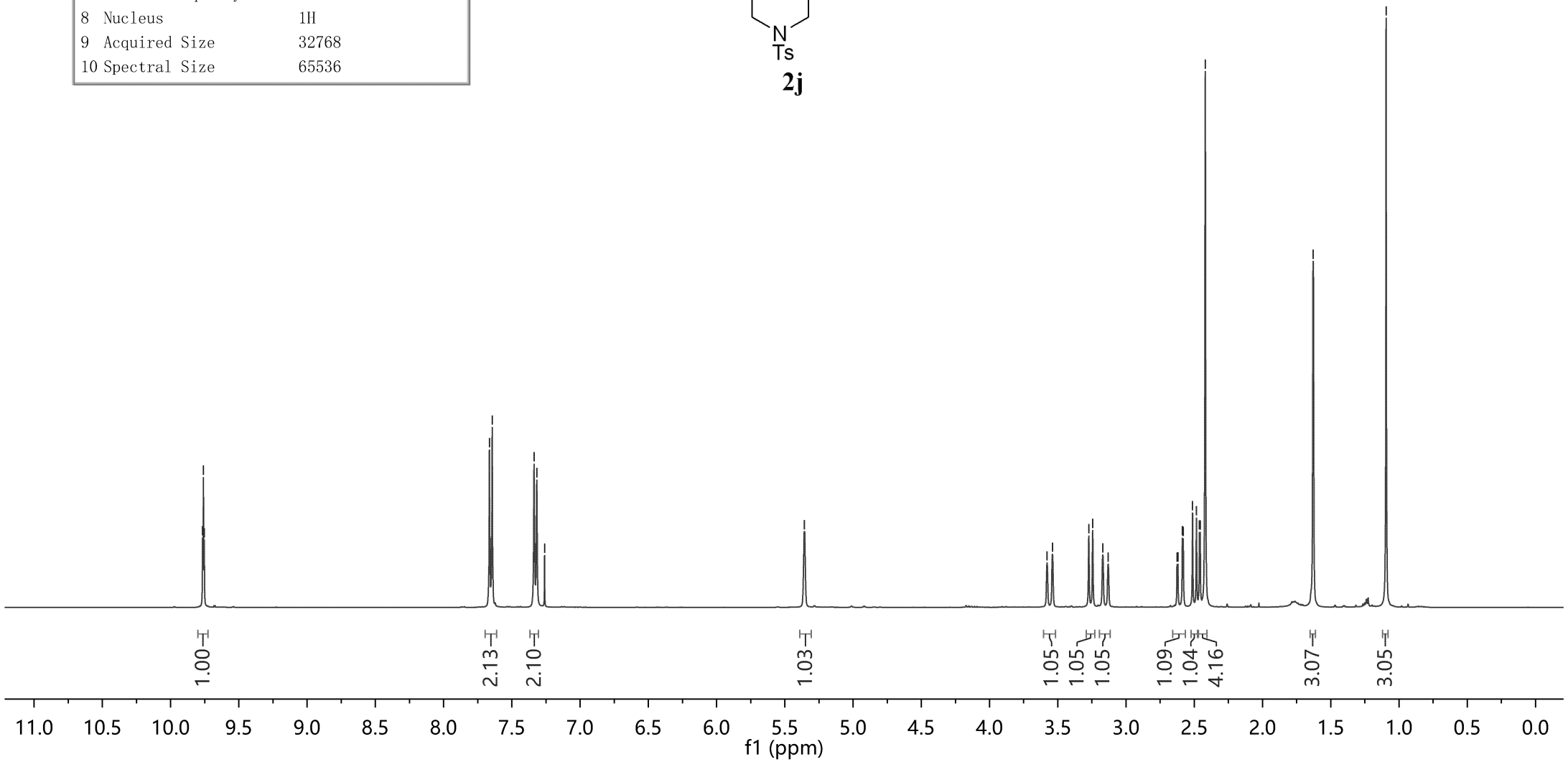

9.828
9.823
9.817
7.725
7.704
7.356
7.336
7.260
6.935
6.889
5.948
5.943
5.939
4.131
4.129
4.092
4.089
3.636
3.631
3.385
3.356
2.728
2.722
2.636
2.607
2.602
2.433
1.231
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 0.0
4 Number of Scans 16
5 Spectrometer Frequency 400.13
6 Spectral Width 8012.8
7 Lowest Frequency -1545.4
8 Nucleus 1H
9 Acquired Size 32768
10 Spectral Size 65536
Me
Me
Me
N
Ts
O
2i
1.04
2.12
2.13
3.16
1.00
1.05
1.05
1.05
1.05
2.14
3.06
6.22
3.05
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

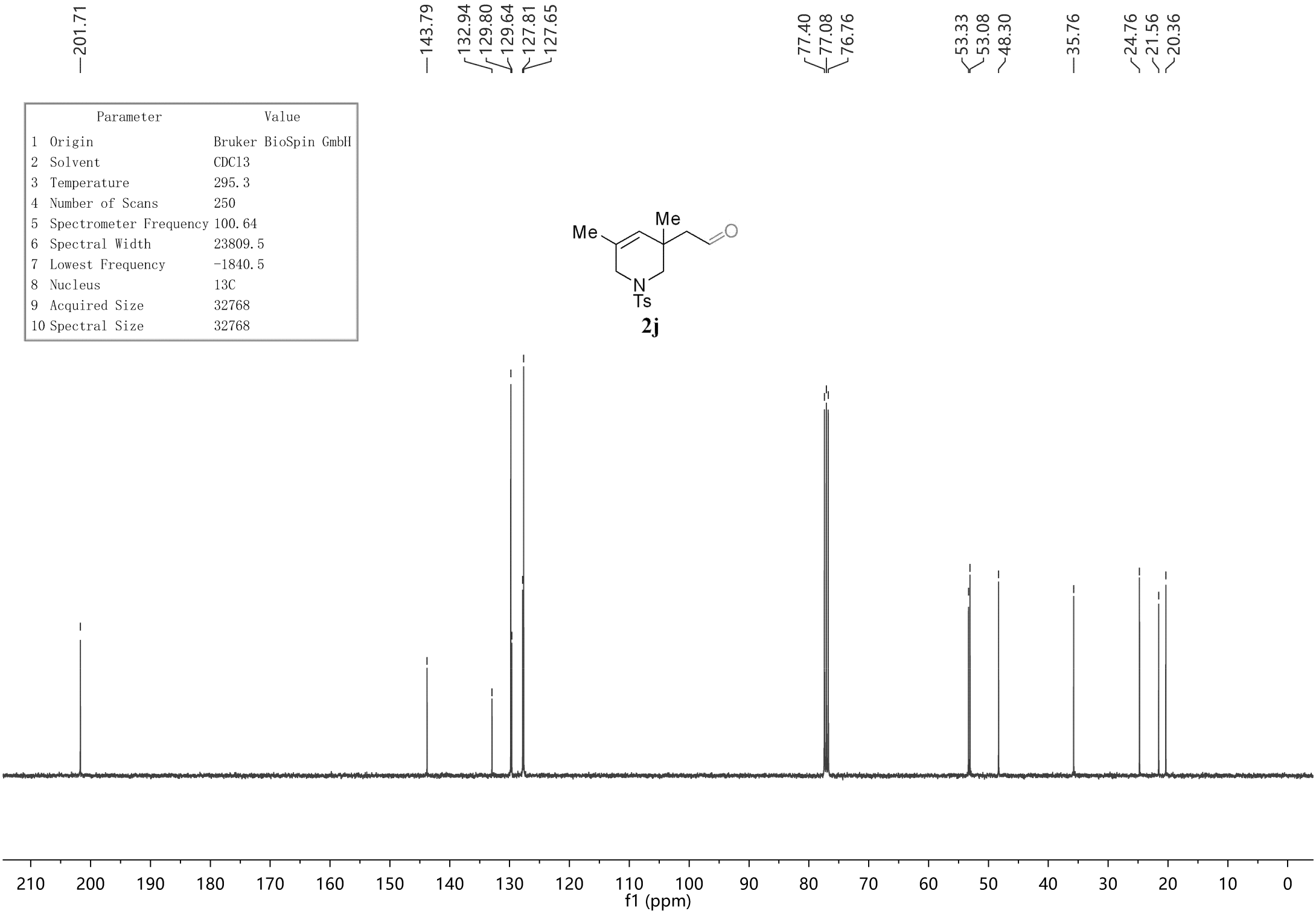

201.27
143.88
138.18
137.90
133.24
132.98
129.86
129.83
129.59
127.70
123.44
77.35
77.04
76.72
53.20
53.09
46.62
36.16
24.68
21.57
21.32
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 0.0
4 Number of Scans 250
5 Spectrometer Frequency 100.61
6 Spectral Width 24038.5
7 Lowest Frequency -1958.9
8 Nucleus 13C
9 Acquired Size 32768
10 Spectral Size 32768
Me
Me
Me
O
N
Ts
2i
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

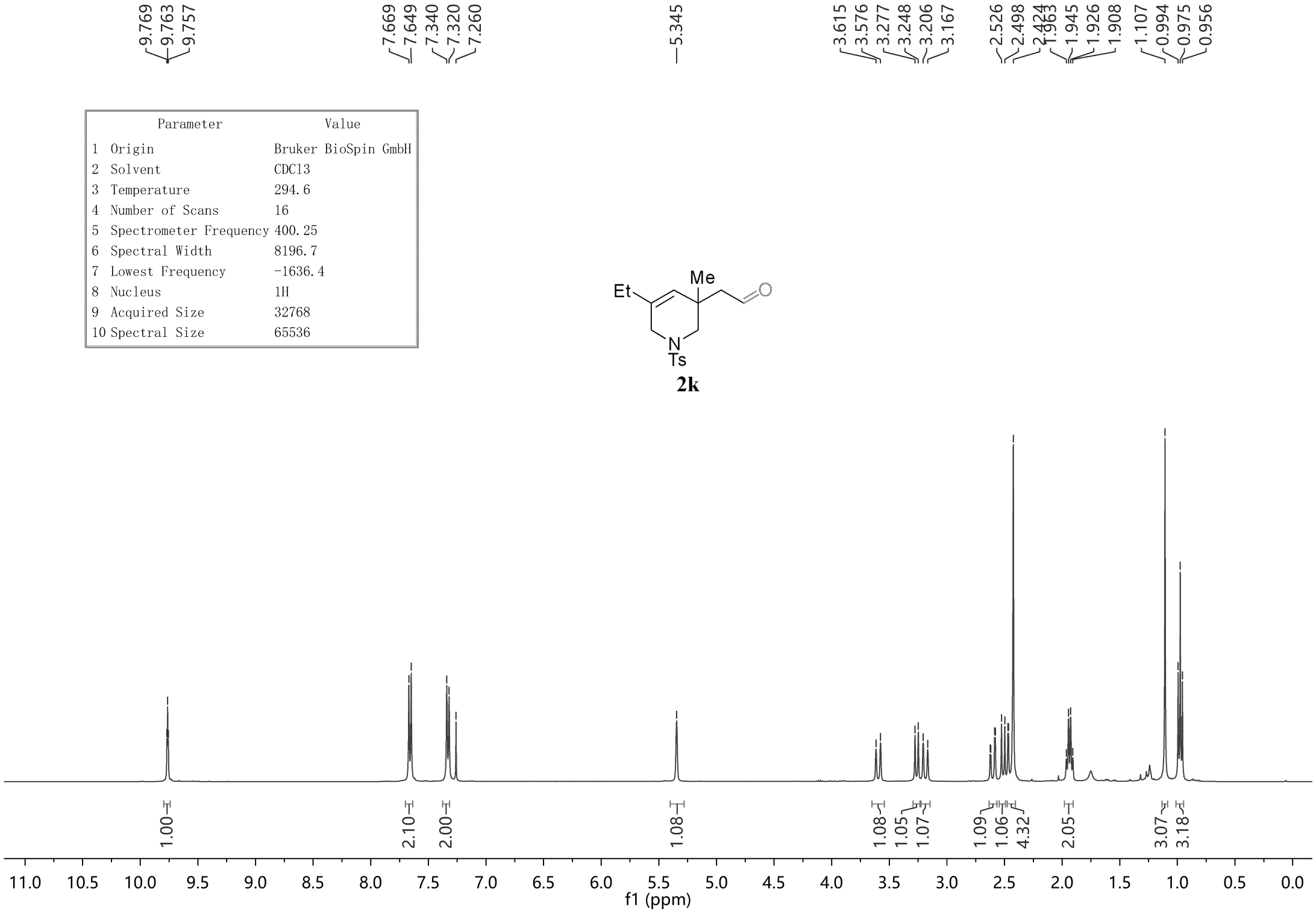
| Parameter | Value |
|---|---|
| 1 Origin | Bruker BioSpin GmbH |
| 2 Solvent | CDCl3 |
| 3 Temperature | 294.6 |
| 4 Number of Scans | 16 |
| 5 Spectrometer Frequency | 400.25 |
| 6 Spectral Width | 8196.7 |
| 7 Lowest Frequency | -1636.3 |
| 8 Nucleus | 1H |
| 9 Acquired Size | 32768 |
| 10 Spectral Size | 65536 |

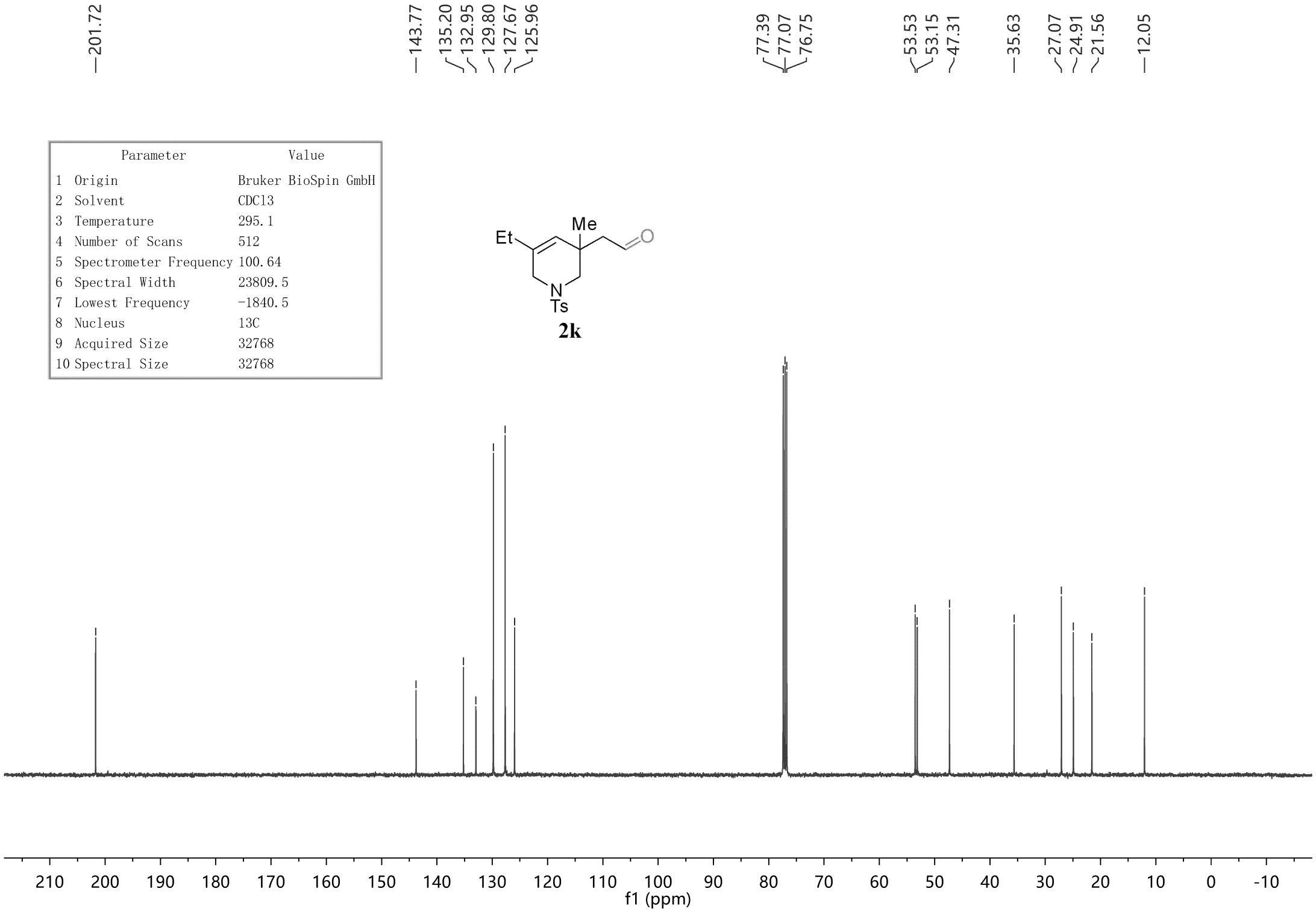



**2j**



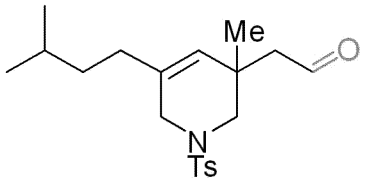

201.71
143.79
132.94
129.80
129.64
127.81
127.65
77.40
77.08
76.76
53.33
53.08
48.30
35.76
24.76
21.56
20.36
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 295.3
4 Number of Scans 250
5 Spectrometer Frequency 100.64
6 Spectral Width 23809.5
7 Lowest Frequency -1840.5
8 Nucleus 13C
9 Acquired Size 32768
10 Spectral Size 32768
Me
Me
O
N
Ts
2j
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)


9.769
9.763
9.757
7.669
7.649
7.340
7.320
7.260
5.345
3.615
3.576
3.277
3.248
3.206
3.167
2.526
2.498
2.424
1.963
1.945
1.926
1.908
1.107
0.994
0.975
0.956
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 294.6
4 Number of Scans 16
5 Spectrometer Frequency 400.25
6 Spectral Width 8196.7
7 Lowest Frequency -1636.4
8 Nucleus 1H
9 Acquired Size 32768
10 Spectral Size 65536
Et
Me
O
N
Ts
2k
1.00
2.10
2.00
1.08
1.08
1.05
1.07
1.09
1.06
4.32
2.05
3.07
3.18
11.0 10.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)

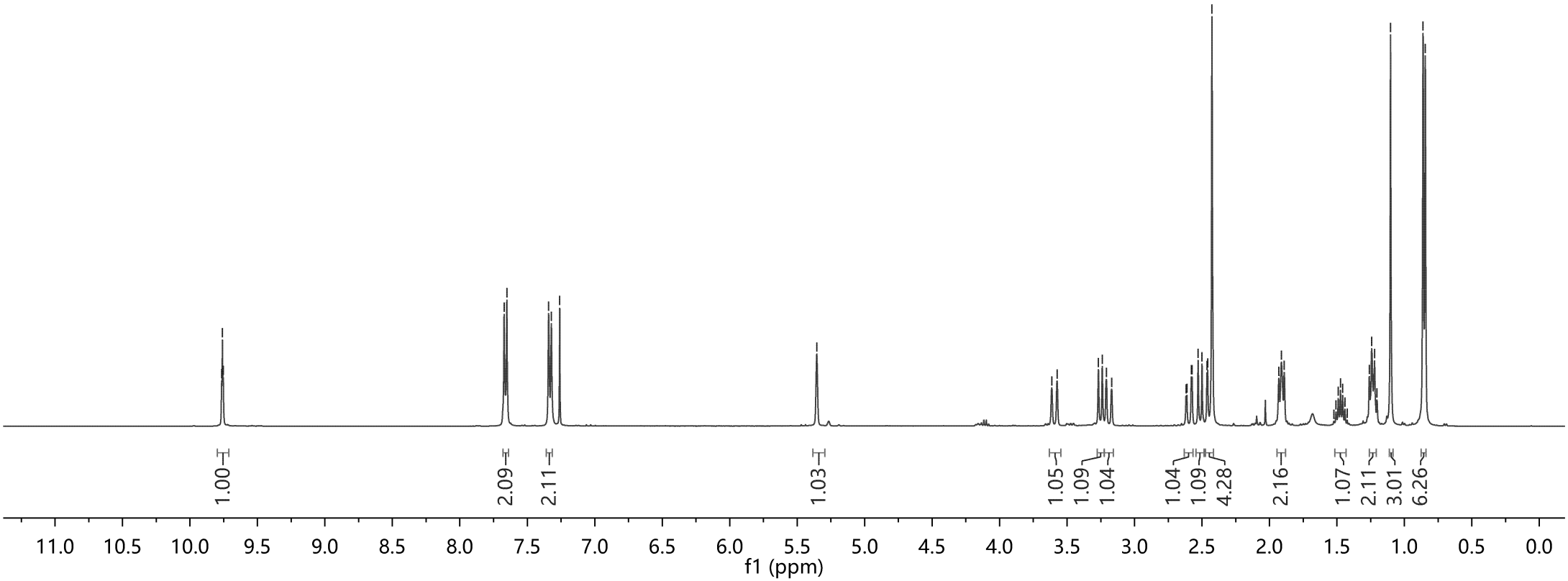

201.72
143.77
135.20
132.95
129.80
127.67
125.96
77.39
77.07
76.75
53.53
53.15
47.31
35.63
27.07
24.91
21.56
12.05
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 295.1
4 Number of Scans 512
5 Spectrometer Frequency 100.64
6 Spectral Width 23809.5
7 Lowest Frequency -1840.5
8 Nucleus 13C
9 Acquired Size 32768
10 Spectral Size 32768
Et
Me
O
N
Ts
2k
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

9.765
9.759
9.753
7.672
7.651
7.342
7.322
7.260
5.355
3.613
3.574
3.268
3.239
3.209
3.170
2.528
2.500
2.426
1.931
1.911
1.890
1.490
1.473
1.457
1.260
1.242
1.221
1.103
0.862

| | Parameter | Value |
|---|---|---|
| 1 | Origin | Bruker BioSpin GmbH |
| 2 | Solvent | CDCl3 |
| 3 | Temperature | 298.2 |
| 4 | Number of Scans | 16 |
| 5 | Spectrometer Frequency | 400.25 |
| 6 | Spectral Width | 8196.7 |
| 7 | Lowest Frequency | -1636.4 |
| 8 | Nucleus | 1H |
| 9 | Acquired Size | 32768 |
| 10 | Spectral Size | 65536 |

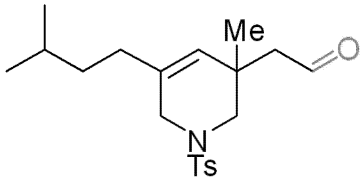



**2l**

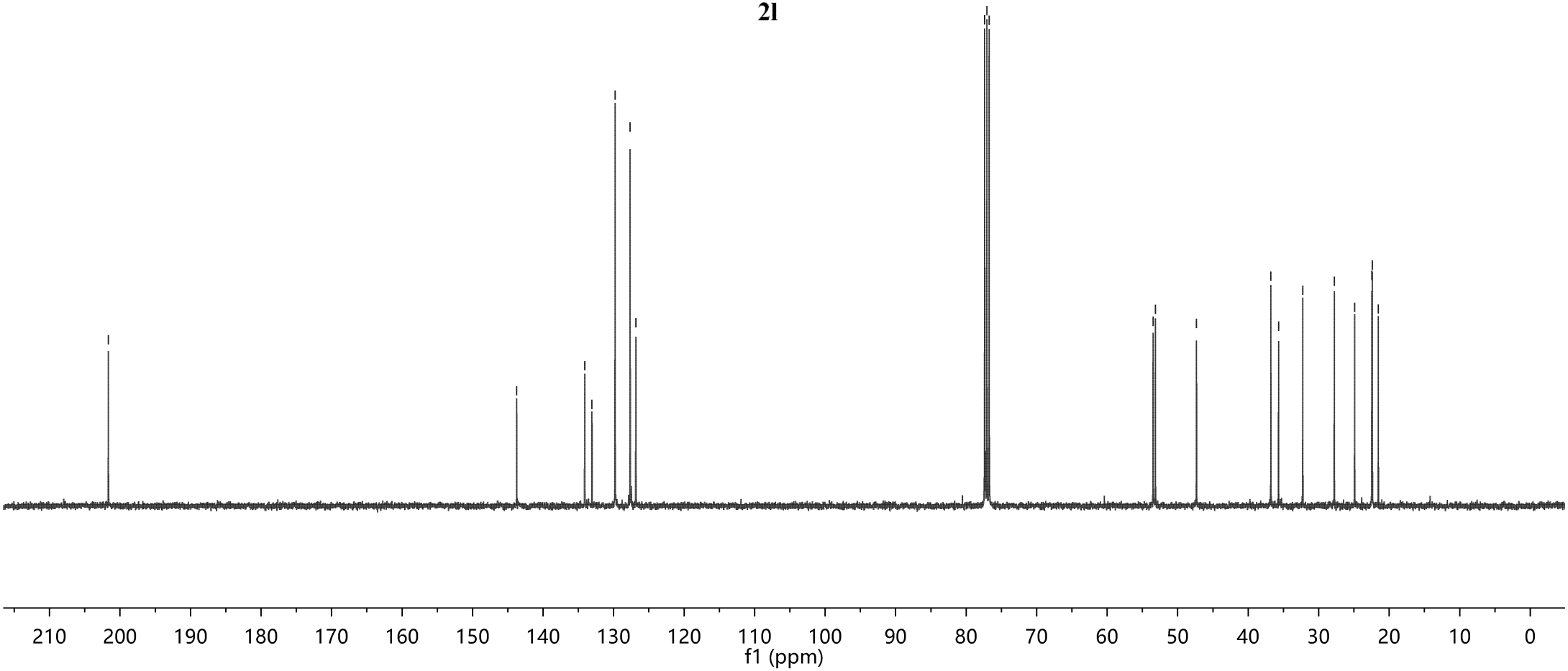


| | Parameter | Value |
|---|---|---|
| 1 | Origin | Bruker BioSpin GmbH |
| 2 | Solvent | CDCl3 |
| 3 | Temperature | 299.0 |
| 4 | Number of Scans | 250 |
| 5 | Spectrometer Frequency | 100.64 |
| 6 | Spectral Width | 23809.5 |
| 7 | Lowest Frequency | -1840.5 |
| 8 | Nucleus | 13C |
| 9 | Acquired Size | 32768 |
| 10 | Spectral Size | 32768 |

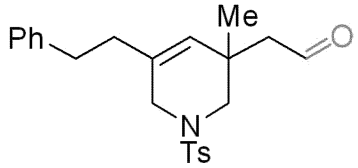
201.65
143.74
134.10
133.07
129.79
127.66
126.85
77.37
77.06
76.74
53.49
53.16
47.33
36.78
35.69
32.26
27.79
24.91
22.46
22.40
21.54



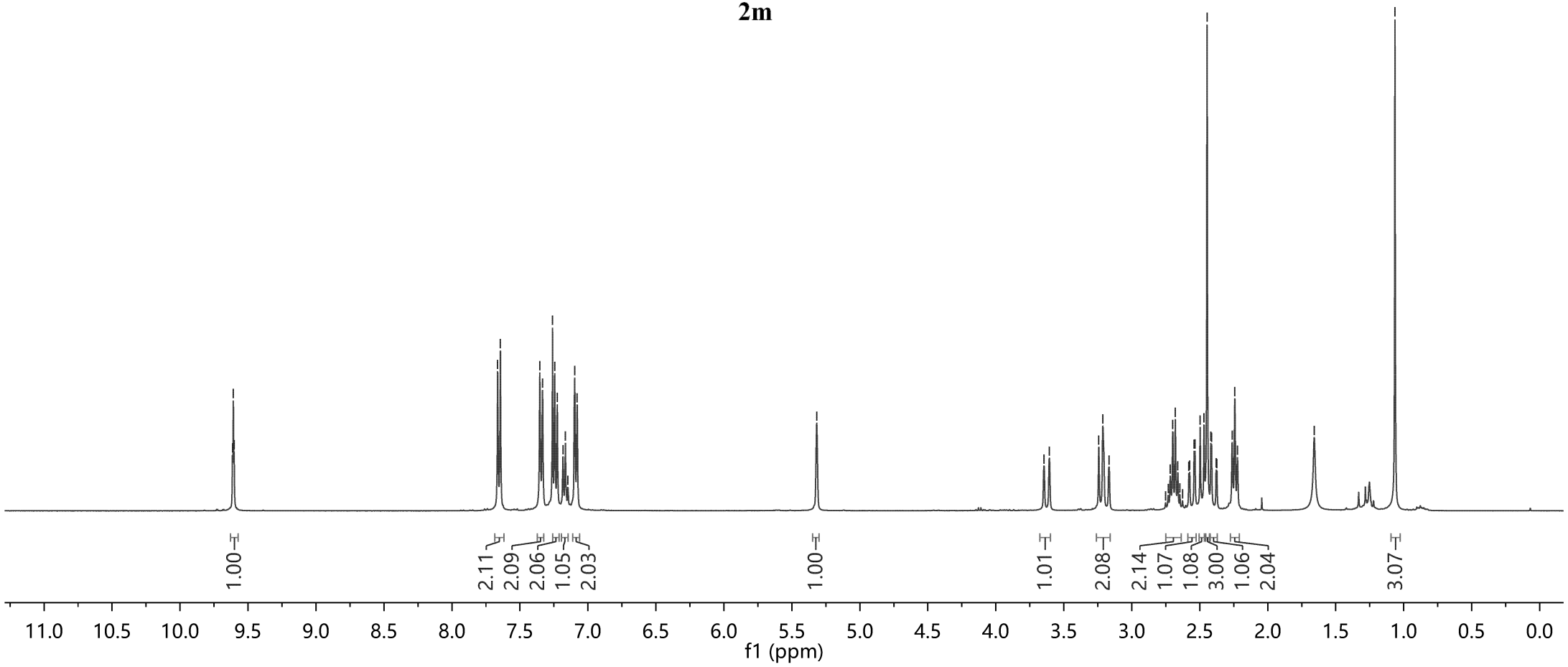

**2l**

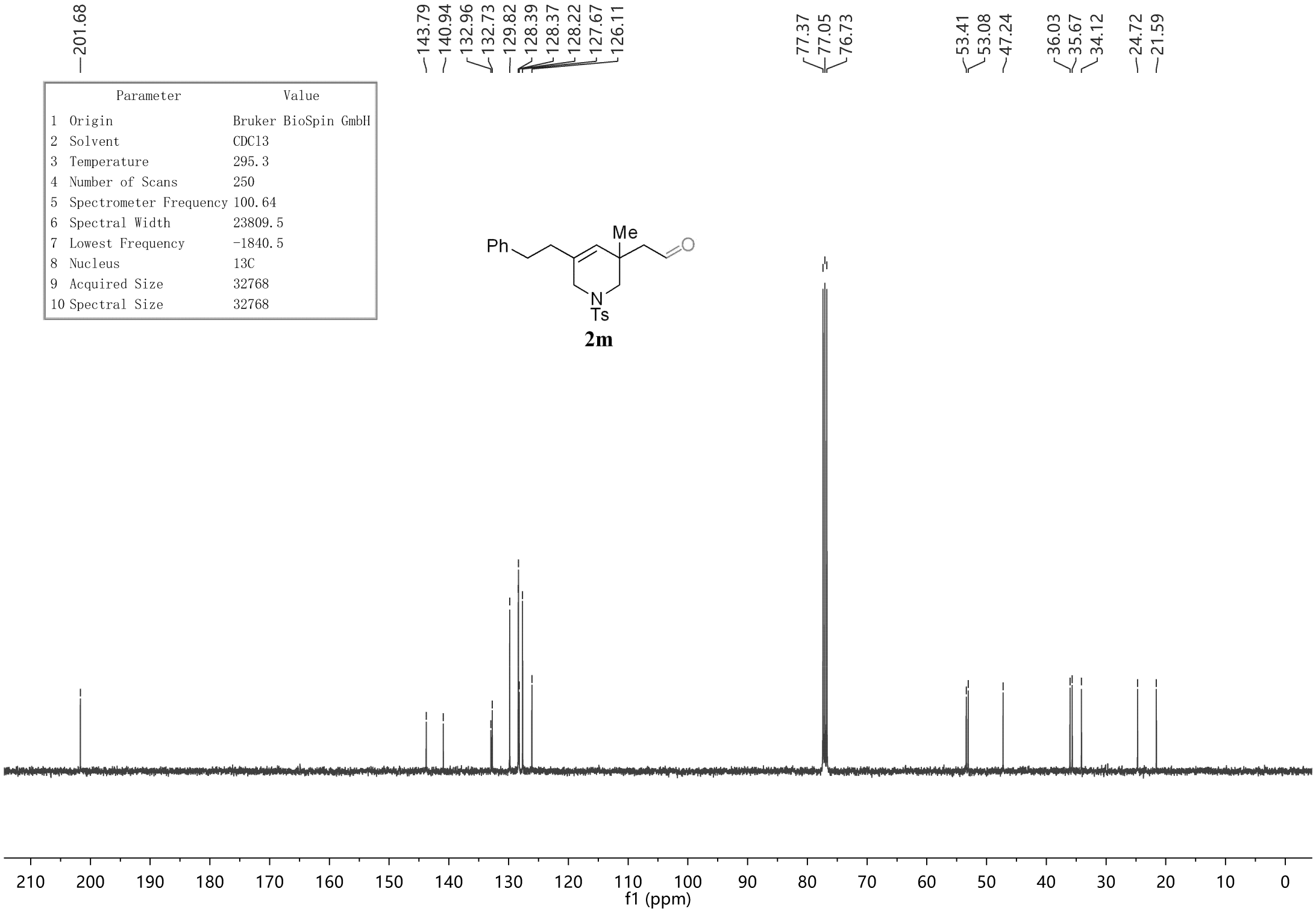


| Parameter | Value |
|---|---|
| 1 Origin | Bruker BioSpin GmbH |
| 2 Solvent | CDCl3 |
| 3 Temperature | 294.7 |
| 4 Number of Scans | 16 |
| 5 Spectrometer Frequency | 400.25 |
| 6 Spectral Width | 8196.7 |
| 7 Lowest Frequency | -1636.6 |
| 8 Nucleus | 1H |
| 9 Acquired Size | 32768 |
| 10 Spectral Size | 65536 |

