Supporting Information

Expanding the Horizon of Intermolecular Trapping of In-Situ Generated *α*-Oxo Gold Carbenes: Efficient Oxidative Union of Allylic Sulfides and Terminal Alkynes via C-C Bond Formation

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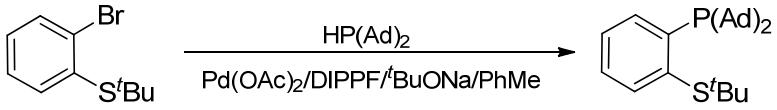
GENERAL. Ethyl acetate (ACS grade), hexanes (ACS grade) and diethyl ether (ACS grade) were purchased from Fisher Scientific and used without further purification. Anhydrous 1,2-dichloroethane (HPLC grade) and dichloromethane (HPLC grade) were purified by distillation over calcium hydride. Tetrahydrofuran was distilled over sodium/ benzophenone. Commercially available reagents were used without further purification. Reactions were monitored by thin layer chromatography (TLC) using Silicycle precoated silica gel plates. Flash column chromatography was performed over Silicycle silica gel (230-400 mesh). ^{1}H NMR and ^{13}C NMR spectra were recorded on a Varian 500 MHz and Varian 600 MHz Unity plus spectrometer using residue solvent peaks as internal standards ($CHCl_3$, ^{1}H: 7.26 ppm; ^{13}C: 77.23 ppm). ^{31}P NMR spectra were recorded on a Varian 400 MHz spectrometer using H_3PO_4 (0.00 ppm) as internal standards. Infrared spectra were recorded with a Perkin Elmer FT-IR spectrum 2000 spectrometer and are reported in reciprocal centimeter (cm^{-1}). Mass spectra were recorded with Micromass $QTOF_2$ Quadrupole/Time-of-Flight Tandem mass spectrometer using electron spray ionization or Waters GCT Premier time-of-flight mass spectrometer with a field ionization (FI) ion source.

PROCEDURE FOR THE SYNTHESIS

1. Synthesis of Catalyst L1AuCl

1.1 Ligand of di(Adamantan-1-yl) 2-(*tert*-butylthio)phenyl phosphine

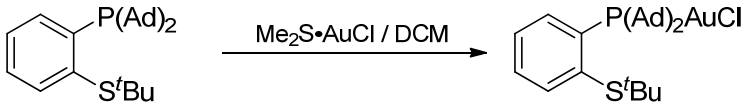


L1a **L1**

L1a was prepared according to the literature procedure [1]. Under nitrogen atmosphere **L1a** (2 mmol, 1 equiv), $Pd(OAc)_2$ (0.04 mmol, 2 mol%), DiPPF (1,1'-bis(diisopropyl-phosphino)ferrocene, 0.06 mmol, 3 mol%), *t*-BuONa (2.4 mmol, 1.2 equiv) and 5 mL dry toluene were added to a flame-dried Schlenk flask and the resulting suspension was stirred until apparently homogeneous. Added di(1-adamantyl)phosphine (2.2 mmol, 1.1

equiv), the flask was heated at 110 °C in oil bath for 20 hours, which then was cooled to room temperature, and purified by column chromatography without work-up to yield the final ligand **L1** in 61 % yield. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.84 – 7.79 (m, 1H), 7.70 – 7.64 (m, 1H), 7.30 – 7.22 (m, 2H), 2.00 – 1.87 (m, 18H), 1.66 (s, 12H), 1.39 (s, 9H). **^{13}C NMR** (126 MHz, $CDCl_3$) δ143.75, 140.51 (d, J_{PC} = 23.5 Hz), 137.17 (d, J_{PC} = 2.4 Hz), 136.77 (d, J_{PC} = 3.5 Hz), 128.12, 125.67, 48.02, 41.97 (d, J_{PC} = 12.9 Hz), 37.89 (d, J_{PC} = 26.6 Hz), 37.21 (d, J_{PC}= 1.0 Hz), 31.98 (d, J_{PC} = 1.2 Hz), 29.12 (d, J_{PC} = 8.5 Hz). **^{31}P NMR** ($CDCl_3$, 162 MHz) δ 23.33. **IR** (neat): 2902, 2848, 1451, 1362, 1301, 908, 733 cm^{-1}; **MS** (ES^+, *m/z*): $[M+H]^+$ calcd. for $C_{30}H_{44}PS$, 467.29; found, 467.24.

1.2 General Procedure for synthesis of Catalyst L1AuCl



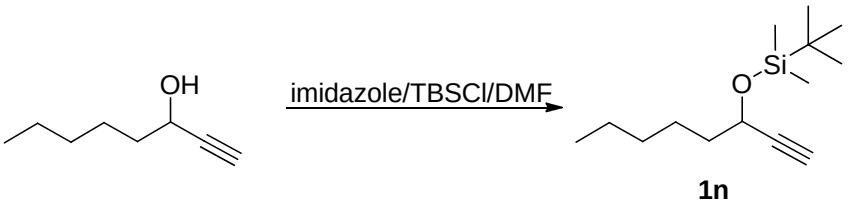
L1 **L1AuCl**

To a solution of 1 mmol ligand **L1** in 5 mL anhydrous DCM was added dimethylsulfide gold (I) chloride (294.5 mg, 1 mmol). The mixture was stirred for 30 min at room temperature and the solvent was evaporated off under reduced pressure to give the desired gold catalyst **L1AuCl** as light beige solid in quantitative yield. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.92 – 7.83 (m, 2H), 7.51 – 7.42 (m, 2H), 2.20 – 2.10 (m, 12H), 1.98 (s, 6H), 1.67 (s, 12H), 1.50 (s, 9H). **^{13}C NMR** (126 MHz, $CDCl_3$) δδ 141.54 (d, J_{PC} = 10.9 Hz), 140.29 (d, J_{PC}= 4.6 Hz), 135.61 (d, J_{PC} = 2.6 Hz), 130.40, 130.06 (d, J_{PC} = 46.6 Hz), 127.10 (d, J_{PC} = 5.9 Hz), 52.02, 42.66 (d, J_{PC} = 22.0 Hz), 42.22 (d, J_{PC} = 3.0 Hz), 36.51 (d, J_{PC} = 1.7 Hz), 31.75, 28.81 (d, J_{PC} = 9.8 Hz). **^{31}P NMR** ($CDCl_3$, 162 MHz) δ 62.45. **IR** (neat): 2906, 2851, 1447, 1301, 1162, 914, 730 cm^{-1}; **MS** (ES^+, *m/z*): $[L1Au]^+$ calcd. for $C_{30}H_{43}AuPS$, 663.25; found, 663.16.

2. Synthesis of substrates

2.1 alkyne substrates

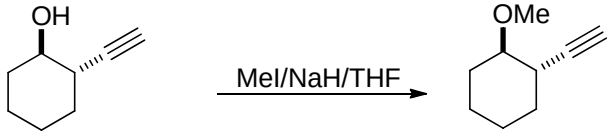
2.1.1 *tert*-butyldimethyl(oct-1-yn-3-yloxy)silane (1n)



1n

1n was prepared according to the literature procedure [2]

2.1.2 (Trans)-1-ethynyl-2-methoxycyclohexane (1o)



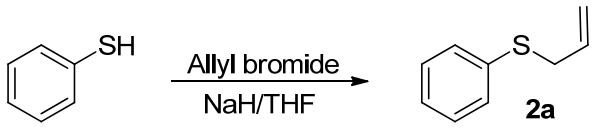
1p-a **1p**

1p-a was prepared according to the literature procedure [3].