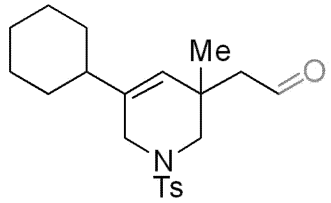



**2m**

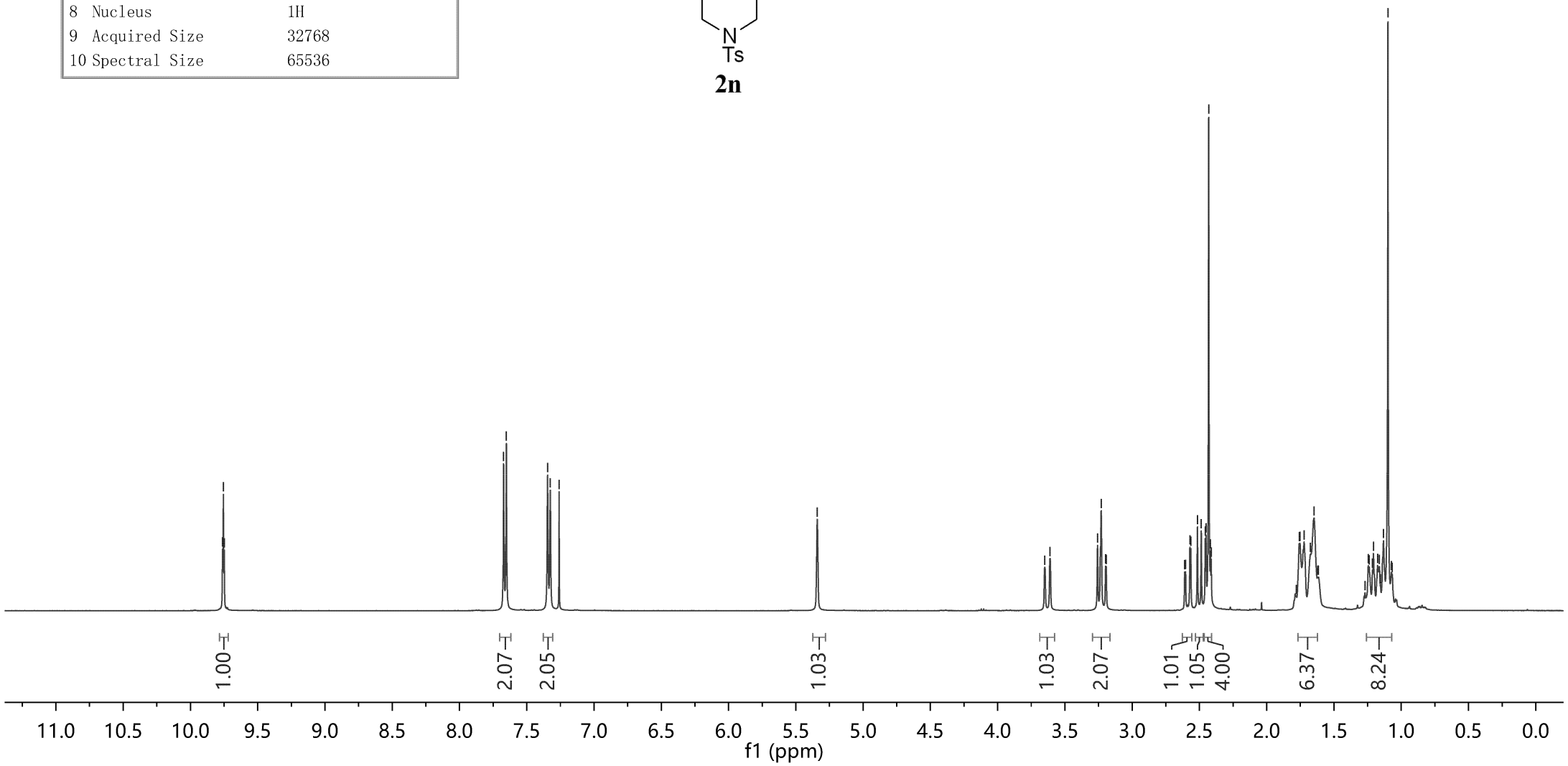


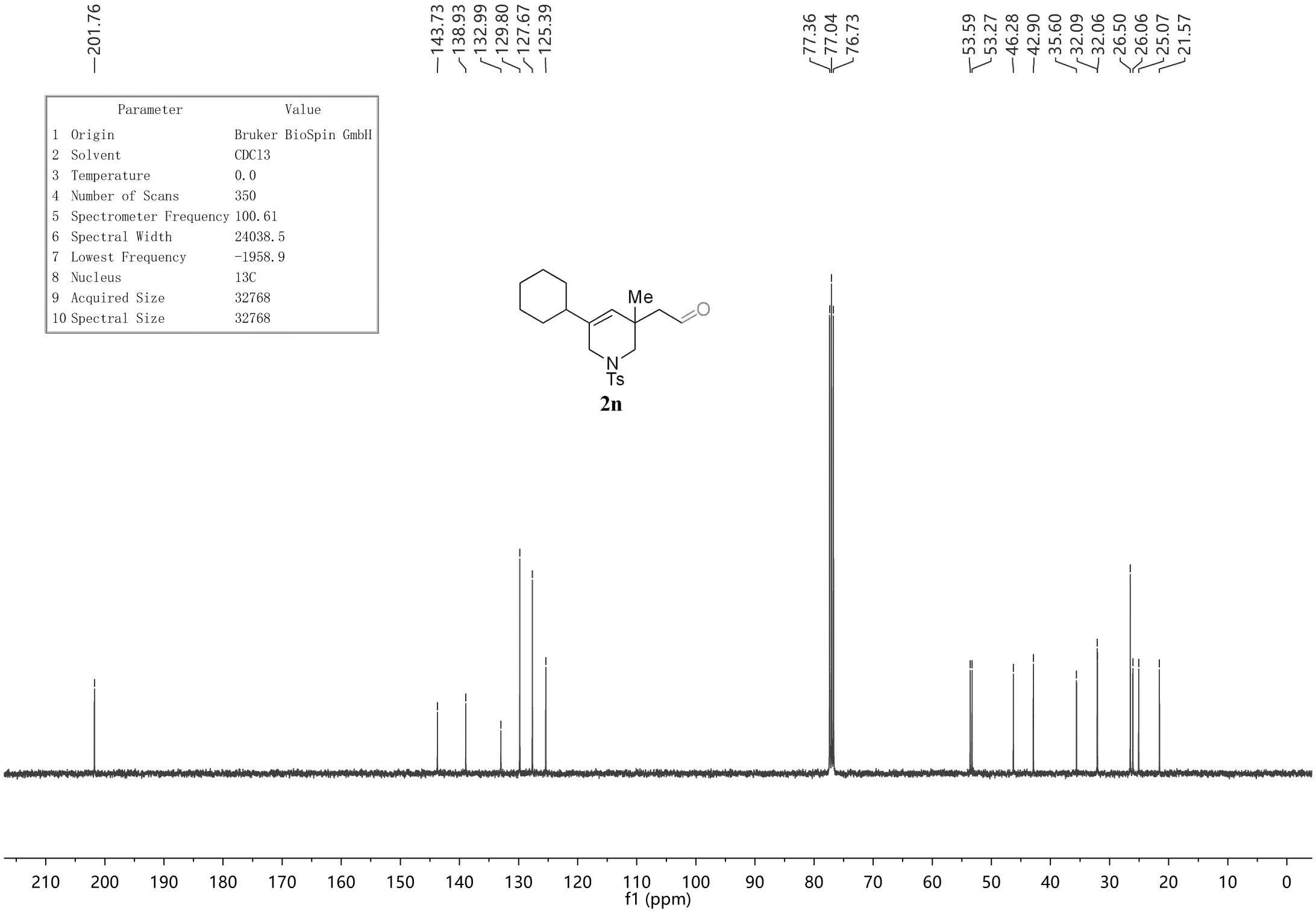

201.68
143.79
140.94
132.96
132.73
129.82
128.39
128.37
128.22
127.67
126.11
77.37
77.05
76.73
53.41
53.08
47.24
36.03
35.67
34.12
24.72
21.59
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 295.3
4 Number of Scans 250
5 Spectrometer Frequency 100.64
6 Spectral Width 23809.5
7 Lowest Frequency -1840.5
8 Nucleus 13C
9 Acquired Size 32768
10 Spectral Size 32768
Ph
Me
O
N
Ts
2m
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

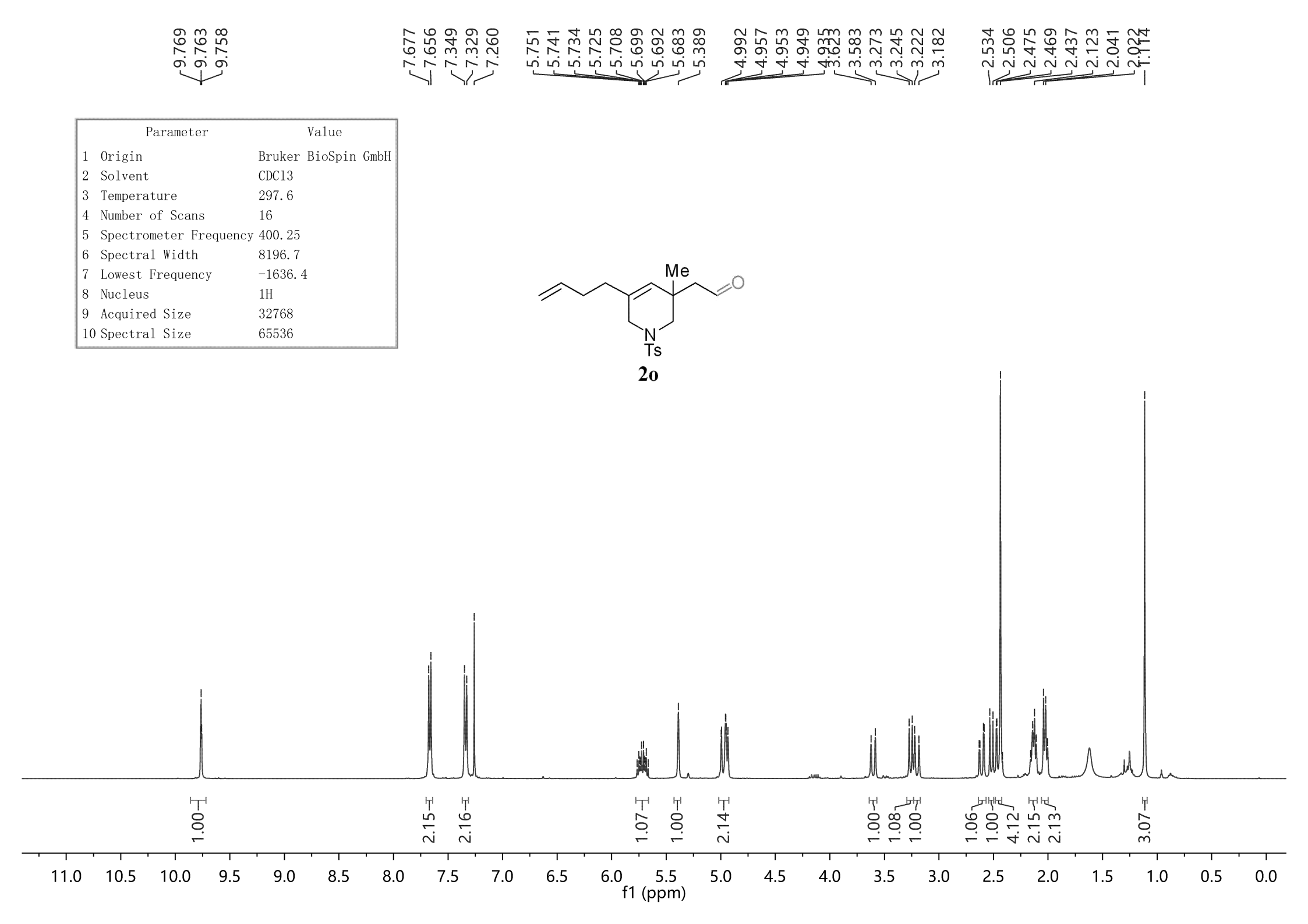
| | Parameter | Value |
|---|---|---|
| 1 | Origin | Bruker BioSpin GmbH |
| 2 | Solvent | CDCl3 |
| 3 | Temperature | 0.0 |
| 4 | Number of Scans | 16 |
| 5 | Spectrometer Frequency | 400.13 |
| 6 | Spectral Width | 8012.8 |
| 7 | Lowest Frequency | -1545.6 |
| 8 | Nucleus | 1H |
| 9 | Acquired Size | 32768 |
| 10 | Spectral Size | 65536 |

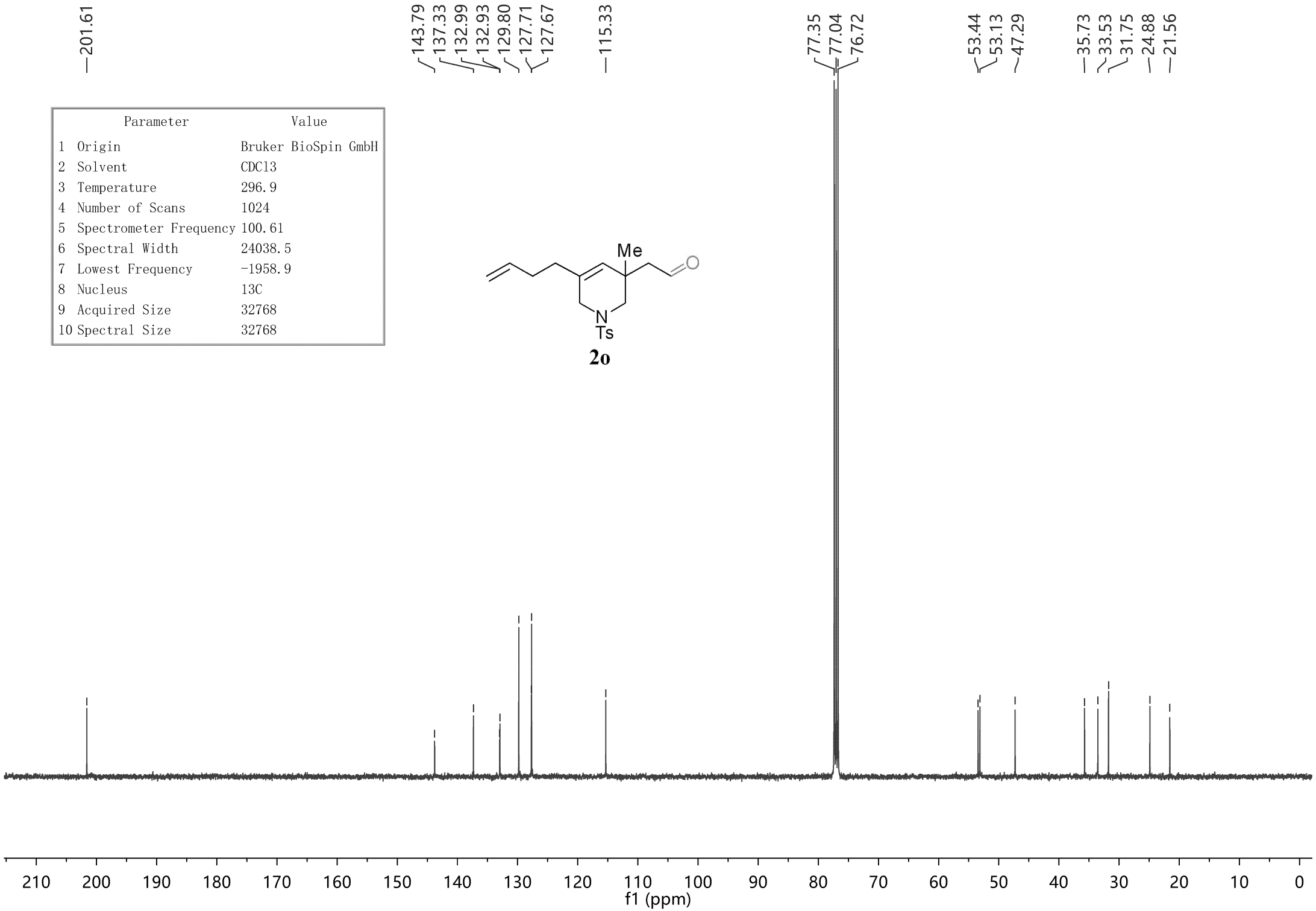


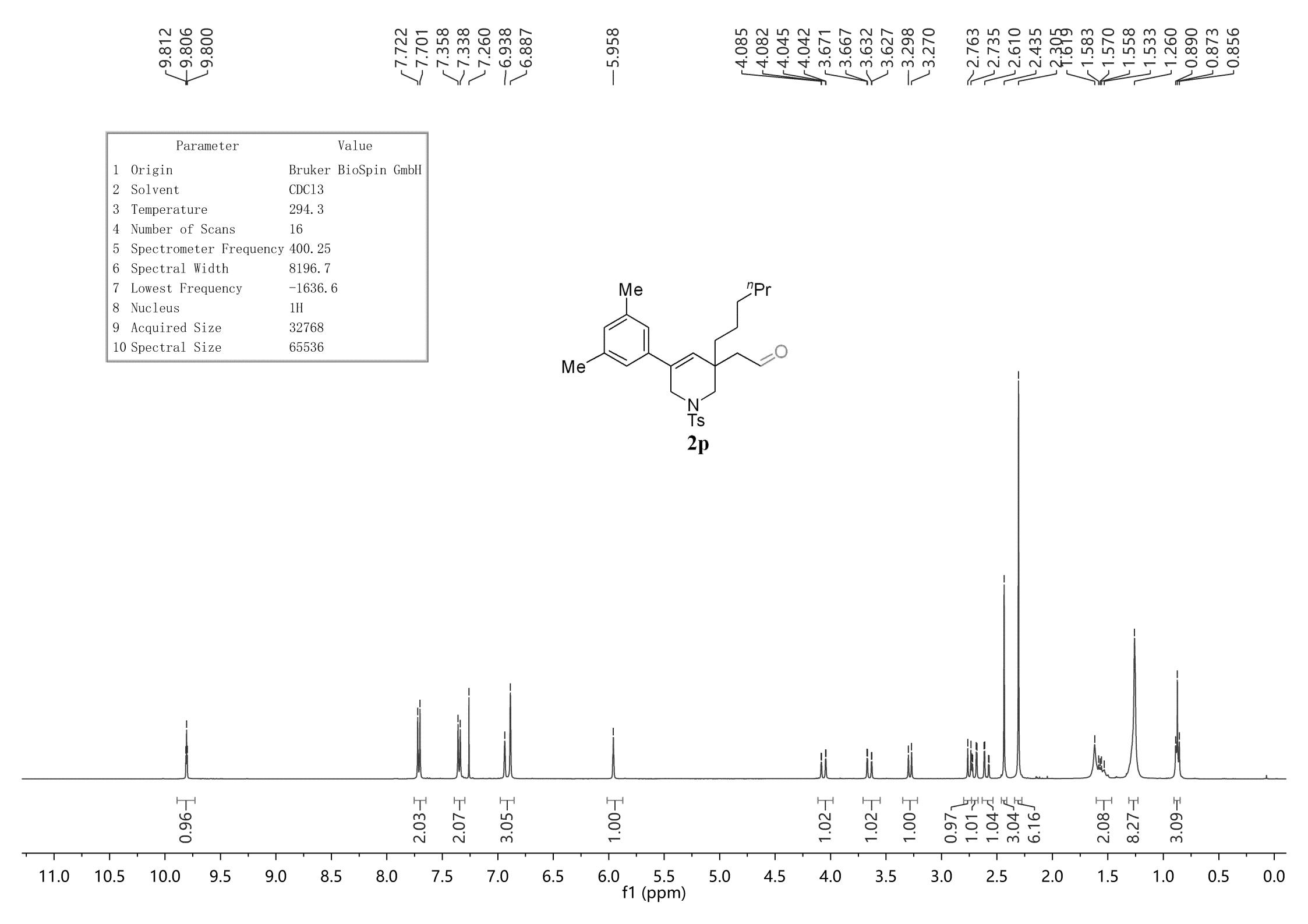

**2n**

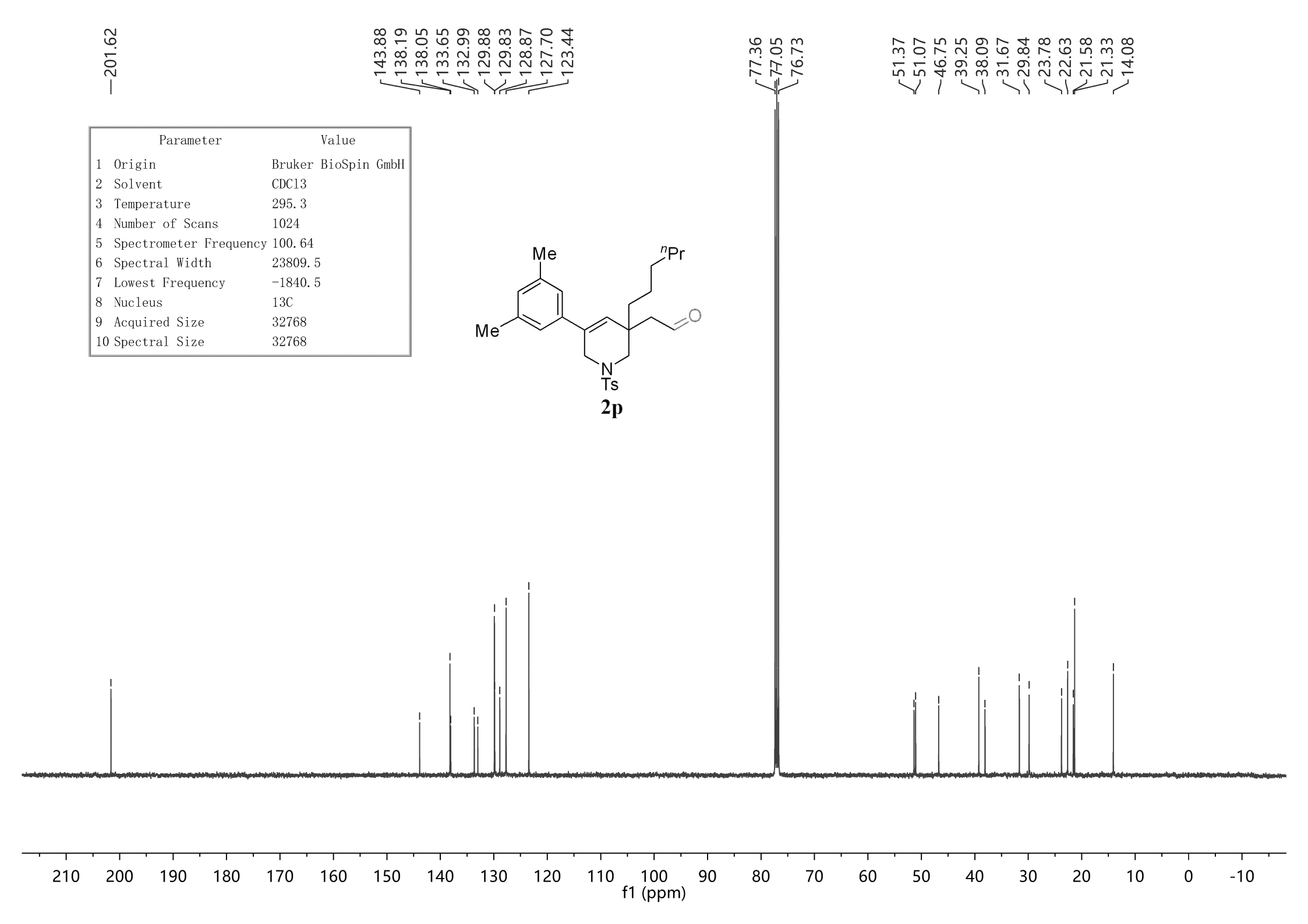


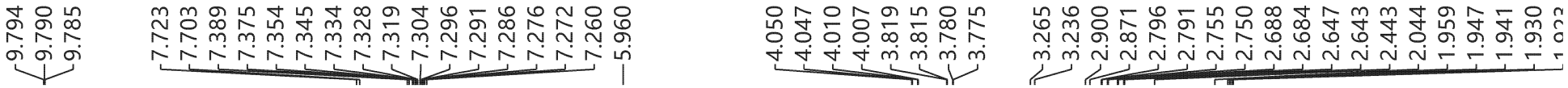

201.76
143.73
138.93
132.99
129.80
127.67
125.39
77.36
77.04
76.73
53.59
53.27
46.28
42.90
35.60
32.09
32.06
26.50
26.06
25.07
21.57
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 0.0
4 Number of Scans 350
5 Spectrometer Frequency 100.61
6 Spectral Width 24038.5
7 Lowest Frequency -1958.9
8 Nucleus 13C
9 Acquired Size 32768
10 Spectral Size 32768
Me
O
N
Ts
2n
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)


9.769
9.763
9.758
7.677
7.656
7.349
7.329
7.260
5.751
5.741
5.734
5.725
5.708
5.699
5.692
5.683
5.389
4.992
4.957
4.953
4.949
4.935
3.623
3.583
3.273
3.245
3.222
3.182
2.534
2.506
2.475
2.469
2.437
2.123
2.041
2.022
1.114
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 297.6
4 Number of Scans 16
5 Spectrometer Frequency 400.25
6 Spectral Width 8196.7
7 Lowest Frequency -1636.4
8 Nucleus 1H
9 Acquired Size 32768
10 Spectral Size 65536
Me
N
Ts
2o
1.00
2.15
2.16
1.07
1.00
2.14
1.00
1.08
1.00
1.06
1.00
4.12
2.15
2.13
3.07
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

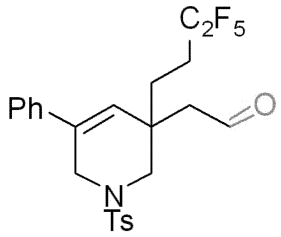

201.61
143.79
137.33
132.99
132.93
129.80
127.71
127.67
115.33
77.35
77.04
76.72
53.44
53.13
47.29
35.73
33.53
31.75
24.88
21.56
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 296.9
4 Number of Scans 1024
5 Spectrometer Frequency 100.61
6 Spectral Width 24038.5
7 Lowest Frequency -1958.9
8 Nucleus 13C
9 Acquired Size 32768
10 Spectral Size 32768
Me
O
N
Ts
2o
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)


9.812
9.806
9.800
7.722
7.701
7.358
7.338
7.260
6.938
6.887
5.958
4.085
4.082
4.045
4.042
3.671
3.667
3.632
3.627
3.298
3.270
2.763
2.735
2.610
2.435
2.305
1.619
1.583
1.570
1.558
1.533
1.260
0.890
0.873
0.856
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 294.3
4 Number of Scans 16
5 Spectrometer Frequency 400.25
6 Spectral Width 8196.7
7 Lowest Frequency -1636.6
8 Nucleus 1H
9 Acquired Size 32768
10 Spectral Size 65536
Me
nPr
Me
O
N
Ts
2p
0.96
2.03
2.07
3.05
1.00
1.02
1.02
1.00
0.97
1.01
1.04
3.04
6.16
2.08
8.27
3.09
11.0 10.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)

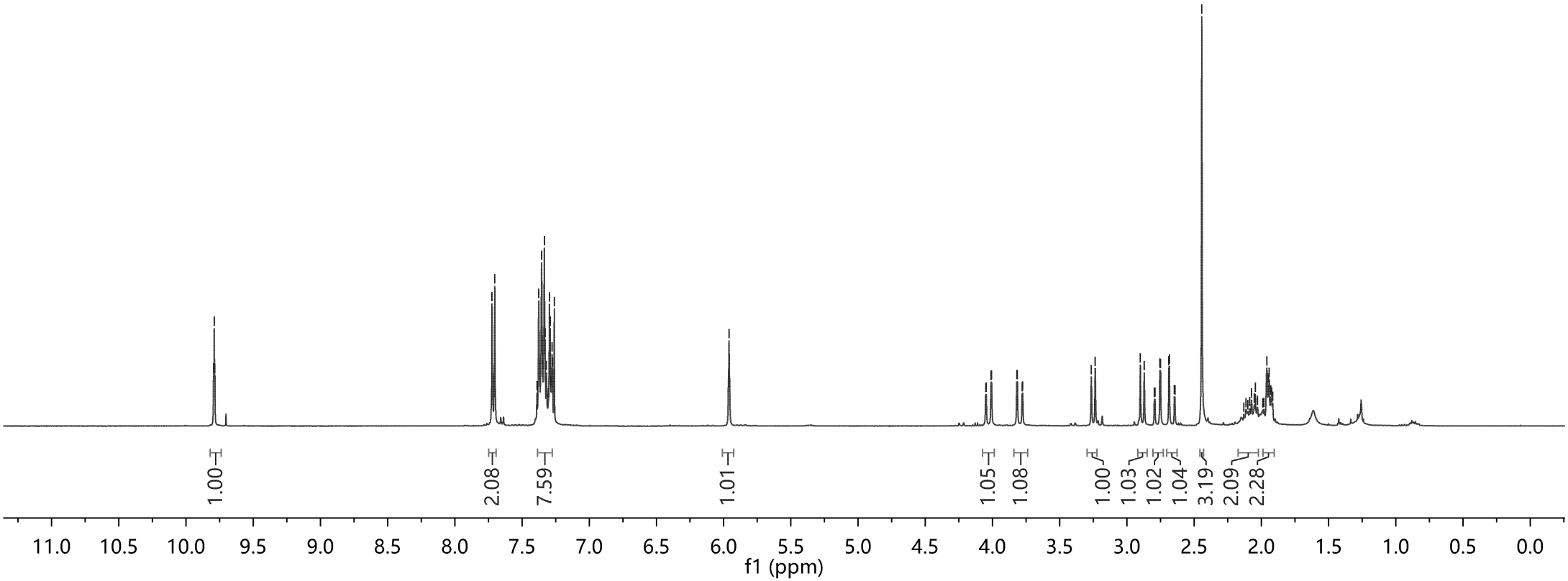

201.62
143.88
138.19
138.05
133.65
132.99
129.88
129.83
128.87
127.70
123.44
77.36
77.05
76.73
51.37
51.07
46.75
39.25
38.09
31.67
29.84
23.78
22.63
21.58
21.33
14.08
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 295.3
4 Number of Scans 1024
5 Spectrometer Frequency 100.64
6 Spectral Width 23809.5
7 Lowest Frequency -1840.5
8 Nucleus 13C
9 Acquired Size 32768
10 Spectral Size 32768
Me
nPr
Me
O
N
Ts
2p
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

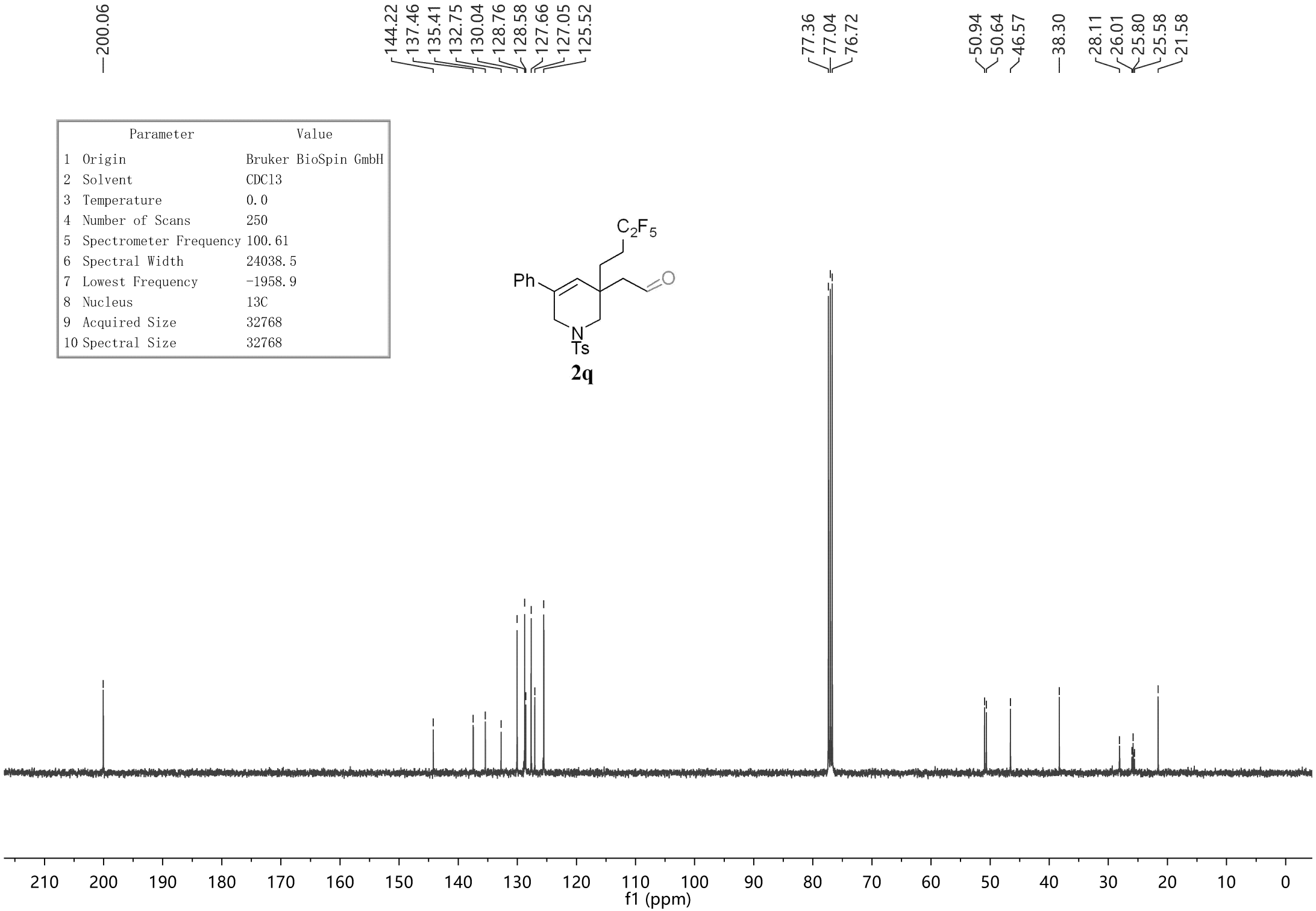



| | Parameter | Value |
|---|---|---|
| 1 | Origin | Bruker BioSpin GmbH |
| 2 | Solvent | CDCl3 |
| 3 | Temperature | 0.0 |
| 4 | Number of Scans | 16 |
| 5 | Spectrometer Frequency | 400.13 |
| 6 | Spectral Width | 8012.8 |
| 7 | Lowest Frequency | -1545.4 |
| 8 | Nucleus | 1H |
| 9 | Acquired Size | 32768 |
| 10 | Spectral Size | 65536 |




**2q**

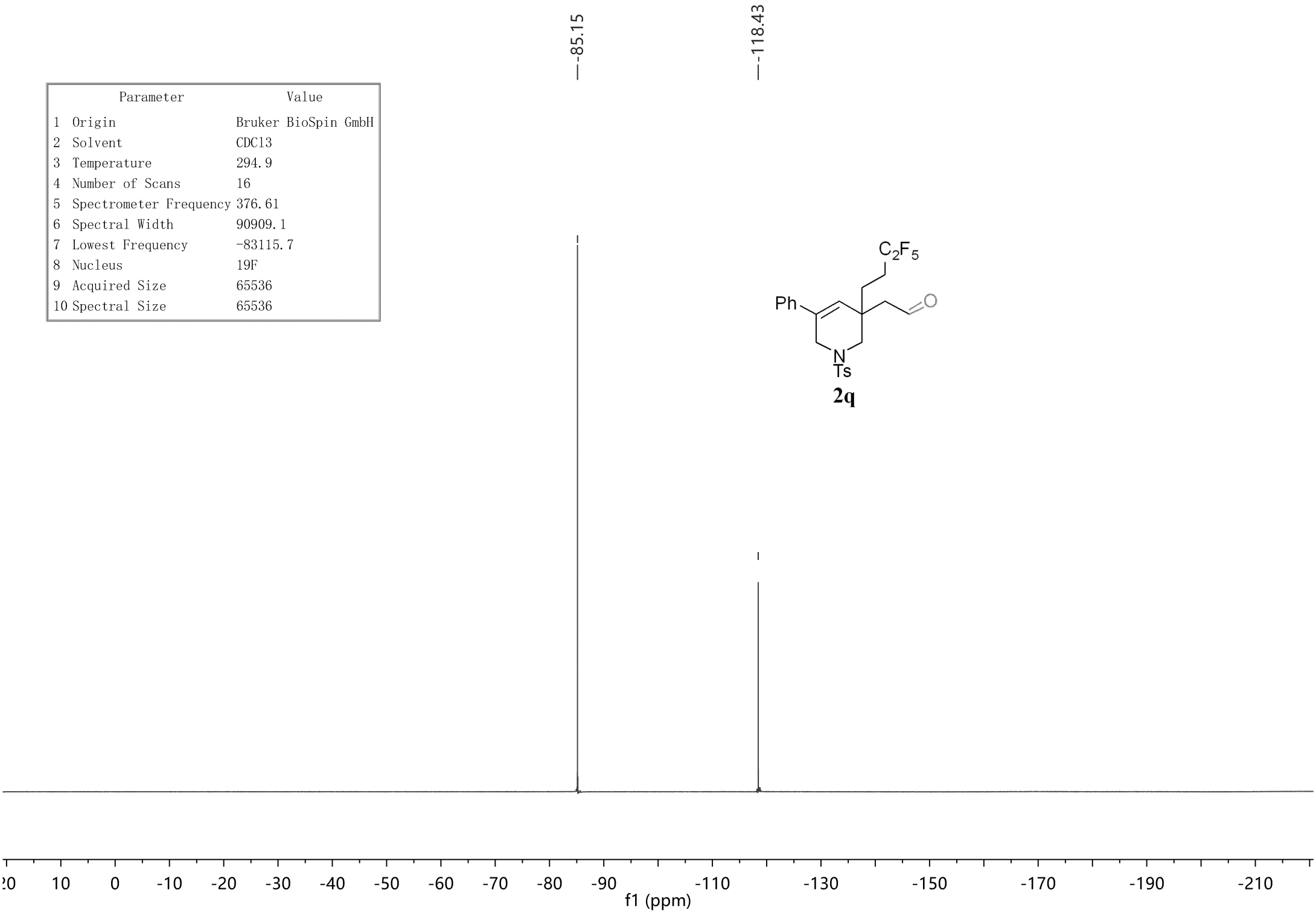



200.06
144.22
137.46
135.41
132.75
130.04
128.76
128.58
127.66
127.05
125.52
77.36
77.04
76.72
50.94
50.64
46.57
38.30
28.11
26.01
25.80
25.58
21.58
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 0.0
4 Number of Scans 250
5 Spectrometer Frequency 100.61
6 Spectral Width 24038.5
7 Lowest Frequency -1958.9
8 Nucleus 13C
9 Acquired Size 32768
10 Spectral Size 32768
C2F5
Ph
O
N
Ts
2q
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

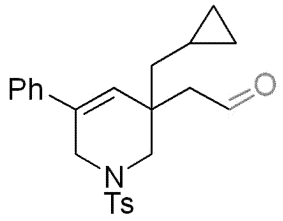
| | Parameter | Value |
|---|---|---|
| 1 | Origin | Bruker BioSpin GmbH |
| 2 | Solvent | CDCl3 |
| 3 | Temperature | 294.9 |
| 4 | Number of Scans | 16 |
| 5 | Spectrometer Frequency | 376.61 |
| 6 | Spectral Width | 90909.1 |
| 7 | Lowest Frequency | -83115.7 |
| 8 | Nucleus | 19F |
| 9 | Acquired Size | 65536 |
| 10 | Spectral Size | 65536 |



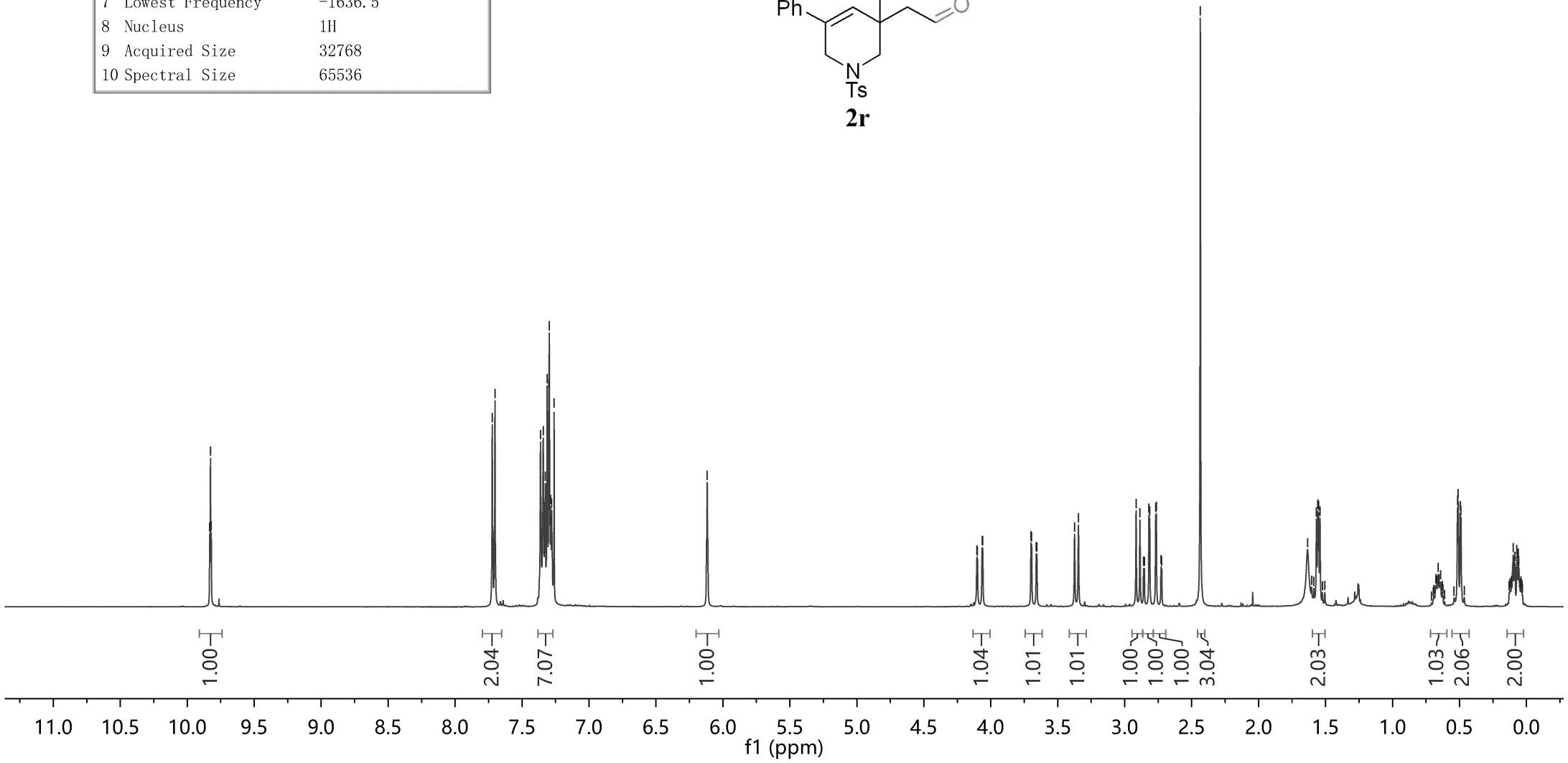

**2q**

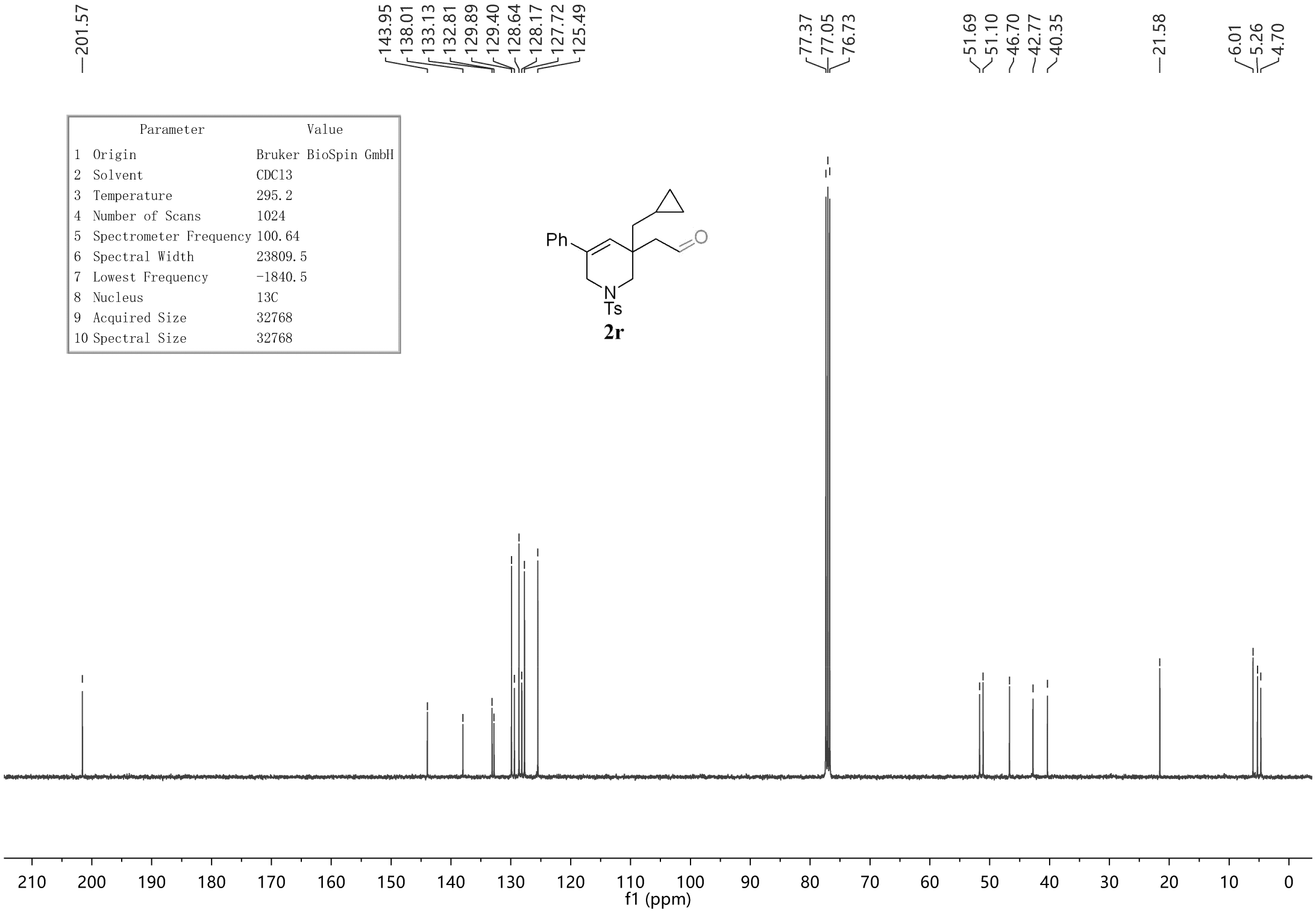


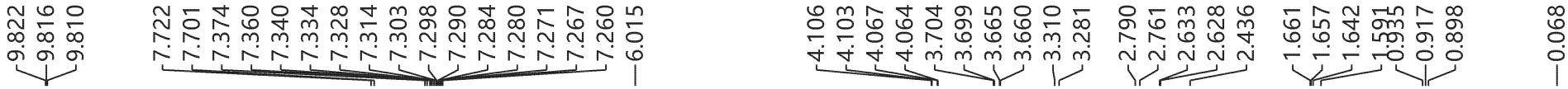
| Parameter | Value |
|---|---|
| 1 Origin | Bruker BioSpin GmbH |
| 2 Solvent | CDCl3 |
| 3 Temperature | 294.6 |
| 4 Number of Scans | 16 |
| 5 Spectrometer Frequency | 400.25 |
| 6 Spectral Width | 8196.7 |
| 7 Lowest Frequency | -1636.5 |
| 8 Nucleus | 1H |
| 9 Acquired Size | 32768 |
| 10 Spectral Size | 65536 |



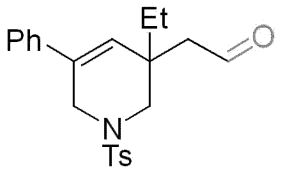

**2r**



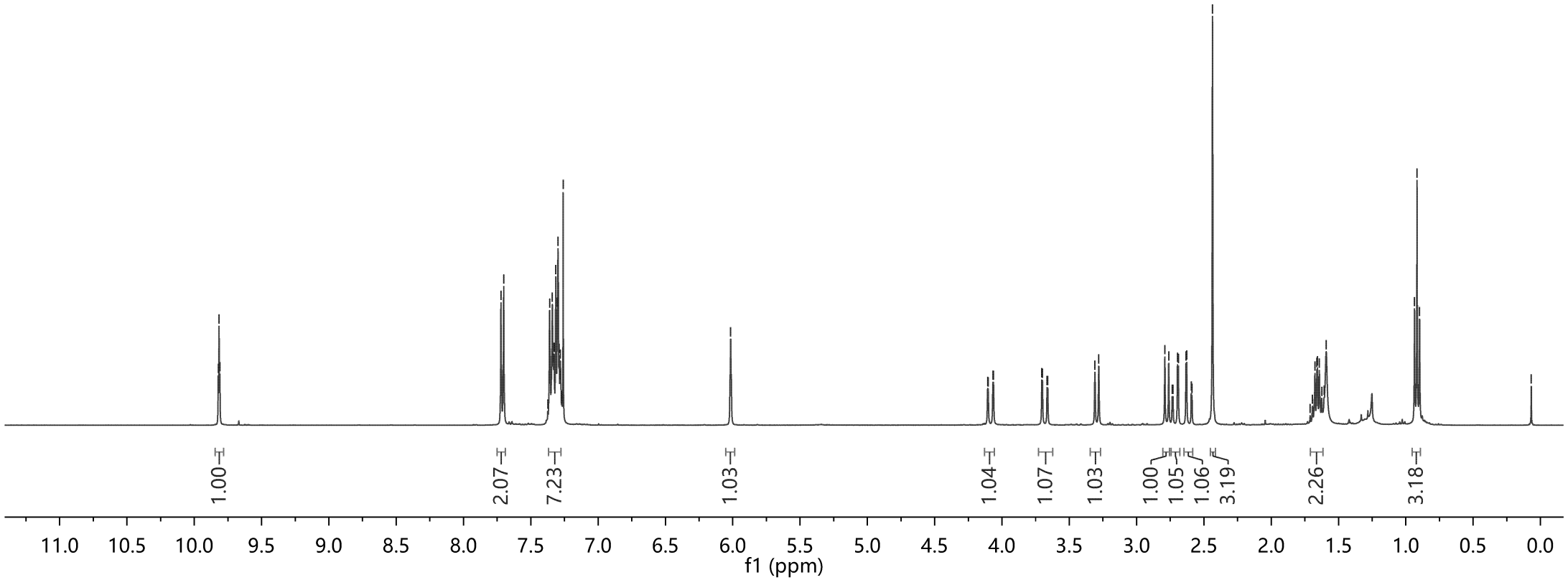

201.57
143.95
138.01
133.13
132.81
129.89
129.40
128.64
128.17
127.72
125.49
77.37
77.05
76.73
51.69
51.10
46.70
42.77
40.35
21.58
6.01
5.26
4.70
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 295.2
4 Number of Scans 1024
5 Spectrometer Frequency 100.64
6 Spectral Width 23809.5
7 Lowest Frequency -1840.5
8 Nucleus 13C
9 Acquired Size 32768
10 Spectral Size 32768
Ph
O
N
Ts
2r
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

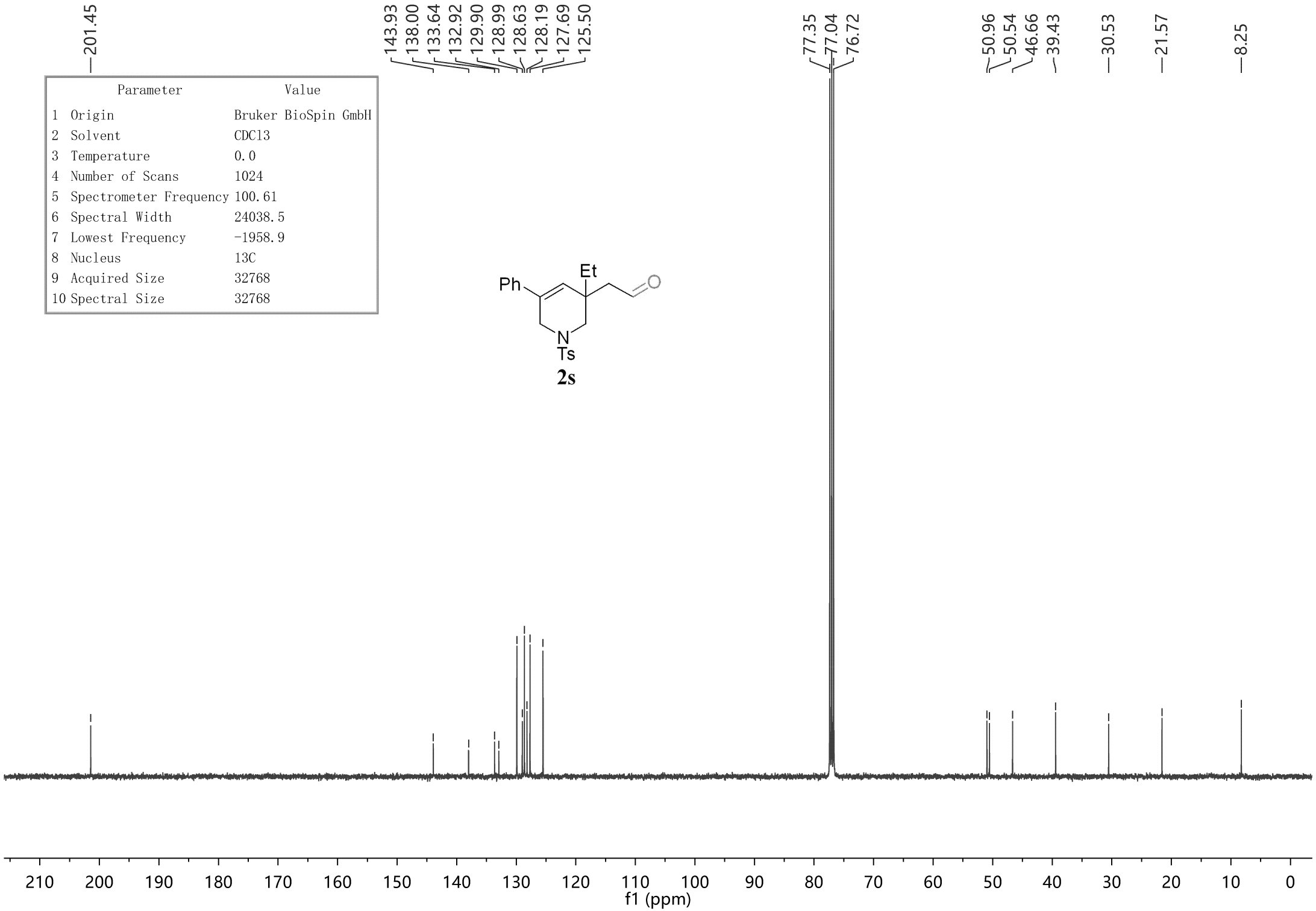



| | Parameter | Value |
|---|---|---|
| 1 | Origin | Bruker BioSpin GmbH |
| 2 | Solvent | CDCl3 |
| 3 | Temperature | 294.7 |
| 4 | Number of Scans | 16 |
| 5 | Spectrometer Frequency | 400.25 |
| 6 | Spectral Width | 8196.7 |
| 7 | Lowest Frequency | -1636.8 |
| 8 | Nucleus | 1H |
| 9 | Acquired Size | 32768 |
| 10 | Spectral Size | 65536 |

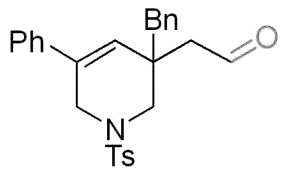



**2s**

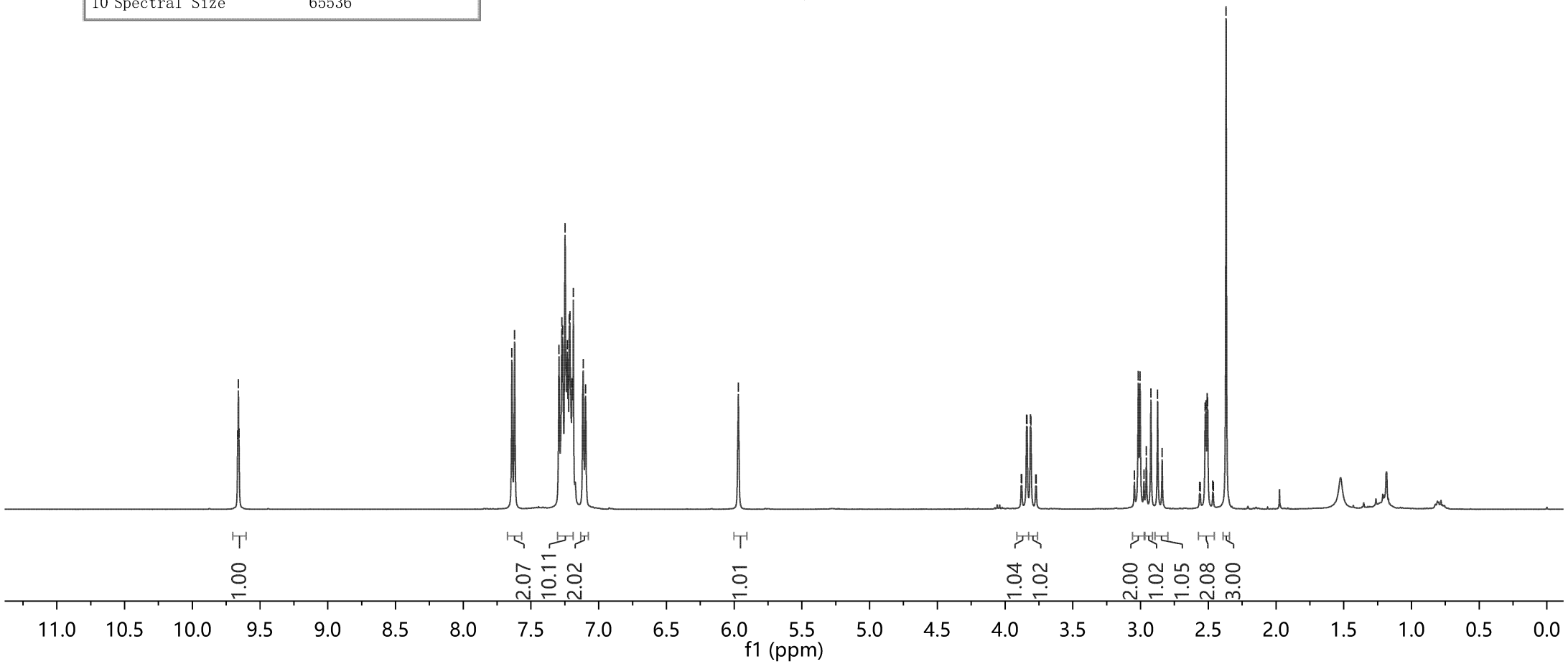


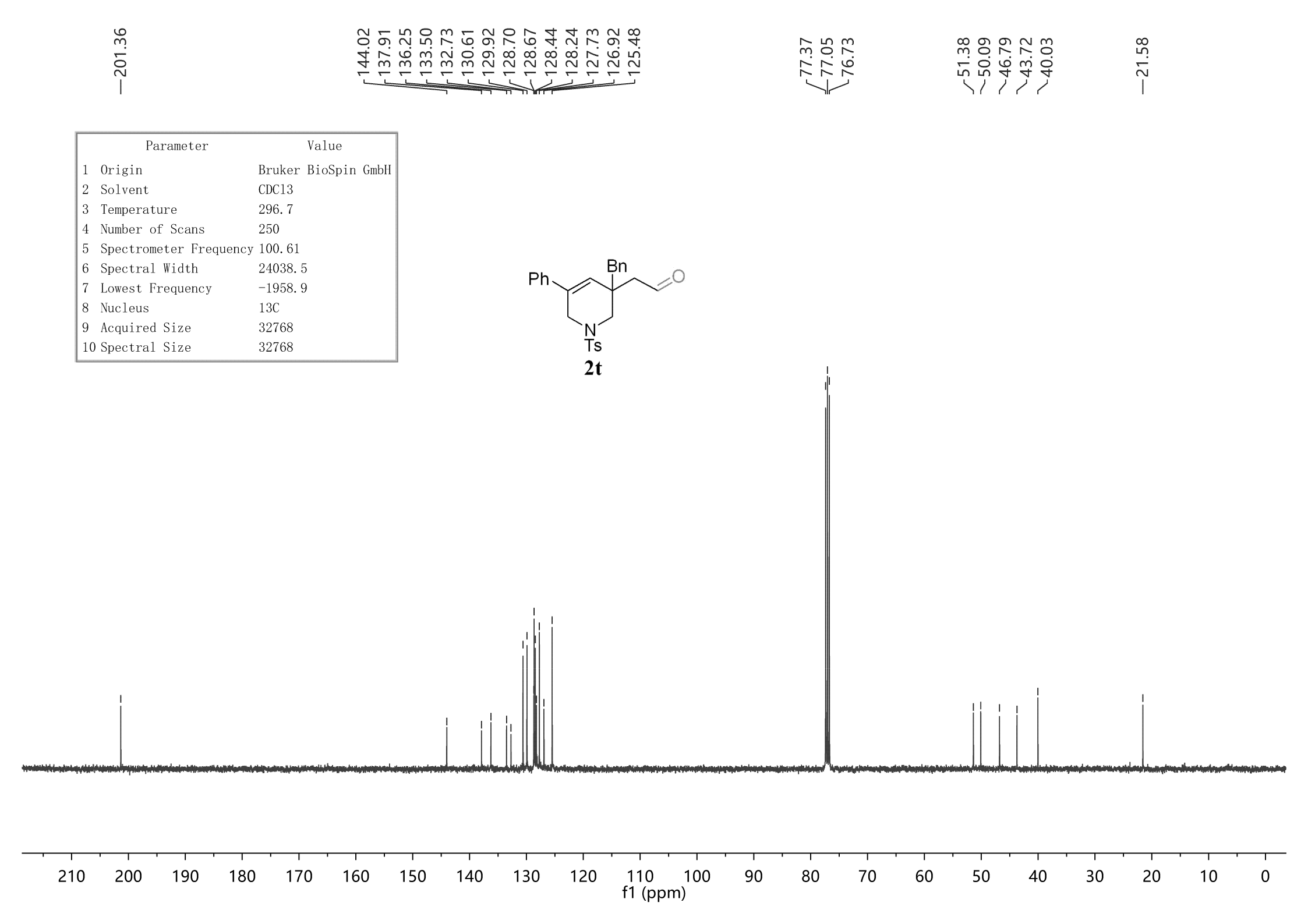

201.45
143.93
138.00
133.64
132.92
129.90
128.99
128.63
128.19
127.69
125.50
77.35
77.04
76.72
50.96
50.54
46.66
39.43
30.53
21.57
8.25
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 0.0
4 Number of Scans 1024
5 Spectrometer Frequency 100.61
6 Spectral Width 24038.5
7 Lowest Frequency -1958.9
8 Nucleus 13C
9 Acquired Size 32768
10 Spectral Size 32768
Ph
Et
O
N
Ts
2s
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

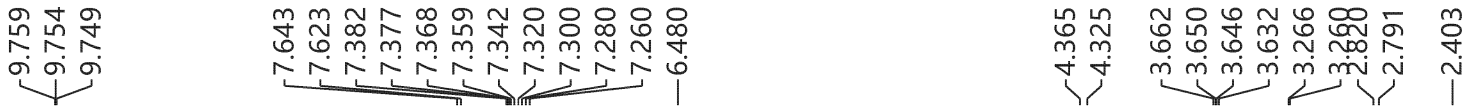
| | Parameter | Value |
|---|---|---|
| 1 | Origin | Bruker BioSpin GmbH |
| 2 | Solvent | CDCl3 |
| 3 | Temperature | 294.3 |
| 4 | Number of Scans | 16 |
| 5 | Spectrometer Frequency | 400.25 |
| 6 | Spectral Width | 8196.7 |
| 7 | Lowest Frequency | -1665.9 |
| 8 | Nucleus | 1H |
| 9 | Acquired Size | 32768 |
| 10 | Spectral Size | 65536 |



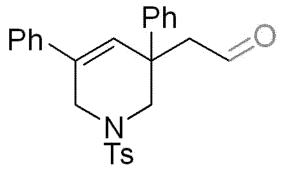

**2t**



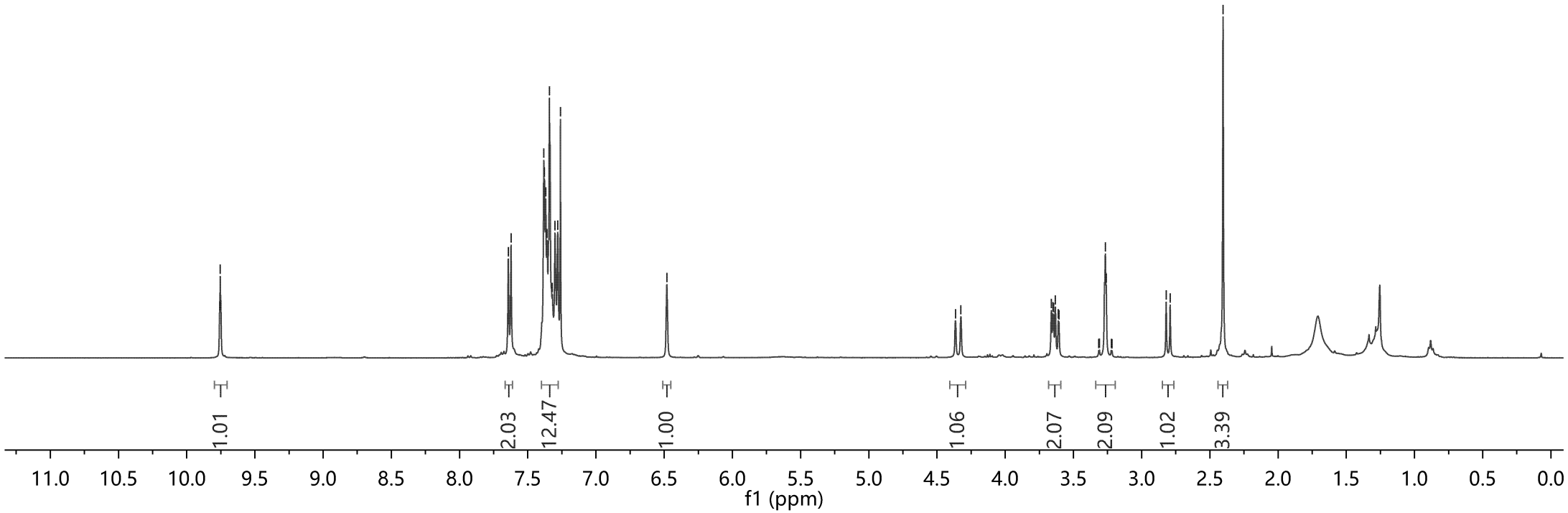

201.36
144.02
137.91
136.25
133.50
132.73
130.61
129.92
128.70
128.67
128.44
128.24
127.73
126.92
125.48
77.37
77.05
76.73
51.38
50.09
46.79
43.72
40.03
21.58
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 296.7
4 Number of Scans 250
5 Spectrometer Frequency 100.61
6 Spectral Width 24038.5
7 Lowest Frequency -1958.9
8 Nucleus 13C
9 Acquired Size 32768
10 Spectral Size 32768
Ph
Bn
O
N
Ts
2t
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

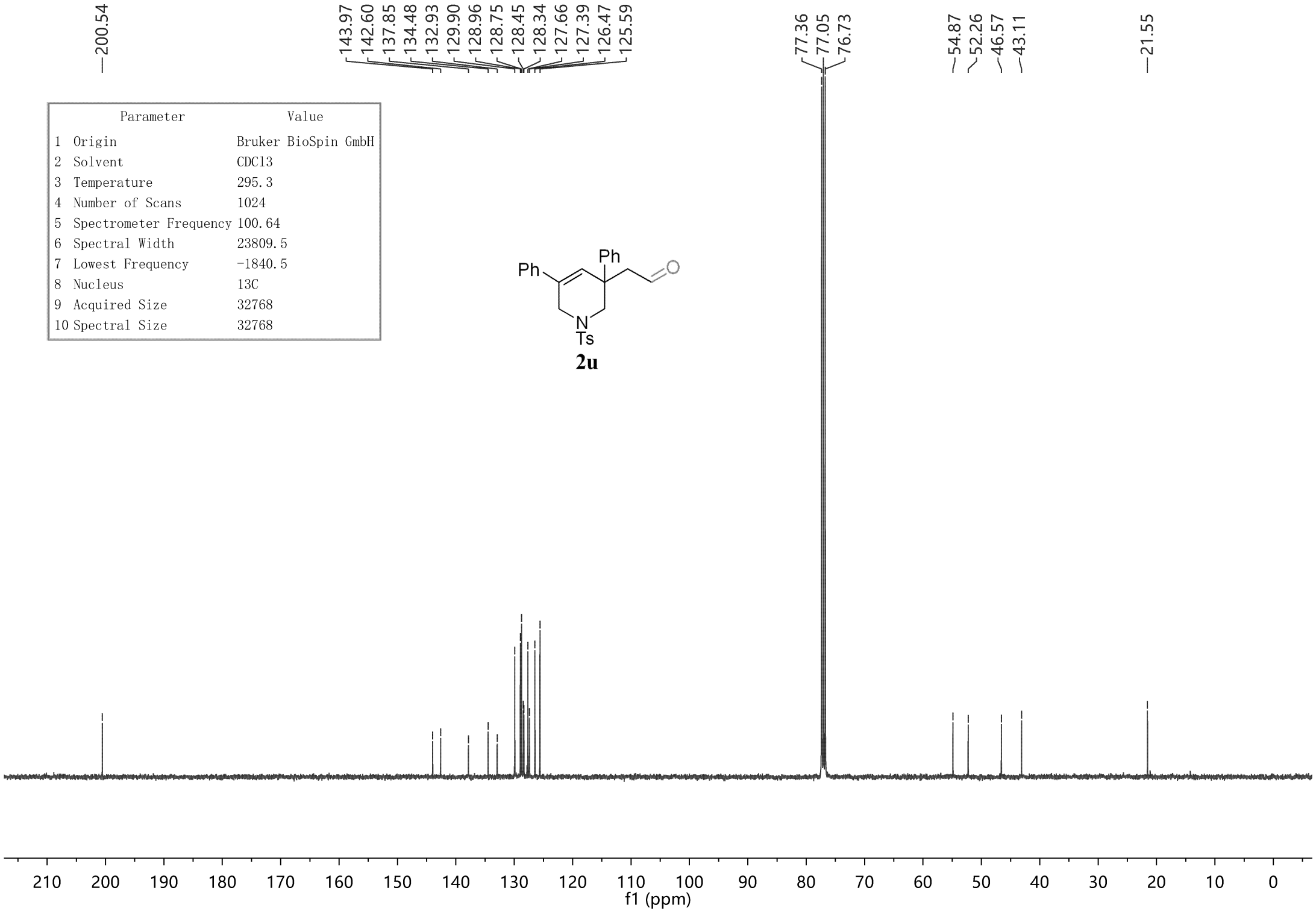



| | Parameter | Value |
|---|---|---|
| 1 | Origin | Bruker BioSpin GmbH |
| 2 | Solvent | CDCl3 |
| 3 | Temperature | 294.8 |
| 4 | Number of Scans | 16 |
| 5 | Spectrometer Frequency | 400.25 |
| 6 | Spectral Width | 8196.7 |
| 7 | Lowest Frequency | -1636.3 |
| 8 | Nucleus | 1H |
| 9 | Acquired Size | 32768 |
| 10 | Spectral Size | 65536 |



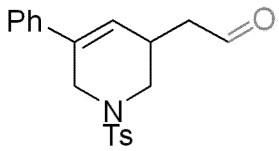

**2u**



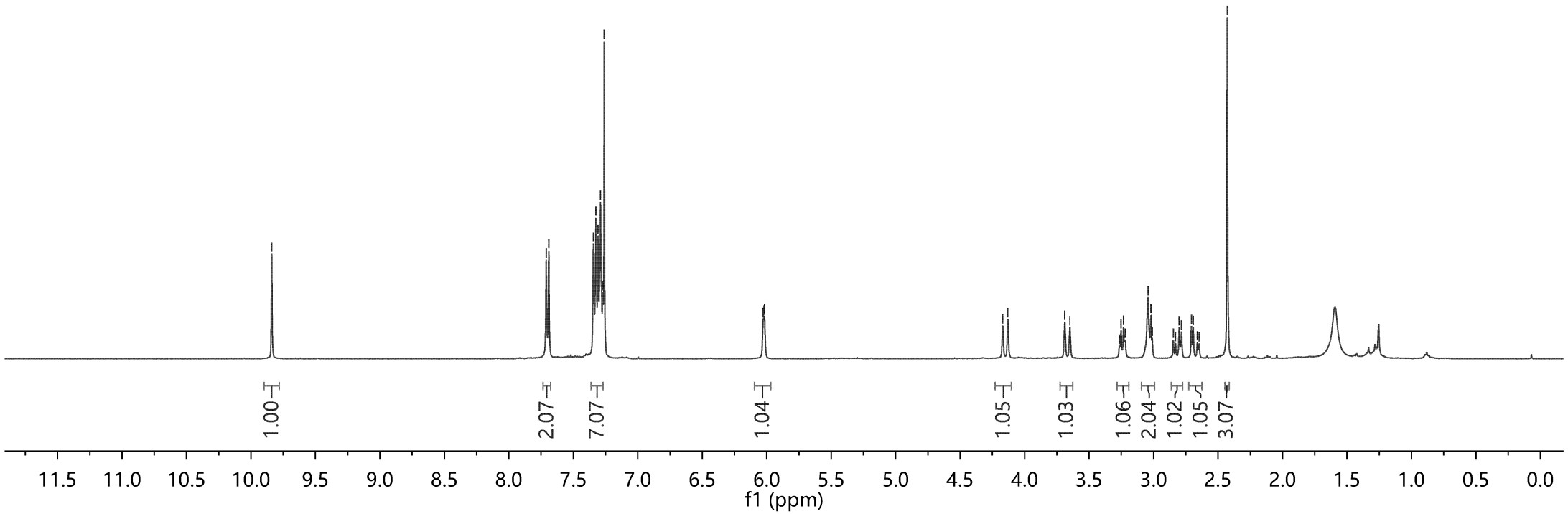

200.54
143.97
142.60
137.85
134.48
132.93
129.90
128.96
128.75
128.45
128.34
127.66
127.39
126.47
125.59
77.36
77.05
76.73
54.87
52.26
46.57
43.11
21.55
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 295.3
4 Number of Scans 1024
5 Spectrometer Frequency 100.64
6 Spectral Width 23809.5
7 Lowest Frequency -1840.5
8 Nucleus 13C
9 Acquired Size 32768
10 Spectral Size 32768
Ph
Ph
O
N
Ts
2u
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