To a solution of **1p-a** (891 mg, 7.19 mmol, 1.0 equiv) in anhydrous tetrahydrofuran (30 mL) at 0 °C was slowly added NaH (432 mg, 10.8 mmol, 1.5 equiv, 60% w/w). The reaction mixture was allowed to warm up to ambient temperature. Methyl iodide (0.54 mL, 8.64 mmol, 1.2 equiv) was added. Upon TLC showed complete consumption of the starting material, the reaction was quenched with saturated aqueous ammonium chloride, extracted twice with ethyl acetate, dried over Na_2SO_4, filtered, and concentrated *in vacuo*. Purification by flash column chromatography afforded the desired alkynyl ether **1p** as the colorless oil (718 mg) in 72 % yield. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 3.41 (s, 3H), 3.15 (td, *J* = 8.0, 3.8 Hz, 1H), 2.45 – 2.37 (m, 1H), 2.08 (d, *J* = 2.4 Hz, 1H), 2.06 – 1.98 (m, 1H), 1.98 – 1.90 (m, 1H), 1.72 – 1.60 (m, 2H), 1.49 – 1.39 (m, 1H), 1.32 – 1.20 (m, 3H); **^{13}C NMR** (126 MHz, $CDCl_3$) δ 86.81, 81.30, 69.31, 56.99, 34.77, 30.44, 29.49, 24.12, 23.27; **IR** (neat): 2925, 2858, 1461, 1100 cm^{-1}; **GCMS-EI**, *m/z,* 138 (M^+)

2.2 Sulfide substrates

2.2.1 General Procedure for Phenyl allyl sulfide (2a)

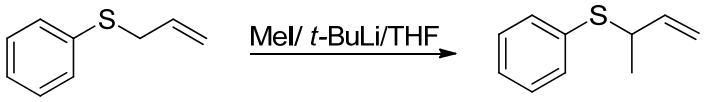


2a

To a flame-dried flask a suspension of 60% NaH (4 g, 0.1 mol) in THF (100 mL) was added and stirred at 0 ºC under water-ice bath. The thiophenol (10.1 mL, 0.1 mol) was then added dropwise to the mixture over 20 min. After completion of the addition, the water-ice bath was removed and the mixture was allowed to warm to room temperature and stirred for 0.5 h. Subsequently, the mixture was again cooled to 0 ºC and allyl bromide (0.067 mol) was added dropwise while stirring. After addition, the mixture was warmed to room temperature and then stirred for 2 h or more according to TLC. Finally, 50 mL of saturated NH_4Cl solution was added to quench the reaction. The organic layer was washed with water (60 mL×2), extracted with Et_2O (60 mL×2), then dried over $MgSO_4$ and concentrated under vacuum. The crude product was purified by silica gel column chromatography (hexanes) to afford **2a** (8.3 g, 82 %) as colorless oil.

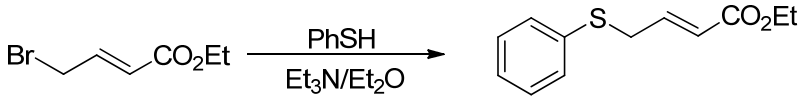
Phenyl 2-methylallyl sulfide (**2d**), phenyl but-2-en-1-yl sulfide(**2e**), phenyl cinnamyl sulfide(**2f**) and benzyl allyl sulfide(**2i**) were prepared using the same procedure for **2a**.

2.2.2 Phenyl but-3-en-2-yl sulfide (2h)



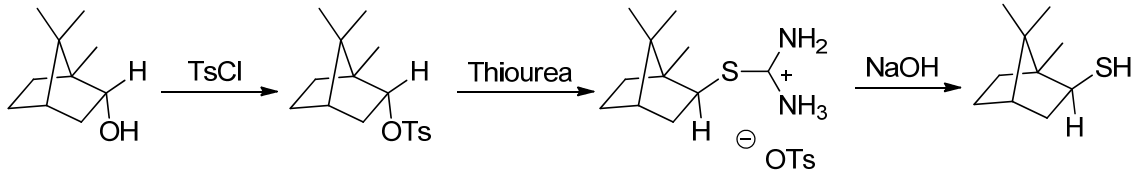
2h was prepared according to the literature procedure [4].

2.2.3 Ethyl (E)-4-(phenylthio)but-2-enoate (2g)

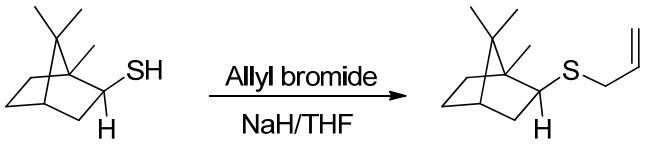


2g was prepared according to the literature procedure [5].

2.2.4 (1S,2S,4S)-1,7,7-Trimethylbicyclo[2.2.1]heptan-2-yl allyl sulfide



(-)-borneol **2l-b** **2l-c** **2l-d**

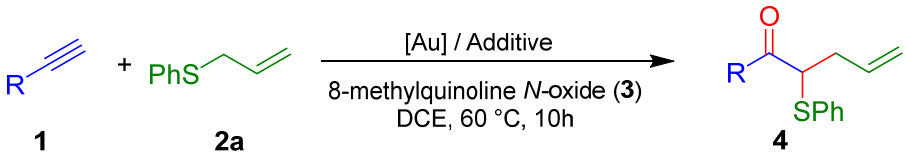


2l-d **2l**

2l-d was synthesized from (-)-borneol via 3 steps according to the literature procedure [6].

2l was prepared using the general procedure for sulfide **2a**. Purified by flash column chromatography to afford **2l** as colorless oil in 71 % yield. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 5.80 (ddt, *J* = 17.1, 10.0, 7.2 Hz, 1H), 5.13 – 5.02 (m, 2H), 3.13 (dt, *J* = 7.2, 1.1 Hz, 2H), 2.62 (dd, *J* = 8.7, 6.3 Hz, 1H), 1.88 – 1.77 (m, 2H), 1.76 – 1.59 (m, 3H), 1.19 – 1.08 (m, 2H), 0.98 (s, 3H), 0.97 (s, 3H), 0.82 (s, 3H). **^{13}C NMR** (126 MHz, $CDCl_3$) δ 135.20, 116.84, 52.63, 49.52, 47.56, 46.08, 40.91, 38.63, 37.42, 27.58, 20.65, 20.43, 14.16. **IR** (neat): 3081, 2985, 2952, 1634, 1454, 1389, 988, 912 cm^{-1}; **GCMS-EI**, *m/z*, 210 (M^+)

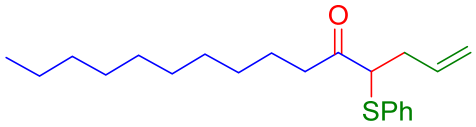
3. General Procedure for Synthesis of Target Compounds 4 series