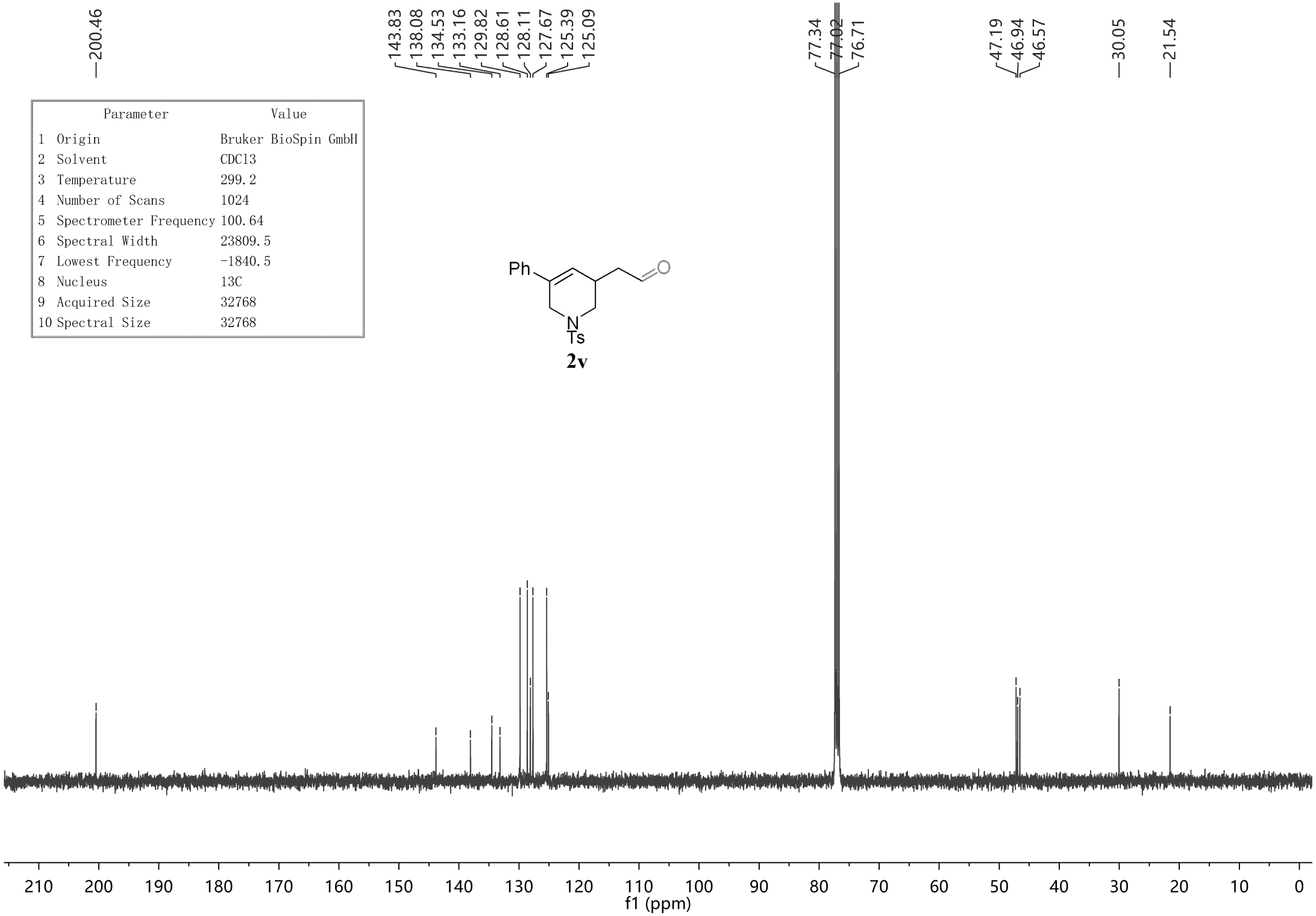
9.839
7.710
7.690
7.344
7.324
7.309
7.289
7.271
7.260
6.027
6.022
6.017
4.170
4.130
3.689
3.649
3.265
3.252
3.233
3.220
3.043
3.021
3.011
2.847
2.830
2.802
2.783
2.706
2.693
2.661
2.647
2.428

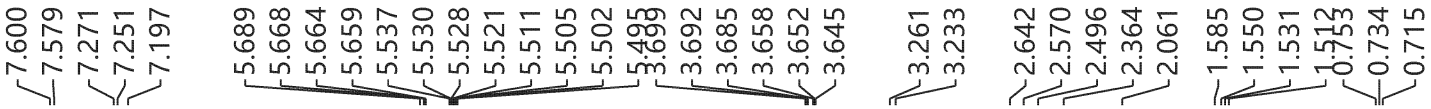
| | Parameter | Value |
|---|---|---|
| 1 | Origin | Bruker BioSpin GmbH |
| 2 | Solvent | CDCl3 |
| 3 | Temperature | 297.5 |
| 4 | Number of Scans | 16 |
| 5 | Spectrometer Frequency | 400.25 |
| 6 | Spectral Width | 8196.7 |
| 7 | Lowest Frequency | -1636.5 |
| 8 | Nucleus | 1H |
| 9 | Acquired Size | 32768 |
| 10 | Spectral Size | 65536 |



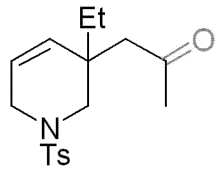

**2v**



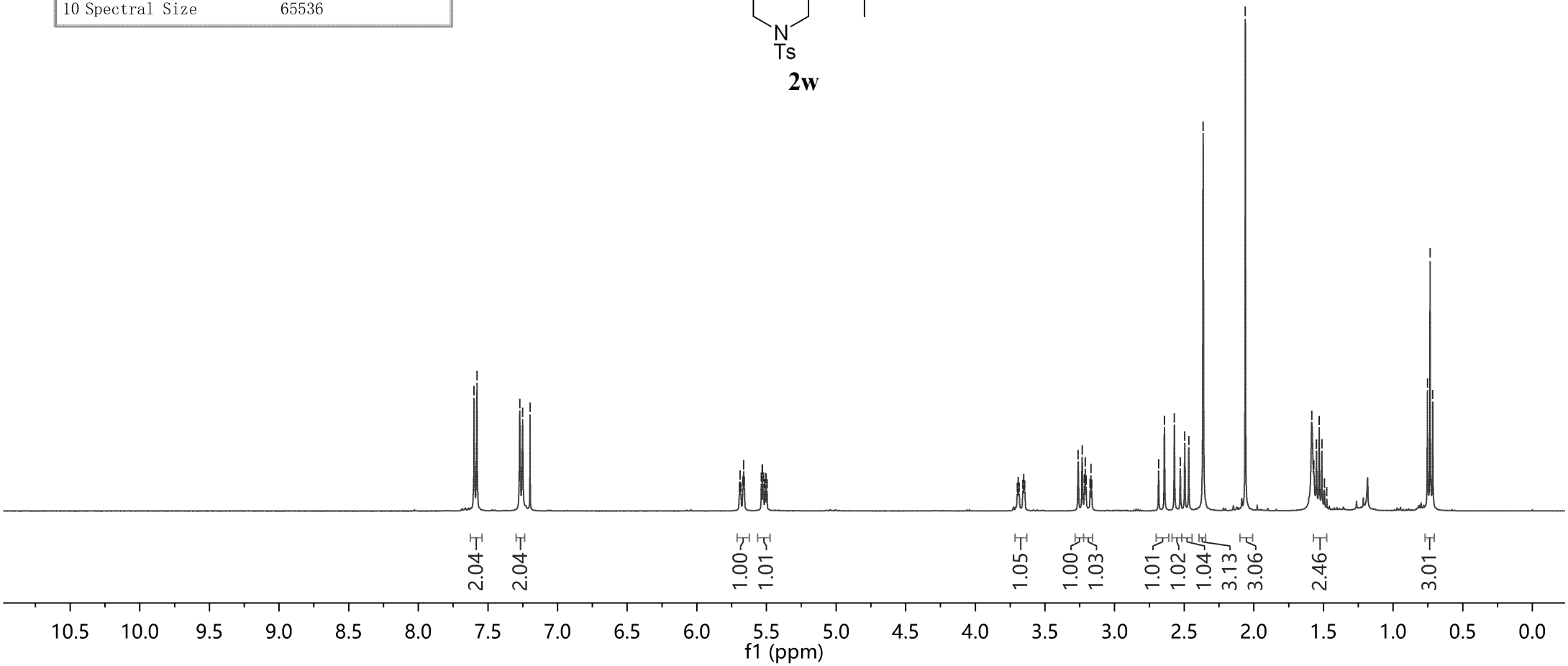

200.46
143.83
138.08
134.53
133.16
129.82
128.61
128.11
127.67
125.39
125.09
77.34
77.02
76.71
47.19
46.94
46.57
30.05
21.54
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 299.2
4 Number of Scans 1024
5 Spectrometer Frequency 100.64
6 Spectral Width 23809.5
7 Lowest Frequency -1840.5
8 Nucleus 13C
9 Acquired Size 32768
10 Spectral Size 32768
Ph
O
N
Ts
2v
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

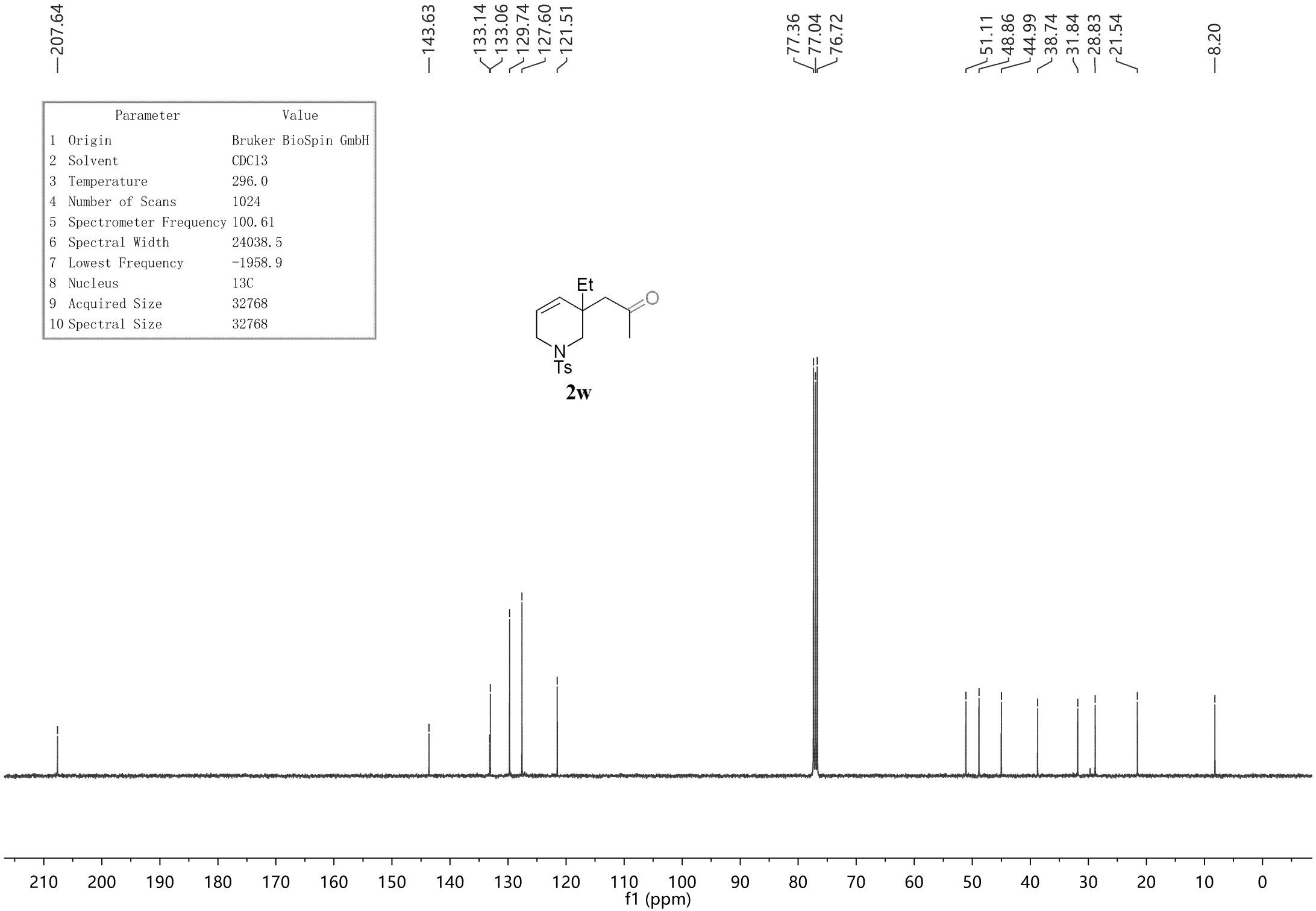



| | Parameter | Value |
|---|---|---|
| 1 | Origin | Bruker BioSpin GmbH |
| 2 | Solvent | CDCl3 |
| 3 | Temperature | 296.2 |
| 4 | Number of Scans | 16 |
| 5 | Spectrometer Frequency | 400.13 |
| 6 | Spectral Width | 8012.8 |
| 7 | Lowest Frequency | -1570.3 |
| 8 | Nucleus | 1H |
| 9 | Acquired Size | 32768 |
| 10 | Spectral Size | 65536 |




**2w**

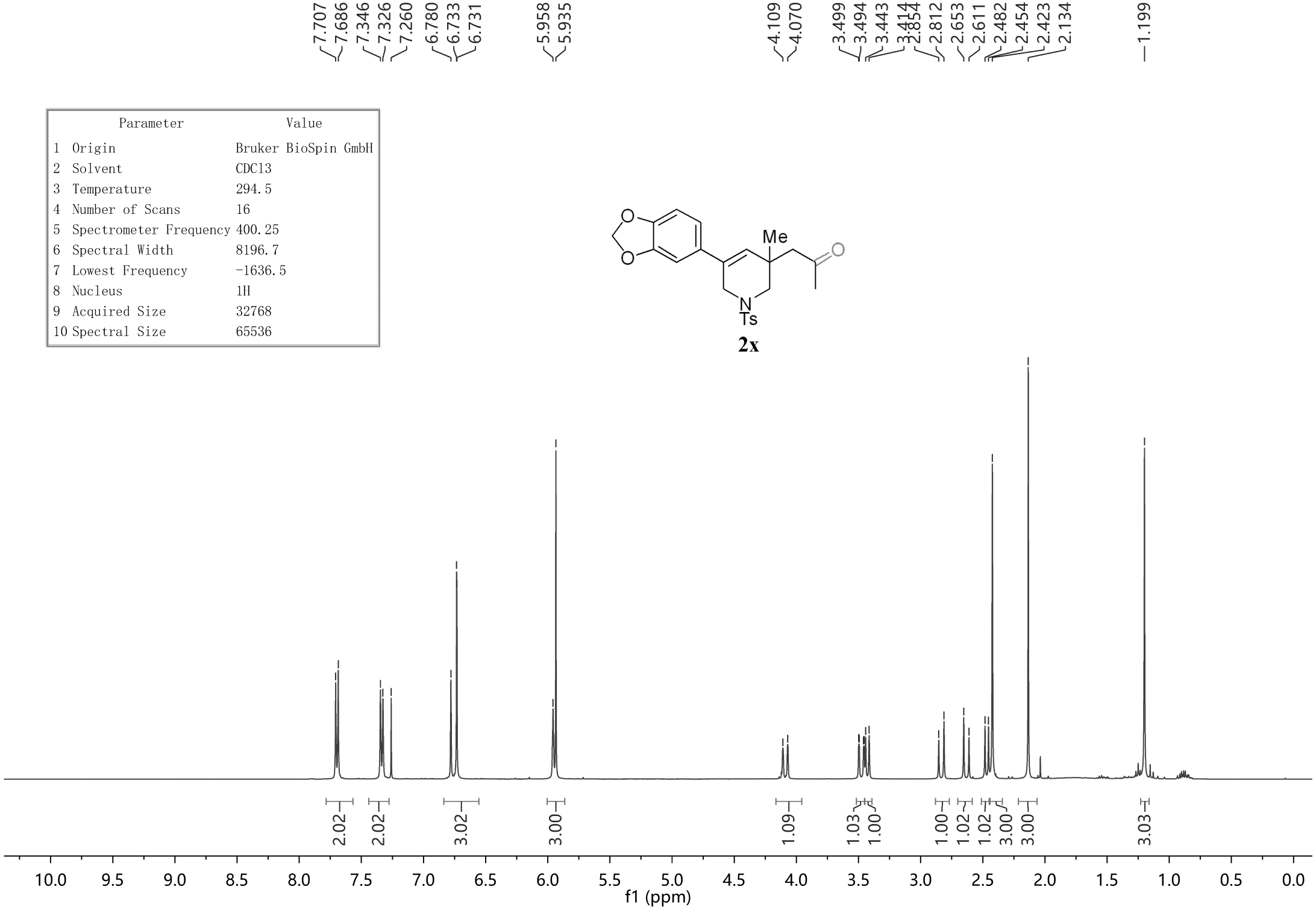


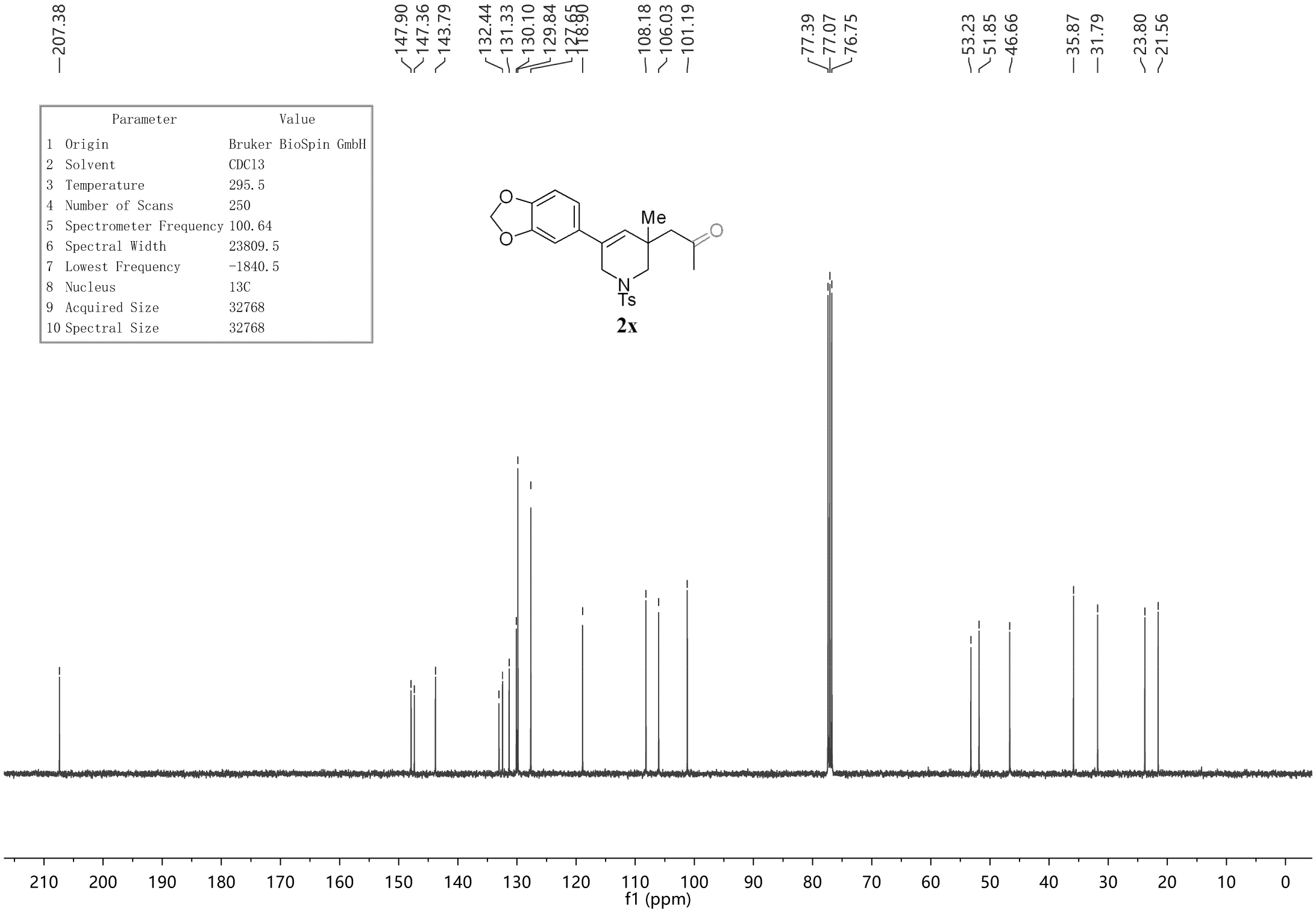

207.64
143.63
133.14
133.06
129.74
127.60
121.51
77.36
77.04
76.72
51.11
48.86
44.99
38.74
31.84
28.83
21.54
8.20
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 296.0
4 Number of Scans 1024
5 Spectrometer Frequency 100.61
6 Spectral Width 24038.5
7 Lowest Frequency -1958.9
8 Nucleus 13C
9 Acquired Size 32768
10 Spectral Size 32768
Et
N
Ts
O
2w
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

| | Parameter | Value |
|---|---|---|
| 1 | Origin | Bruker BioSpin GmbH |
| 2 | Solvent | CDCl3 |
| 3 | Temperature | 294.5 |
| 4 | Number of Scans | 16 |
| 5 | Spectrometer Frequency | 400.25 |
| 6 | Spectral Width | 8196.7 |
| 7 | Lowest Frequency | -1636.5 |
| 8 | Nucleus | 1H |
| 9 | Acquired Size | 32768 |
| 10 | Spectral Size | 65536 |




**2x**

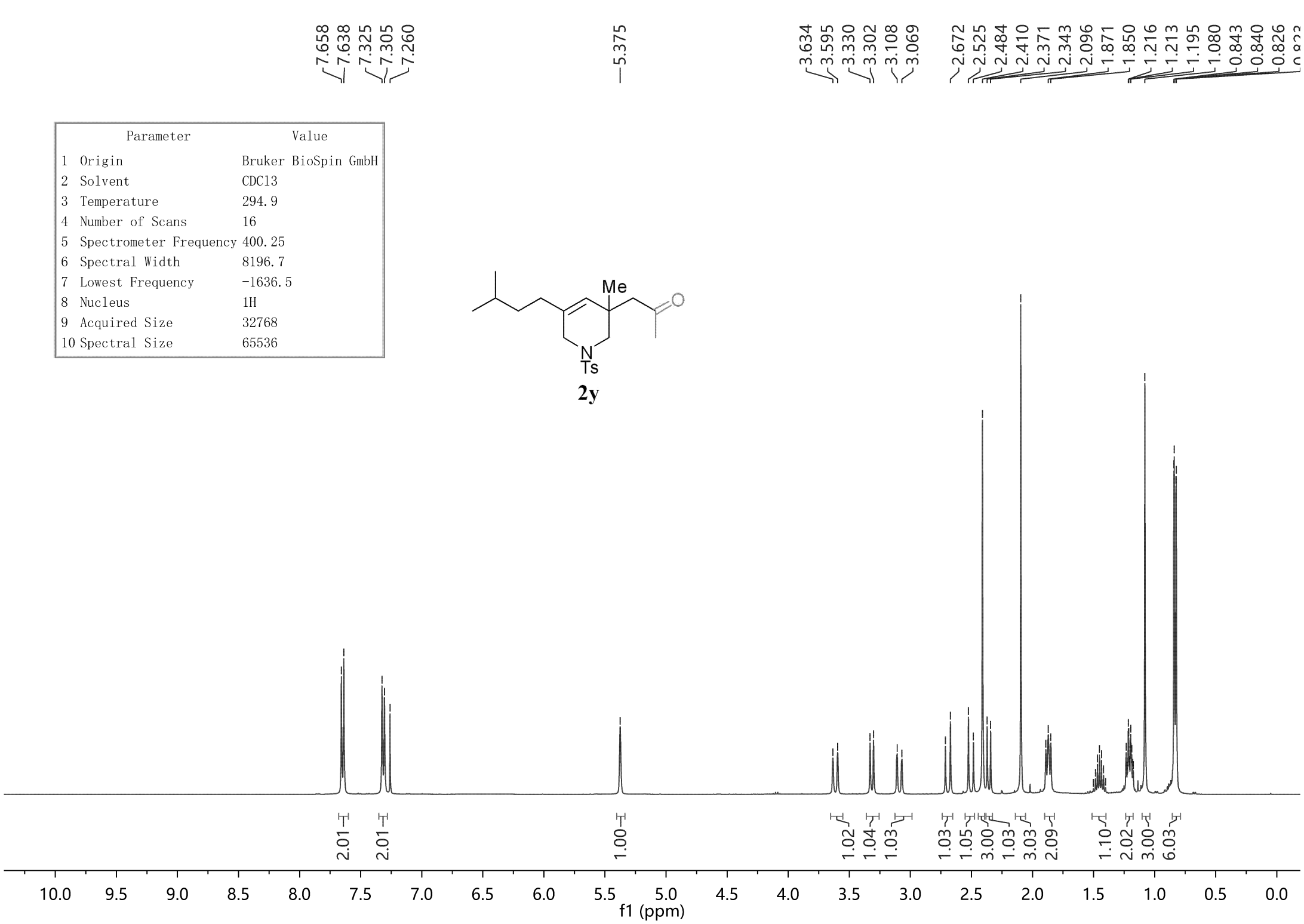


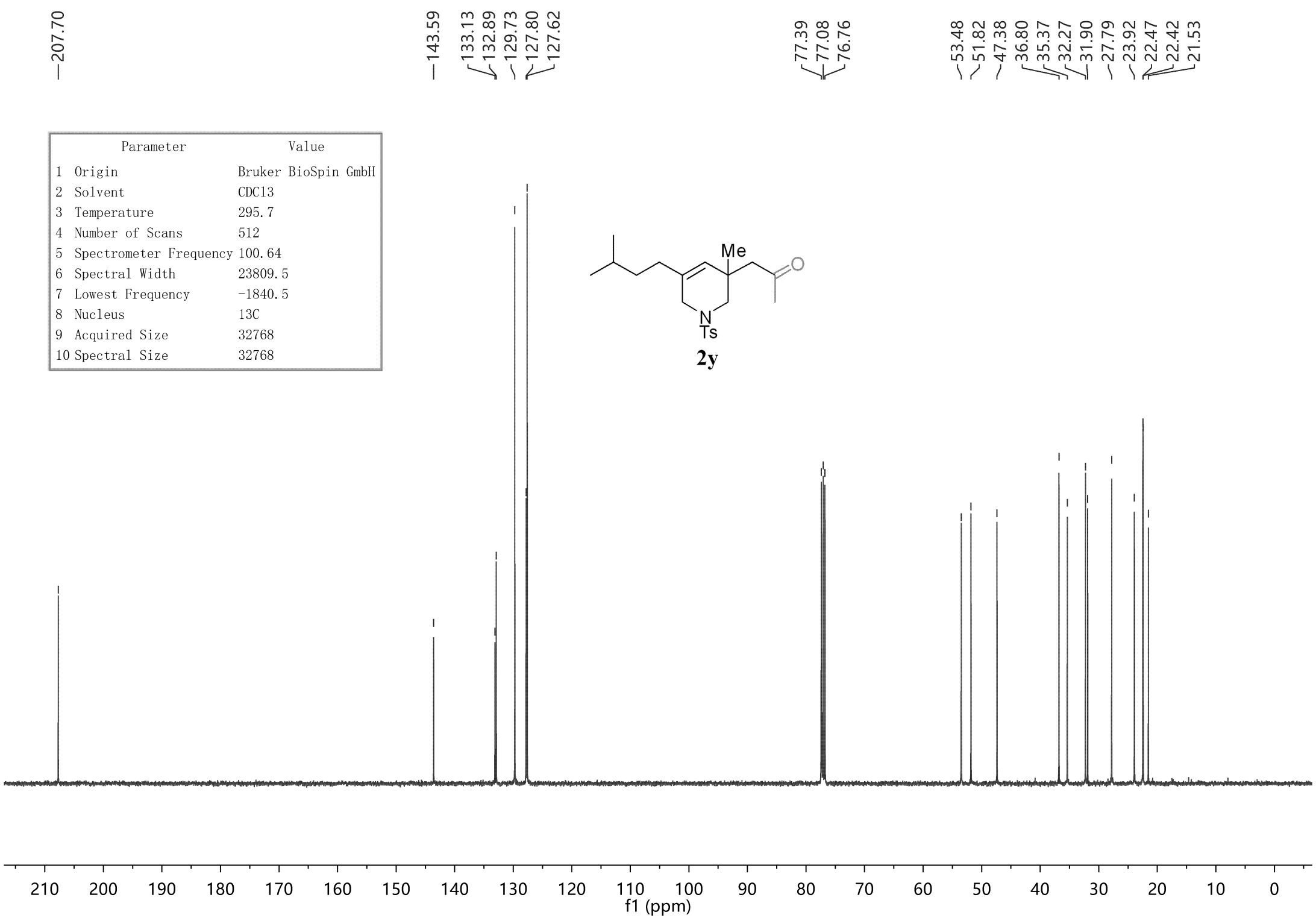

207.38
147.90
147.36
143.79
132.44
131.33
130.10
129.84
127.65
118.90
108.18
106.03
101.19
77.39
77.07
76.75
53.23
51.85
46.66
35.87
31.79
23.80
21.56
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 295.5
4 Number of Scans 250
5 Spectrometer Frequency 100.64
6 Spectral Width 23809.5
7 Lowest Frequency -1840.5
8 Nucleus 13C
9 Acquired Size 32768
10 Spectral Size 32768
O
O
Me
O
N
Ts
2x
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

| | Parameter | Value |
|---|---|---|
| 1 | Origin | Bruker BioSpin GmbH |
| 2 | Solvent | CDCl3 |
| 3 | Temperature | 294.9 |
| 4 | Number of Scans | 16 |
| 5 | Spectrometer Frequency | 400.25 |
| 6 | Spectral Width | 8196.7 |
| 7 | Lowest Frequency | -1636.5 |
| 8 | Nucleus | 1H |
| 9 | Acquired Size | 32768 |
| 10 | Spectral Size | 65536 |

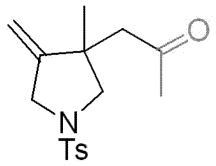



**2y**

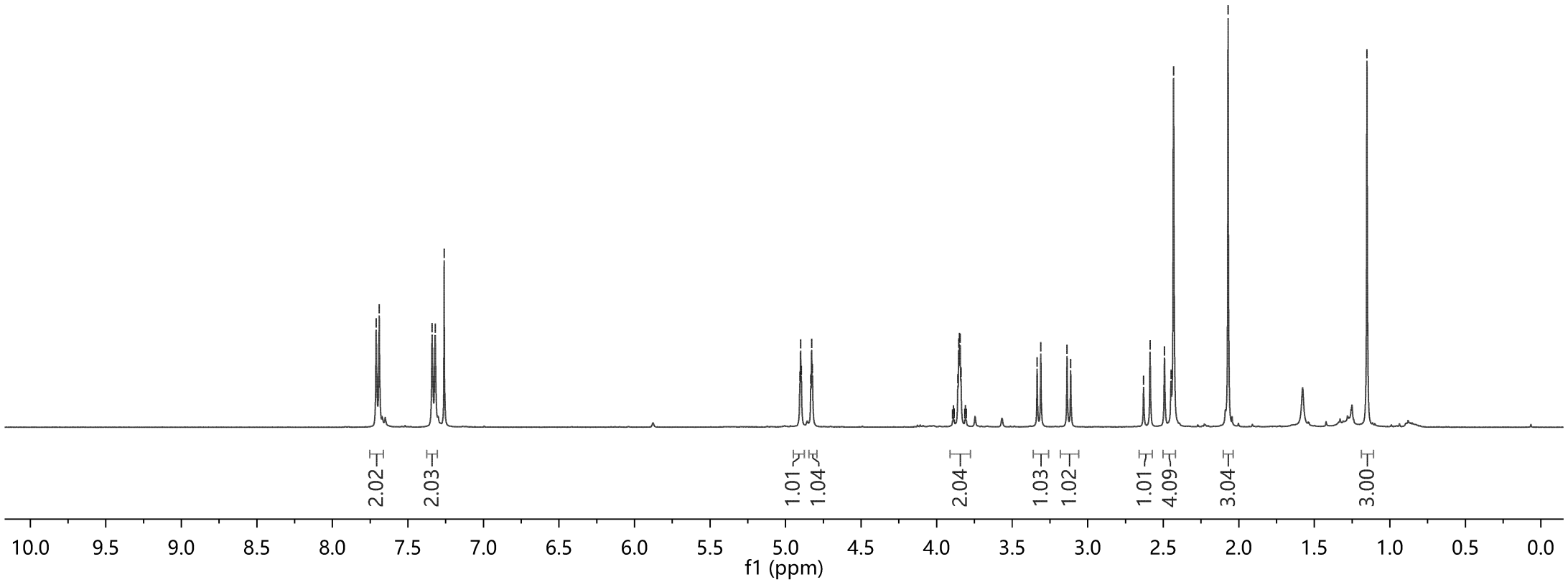


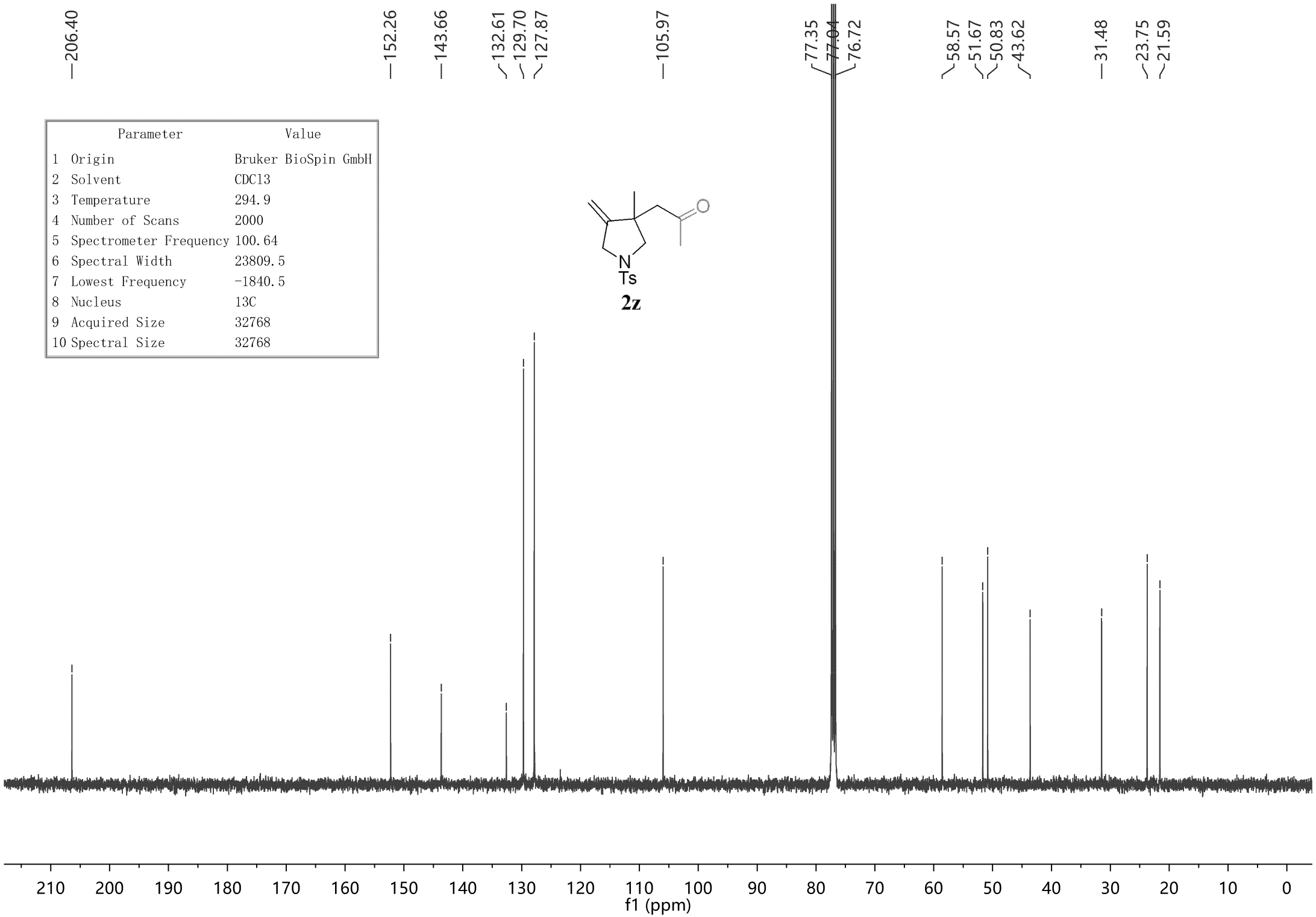

207.70
143.59
133.13
132.89
129.73
127.80
127.62
77.39
77.08
76.76
53.48
51.82
47.38
36.80
35.37
32.27
31.90
27.79
23.92
22.47
22.42
21.53
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 295.7
4 Number of Scans 512
5 Spectrometer Frequency 100.64
6 Spectral Width 23809.5
7 Lowest Frequency -1840.5
8 Nucleus 13C
9 Acquired Size 32768
10 Spectral Size 32768
Me
O
N
Ts
2y
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

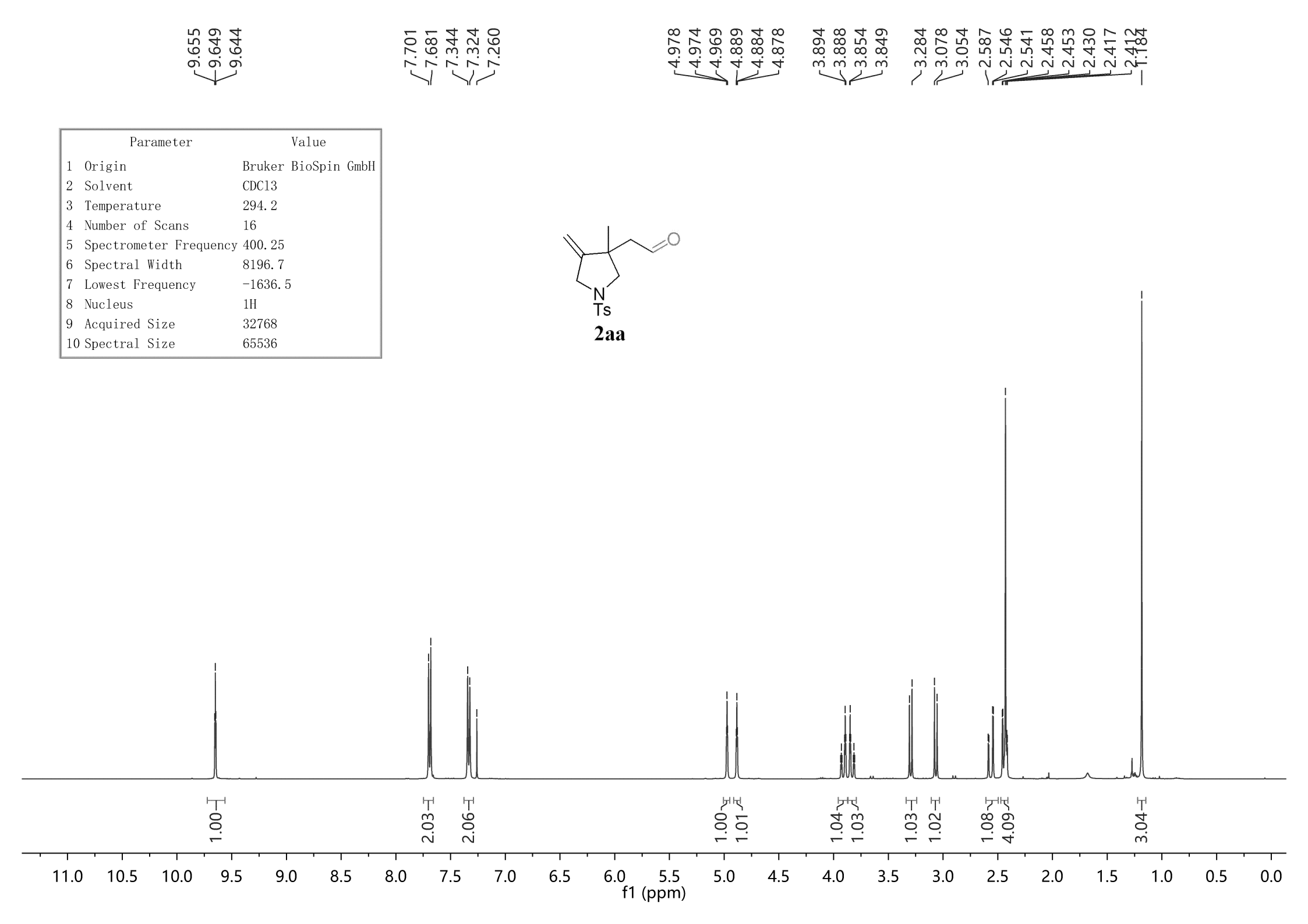
| Parameter | Value |
|---|---|
| 1 Origin | Bruker BioSpin GmbH |
| 2 Solvent | CDCl3 |
| 3 Temperature | 294.3 |
| 4 Number of Scans | 16 |
| 5 Spectrometer Frequency | 400.25 |
| 6 Spectral Width | 8196.7 |
| 7 Lowest Frequency | -1636.5 |
| 8 Nucleus | 1H |
| 9 Acquired Size | 32768 |
| 10 Spectral Size | 65536 |

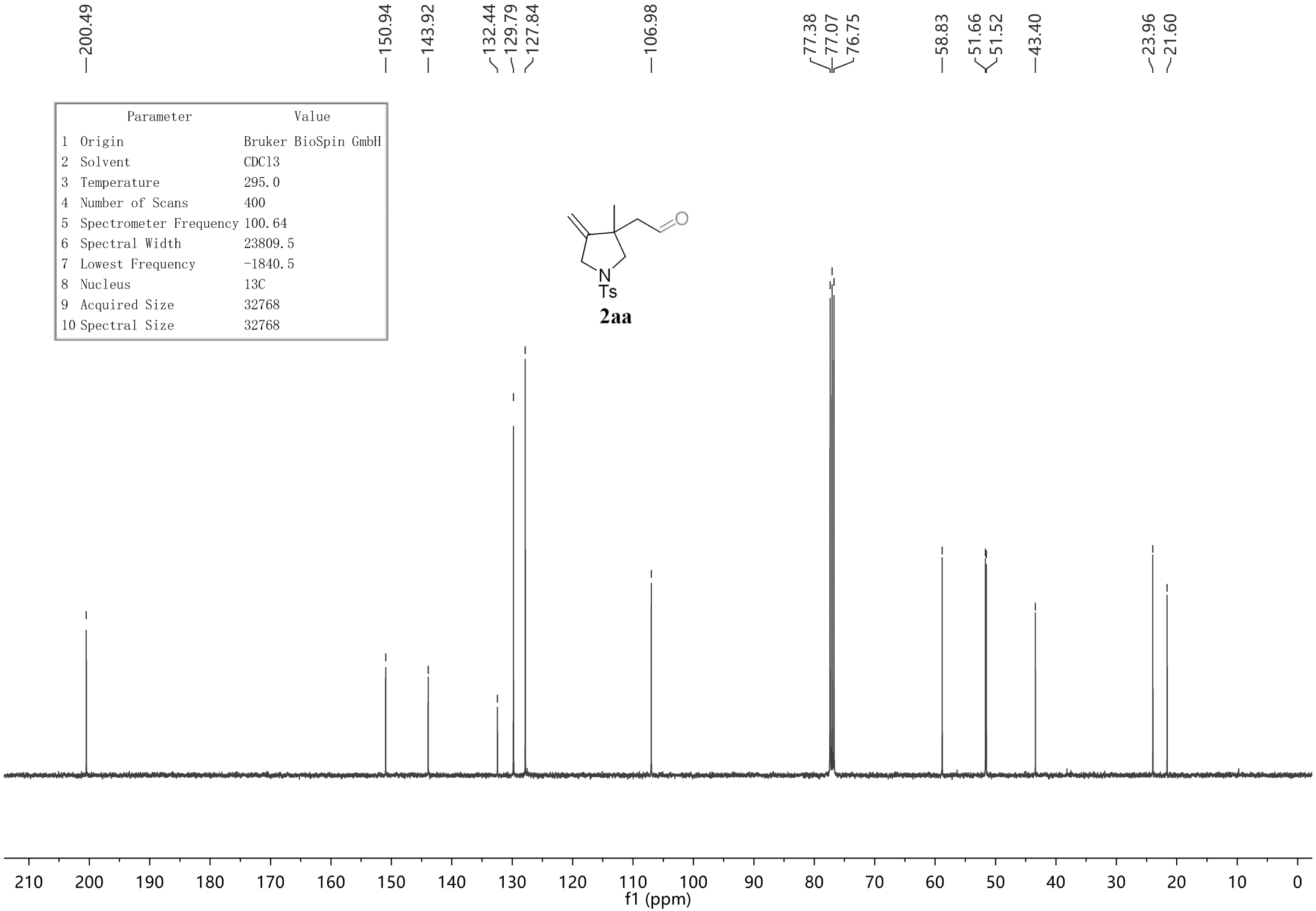



**2z**

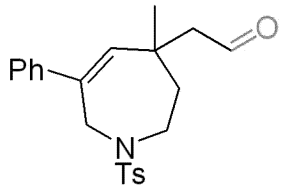



206.40
152.26
143.66
132.61
129.70
127.87
105.97
77.35
77.04
76.72
58.57
51.67
50.83
43.62
31.48
23.75
21.59
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 294.9
4 Number of Scans 2000
5 Spectrometer Frequency 100.64
6 Spectral Width 23809.5
7 Lowest Frequency -1840.5
8 Nucleus 13C
9 Acquired Size 32768
10 Spectral Size 32768
N
Ts
2z
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

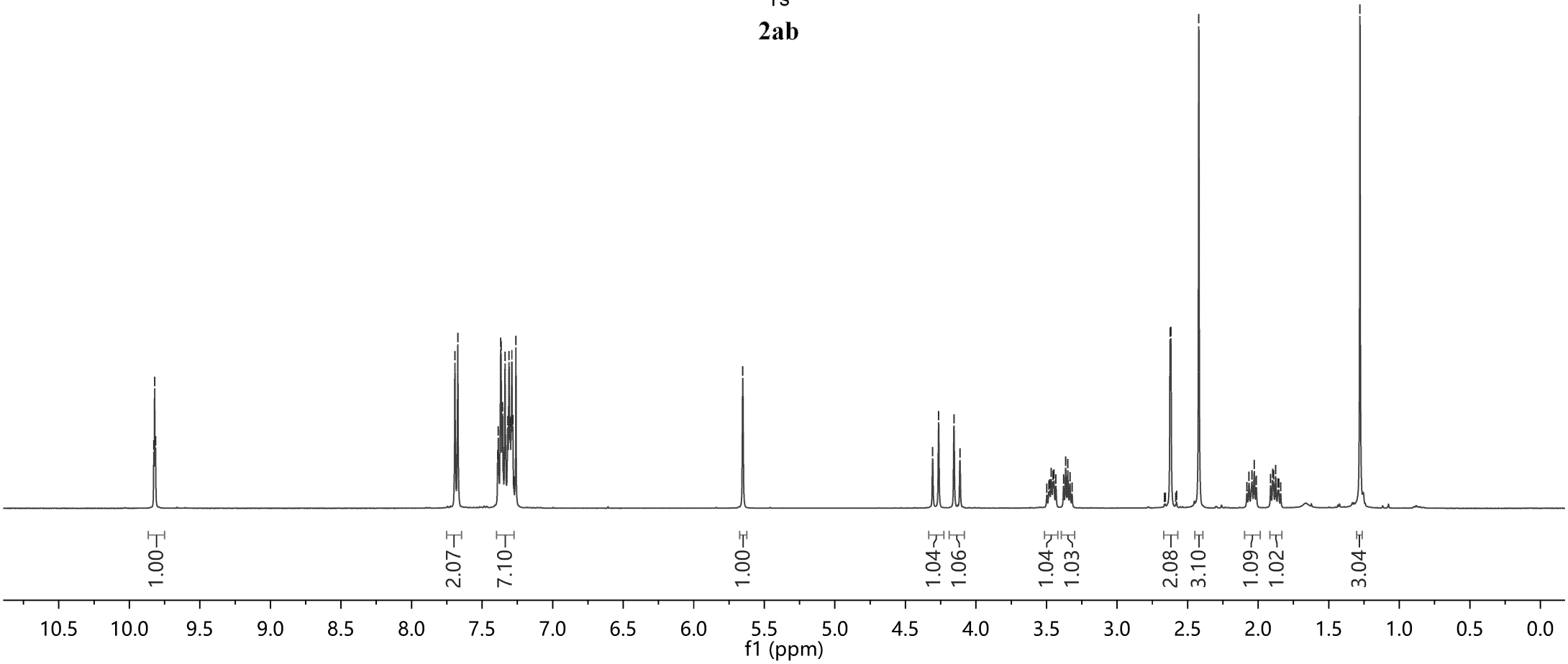

9.655
9.649
9.644
7.701
7.681
7.344
7.324
7.260
4.978
4.974
4.969
4.889
4.884
4.878
3.894
3.888
3.854
3.849
3.284
3.078
3.054
2.587
2.546
2.541
2.458
2.453
2.430
2.417
2.412
1.184
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 294.2
4 Number of Scans 16
5 Spectrometer Frequency 400.25
6 Spectral Width 8196.7
7 Lowest Frequency -1636.5
8 Nucleus 1H
9 Acquired Size 32768
10 Spectral Size 65536
N
Ts
2aa
1.00
2.03
2.06
1.00
1.01
1.04
1.03
1.03
1.02
1.08
4.09
3.04
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

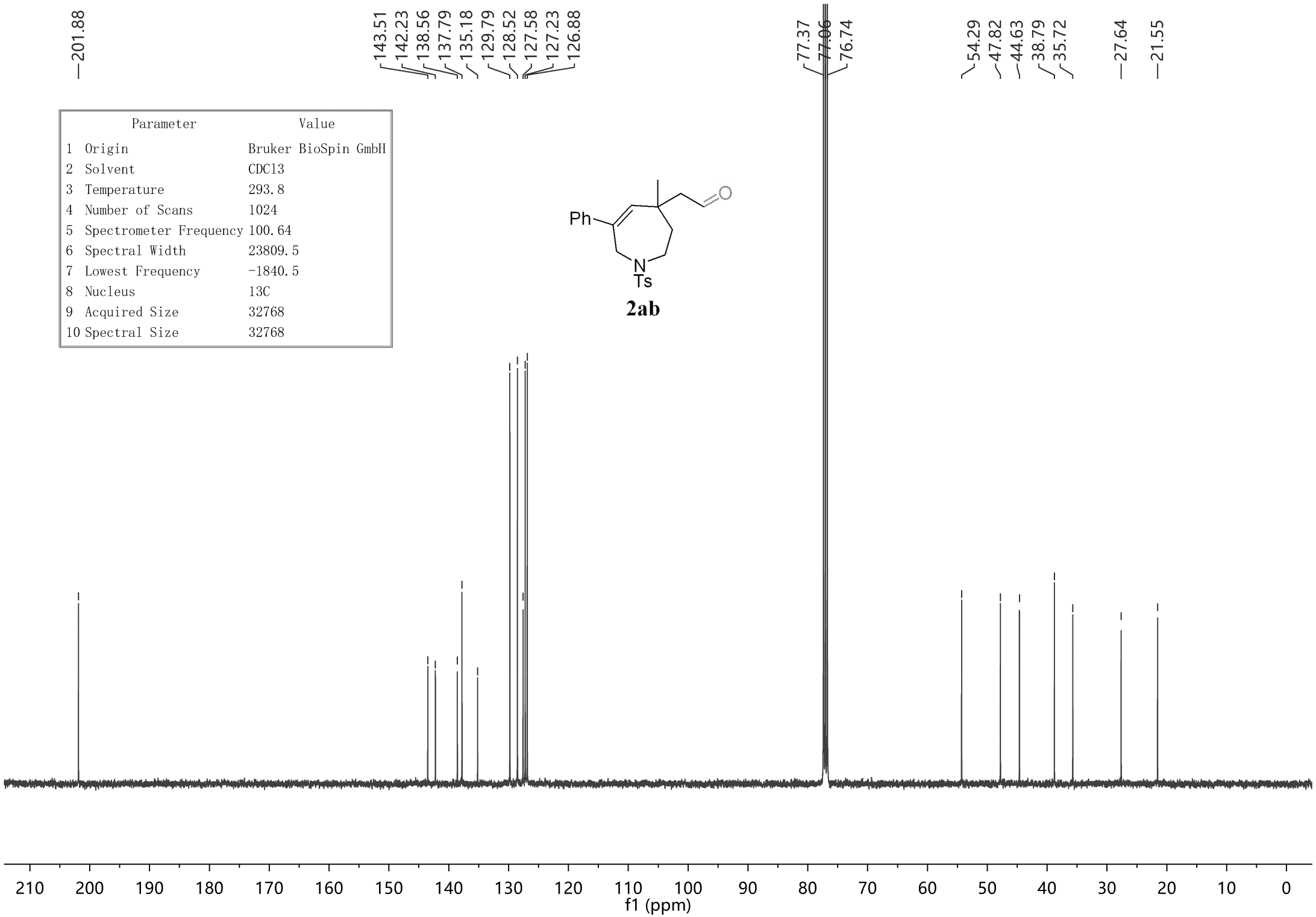

200.49
150.94
143.92
132.44
129.79
127.84
106.98
77.38
77.07
76.75
58.83
51.66
51.52
43.40
23.96
21.60
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 295.0
4 Number of Scans 400
5 Spectrometer Frequency 100.64
6 Spectral Width 23809.5
7 Lowest Frequency -1840.5
8 Nucleus 13C
9 Acquired Size 32768
10 Spectral Size 32768
N
Ts
2aa
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

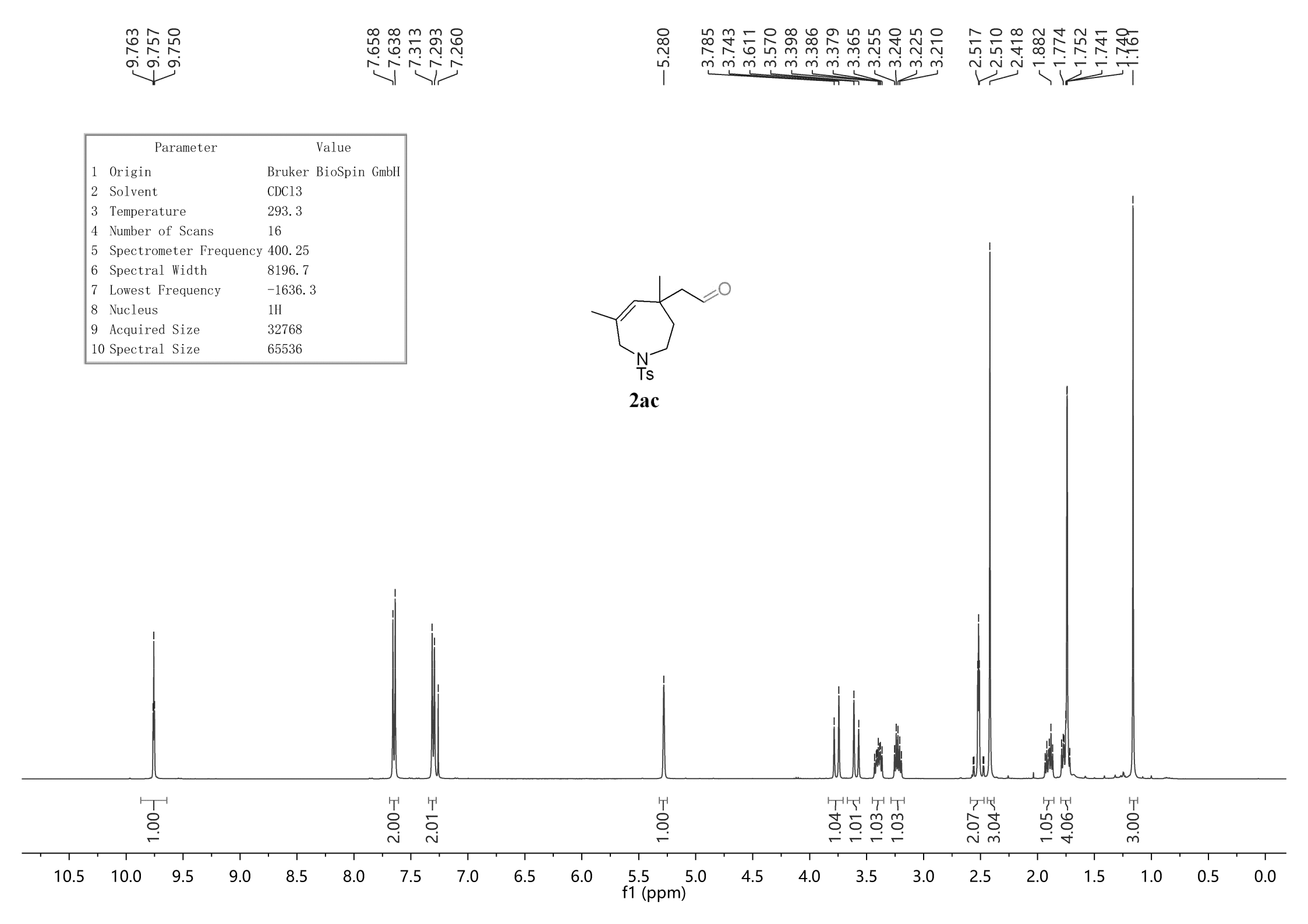

| | Parameter | Value |
|---|---|---|
| 1 | Origin | Bruker BioSpin GmbH |
| 2 | Solvent | CDCl3 |
| 3 | Temperature | 293.3 |
| 4 | Number of Scans | 16 |
| 5 | Spectrometer Frequency | 400.25 |
| 6 | Spectral Width | 8196.7 |
| 7 | Lowest Frequency | -1636.4 |
| 8 | Nucleus | 1H |
| 9 | Acquired Size | 32768 |
| 10 | Spectral Size | 65536 |

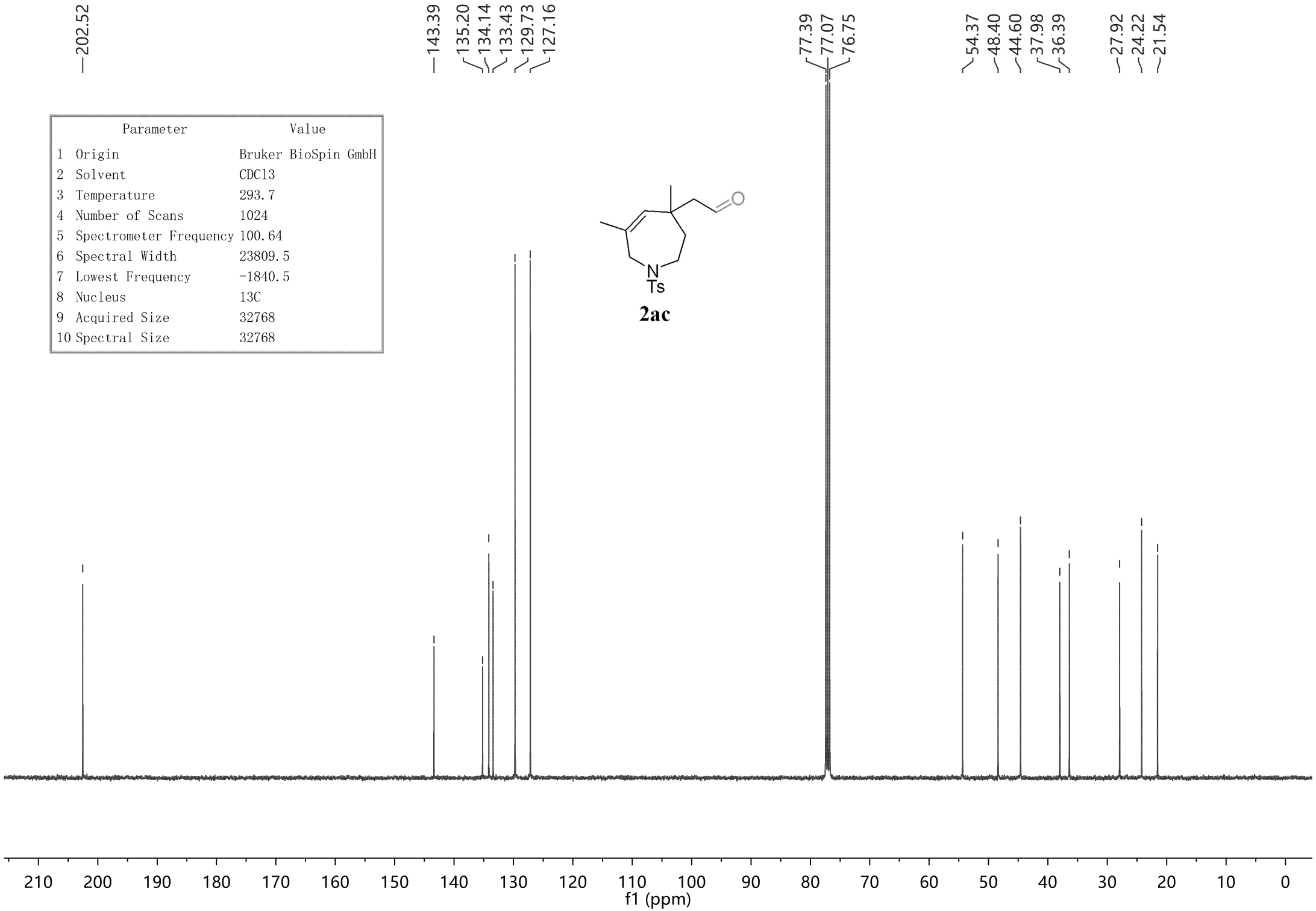



**2ab**




201.88
143.51
142.23
138.56
137.79
135.18
129.79
128.52
127.58
127.23
126.88
77.37
77.06
76.74
54.29
47.82
44.63
38.79
35.72
27.64
21.55
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 293.8
4 Number of Scans 1024
5 Spectrometer Frequency 100.64
6 Spectral Width 23809.5
7 Lowest Frequency -1840.5
8 Nucleus 13C
9 Acquired Size 32768
10 Spectral Size 32768
Ph
O
N
Ts
2ab
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

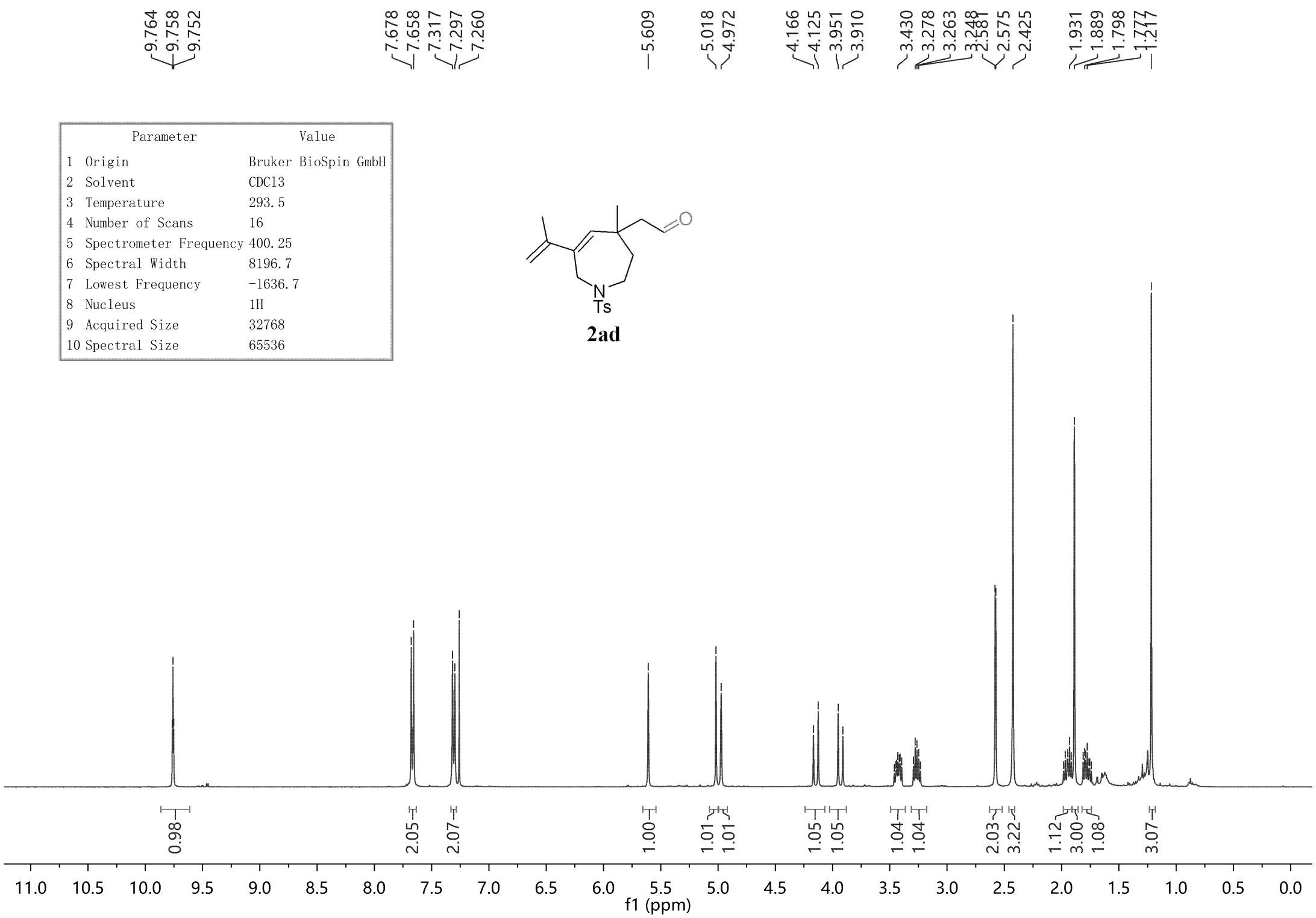

9.763
9.757
9.750
7.658
7.638
7.313
7.293
7.260
5.280
3.785
3.743
3.611
3.570
3.398
3.386
3.379
3.365
3.255
3.240
3.225
3.210
2.517
2.510
2.418
1.882
1.774
1.752
1.741
1.740
1.161
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 293.3
4 Number of Scans 16
5 Spectrometer Frequency 400.25
6 Spectral Width 8196.7
7 Lowest Frequency -1636.3
8 Nucleus 1H
9 Acquired Size 32768
10 Spectral Size 65536
N
Ts
O
2ac
1.00
2.00
2.01
1.00
1.04
1.01
1.03
1.03
2.07
3.04
1.05
4.06
3.00
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

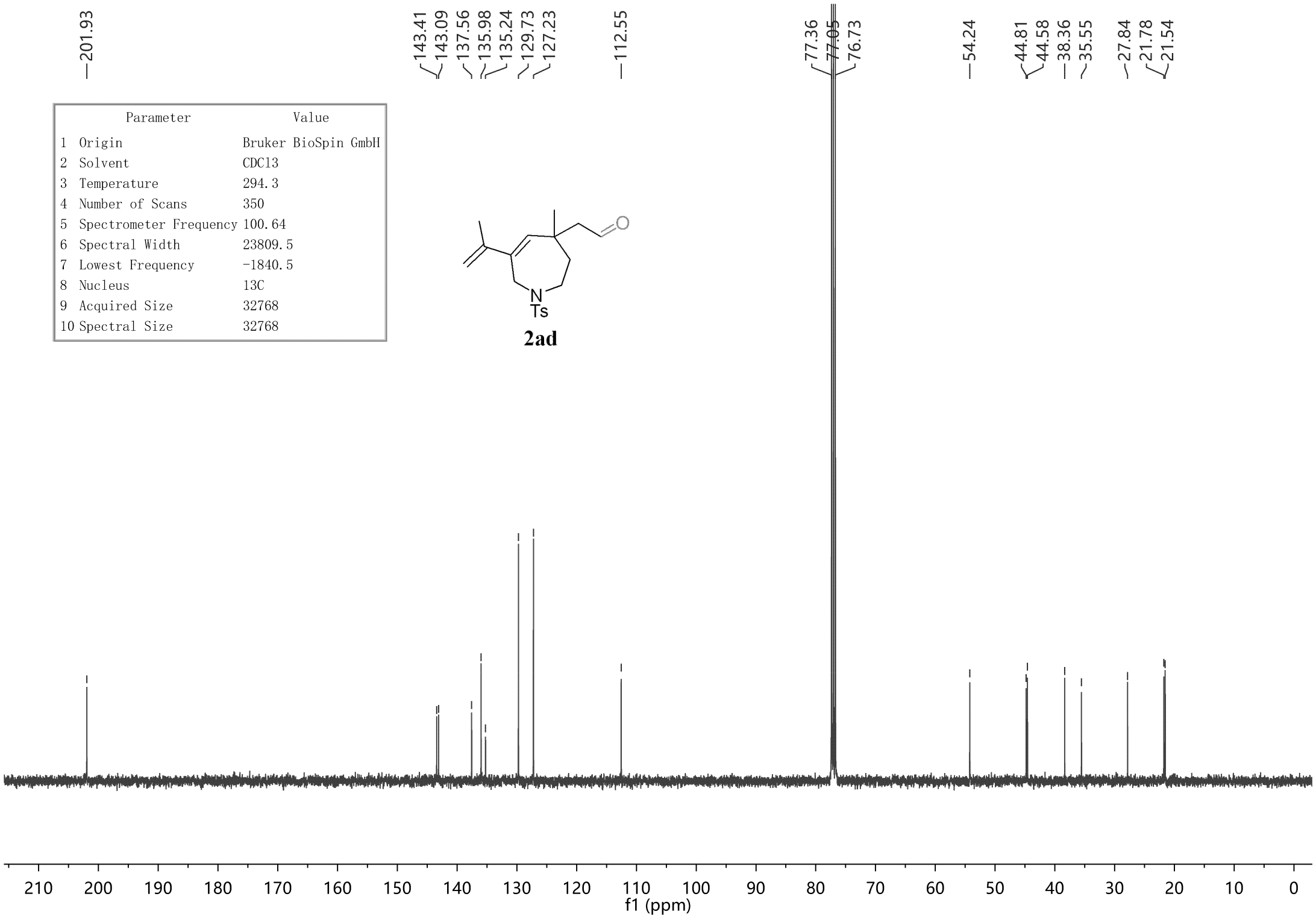

202.52
143.39
135.20
134.14
133.43
129.73
127.16
77.39
77.07
76.75
54.37
48.40
44.60
37.98
36.39
27.92
24.22
21.54
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 293.7
4 Number of Scans 1024
5 Spectrometer Frequency 100.64
6 Spectral Width 23809.5
7 Lowest Frequency -1840.5
8 Nucleus 13C
9 Acquired Size 32768
10 Spectral Size 32768
N
Ts
2ac
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

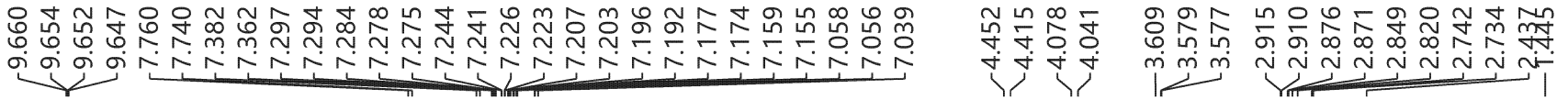
| Parameter | Value |
|---|---|
| 1 Origin | Bruker BioSpin GmbH |
| 2 Solvent | CDCl3 |
| 3 Temperature | 293.5 |
| 4 Number of Scans | 16 |
| 5 Spectrometer Frequency | 400.25 |
| 6 Spectral Width | 8196.7 |
| 7 Lowest Frequency | -1636.7 |
| 8 Nucleus | 1H |
| 9 Acquired Size | 32768 |
| 10 Spectral Size | 65536 |