1 **2a** **4**

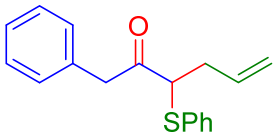
To a 2 dram septum-capped vial were added sequentially **1** (0.20 mmol), **2** (0.30 mmol, 1.5 *equiv*), **L1**AuCl (2.8 mg, 4 μmol, 2 mol %), $NaBAr^F_4$ (5.4 mg, 6 μmol, 3 mol %) and 1 mL of dry DCE, then **3** (19.7 mg, 0.26 mmol, 1.3 *eq*) in 1 mL of dry DCE was introduced into reaction by syringe pump at the rate of 0.1 mL per hour. After stirring at 60℃ for 10 h, the solvent was removed under reduced pressure. Based on the TLC monitoring, if 8-methylquinoline can be clearly separated from the product, there is no need to work up; otherwise, the residue dissolved with 20 mL of ethyl acetate, then washed by HCl solution (1 mol/L, 10 mL×3) and brine (10 mL×2) respectively. After dried over $MgSO_4$ and removed the solvent, the crude product was purified through flash chromatography on silica gel to afford target compounds **4** series as following.

4-(phenylthio)pentadec-1-en-5-one (4a)



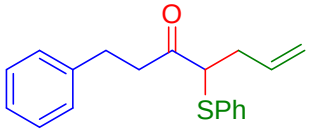
Purified by flash column chromatography (hexanes/ethyl acetate, 50/1) to afford **4a** (55 mg, 83 %) as pale yellow oil. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.40 – 7.35 (m, 2H), 7.33 – 7.27 (m, 3H), 5.86 – 5.73 (m, 1H), 5.16 – 5.02 (m, 2H), 3.67 (dd, *J* = 8.1, 6.9 Hz, 1H), 2.66 – 2.37 (m, 4H), 1.55 (m, 2H), 1.34 – 1.16 (m, 14H), 0.88 (t, *J* = 7.0 Hz, 3H).; **^{13}C NMR** (126 MHz, $CDCl_3$) δ 206.81, 134.55, 133.20, 132.86, 129.26, 128.31, 118.03, 56.33, 40.27, 34.84, 32.11, 29.77, 29.68, 29.58, 29.52, 29.38, 24.04, 22.90, 14.33. **IR** (neat): 3078, 2925, 2854, 1710, 1467, 1439, 918, 745 cm^{-1}; **MS** (ES^+, *m/z*) Calculated for $C_{21}H_{32}NaOS$: 355.2; Found: 355.2 $[M+Na]^+$.

1-phenyl-3-(phenylthio)hex-5-en-2-one (4b)



Purified by flash column chromatography (hexanes/ethyl acetate, 30/1) to afford **4b** (45.5 mg, 81 %) as pale yellow oil. **^{1}H NMR** (600 MHz, $CDCl_3$) δ 7.40 – 7.35 (m, 2H), 7.34 – 7.28 (m, 5H), 7.28 – 7.24 (m, 1H), 7.16 (d, *J* = 7.2 Hz, 2H), 5.79 – 5.68 (m, *J* = 23.3, 10.7, 6.8 Hz, 1H), 5.10 – 5.02 (m, *J* = 11.8, 6.1 Hz, 2H), 3.93 (d, *J* = 15.5 Hz, 1H), 3.87 (d, *J* = 15.5 Hz, 1H), 3.76 (dd, *J* = 7.9, 7.1 Hz, 1H), 2.65 – 2.50 (m, 1H), 2.50 – 2.39 (m, 1H). **^{13}C NMR** (151 MHz, $CDCl_3$) δ 203.27, 134.36, 134.05, 133.69, 132.28, 129.86, 129.33, 128.80, 128.61, 127.21, 118.07, 55.42, 47.31, 34.59. **IR** (neat): 3062, 3030, 2919, 1711, 1496, 1439, 1025, 919 cm^{-1}; **MS** (ES^+, *m/z*) Calculated for $C_{18}H_{18}NaOS$: 305.1; Found: 305.1 $[M+Na]^+$.

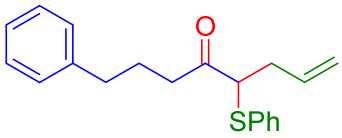
1-phenyl-4-(phenylthio)hept-6-en-3-one (4c)



Purified by flash column chromatography (hexanes/ethyl acetate, 30/1) to afford **4c** (48 mg, 81 %) as pale yellow oil. **^{1}H NMR** (600 MHz, $CDCl_3$) δ 7.32 – 7.26 (m, 7H), 7.22 –

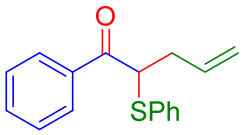
7.16 (m, 3H), 5.82 – 7.70 (m, 1H), 5.13 – 5.05 (m, 2H), 3.63 (dd, *J* = 7.9, 7.1 Hz, 1H), 3.04 – 2.82 (m, 4H), 2.61 – 2.48 (m, 1H), 2.48 – 2.37 (m, 1H). **^{13}C NMR** (151 MHz, $CDCl_3$) δ 205.56, 141.10, 134.39, 133.45, 132.42, 129.28, 128.67, 128.65, 128.44, 126.32, 118.09, 56.41, 41.77, 34.62, 30.06. **IR** (neat): 3062, 3027, 2924, 1709, 1439, 919, 748 cm^{-1}; **MS** (ES^+, *m/z*) Calculated for $C_{19}H_{20}NaOS$: 319.1; Found: 319.1 $[M+Na]^+$.

1-phenyl-5-(phenylthio)oct-7-en-4-one (4d)



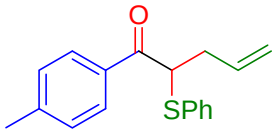
Purified by flash column chromatography (hexanes/ethyl acetate, 30/1) to afford **4d** (51 mg, 82 %) as pale yellow oil. **^{1}H NMR** (600 MHz, $CDCl_3$) δ 7.39 – 7.33 (m, 2H), 7.32 – 7.25 (m, 5H), 7.22 – 7.14 (m, 3H), 5.84 – 5.74 (m, 1H), 5.13 – 5.07 (m, 2H), 3.66 (dd, *J* = 7.9, 7.1 Hz, 1H), 2.72 – 2.50 (m, 5H), 2.50 – 2.40 (m, 1H), 1.97 – 1.83 (m, 2H). **^{13}C NMR** (151 MHz, $CDCl_3$) δ 206.38, 141.79, 134.47, 133.25, 132.74, 129.28, 128.66, 128.56, 128.37, 126.12, 118.10, 56.36, 39.50, 35.27, 34.79, 25.50. **IR** (neat): 3062, 3026, 2928, 2858, 1708, 1439, 747 cm^{-1}; **MS** (ES^+, *m/z*) Calculated for $C_{20}H_{22}NaOS$: 333.1; Found: 333.2 $[M+Na]^+$.