**2ad**



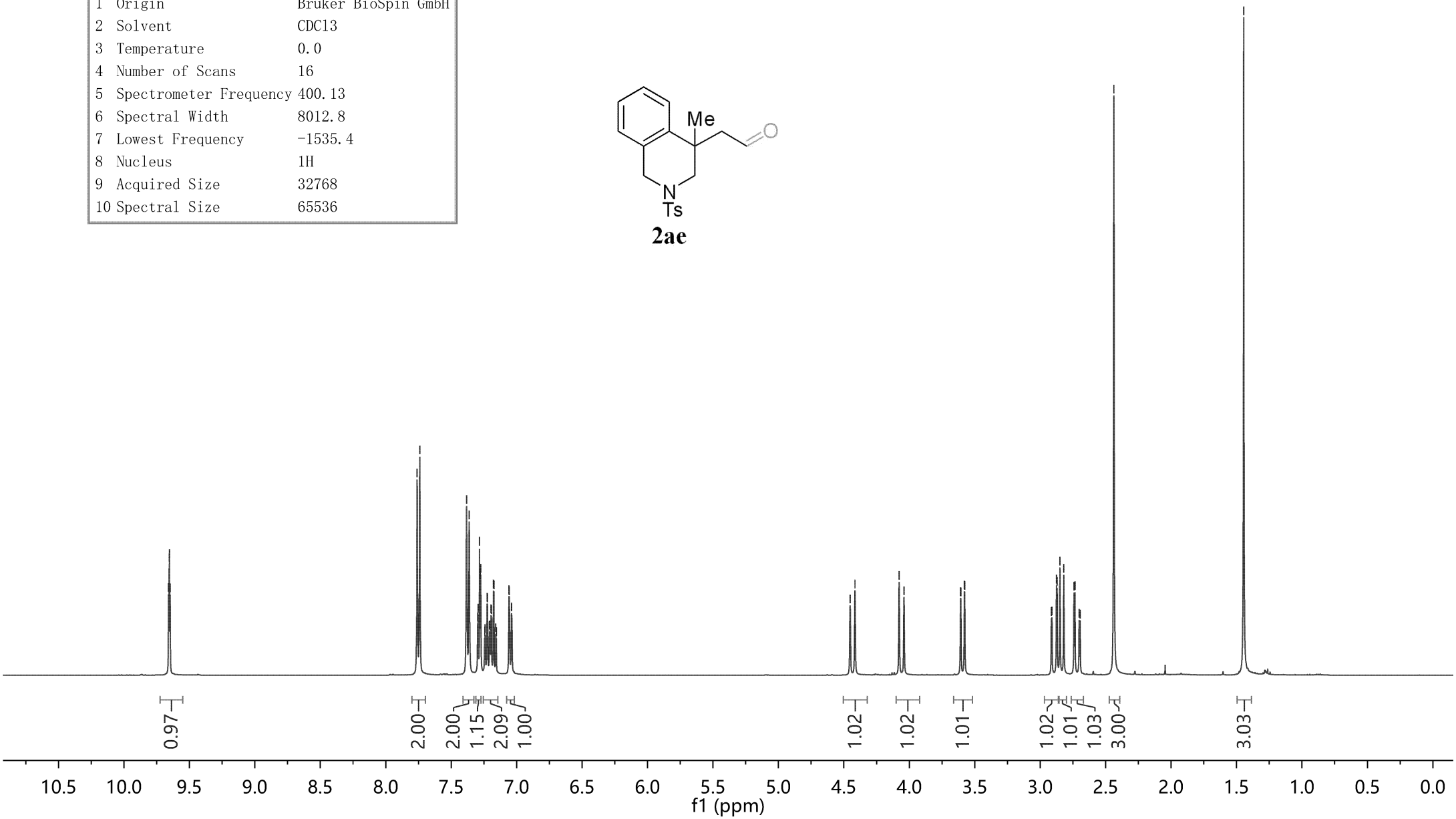

201.93
143.41
143.09
137.56
135.98
135.24
129.73
127.23
112.55
77.36
77.05
76.73
54.24
44.81
44.58
38.36
35.55
27.84
21.78
21.54
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 294.3
4 Number of Scans 350
5 Spectrometer Frequency 100.64
6 Spectral Width 23809.5
7 Lowest Frequency -1840.5
8 Nucleus 13C
9 Acquired Size 32768
10 Spectral Size 32768
O
N
Ts
2ad
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

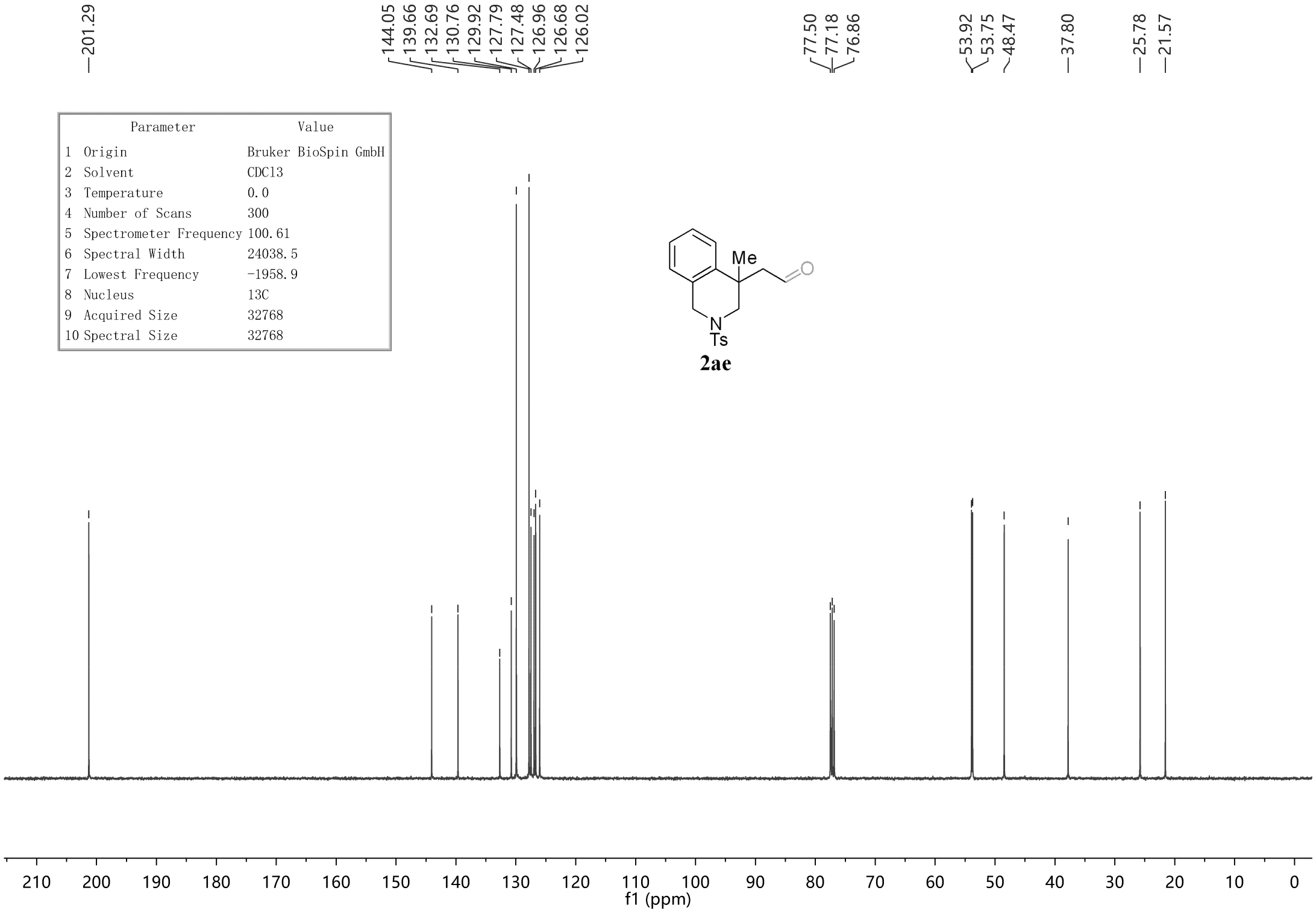


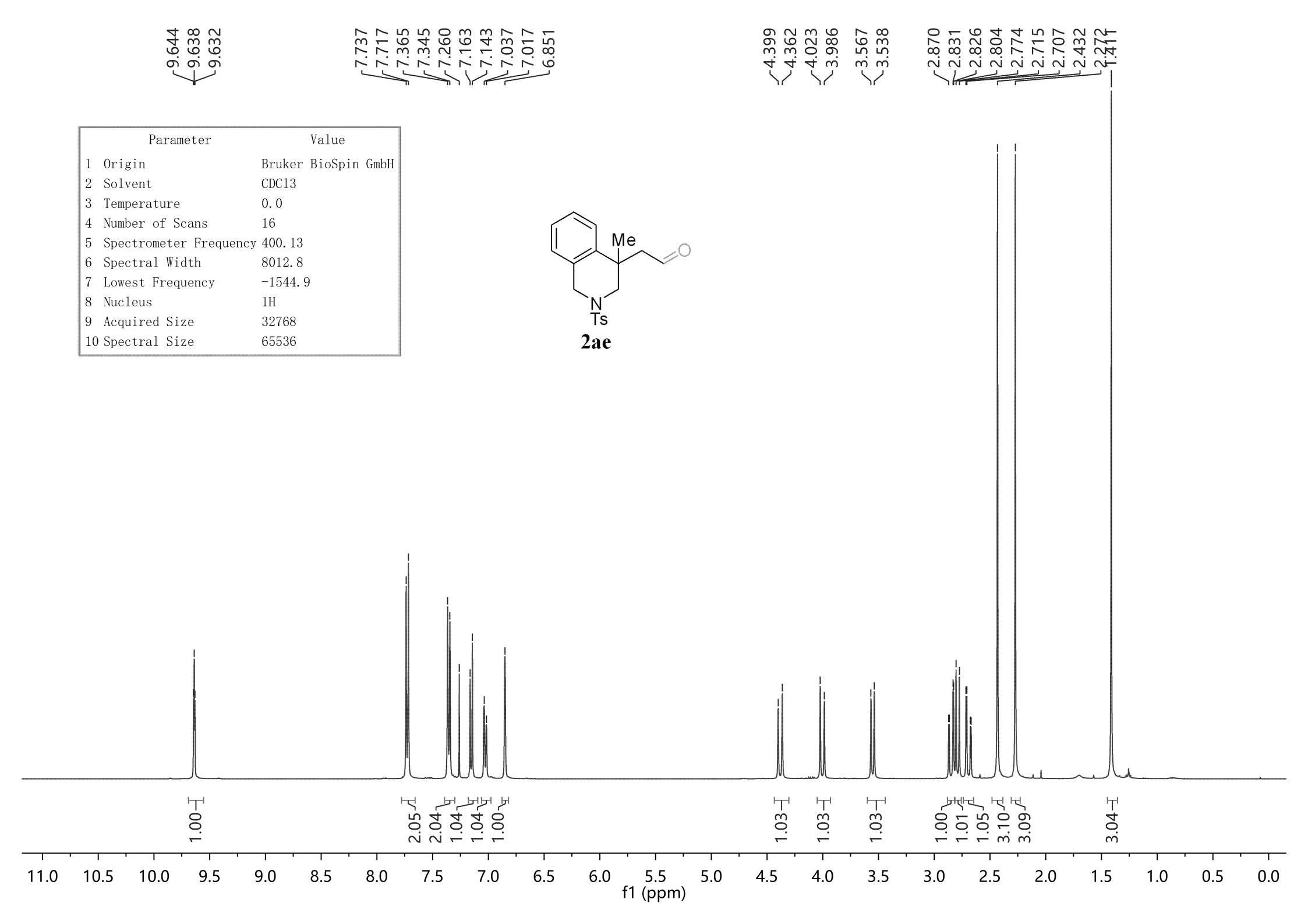

| | Parameter | Value |
|---|---|---|
| 1 | Origin | Bruker BioSpin GmbH |
| 2 | Solvent | CDC13 |
| 3 | Temperature | 0.0 |
| 4 | Number of Scans | 16 |
| 5 | Spectrometer Frequency | 400.13 |
| 6 | Spectral Width | 8012.8 |
| 7 | Lowest Frequency | -1535.4 |
| 8 | Nucleus | 1H |
| 9 | Acquired Size | 32768 |
| 10 | Spectral Size | 65536 |

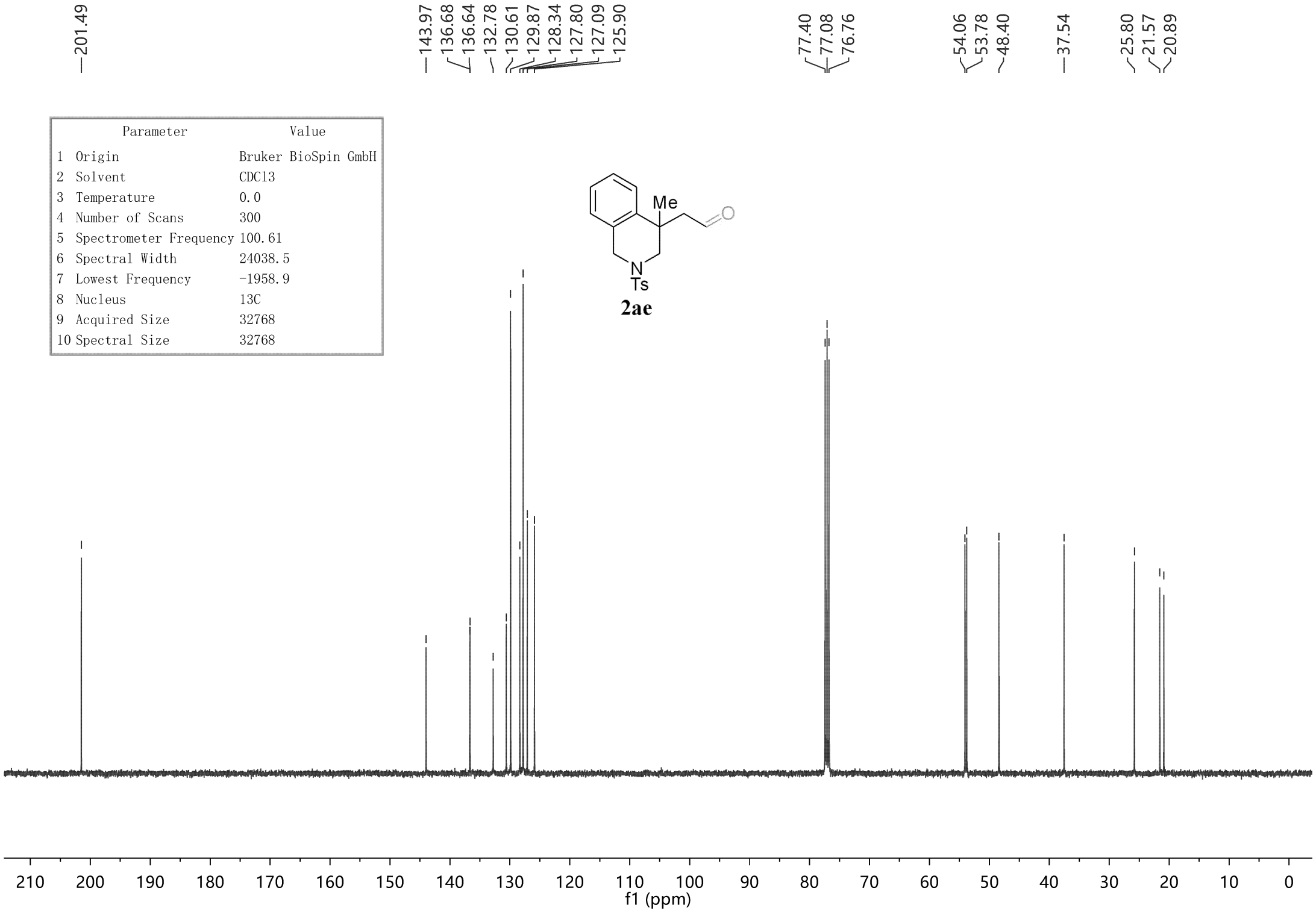


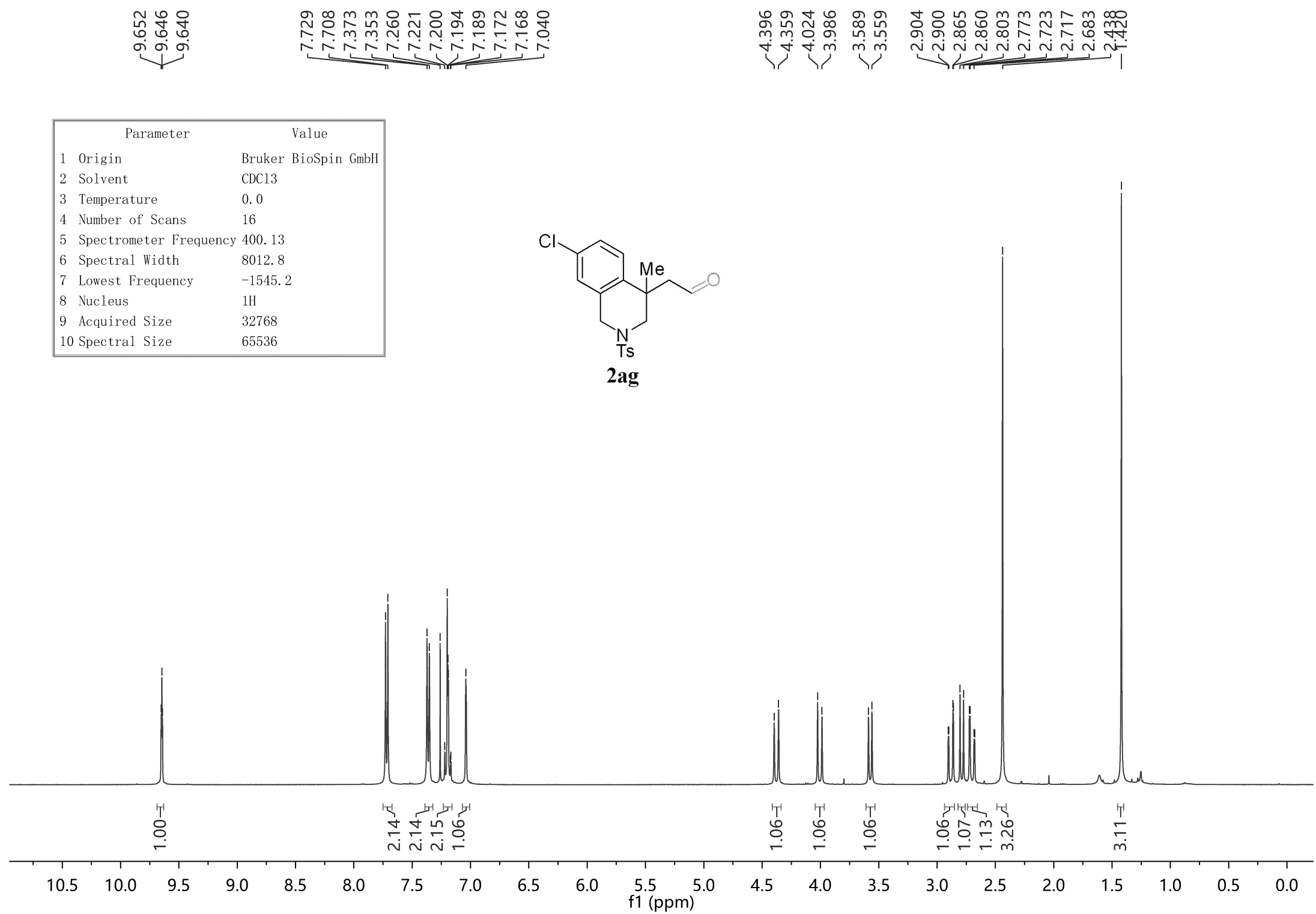

**2ae**

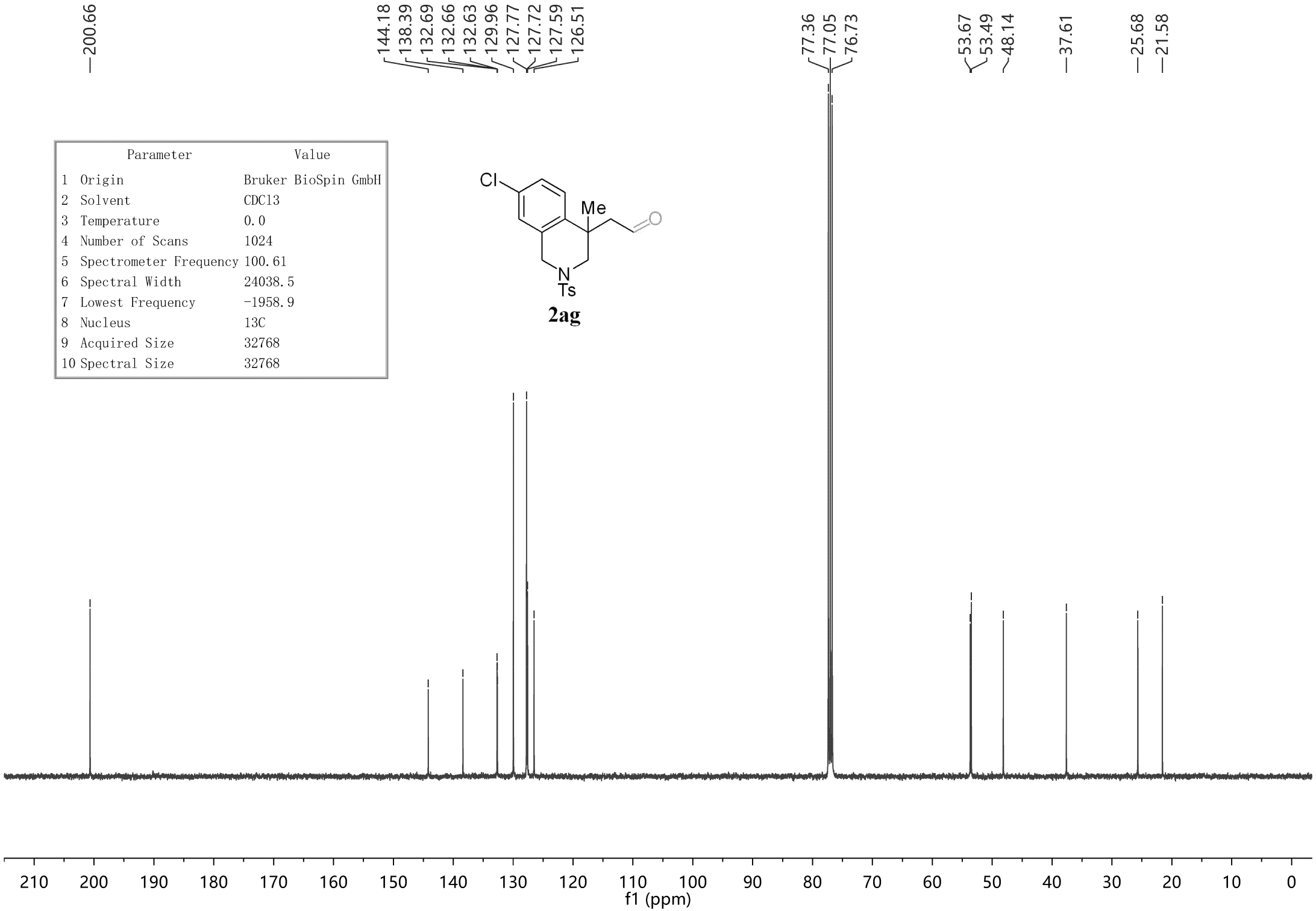


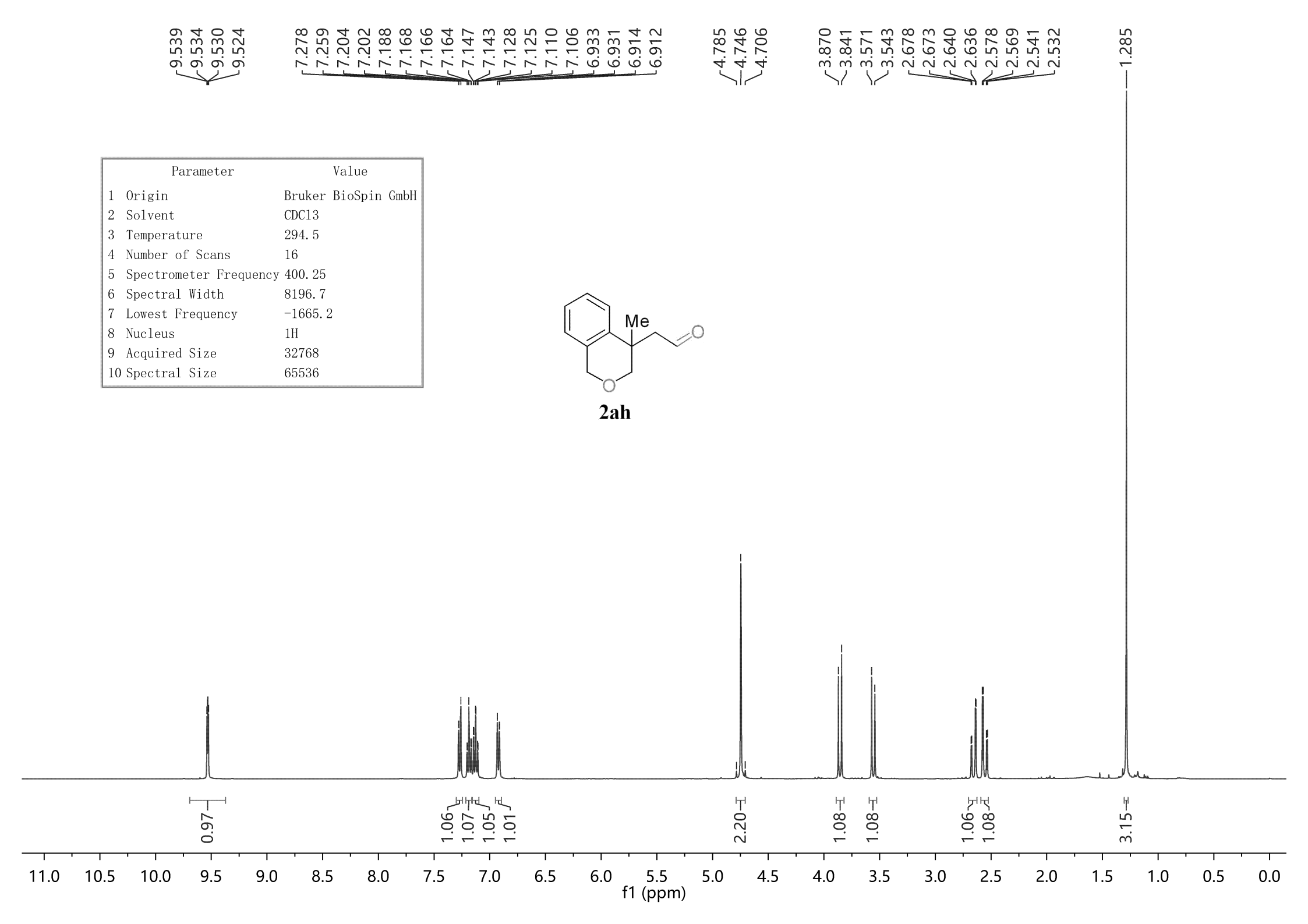

201.29
144.05
139.66
132.69
130.76
129.92
127.79
127.48
126.96
126.68
126.02
77.50
77.18
76.86
53.92
53.75
48.47
37.80
25.78
21.57
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 0.0
4 Number of Scans 300
5 Spectrometer Frequency 100.61
6 Spectral Width 24038.5
7 Lowest Frequency -1958.9
8 Nucleus 13C
9 Acquired Size 32768
10 Spectral Size 32768
Me
N
Ts
O
2ae
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

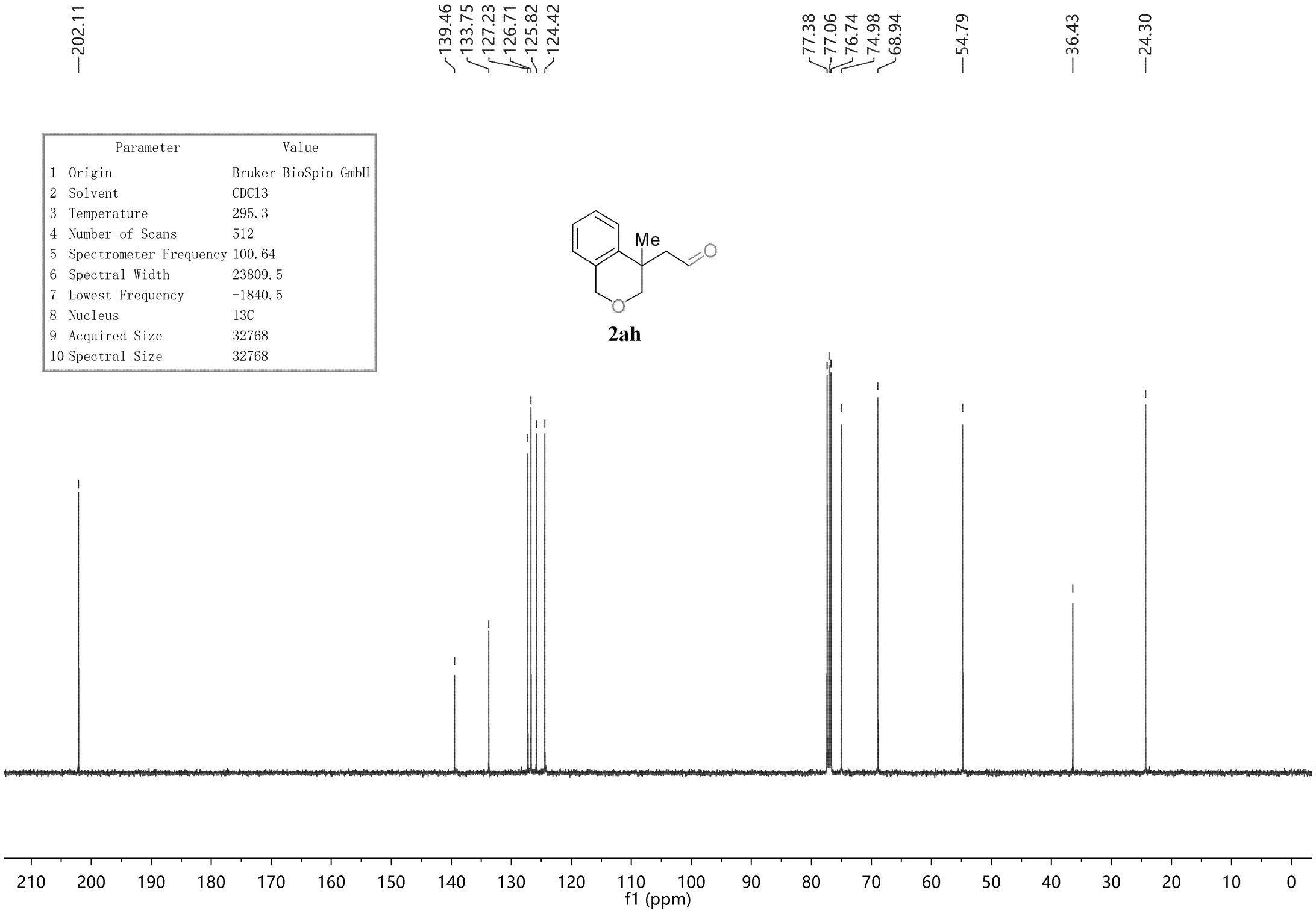

9.644
9.638
9.632
7.737
7.717
7.365
7.345
7.260
7.163
7.143
7.037
7.017
6.851
4.399
4.362
4.023
3.986
3.567
3.538
2.870
2.831
2.826
2.804
2.774
2.715
2.707
2.432
2.272
1.411
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 0.0
4 Number of Scans 16
5 Spectrometer Frequency 400.13
6 Spectral Width 8012.8
7 Lowest Frequency -1544.9
8 Nucleus 1H
9 Acquired Size 32768
10 Spectral Size 65536
Me
N
Ts
O
2ae
1.00
2.05
2.04
1.04
1.04
1.00
1.03
1.03
1.03
1.00
1.01
1.05
3.10
3.09
3.04
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)


201.49
143.97
136.68
136.64
132.78
130.61
129.87
128.34
127.80
127.09
125.90
77.40
77.08
76.76
54.06
53.78
48.40
37.54
25.80
21.57
20.89
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 0.0
4 Number of Scans 300
5 Spectrometer Frequency 100.61
6 Spectral Width 24038.5
7 Lowest Frequency -1958.9
8 Nucleus 13C
9 Acquired Size 32768
10 Spectral Size 32768
Me
O
N
Ts
2ae
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

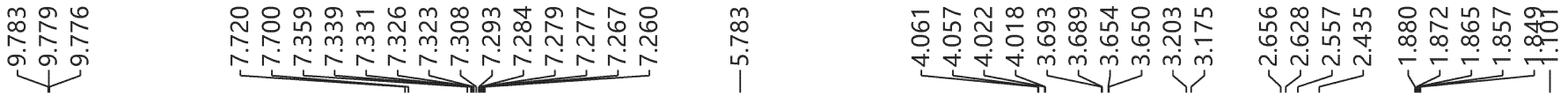

9.652
9.646
9.640
7.729
7.708
7.373
7.353
7.260
7.221
7.200
7.194
7.189
7.172
7.168
7.040
4.396
4.359
4.024
3.986
3.589
3.559
2.904
2.900
2.865
2.860
2.803
2.773
2.723
2.717
2.683
2.438
1.420
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 0.0
4 Number of Scans 16
5 Spectrometer Frequency 400.13
6 Spectral Width 8012.8
7 Lowest Frequency -1545.2
8 Nucleus 1H
9 Acquired Size 32768
10 Spectral Size 65536
Cl
Me
N
Ts
2ag
1.00
2.14
2.14
2.15
1.06
1.06
1.06
1.06
1.06
1.07
1.13
3.26
3.11
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)


200.66
144.18
138.39
132.69
132.66
132.63
129.96
127.77
127.72
127.59
126.51
77.36
77.05
76.73
53.67
53.49
48.14
37.61
25.68
21.58
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 0.0
4 Number of Scans 1024
5 Spectrometer Frequency 100.61
6 Spectral Width 24038.5
7 Lowest Frequency -1958.9
8 Nucleus 13C
9 Acquired Size 32768
10 Spectral Size 32768
Cl
Me
O
N
Ts
2ag
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

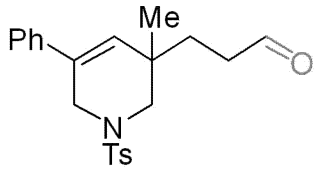

9.539
9.534
9.530
9.524
7.278
7.259
7.204
7.202
7.188
7.168
7.166
7.164
7.147
7.143
7.128
7.125
7.110
7.106
6.933
6.931
6.914
6.912
4.785
4.746
4.706
3.870
3.841
3.571
3.543
2.678
2.673
2.640
2.636
2.578
2.569
2.541
2.532
1.285
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 294.5
4 Number of Scans 16
5 Spectrometer Frequency 400.25
6 Spectral Width 8196.7
7 Lowest Frequency -1665.2
8 Nucleus 1H
9 Acquired Size 32768
10 Spectral Size 65536
Me
O
O
2ah
0.97
1.06
1.07
1.05
1.01
2.20
1.08
1.08
1.06
1.08
3.15
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)



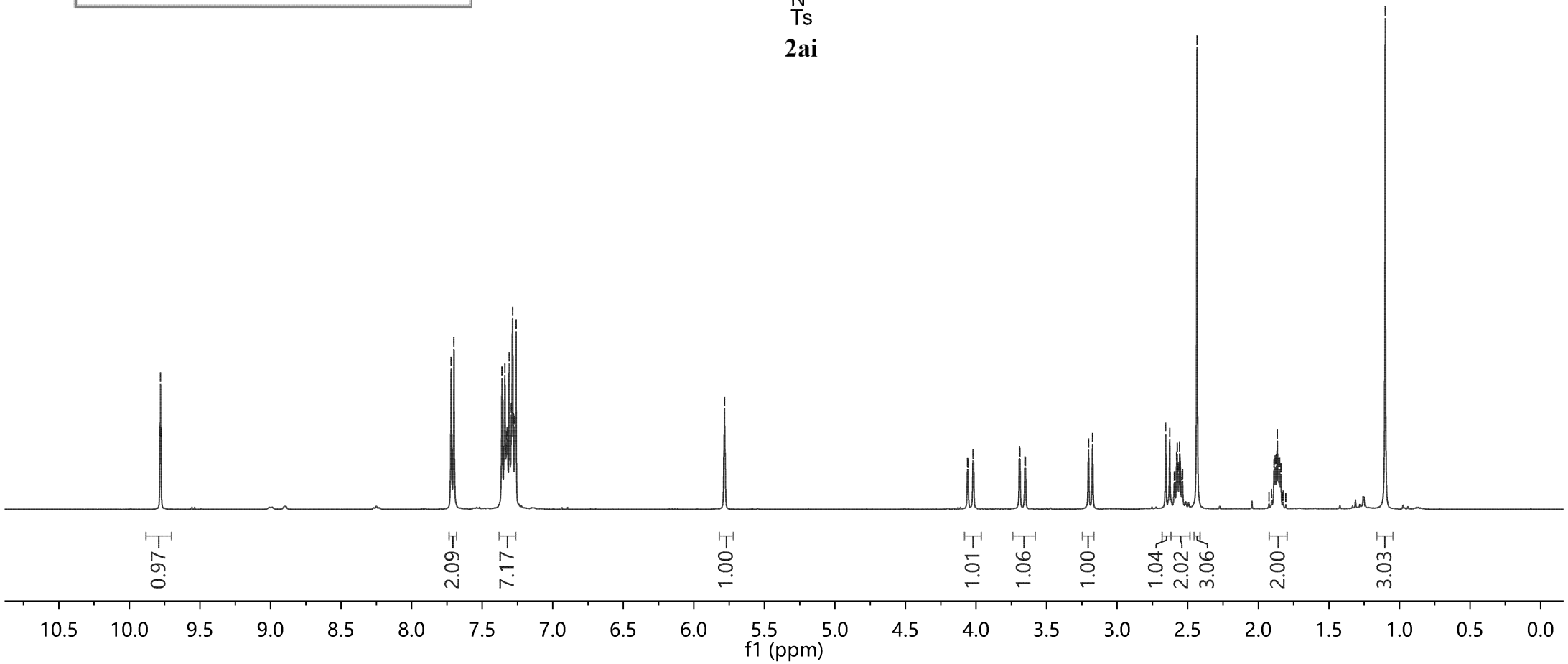

| | Parameter | Value |
|---|---|---|
| 1 | Origin | Bruker BioSpin GmbH |
| 2 | Solvent | CDCl3 |
| 3 | Temperature | 295.3 |
| 4 | Number of Scans | 512 |
| 5 | Spectrometer Frequency | 100.64 |
| 6 | Spectral Width | 23809.5 |
| 7 | Lowest Frequency | -1840.5 |
| 8 | Nucleus | 13C |
| 9 | Acquired Size | 32768 |
| 10 | Spectral Size | 32768 |

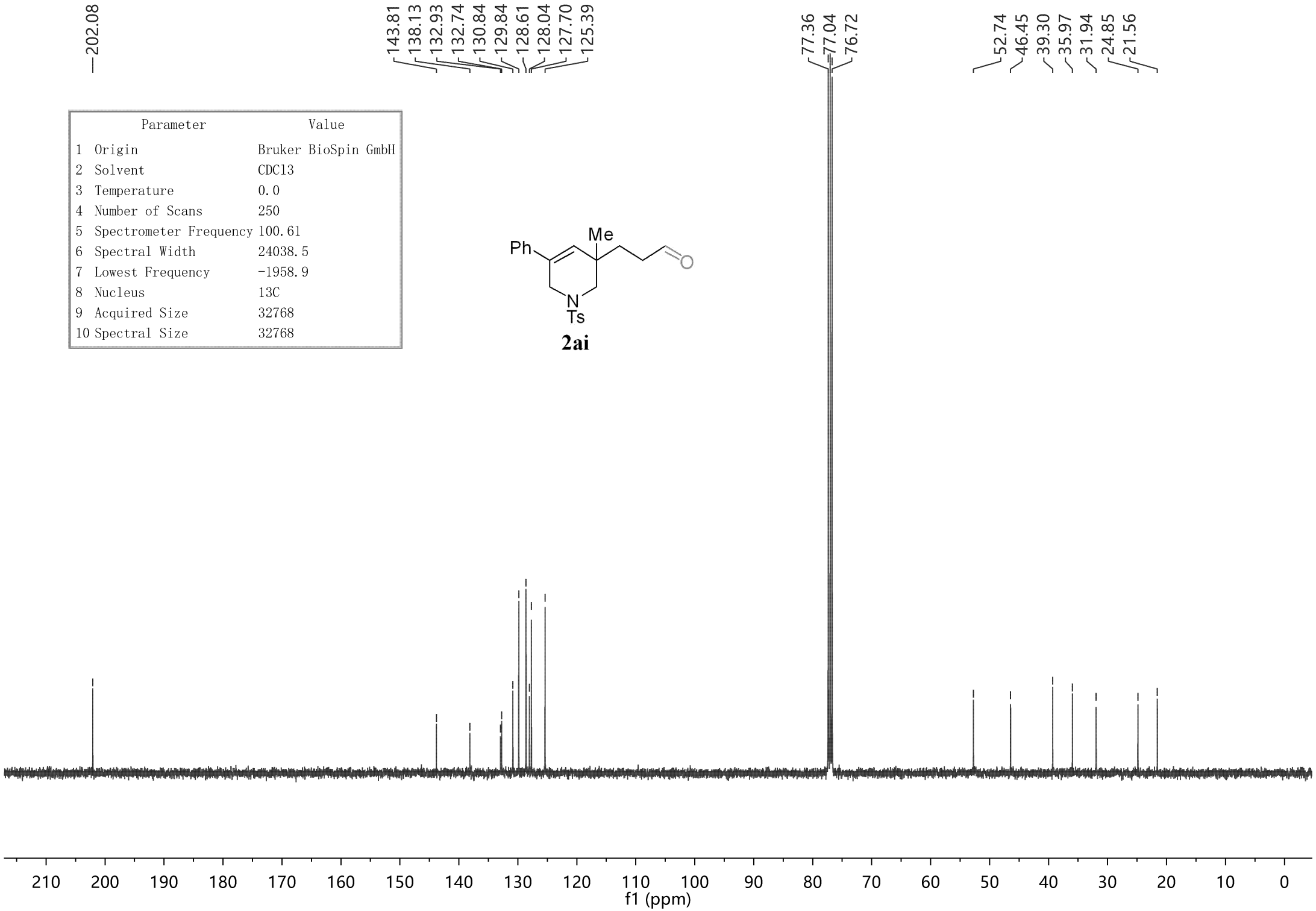


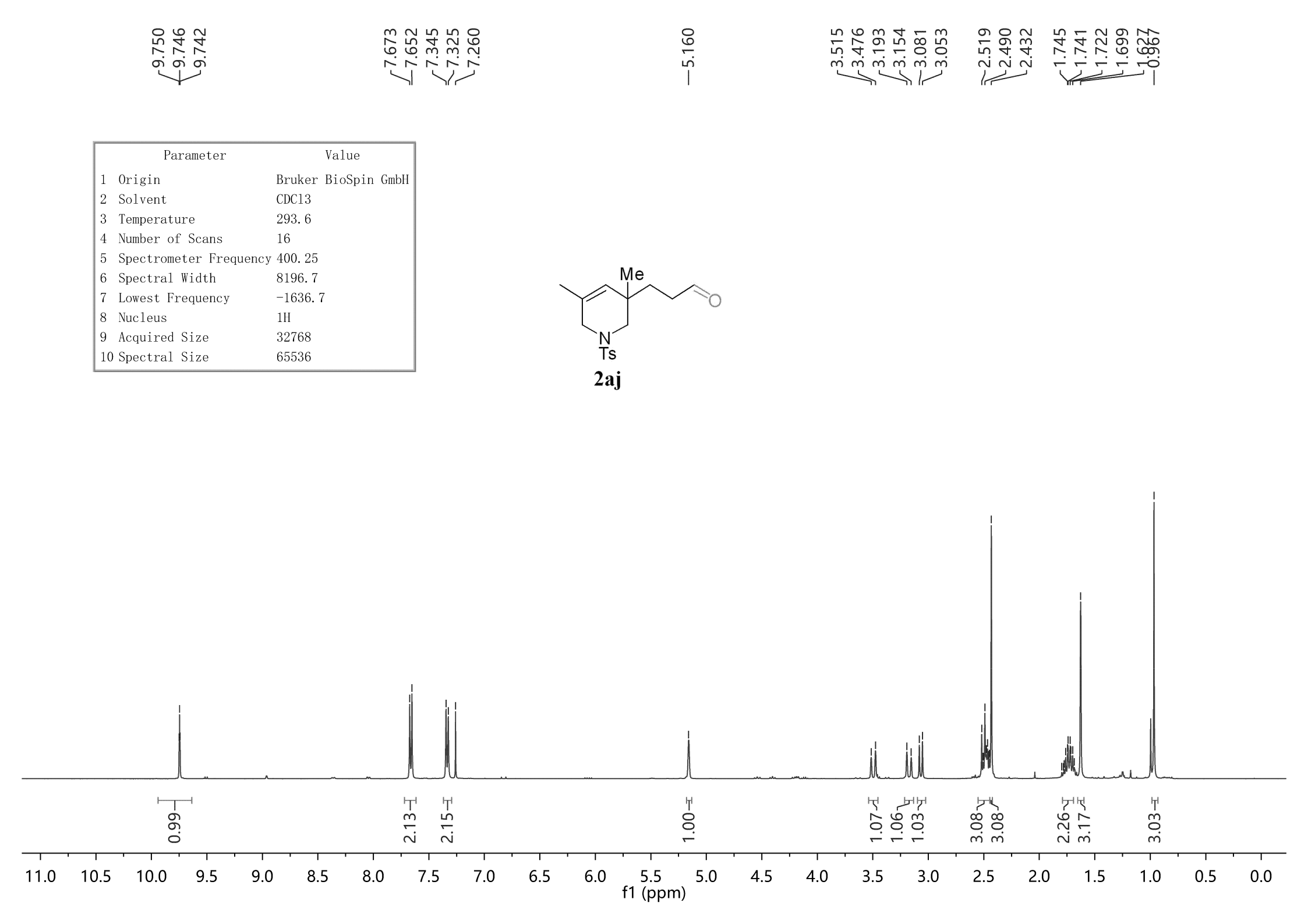

| | Parameter | Value |
|---|---|---|
| 1 | Origin | Bruker BioSpin GmbH |
| 2 | Solvent | CDCl3 |
| 3 | Temperature | 293.3 |
| 4 | Number of Scans | 16 |
| 5 | Spectrometer Frequency | 400.25 |
| 6 | Spectral Width | 8196.7 |
| 7 | Lowest Frequency | -1636.7 |
| 8 | Nucleus | 1H |
| 9 | Acquired Size | 32768 |
| 10 | Spectral Size | 65536 |

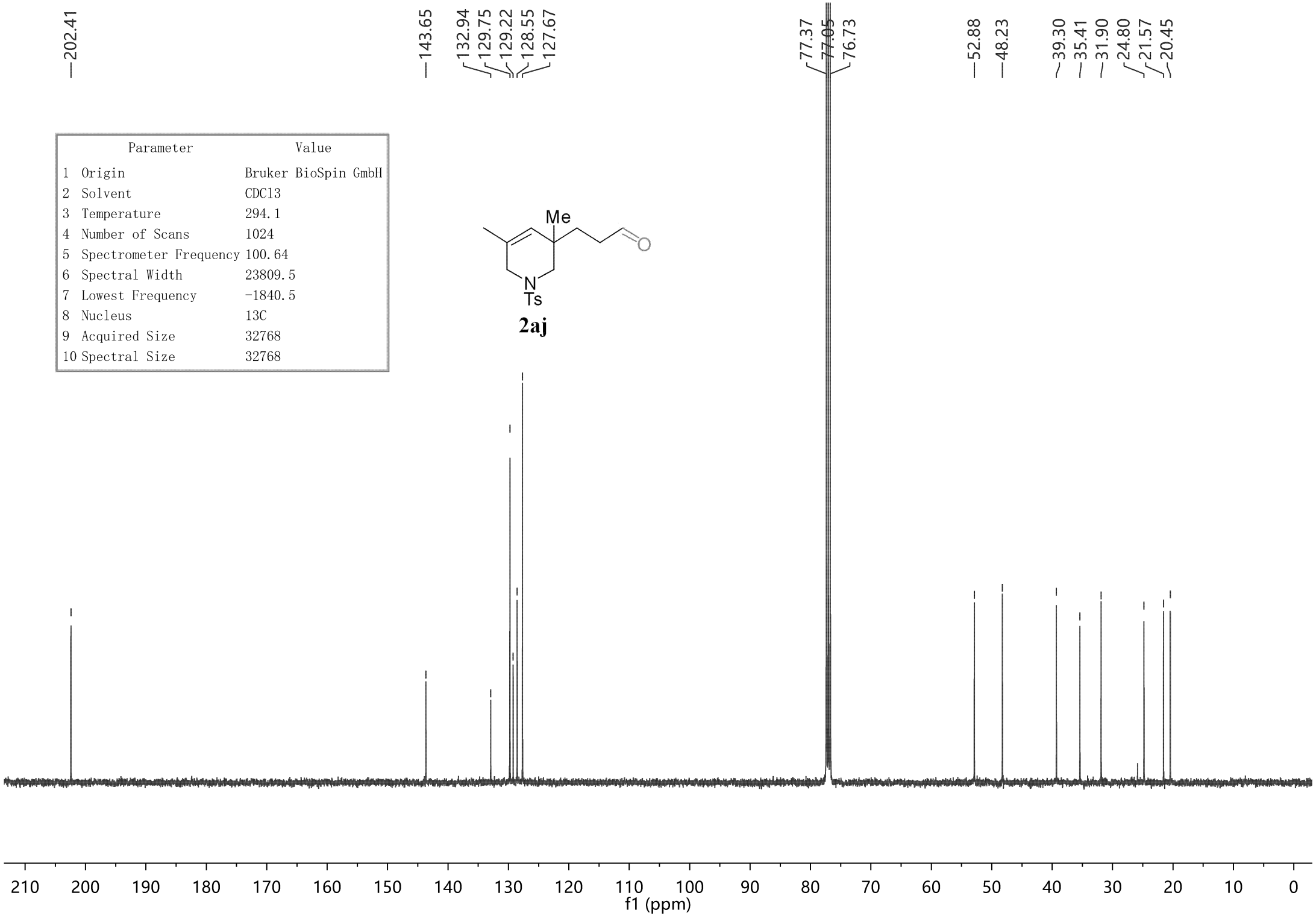



**2ai**

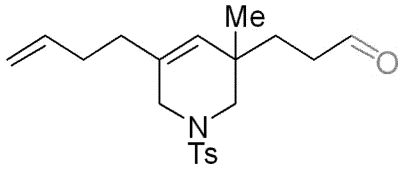



202.08
143.81
138.13
132.93
132.74
130.84
129.84
128.61
128.04
127.70
125.39
77.36
77.04
76.72
52.74
46.45
39.30
35.97
31.94
24.85
21.56
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 0.0
4 Number of Scans 250
5 Spectrometer Frequency 100.61
6 Spectral Width 24038.5
7 Lowest Frequency -1958.9
8 Nucleus 13C
9 Acquired Size 32768
10 Spectral Size 32768
Ph
Me
N
Ts
O
2ai
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

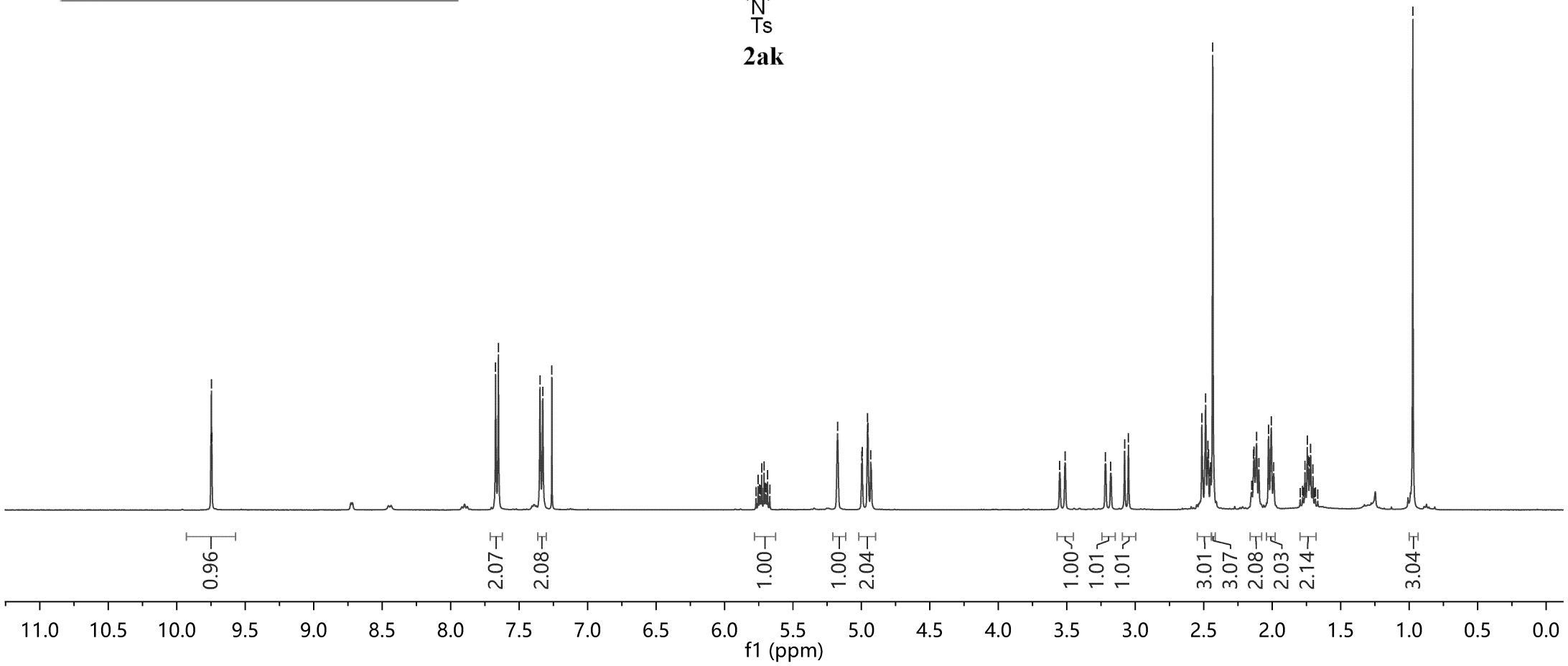

9.750
9.746
9.742
7.673
7.652
7.345
7.325
7.260
5.160
3.515
3.476
3.193
3.154
3.081
3.053
2.519
2.490
2.432
1.745
1.741
1.722
1.699
1.627
0.967
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 293.6
4 Number of Scans 16
5 Spectrometer Frequency 400.25
6 Spectral Width 8196.7
7 Lowest Frequency -1636.7
8 Nucleus 1H
9 Acquired Size 32768
10 Spectral Size 65536
Me
N
Ts
O
2aj
0.99
2.13
2.15
1.00
1.07
1.06
1.03
3.08
3.08
2.26
3.17
3.03
11.0 10.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)

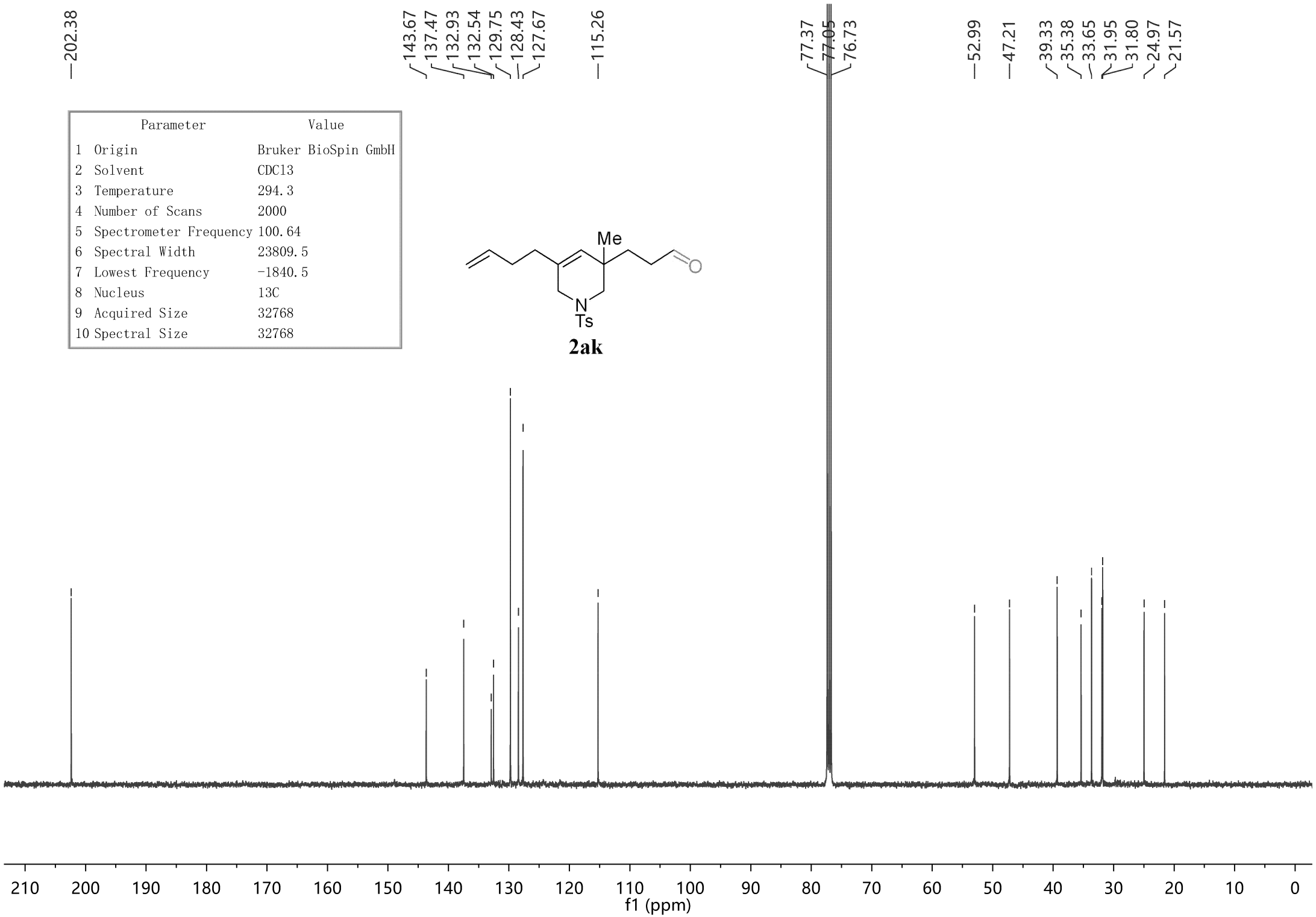

202.41
143.65
132.94
129.75
129.22
128.55
127.67
77.37
77.05
76.73
52.88
48.23
39.30
35.41
31.90
24.80
21.57
20.45
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 294.1
4 Number of Scans 1024
5 Spectrometer Frequency 100.64
6 Spectral Width 23809.5
7 Lowest Frequency -1840.5
8 Nucleus 13C
9 Acquired Size 32768
10 Spectral Size 32768
Me
N
Ts
O
2aj
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

| | Parameter | Value |
|---|---|---|
| 1 | Origin | Bruker BioSpin GmbH |
| 2 | Solvent | CDCl3 |
| 3 | Temperature | 293.7 |
| 4 | Number of Scans | 16 |
| 5 | Spectrometer Frequency | 400.25 |
| 6 | Spectral Width | 8196.7 |
| 7 | Lowest Frequency | -1636.3 |
| 8 | Nucleus | 1H |
| 9 | Acquired Size | 32768 |
| 10 | Spectral Size | 65536 |



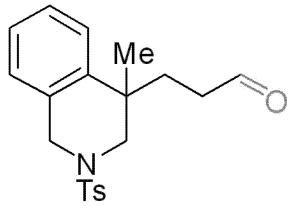

**2ak**



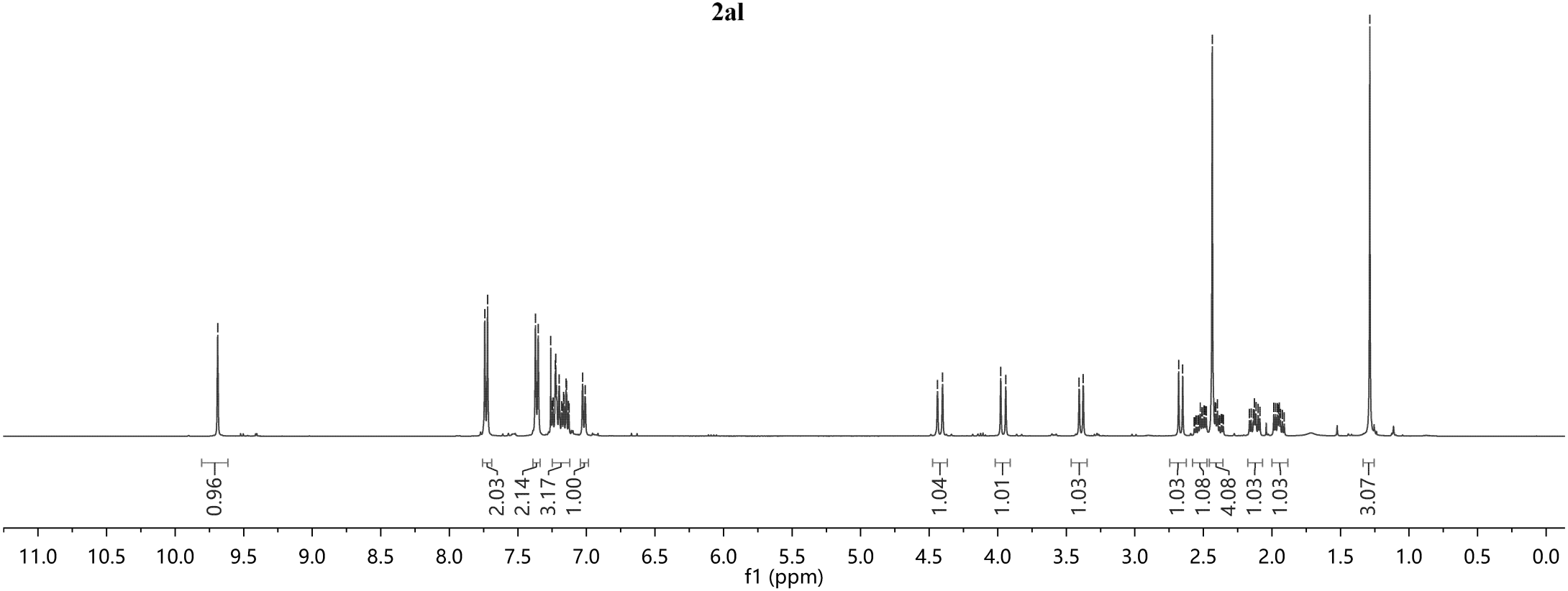

202.38
143.67
137.47
132.93
132.54
129.75
128.43
127.67
115.26
77.37
77.05
76.73
52.99
47.21
39.33
35.38
33.65
31.95
31.80
24.97
21.57
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 294.3
4 Number of Scans 2000
5 Spectrometer Frequency 100.64
6 Spectral Width 23809.5
7 Lowest Frequency -1840.5
8 Nucleus 13C
9 Acquired Size 32768
10 Spectral Size 32768
Me
N
Ts
O
2ak
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

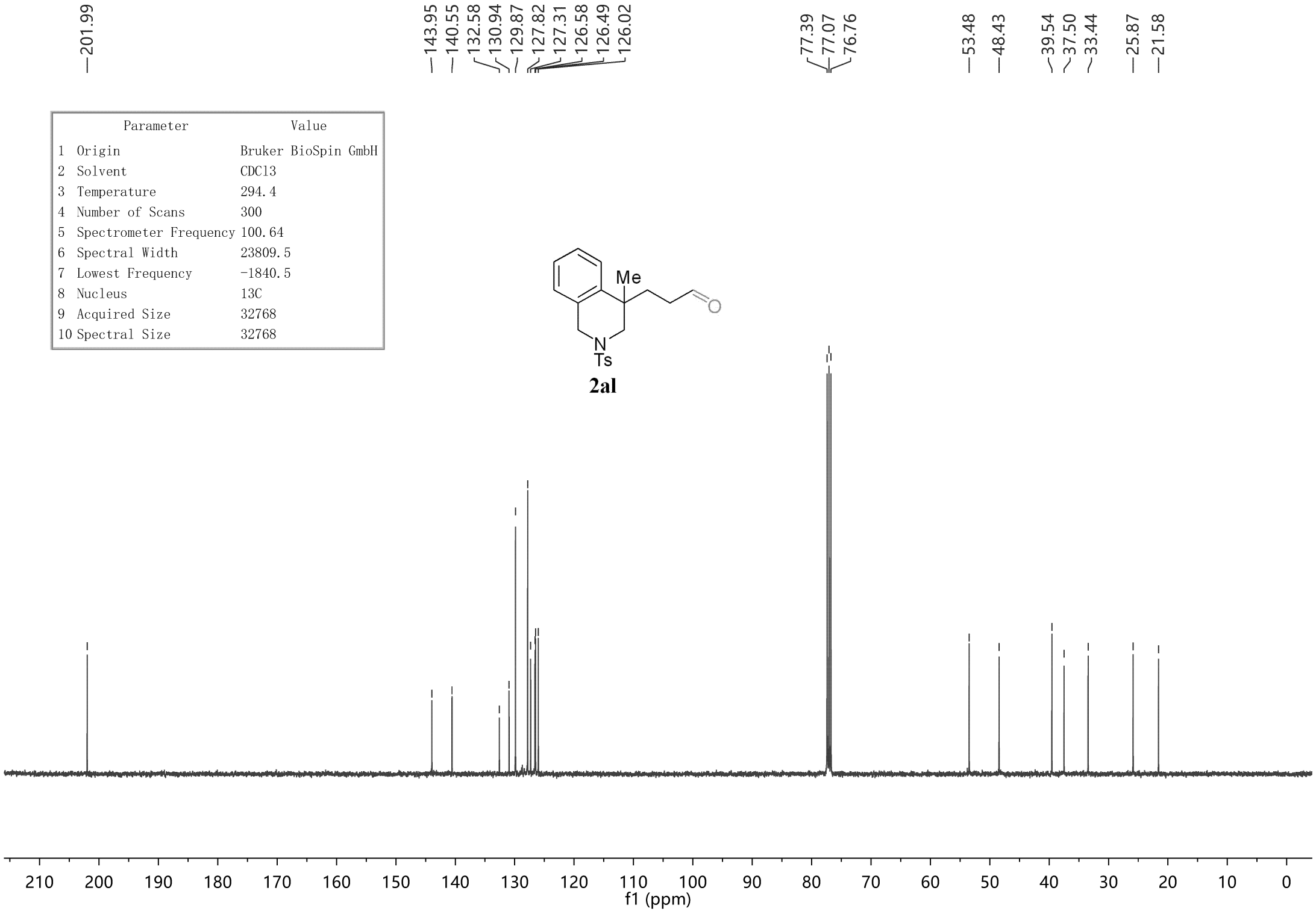
9.689 7.742 7.721 7.372 7.352 7.260 7.247 7.243 7.227 7.224 7.218 7.199 7.181 7.178 7.168 7.163 7.149 7.145 7.131 7.127 7.028 7.010 4.439 4.403 3.978 3.941 3.406 3.377 2.680 2.651 2.523 2.510 2.506 2.496 2.492 2.482 2.479 2.435 2.413 2.410 2.397 2.369 2.366 2.357 2.164 2.151 2.136 2.128 2.116 2.100 2.088 1.987 1.973 1.959 1.951 1.946 1.938 1.924 1.910 1.286

| | Parameter | Value |
|---|---|---|
| 1 | Origin | Bruker BioSpin GmbH |
| 2 | Solvent | CDCl3 |
| 3 | Temperature | 293.6 |
| 4 | Number of Scans | 16 |
| 5 | Spectrometer Frequency | 400.25 |
| 6 | Spectral Width | 8196.7 |
| 7 | Lowest Frequency | -1636.4 |
| 8 | Nucleus | 1H |
| 9 | Acquired Size | 32768 |
| 10 | Spectral Size | 65536 |




**2al**



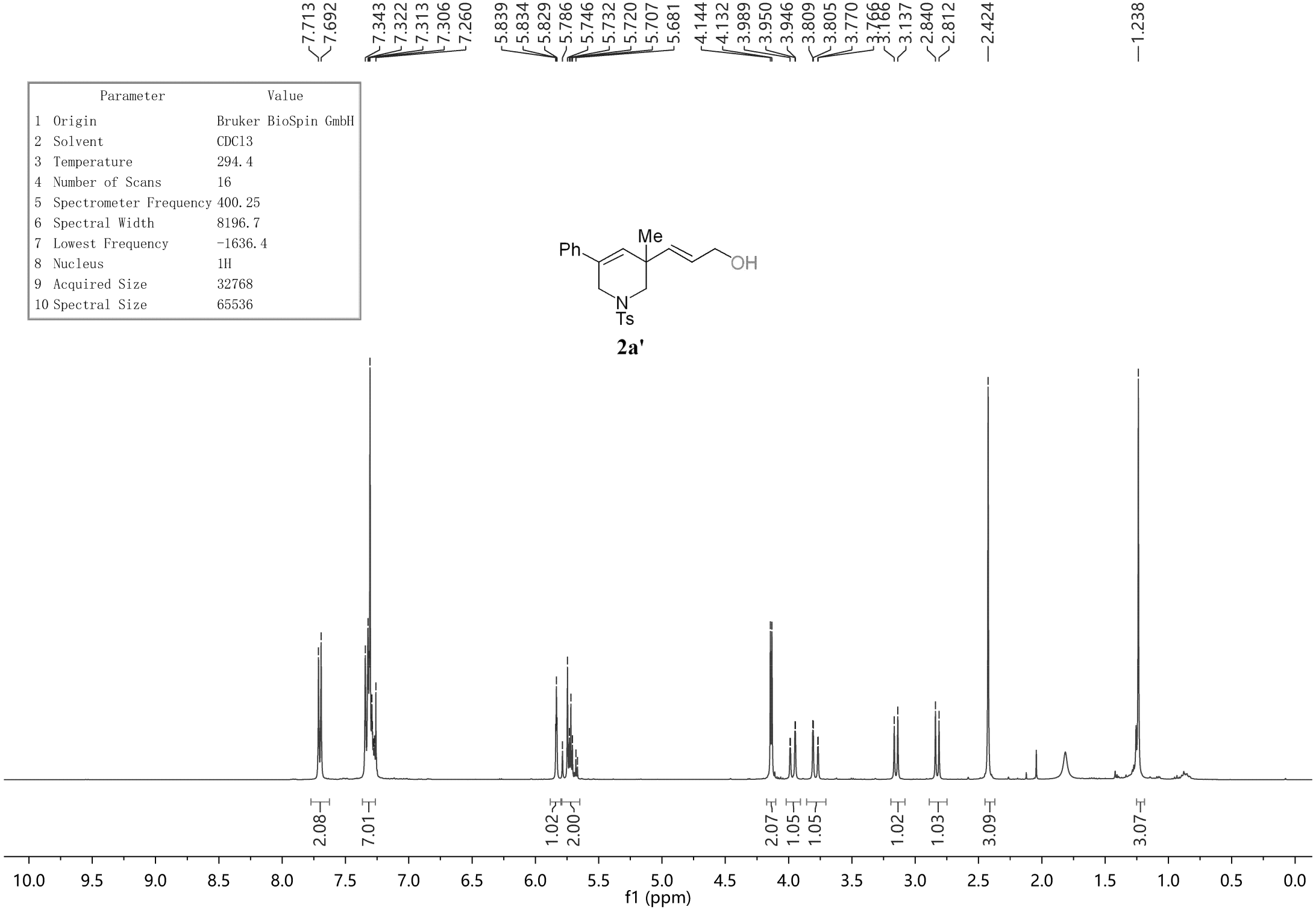


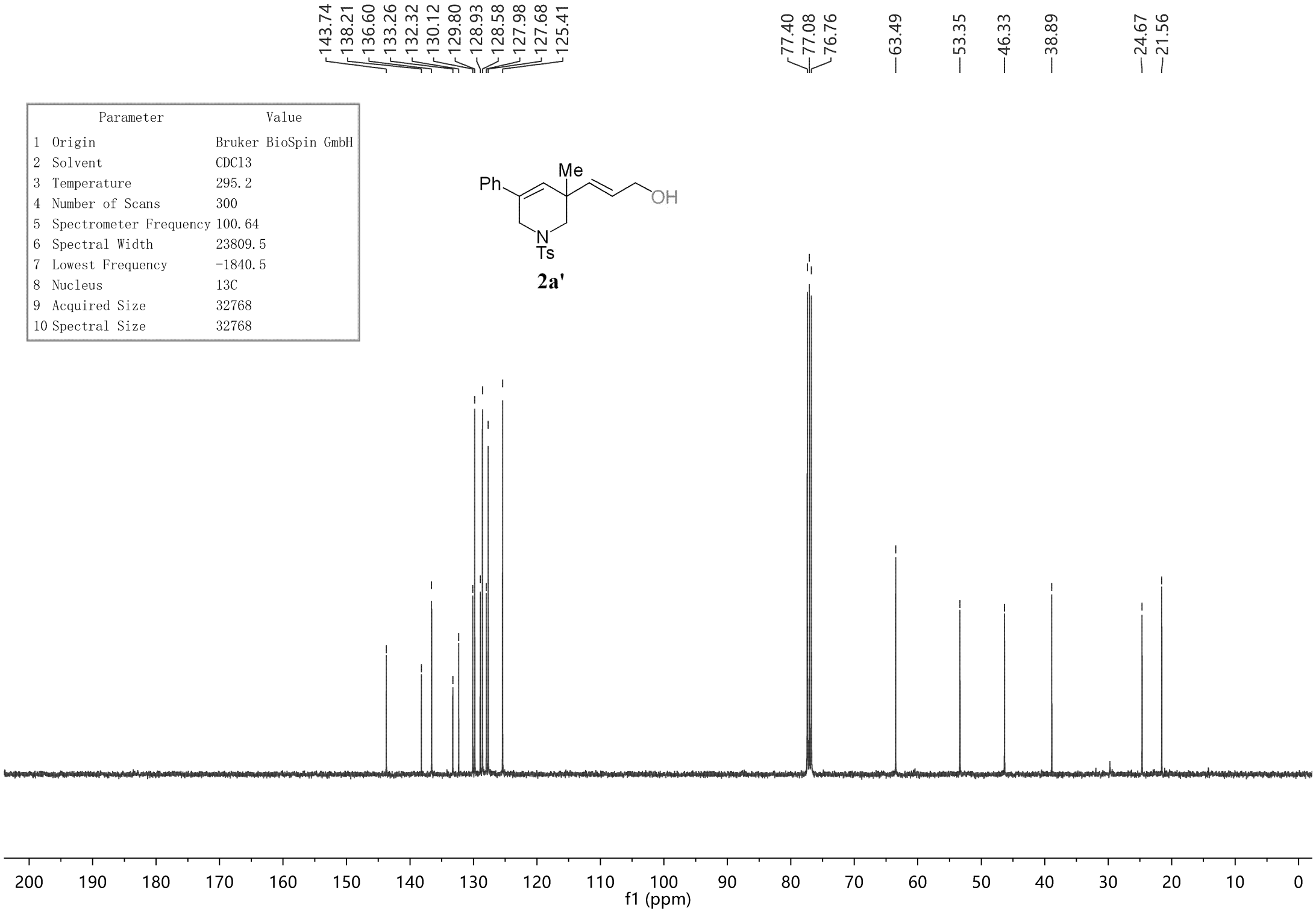

| | Parameter | Value |
|---|---|---|
| 1 | Origin | Bruker BioSpin GmbH |
| 2 | Solvent | CDCl3 |
| 3 | Temperature | 294.4 |
| 4 | Number of Scans | 300 |
| 5 | Spectrometer Frequency | 100.64 |
| 6 | Spectral Width | 23809.5 |
| 7 | Lowest Frequency | -1840.5 |
| 8 | Nucleus | 13C |
| 9 | Acquired Size | 32768 |
| 10 | Spectral Size | 32768 |

| Parameter | Value |
|---|---|
| 1 Origin | Bruker BioSpin GmbH |
| 2 Solvent | CDCl3 |
| 3 Temperature | 294.4 |
| 4 Number of Scans | 16 |
| 5 Spectrometer Frequency | 400.25 |
| 6 Spectral Width | 8196.7 |
| 7 Lowest Frequency | -1636.4 |
| 8 Nucleus | 1H |
| 9 Acquired Size | 32768 |
| 10 Spectral Size | 65536 |