1-phenyl-2-(phenylthio)pent-4-en-1-one (4e)



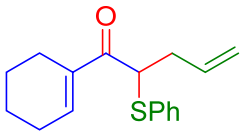
Purified by flash column chromatography (hexanes/ethyl acetate, 20/1) to afford **4e** (46 mg, 86 %) as pale yellow oil. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.92 (dd, *J* = 8.4, 1.2 Hz, 2H), 7.65 – 7.50 (m, 1H), 7.50 – 7.39 (m, 2H), 7.38 – 7.22 (m, 5H), 5.92 – 5.84 (m, 1H), 5.20 – 5.02 (m, 2H), 4.50 (dd, *J* = 7.8, 6.8 Hz, 1H), 2.81 – 2.73 (m, 1H), 2.63 – 2.56 (m, 1H). **^{13}C NMR** (126 MHz, $CDCl_3$) δ 195.37, 136.29, 134.99, 134.98, 133.27, 131.70, 129.16, 128.97, 128.78, 128.76, 117.95, 51.02, 35.27. **IR** (neat): 3061, 2923, 2853, 1678, 1596, 1447, 1240, 917, 748 cm^{-1}; **MS** (ES^+, *m/z*) Calculated for $C_{17}H_{16}NaOS$: 291.1; Found: 291.1 $[M+Na]^+$. Data was in accordance with that reported in the literature [7]

2-(phenylthio)-1-(p-tolyl)pent-4-en-1-one (4f)



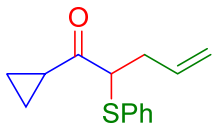
Purified by flash column chromatography (hexanes/ethyl acetate, 20/1) to afford **4f** (45 mg, 80 %) as pale yellow oil. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.92 – 7.75 (m, 2H), 7.43 – 7.19 (m, 7H), 5.93 – 5.83 (m, 1H), 5.19 – 4.98 (m, 2H), 4.49 (dd, *J* = 7.9, 6.7 Hz, 1H), 2.81 – 2.71 (m, 1H), 2.62 – 2.53 (m, 1H), 2.41 (s, 3H). **^{13}C NMR** (126 MHz, $CDCl_3$) δ 195.11, 144.16, 135.07, 134.87, 133.70, 131.91, 129.49, 129.13, 128.90, 128.86, 117.85, 50.95, 35.36, 21.86. **IR** (neat): 3076, 2921, 1675, 1607, 1438, 1247, 1183, 749 cm^{-1}; **MS** (ES^+, *m/z*) Calculated for $C_{18}H_{18}NaOS$: 305.1; Found: 305.1 $[M+Na]^+$.

1-(cyclohex-1-en-1-yl)-2-(phenylthio)pent-4-en-1-one (4g)



Purified by flash column chromatography (hexanes/ethyl acetate, 30/1) to afford **4g** (42 mg, 78 %) as pale yellow oil. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.47 – 7.35 (m, 2H), 7.35 – 7.27 (m, 3H), 6.71 – 6.61 (m, 1H), 5.89 – 5.71 (m, 1H), 5.16 – 4.98 (m, 2H), 4.25 (dd, *J* = 8.1, 6.5 Hz, 1H), 2.71 – 2.59 (m, 1H), 2.53 – 2.42 (m, 1H), 2.35 – 2.25 (m, 1H), 2.23 – 2.03 (m, 2H), 1.72 – 1.50 (m, 4H). **^{13}C NMR** (126 MHz, $CDCl_3$) δ 197.01, 140.45, 138.64, 135.18, 134.68, 133.00, 129.07, 128.60, 117.64, 49.79, 35.65, 26.32, 23.79, 22.13, 21.62. **IR** (neat): 3075, 2933, 2860, 1660, 1636, 1438, 919, 748 cm^{-1}; **MS** (ES^+, *m/z*) Calculated for $C_{17}H_{20}NaOS$: 295.1; Found: 295.1 $[M+Na]^+$.

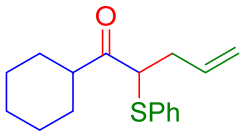
1-cyclopropyl-2-(phenylthio)pent-4-en-1-one (4h)



Purified by flash column chromatography (hexanes/ethyl acetate, 30/1) to afford **4h** (34.4 mg, 74 %) as pale yellow oil. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.47 – 7.35 (m, 2H), 7.32 – 7.23 (m, 3H), 5.92 – 5.76 (m, 1H), 5.20 – 5.05 (m, 2H), 3.82 (dd, *J* = 7.9, 7.1 Hz, 1H),

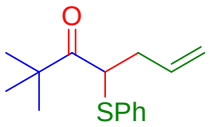
2.70 – 2.58 (m, 1H), 2.56 – 2.44 (m, 1H), 2.23 (tt, J = 7.8, 4.6 Hz, 1H), 1.08 – 0.99 (m, 1H), 0.99 – 0.80 (m, 3H). **^{13}C NMR** (126 MHz, $CDCl_3$) δ 206.61, 134.53, 133.33, 132.75, 129.18, 128.26, 117.96, 57.54, 34.86, 19.00, 11.83, 11.72. **IR** (neat): 3077, 3008, 2921, 1694, 1439, 1381, 1086, 918, 744 cm^{-1}; **MS** (ES^+, *m/z*) Calculated for $C_{14}H_{16}NaOS$: 255.1; Found: 255.1 $[M+Na]^+$.

1-cyclohexyl-2-(phenylthio)pent-4-en-1-one (4i)



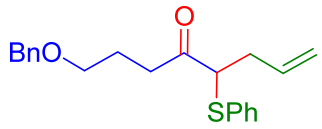
Purified by flash column chromatography (hexanes/ethyl acetate, 30/1) to afford **4i** (44 mg, 80 %) as pale yellow oil. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.43 – 7.34 (m, 2H), 7.33 – 7.26 (m, 3H), 5.83 – 5.68 (m, 1H), 5.15 – 5.01 (m, 2H), 3.74 (dd, J = 8.3, 6.5 Hz, 1H), 2.67 (tt, J = 11.2, 2.9 Hz, 1H), 2.61 – 2.53 (m, 1H), 2.45 – 2.36 (m, 1H), 1.84 – 1.71 (m, 4H), 1.71 – 1.61 (m, 1H), 1.55 – 1.39 (m, 1H), 1.32 – 1.12 (m, 4H). **^{13}C NMR** (126 MHz, $CDCl_3$) δ 208.57, 134.84, 133.91, 132.39, 129.19, 128.51, 117.92, 54.65, 48.89, 34.80, 29.66, 28.51, 26.14, 25.97, 25.55. **IR** (neat): 3077, 2930, 2854, 1705, 1439, 918, 746 cm^{-1}; **MS** (ES^+, *m/z*) Calculated for $C_{17}H_{22}NaOS$: 297.1; Found: 297.2 $[M+Na]^+$.

2,2-dimethyl-4-(phenylthio)hept-6-en-3-one (4j)



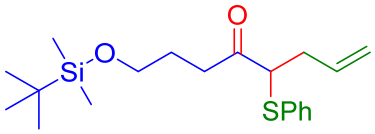
The reaction was run at 35 ℃. Purified by flash column chromatography (hexanes/ethyl acetate, 50/1) to afford **4j** (13.6 mg, 28 %) as pale yellow oil. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.46 – 7.38 (m, 2H), 7.36 – 7.28 (m, 3H), 5.77 – 5.65 (m, 1H), 5.12 – 5.00 (m, 2H), 4.02 (dd, J = 8.8, 5.9 Hz, 1H), 2.67 – 2.53 (m, 1H), 2.47 – 2.39 (m, 1H), 1.18 (s, J = 3.7 Hz, 9H). **^{13}C NMR** (126 MHz, $CDCl_3$) δ 210.46, 134.95, 134.41, 132.59, 129.12, 128.62, 118.12, 49.82, 44.24, 36.90, 27.06. **IR** (neat): 3077, 2969, 2932, 2870, 1701, 1476, 1439, 1068, 949, 749 cm^{-1}; **MS** (ES^+, *m/z*) Calculated for $C_{15}H_{20}NaOS$: 271.1; Found: 271.1 $[M+Na]^+$.

1-(benzyloxy)-5-(phenylthio)oct-7-en-4-one (4k)



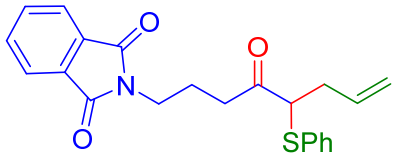
Work-up needed. Purified by flash column chromatography (hexanes/ethyl acetate, 10/1) to afford **4k** (54.2 mg, 80 %) as pale yellow oil. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.40 – 7.26 (m, 10H), 5.85 – 5.73 (m, 1H), 5.13 – 5.05 (m, 2H), 4.47 (s, 2H), 3.69 (dd, *J* = 8.0, 7.0 Hz, 1H), 3.46 (t, *J* = 6.2 Hz, 2H), 2.81 – 2.62 (m, 2H), 2.60 – 2.41 (m, 2H), 1.94 – 1.84 (m, 2H). **^{13}C NMR** (126 MHz, $CDCl_3$) δ 206.36, 138.60, 134.53, 133.22, 132.78, 129.28, 128.56, 128.33, 127.83, 127.76, 118.05, 73.04, 69.45, 56.42, 36.91, 34.74, 24.20. **IR** (neat): 3062, 2925, 2855, 1439, 1099, 745 cm^{-1}; **MS** (ES^+, *m/z*) Calculated for $C_{21}H_{24}NaO_2S$: 363.2; Found: 363.2 $[M+Na]^+$.

1-((*tert*-butyldimethylsilyl)oxy)-5-(phenylthio)oct-7-en-4-one (4l)



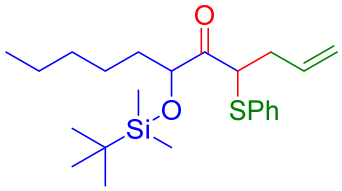
Purified by flash column chromatography (hexanes/ethyl acetate, 20/1) to afford **4l** (60 mg, 82 %) as pale yellow oil. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.42 – 7.35 (m, 2H), 7.34 – 7.23 (m, 3H), 5.87 – 5.74 (m, 1H), 5.16 – 5.05 (m, 2H), 3.69 (dd, *J* = 8.1, 6.9 Hz, 1H), 3.58 (t, *J* = 6.2 Hz, 2H), 2.80 – 2.68 (m, 1H), 2.68 – 2.52 (m, 2H), 2.51 – 2.40 (m, 1H), 1.80 – 1.72 (m, 2H), 0.88 (s, 9H), 0.03 (s, 6H). **^{13}C NMR** (126 MHz, $CDCl_3$) δ 206.70, 134.54, 133.23, 132.82, 129.28, 128.35, 118.06, 62.27 (t, *J* = 3.6 Hz), 56.46 (d, *J* = 7.0 Hz), 36.54, 34.84, 27.16, 26.15 (d, *J* = 3.8 Hz), 18.50, -5.11 (d, *J* = 6.0 Hz). **IR** (neat): 3077, 2955, 2929, 2885, 2857, 1709, 1472, 1439, 1255, 1097, 836, 745 cm^{-1}; **MS** (ES^+, *m/z*) Calculated for $C_{20}H_{32}NaO_2SSi$: 387.2; Found: 287.2 $[M+Na]^+$.

2-(4-oxo-5-(phenylthio)oct-7-en-1-yl)isoindoline-1,3-dione (4m)



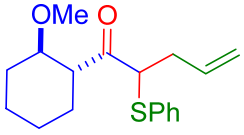
Work-up needed. Purified by flash column chromatography (hexanes/ethyl acetate, 5/1) to afford **4m** (55 mg, 73 %) as white solid. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.89 – 7.79 (m, 2H), 7.76 – 7.69 (m, 2H), 7.38 – 7.32 (m, 2H), 7.28 – 7.22 (m, 3H), 5.84 – 5.74 (m, 1H), 5.14 – 5.05 (m, 2H), 3.71 – 3.63 (m, 3H), 2.71 (ddd, *J* = 17.5, 8.6, 6.1 Hz, 1H), 2.61 – 2.52 (m, 2H), 2.47 – 2.39 (m, 1H), 2.03 – 1.86 (m, 2H). **^{13}C NMR** (126 MHz, $CDCl_3$) δ 205.40, 168.55, 134.47, 134.17, 133.39, 132.57, 132.30, 129.30, 128.45, 123.47, 118.15, 56.32, 37.66, 37.55, 34.65, 23.22. **IR** (neat): 3075, 2925, 2851, 1770, 1707, 1394, 750 cm^{-1}; **MS** (ES^+, *m/z*) Calculated for $C_{22}H_{21}NNaO_3S$: 418.1; Found: 418.1 $[M+K]^+$.

2-(4-oxo-5-(phenylthio)oct-7-en-1-yl)isoindoline-1,3-dione (4n)



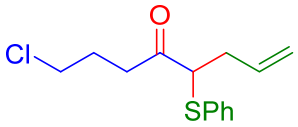
Purified by flash column chromatography (hexanes/ethyl acetate, 30/1) to afford **4n** (56 mg, 69 %, dr = 57/43) as pale yellow oil. **^{1}H NMR** (600 MHz, $CDCl_3$) δ 7.43 (dd, *J* = 6.1, 2.5 Hz, 1H), 7.37 (d, *J* = 8.0 Hz, 1H), 7.33 – 7.27 (m, 3H), 5.83 – 5.71 (m, 1H), 5.12 – 5.03 (m, 2H), 4.41 – 4.11 (m, 2H), 2.61 – 2.33 (m, 2H), 1.77 – 1.61 (m, 2H), 1.42 – 1.24 (m, 6H), 0.93 (s, 9H, minor diastereoisomer), 0.91 (s, 9H, major diastereoisomer), 0.89 – 0.84 (m, 3H), 0.13 (s, 3H, minor diastereoisomer), 0.10 (s, 3H, minor diastereoisomer), 0.06 (s, 6H, major diastereoisomer). **^{13}C NMR** (151 MHz, $CDCl_3$) δ 207.75, 207.22, 134.93, 134.78, 134.75, 133.62, 133.02, 131.49, 129.18, 129.05, 128.78, 128.36, 118.18, 117.93, 78.08, 76.92, 49.62, 48.88, 35.85, 35.05, 34.58, 32.04, 31.79, 26.11, 26.03, 25.26, 24.09, 22.69, 22.68, 18.36, 14.21, 14.18, -4.22, -4.37, -4.46, -4.56. **IR** (neat): 3078, 2955, 2930, 2858, 1710, 1472, 1257, 1096, 837, 777, 747 cm^{-1}; **MS** (ES^+, *m/z*) Calculated for $C_{23}H_{38}KO_2SSi$: 445.2; Found: 445.2 $[M+K]^+$.