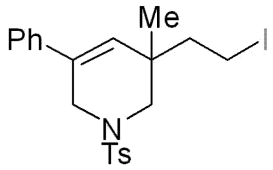



**2a'**

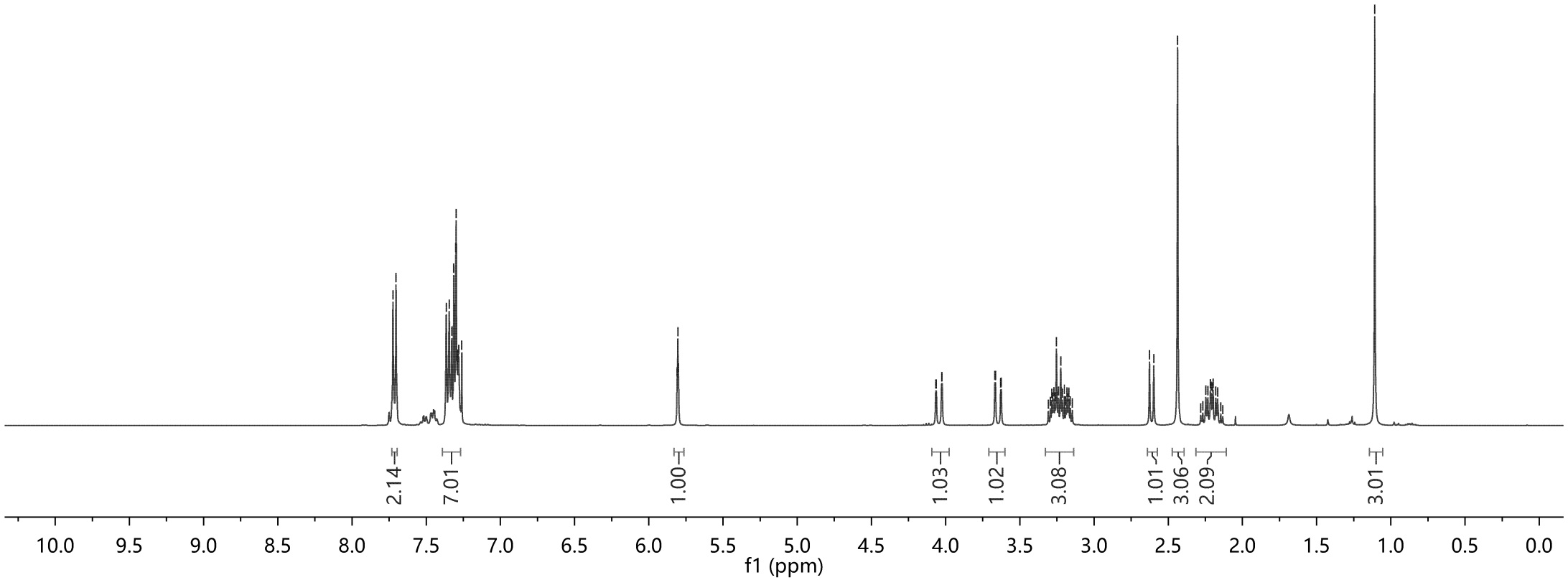



143.74
138.21
136.60
133.26
132.32
130.12
129.80
128.93
128.58
127.98
127.68
125.41
77.40
77.08
76.76
63.49
53.35
46.33
38.89
24.67
21.56
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 295.2
4 Number of Scans 300
5 Spectrometer Frequency 100.64
6 Spectral Width 23809.5
7 Lowest Frequency -1840.5
8 Nucleus 13C
9 Acquired Size 32768
10 Spectral Size 32768
Me
Ph
OH
N
Ts
2a'
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

| | Parameter | Value |
|---|---|---|
| 1 | Origin | Bruker BioSpin GmbH |
| 2 | Solvent | CDCl3 |
| 3 | Temperature | 294.3 |
| 4 | Number of Scans | 16 |
| 5 | Spectrometer Frequency | 400.25 |
| 6 | Spectral Width | 8196.7 |
| 7 | Lowest Frequency | -1636.4 |
| 8 | Nucleus | 1H |
| 9 | Acquired Size | 32768 |
| 10 | Spectral Size | 65536 |

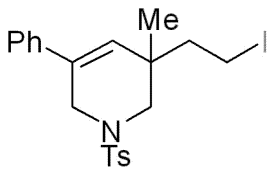



**3**

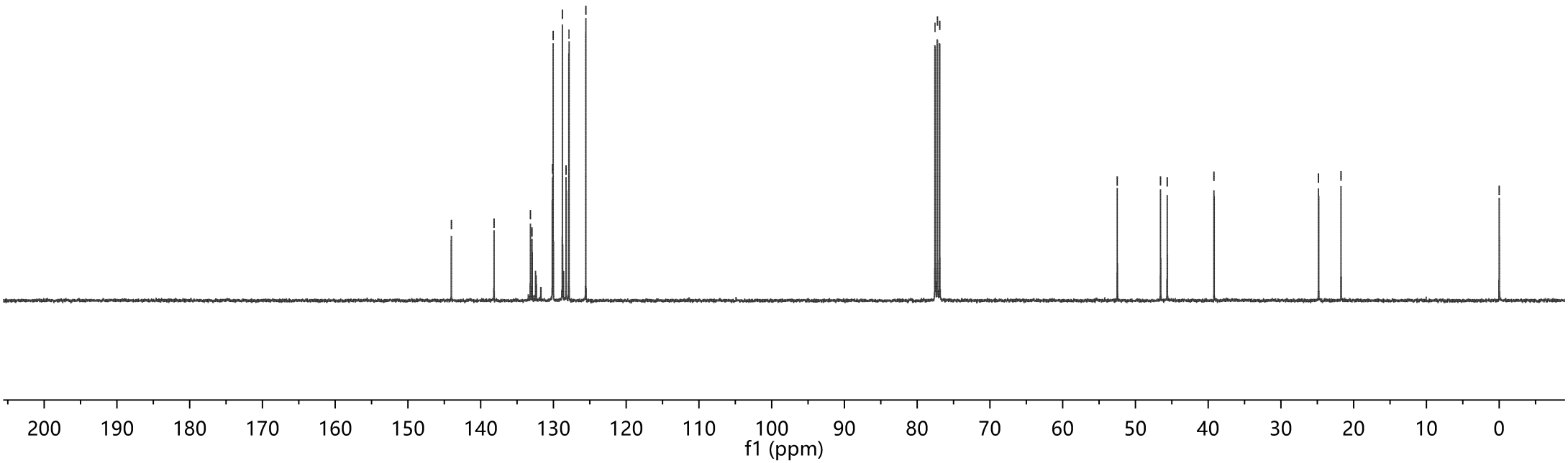


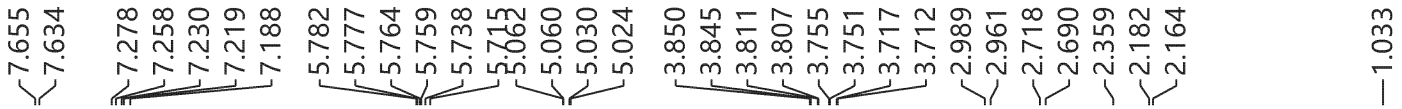
144.04
138.18
133.17
132.94
130.15
130.04
128.78
128.26
127.87
125.56
77.56
77.24
76.92
52.51
46.56
45.64
39.20
24.84
21.75
0.00

| Parameter | Value |
|---|---|
| 1 Origin | Bruker BioSpin GmbH |
| 2 Solvent | CDCl3 |
| 3 Temperature | 295.2 |
| 4 Number of Scans | 250 |
| 5 Spectrometer Frequency | 100.64 |
| 6 Spectral Width | 23809.5 |
| 7 Lowest Frequency | -1826.8 |
| 8 Nucleus | 13C |
| 9 Acquired Size | 32768 |
| 10 Spectral Size | 32768 |

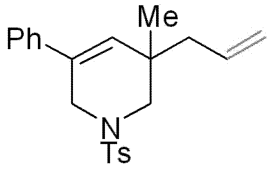



**3**

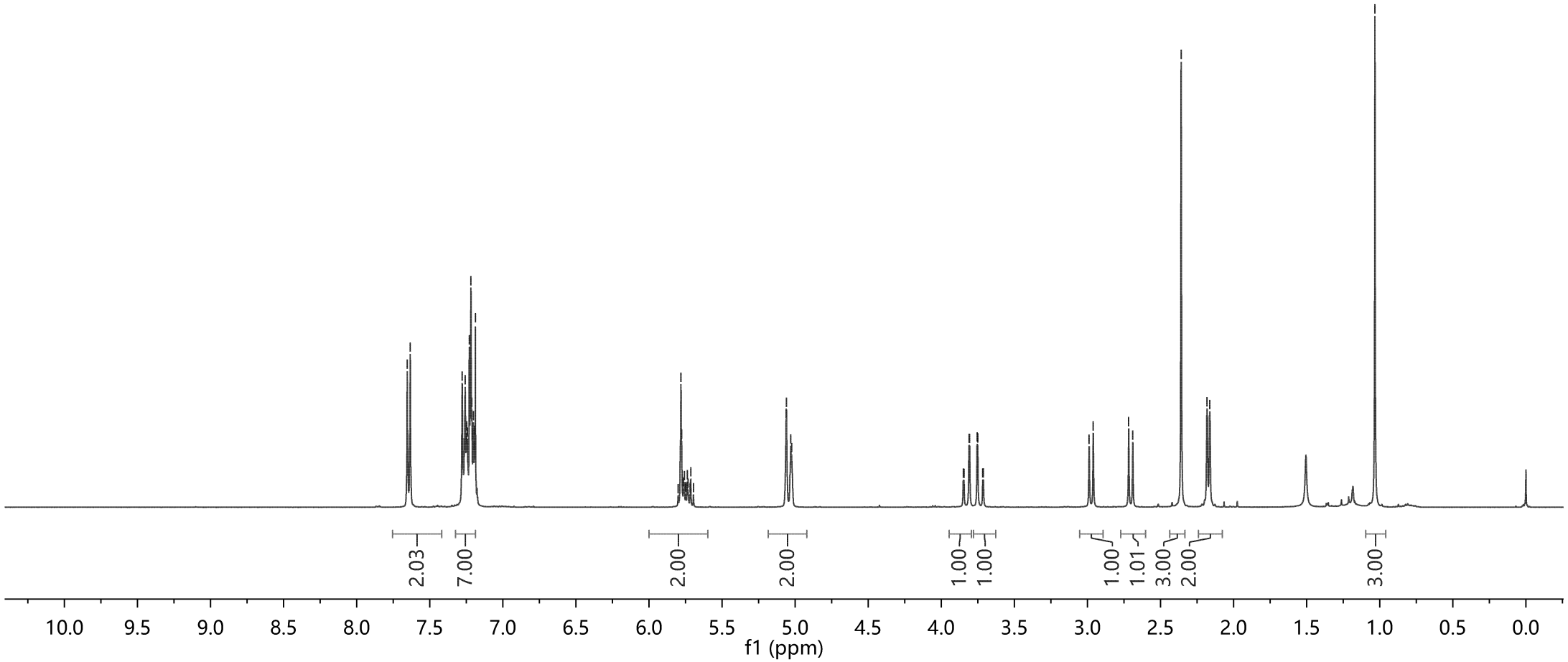


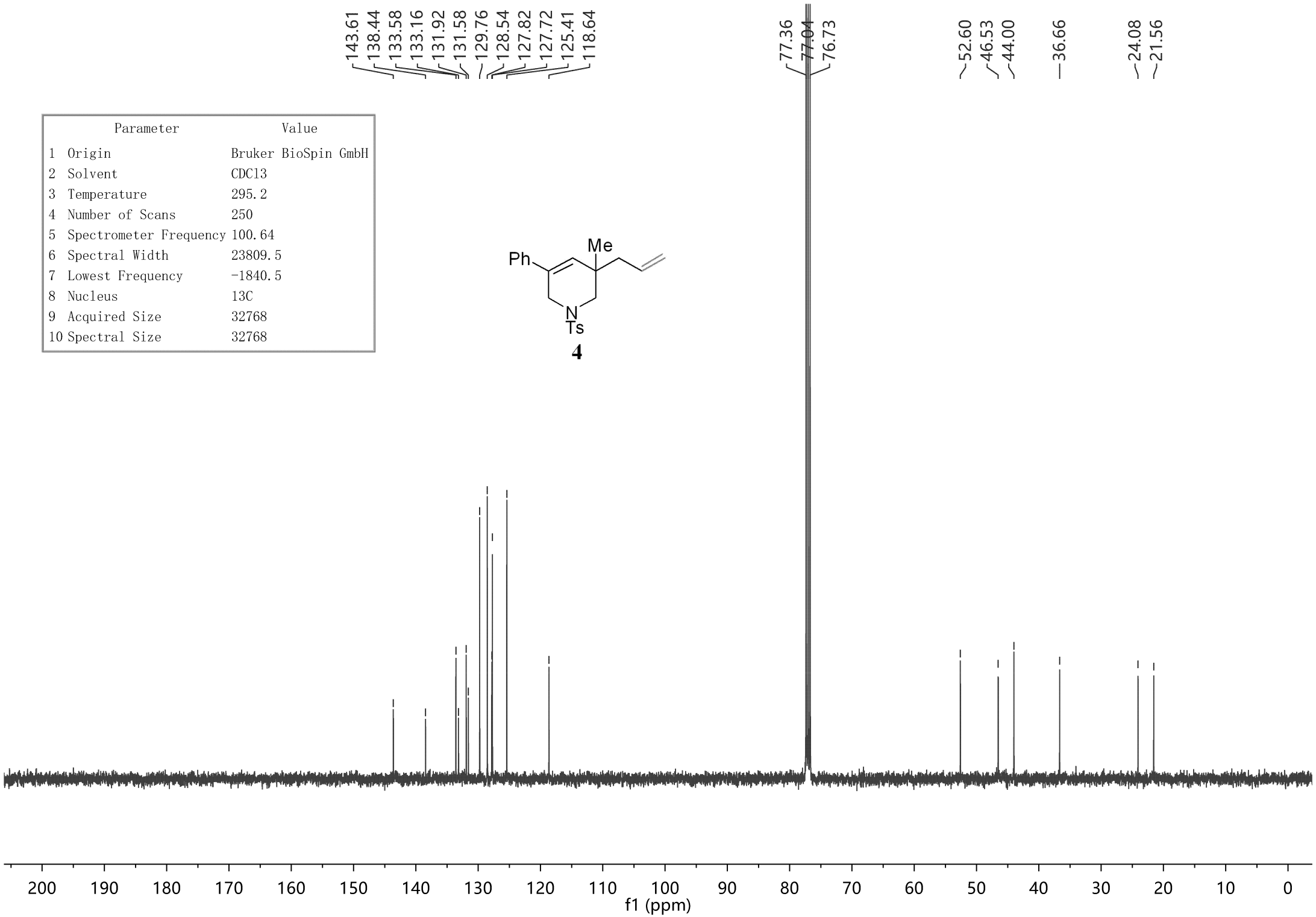



| | Parameter | Value |
|---|---|---|
| 1 | Origin | Bruker BioSpin GmbH |
| 2 | Solvent | CDCl3 |
| 3 | Temperature | 294.6 |
| 4 | Number of Scans | 16 |
| 5 | Spectrometer Frequency | 400.25 |
| 6 | Spectral Width | 8196.7 |
| 7 | Lowest Frequency | -1665.1 |
| 8 | Nucleus | 1H |
| 9 | Acquired Size | 32768 |
| 10 | Spectral Size | 65536 |

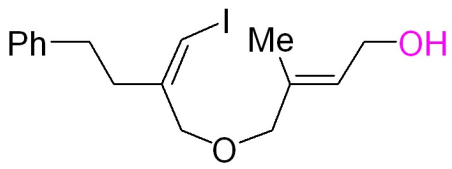



**4**

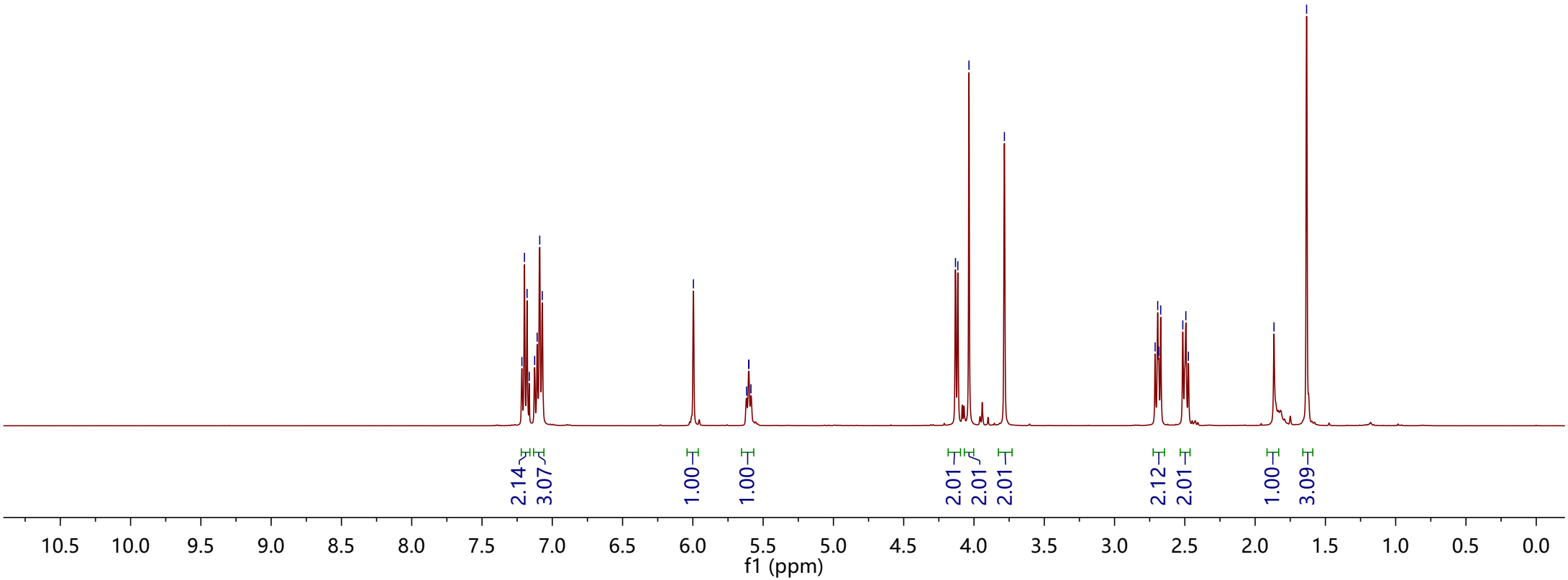


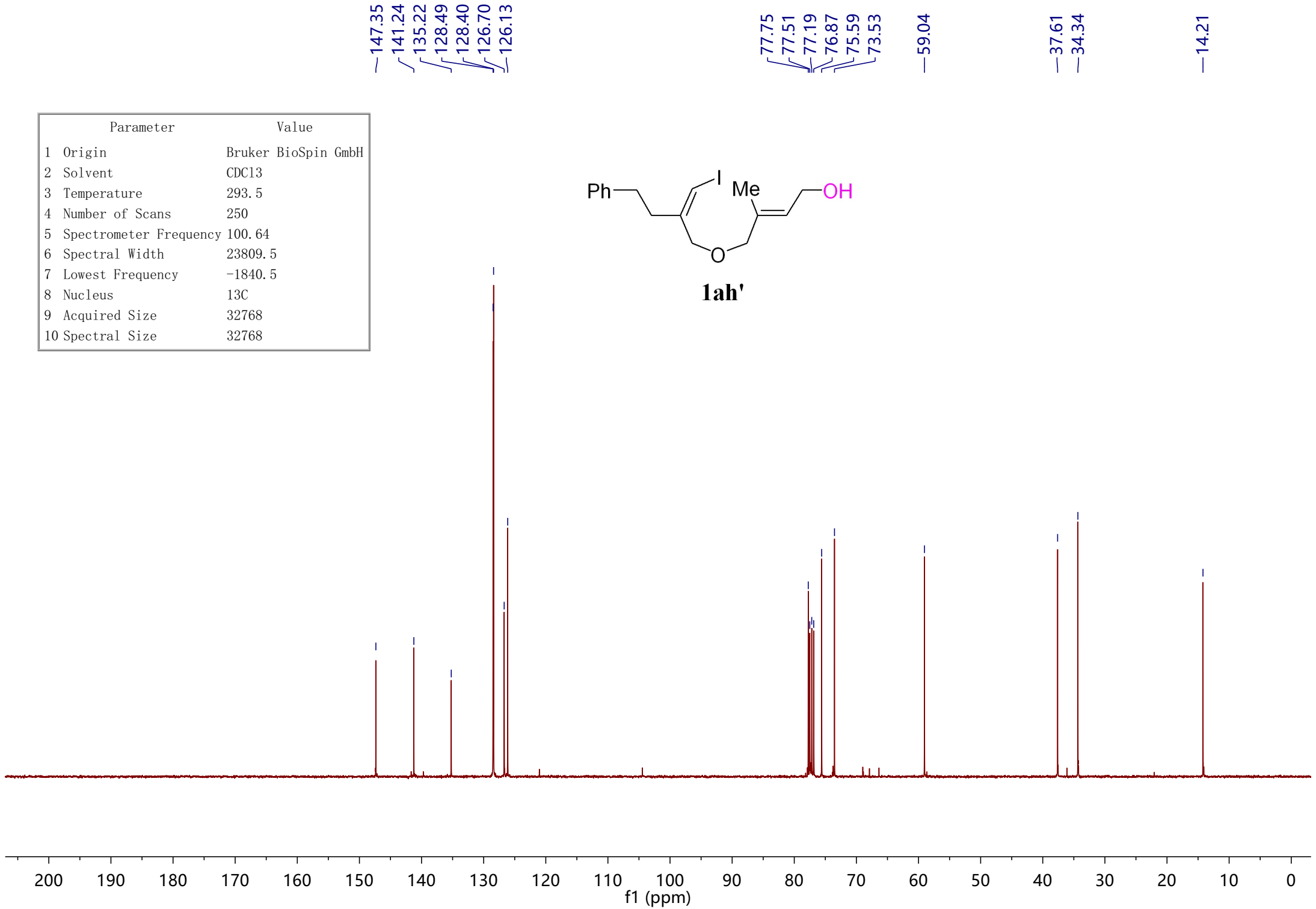

143.61
138.44
133.58
133.16
131.92
131.58
129.76
128.54
127.82
127.72
125.41
118.64
77.36
77.04
76.73
52.60
46.53
44.00
36.66
24.08
21.56
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 295.2
4 Number of Scans 250
5 Spectrometer Frequency 100.64
6 Spectral Width 23809.5
7 Lowest Frequency -1840.5
8 Nucleus 13C
9 Acquired Size 32768
10 Spectral Size 32768
Ph
Me
N
Ts
4
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

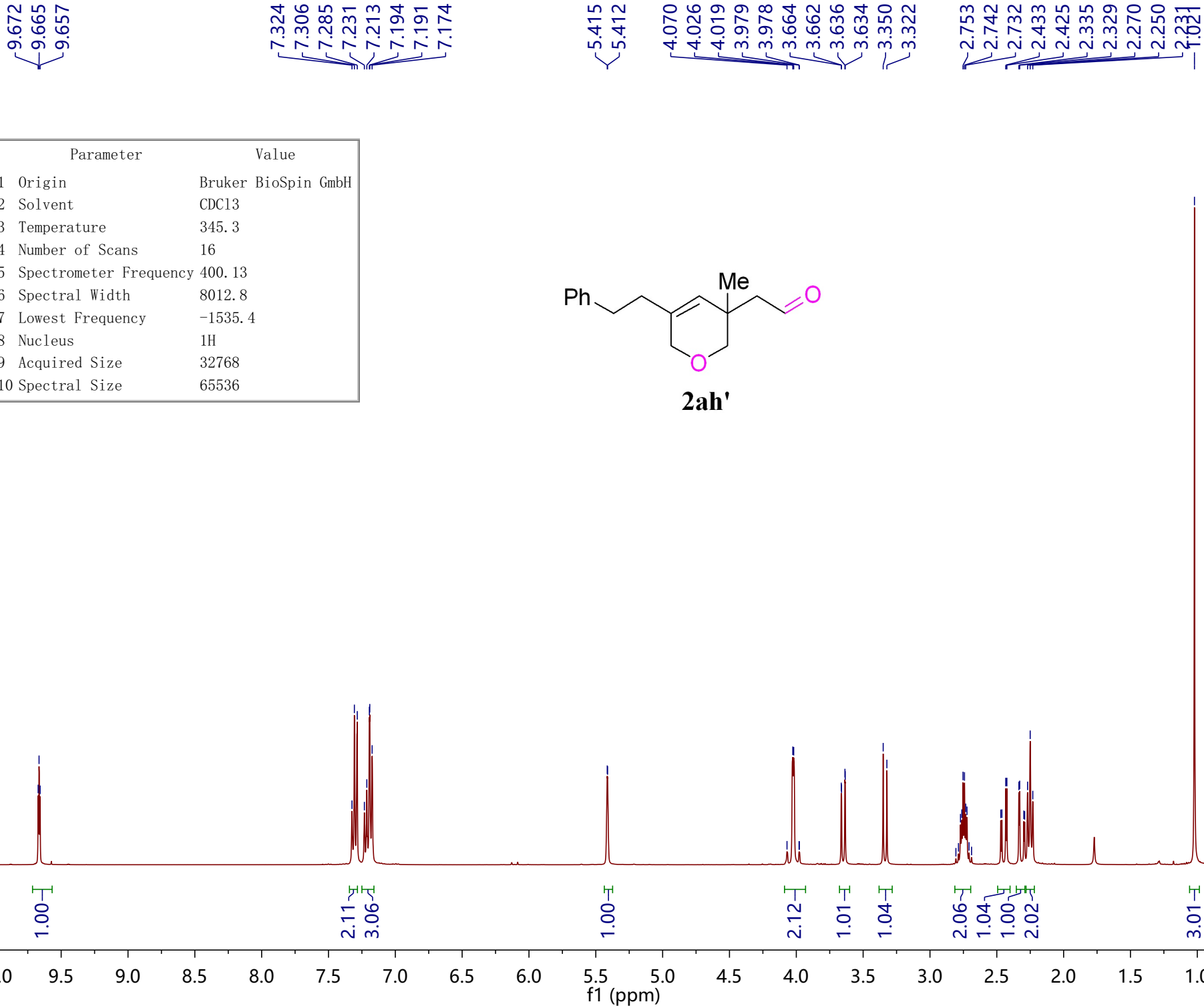

| | Parameter | Value |
|---|---|---|
| 1 | Origin | Bruker BioSpin GmbH |
| 2 | Solvent | CDCl3 |
| 3 | Temperature | 292.7 |
| 4 | Number of Scans | 16 |
| 5 | Spectrometer Frequency | 400.25 |
| 6 | Spectral Width | 8196.7 |
| 7 | Lowest Frequency | -1674.9 |
| 8 | Nucleus | 1H |
| 9 | Acquired Size | 32768 |
| 10 | Spectral Size | 65536 |

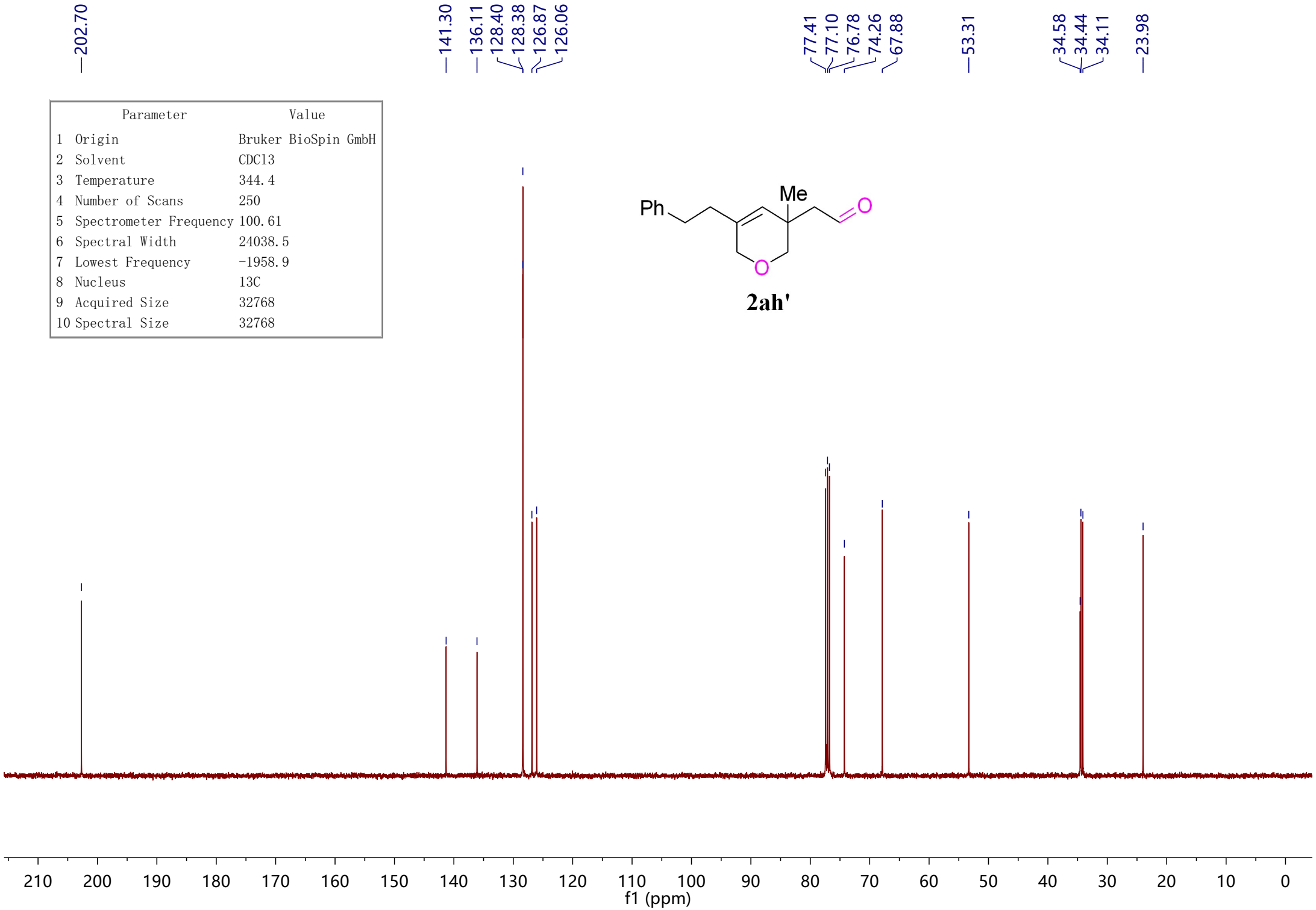



**1ah'**




147.35
141.24
135.22
128.49
128.40
126.70
126.13
77.75
77.51
77.19
76.87
75.59
73.53
59.04
37.61
34.34
14.21
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 293.5
4 Number of Scans 250
5 Spectrometer Frequency 100.64
6 Spectral Width 23809.5
7 Lowest Frequency -1840.5
8 Nucleus 13C
9 Acquired Size 32768
10 Spectral Size 32768
Ph
I
Me
OH
O
1ah'
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)


9.672
9.665
9.657
7.324
7.306
7.285
7.231
7.213
7.194
7.191
7.174
5.415
5.412
4.070
4.026
4.019
3.979
3.978
3.664
3.662
3.636
3.634
3.350
3.322
2.753
2.742
2.732
2.433
2.425
2.335
2.329
2.270
2.250
2.231
1.621
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 345.3
4 Number of Scans 16
5 Spectrometer Frequency 400.13
6 Spectral Width 8012.8
7 Lowest Frequency -1535.4
8 Nucleus 1H
9 Acquired Size 32768
10 Spectral Size 65536
Ph
Me
O
O
2ah'
1.00
2.11
3.06
1.00
2.12
1.01
1.04
2.06
1.04
1.00
2.02
3.01
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)


202.70
141.30
136.11
128.40
128.38
126.87
126.06
77.41
77.10
76.78
74.26
67.88
53.31
34.58
34.44
34.11
23.98
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 344.4
4 Number of Scans 250
5 Spectrometer Frequency 100.61
6 Spectral Width 24038.5
7 Lowest Frequency -1958.9
8 Nucleus 13C
9 Acquired Size 32768
10 Spectral Size 32768
Ph
Me
O
O
2ah'
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)