1-(2-methoxycyclohexyl)-2-(phenylthio)pent-4-en-1-one (4o)



Work-up needed. Purified by flash column chromatography (hexanes/ethyl acetate, 20/1) to afford **4o** (43.2 mg, 71 %, dr = 51/49) as pale yellow oil. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.43 – 7.35 (m, 2H), 7.32 – 7.22 (m, 3H), 5.86 – 5.71 (m, 1H), 5.14 – 5.01 (m, 2H), 3.81 (t, *J* = 7.3 Hz, 1H, minor diastereoisomer), 3.72 (t, *J* = 7.2 Hz, 1H, major diastereoisomer), 3.42 (td, *J* = 10.2, 4.2 Hz, 1H, minor diastereoisomer), 3.30 (s, 3H, minor diastereoisomer), 3.23 – 3.16 (m, 4H, major diastereoisomer), 2.93 – 2.85 (m, 1H, minor diastereoisomer), 2.80 – 2.72 (m, 1H, major diastereoisomer), 2.64 – 2.55 (m, 1H), 2.44 – 2.30 (m, 1H), 2.25 – 2.13 (m, 1H), 1.92 – 1.51 (m, 4H), 1.19 – 1.02 (m, 2H). **^{13}C NMR** (126 MHz, $CDCl_3$) δ 208.70, 207.89, 135.35, 134.79, 133.83, 133.11, 132.85, 132.31, 129.11, 128.97, 128.35, 127.90, 117.82, 117.13, 83.15, 80.00, 57.70, 56.65, 56.45, 55.94, 55.18, 53.62, 34.41, 34.00, 30.71, 30.11, 29.62, 28.98, 25.39, 24.97, 24.35, 24.34. **IR** (neat): 3076, 2933, 2858, 2825, 1707, 1439, 1100, 917, 747 cm^{-1}; **MS** (ES^+, *m/z*) Calculated for $C_{18}H_{24}NaO_2S$: 327.2; Found: 327.2 $[M+Na]^+$

1-chloro-5-(phenylthio)oct-7-en-4-one (4p)

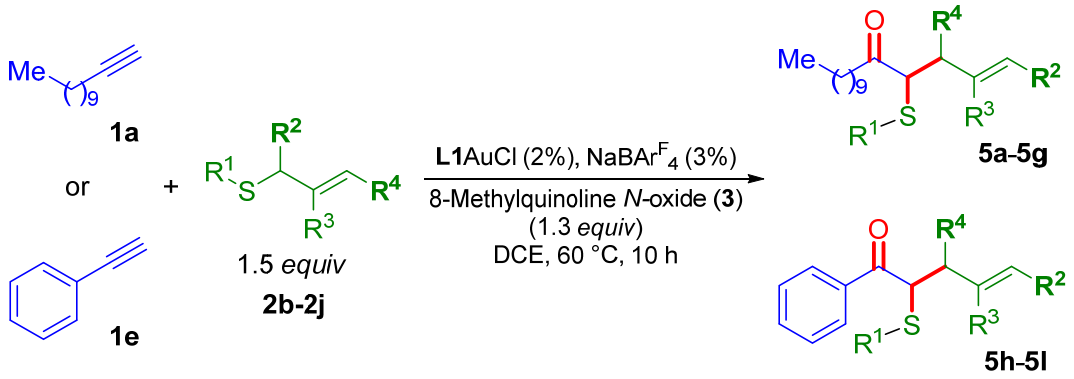


Purified by flash column chromatography (hexanes/ethyl acetate, 20/1) to afford **4p** (43.4 mg, 81 %) as pale yellow oil. **^{1}H NMR** (600 MHz, $CDCl_3$) δ 7.43 – 7.35 (m, 2H), 7.34 – 7.27 (m, 3H), 5.86 – 5.74 (m, 1H), 5.16 – 5.07 (m, 2H), 3.70 (dd, *J* = 8.2, 6.9 Hz, 1H), 3.53 (t, *J* = 6.3 Hz, 2H), 2.85 (dt, *J* = 17.9, 7.0 Hz, 1H), 2.71 (dt, *J* = 17.9, 6.9 Hz, 1H), 2.64 – 2.54 (m, 1H), 2.53 – 2.44 (m, 1H), 2.03 (p, *J* = 6.7 Hz, 2H). **^{13}C NMR** (151 MHz, $CDCl_3$) δ 205.61, 134.27, 133.25, 132.61, 129.35, 128.49, 118.26, 56.47, 44.55, 36.82, 34.81, 26.72. **IR** (neat): 3077, 2923, 1708, 1481, 1439, 920, 748 cm^{-1}; **MS** (ES^+, *m/z*) Calculated for $C_{14}H_{17}ClNaOS$: 291.1; Found: 291.1 $[M+Na]^+$.

9-(benzyloxy)-4-(phenylthio)non-1-en-5-one (4q)

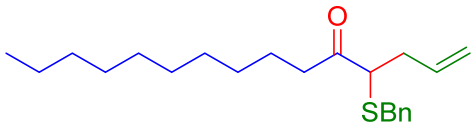
Work-up needed. Purified by flash column chromatography (hexanes/ethyl acetate, 10/1) to afford **4q** (50 mg, 71 %) as a pale yellow oil. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.42 – 7.36 (m, 2H), 7.36 – 7.31 (m, 4H), 7.31 – 7.24 (m, 4H), 5.79 (ddt, *J* = 17.0, 10.2, 6.8 Hz, 1H), 5.13 – 5.06 (m, 2H), 4.49 (s, 2H), 3.67 (dd, *J* = 8.1, 6.9 Hz, 1H), 3.46 (t, *J* = 6.2 Hz, 2H), 2.71 – 2.62 (m, 1H), 2.61 – 2.52 (m, 2H), 2.49 – 2.41 (m, 1H), 1.70 – 1.56 (m, 4H). **^{13}C NMR** (126 MHz, $CDCl_3$) δ 206.45, 138.73, 134.47, 133.18, 132.79, 129.26, 128.55, 128.32, 127.82, 127.71, 118.06, 77.48, 77.23, 76.98, 73.09, 70.16, 56.27, 39.89, 34.79, 29.33, 20.79. **IR** (neat): 3062, 2925, 2854, 1439, 1360, 1100, 919, 745 cm^{-1}; **MS** (ES^+, *m/z*) Calculated for $[C_{22}H_{27}O_2S]$: 355.17; Found: 355.17$[M+H]^+$.

4. Synthesis of target compounds 5 series



Compound **5** series were prepared using the same procedure of Compound **4** series.

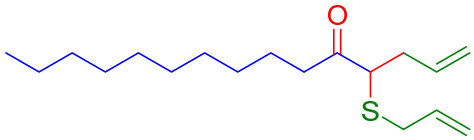
4-(benzylthio)pentadec-1-en-5-one (5a)



Purified by flash chromatography (hexanes/ethyl acetate, 30/1) to afford **5a** (41.3 mg, 60 %) as a pale yellow oil. **^{1}H NMR** (600 MHz, $CDCl_3$) δ 7.33 – 7.27 (m, 4H), 7.26 – 7.21 (m, 1H), 5.78 – 5.67 (m, 1H), 5.11 – 5.00 (m, 2H), 3.67 (d, *J* = 13.0 Hz, 1H), 3.59 (d, *J* = 13.0 Hz, 1H), 3.25 (dd, *J* = 8.3, 7.0 Hz, 1H), 2.63 – 2.56 (m, 1H), 2.55 – 2.50 (m, 2H), 2.43 – 2.36 (m, 1H), 1.59 – 1.51 (m, 2H), 1.33 – 1.22 (m, 14H), 0.88 (t, *J* = 7.0 Hz, 3H).

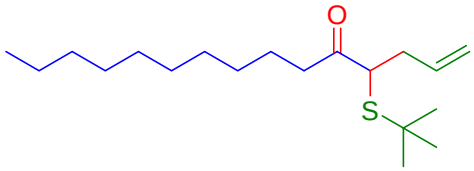
^{13}C NMR (151 MHz, $CDCl_3$) δ 206.55, 137.54, 134.67, 129.34, 128.76, 127.45, 117.71, 52.53, 39.36, 34.93, 34.45, 32.12, 29.80, 29.73, 29.63, 29.55, 29.42, 24.20, 22.91, 14.34. **IR** (neat): 3063, 3029, 2957, 2925, 2854, 1704, 1495, 1454, 917 cm^{-1}; **MS** (ES^+, *m/z*) Calculated for $C_{22}H_{34}NaOS$: 369.2; Found: 369.2 $[M+Na]^+$.

4-(allylthio)pentadec-1-en-5-one (5b)



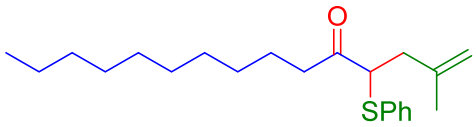
Purified by flash chromatography (hexanes/ethyl acetate, 50/1) to afford **5b** (43.2 mg, 76 %) as a pale yellow oil. ^{1}H **NMR** (500 MHz, $CDCl_3$) δ 5.82 – 5.67 (m, 2H), 5.23 – 5.00 (m, 4H), 3.35 – 3.20 (m, 1H), 3.16 – 2.98 (m, 2H), 2.65 – 2.48 (m, 3H), 2.46 – 2.33 (m, 1H), 1.66 – 1.48 (m, 2H), 1.34 – 1.19 (m, 14H), 0.87 (t, *J* = 7.0 Hz, 3H). ^{13}C **NMR** (126 MHz, $CDCl_3$) δ 206.71, 134.69, 133.64, 118.28, 117.71, 52.04, 39.32, 34.64, 33.68, 32.09, 29.77, 29.69, 29.61, 29.51, 29.38, 24.17, 22.88, 14.31. **IR** (neat): 3082, 2955, 2925, 2855, 1705, 1639, 1466, 1439, 989, 918 cm^{-1}; **MS** (ES^+, *m/z*) Calculated for $C_{18}H_{32}NaOS$: 319.2; Found: 319.2 $[M+Na]^+$.

4-(*tert*-butylthio)pentadec-1-en-5-one (5c)



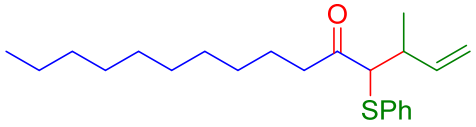
Purified by flash chromatography (hexanes/ethyl acetate, 50/1) to afford **5c** (29.3 mg, 47 %) as a pale yellow oil. ^{1}H **NMR** (500 MHz, $CDCl_3$) δ 5.80 – 5.67 (m, 1H), 5.12 – 5.01 (m, 2H), 3.33 (dd, *J* = 9.4, 6.1 Hz, 1H), 2.66 (dt, *J* = 17.0, 7.4 Hz, 1H), 2.62 – 2.54 (m, 1H), 2.49 (dt, *J* = 17.0, 7.4 Hz, 1H), 2.44 – 2.36 (m, 1H), 1.61 – 1.56 (m, 2H), 1.33 (s, 9H), 1.29 – 1.24 (m, 14H), 0.88 (t, *J* = 7.0 Hz, 3H). ^{13}C **NMR** (126 MHz, $CDCl_3$) δ 209.17, 134.88, 117.67, 51.91, 44.78, 38.49, 37.50, 32.12, 31.40, 29.81, 29.72, 29.65, 29.54, 29.44, 24.15, 22.91, 14.34. **IR** (neat): 3081, 2957, 2925, 2855, 1708, 1460, 1366, 1160, 917 cm^{-1}; **MS** (ES^+, *m/z*) Calculated for $C_{19}H_{36}NaOS$, 335.2; Found 335.2 $[M+Na]^+$.

2-methyl-4-(phenylthio)pentadec-1-en-5-one (5d)



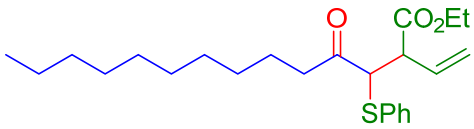
Purified by flash chromatography (hexanes/ethyl acetate, 30/1) to afford **5d** (50.5 mg, 73 %) as a pale yellow oil. **^{1}H NMR** (600 MHz, $CDCl_3$) δ 7.38 (dd, *J* = 7.8, 1.4 Hz, 2H), 7.32 – 7.27 (m, 3H), 4.83 (s, 1H), 4.73 (s, 1H), 3.84 (dd, *J* = 8.8, 6.6 Hz, 1H), 2.60 – 2.54 (m, 3H), 2.42 (dd, *J* = 14.9, 6.5 Hz, 1H), 1.74 (s, 3H), 1.57 – 1.49 (m, 2H), 1.32 – 1.18 (m, 14H), 0.88 (t, *J* = 7.0 Hz, 3H). **^{13}C NMR** (151 MHz, $CDCl_3$) δ 206.95, 141.84, 133.15, 132.89, 129.24, 128.17, 113.47, 55.02, 39.72, 38.70, 32.11, 29.77, 29.69, 29.59, 29.53, 29.38, 23.99, 22.90, 22.66, 14.33. **IR** (neat): 3077, 2925, 2854, 1709, 1456, 1439, 895, 747 cm^{-1}; **MS** (ES^+, *m/z*) Calculated for $C_{22}H_{34}NaOS$: 369.2; Found: 369.2 $[M+Na]^+$.

3-methyl-4-(phenylthio)pentadec-1-en-5-one (5e)



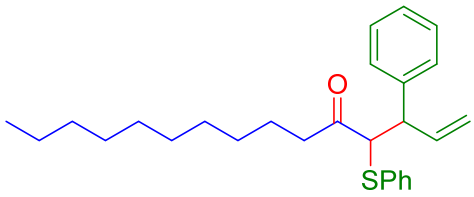
Purified by flash chromatography (hexanes/ethyl acetate, 30/1) to afford **5e** (51.2 mg, 74 %, dr = 65/35) as a pale yellow oil. **^{1}H NMR** (600 MHz, $CDCl_3$) δ 7.40 – 7.34 (m, 2H), 7.31 – 7.21 (m, 3H), 5.93 – 5.82 (m, 1H, major diastereoisomer), 5.76 – 5.66 (m, 1H, minor diastereoisomer), 5.18 – 5.10 (m, 2H, major diastereoisomer), 5.09 – 4.98 (m, 2H, minor diastereoisomer), 3.53 (d, *J* = 9.6 Hz, 1H, major diastereoisomer), 3.50 (d, *J* = 9.9 Hz, 1H, minor diastereoisomer), 2.71 – 2.62 (m, 1H), 2.59 – 2.50 (m, 1H), 2.49 – 2.37 (m, 1H), 1.53 – 1.45 (m, 2H), 1.28 (d, *J* = 6.8 Hz, 2H, minor diastereoisomer), 1.27 – 1.18 (m, 14H), 1.08 (d, *J* = 6.7 Hz, 2H, major diastereoisomer), 0.88 (t, *J* = 7.0 Hz, 3H). **^{13}C NMR** (151 MHz, $CDCl_3$) δ 207.32, 207.06, 140.43, 140.35, 134.16, 134.04, 132.46, 132.37, 129.32, 129.25, 127.91, 127.90, 116.09, 116.04, 63.80, 63.08, 40.61, 40.51, 38.97, 38.95, 32.15, 29.81, 29.71, 29.62, 29.56, 29.40, 24.02, 23.92, 22.94, 19.19, 18.50, 14.37. **IR** (neat): 3078, 2956, 2925, 2854, 1708, 1466, 917, 744 cm^{-1}; **MS** (ES^+, *m/z*) Calculated for $C_{22}H_{34}NaOS$: 369.2; Found: 369.2 $[M+Na]^+$.

Ethyl 4-oxo-3-(phenylthio)-2-vinyltetradecanoate (5f)



Work-up needed. Purified by flash chromatography (hexanes/ethyl acetate, 10/1) to afford **5f** (59 mg, 73 %, dr = 75/25) as a pale yellow oil. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.48 – 7.35 (m, 2H), 7.35 – 7.27 (m, 3H), 5.90 (ddd, *J* = 17.1, 10.2, 8.4 Hz, 1H, major diastereoisomer), 5.75 (ddd, *J* = 17.2, 10.2, 8.5 Hz, 1H, minor diastereoisomer), 5.39 – 5.27 (m, 2H, major diastereoisomer), 5.26 – 5.14 (m, 2H, minor diastereoisomer), 4.32 – 4.15 (m, 2H, minor diastereoisomer), 4.07 (q, *J* = 7.1 Hz, 2H, major diastereoisomer), 3.96 (d, *J* = 10.9 Hz, 1H, minor diastereoisomer), 3.90 (d, *J* = 11.2 Hz, 1H, major diastereoisomer), 3.57 (dd, *J* = 10.9, 8.5 Hz, 1H, minor diastereoisomer), 3.42 (dd, *J* = 11.2, 8.4 Hz, 1H, major diastereoisomer), 2.84 – 2.40 (m, 2H), 1.65 – 1.48 (m, 2H), 1.37 – 1.16 (m, 17H), 0.88 (t, *J* = 7.0 Hz, 3H). **^{13}C NMR** (126 MHz, $CDCl_3$) δ 205.43, 203.47, 172.35, 171.41, 134.28, 133.99, 133.02, 132.96, 132.64, 132.58, 131.95, 131.01, 129.11, 128.83, 120.17, 120.11, 61.19, 61.14, 57.57, 56.71, 50.82, 49.40, 41.29, 40.90, 31.89, 31.89, 29.56, 29.54, 29.48, 29.45, 29.37, 29.33, 29.31, 29.30, 29.15, 29.08, 23.86, 23.64, 22.68, 14.17, 13.97. **IR** (neat): 3061, 2926, 2855, 1728, 1713, 1466, 1440, 1369, 1353, 1195, 1156, 1025, 924, 748 cm^{-1}; **MS** (ES^+, *m/z*) Calculated for $C_{24}H_{36}NaO_3S$: 427.2; Found: 427.2 $[M+Na]^+$.

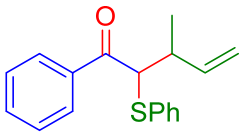
3-phenyl-4-(phenylthio)pentadec-1-en-5-one (5g)



Purified by flash chromatography (hexanes/ethyl acetate, 20/1) to afford **5g** (52.2 mg, 64 %, dr = 51/49) as a pale yellow oil. **^{1}H NMR** (600 MHz, $CDCl_3$) δ 7.47 – 7.40 (m, 1H), 7.38 – 7.11 (m, 9H), 6.19 (ddd, *J* = 17.1, 10.1, 8.3 Hz, 1H, major diastereoisomer), 5.95 (ddd, *J* = 16.9, 10.4, 8.2 Hz, 1H, minor diastereoisomer), 5.25 – 5.01 (m, 2H), 4.02 (dd, *J* = 16.0, 11.2 Hz, 1H), 3.75 (dd, *J* = 10.8, 8.6 Hz, 1H), 2.63 – 2.43 (m, 1H, minor diastereoisomer), 2.30 – 2.17 (m, 1H, major diastereoisomer), 1.55 – 1.48 (m, 1H), 1.31 – 1.06 (m, 14H), 1.01 – 0.93 (m, 1H), 0.91 – 0.86 (m, 3H). **^{13}C NMR** (151 MHz, $CDCl_3$)

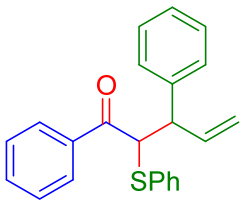
δ 206.47, 205.72, 141.29, 140.34, 138.67, 138.44, 133.44, 133.10, 129.26, 129.10, 128.92, 128.82, 128.62, 128.36, 128.25, 128.14, 127.35, 127.24, 117.63, 117.26, 62.40, 61.78, 51.06, 50.63, 41.23, 40.81, 32.12, 32.10, 29.78, 29.73, 29.69, 29.60, 29.54, 29.51, 29.47, 29.34, 29.04, 23.81, 23.59, 22.90, 22.90, 14.34. **IR** (neat): 3062, 3029, 2925, 2854, 1709, 1454, 1439, 1025, 919, 747 cm^{-1}; **MS** (ES^+, *m/z*) Calculated for $C_{27}H_{36}NaOS$: 431.1; Found: 431.2 $[M+Na]^+$.

3-methyl-1-phenyl-2-(phenylthio)pent-4-en-1-one (5h)



Purified by flash chromatography (hexanes/ethyl acetate, 20/1) to afford **5h** (46.8 mg, 83 %, dr = 61/39) as a pale yellow oil. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 6.89 – 6.82 (m, 2H), 6.57 – 6.50 (m, 1H), 6.45 – 6.38 (m, 2H), 6.37 – 6.32 (m, 2H), 6.28 – 6.21 (m, 3H), 5.16 – 4.96 (m, 1H, major diastereoisomer), 4.86 – 4.69 (m, 1H, minor diastereoisomer), 4.27 – 4.14 (m, 2H, major diastereoisomer), 4.08 – 3.90 (m, 2H, minor diastereoisomer), 3.32 (d, *J* = 9.7 Hz, 1H), 1.98 – 1.84 (m, 1H), 0.40 (d, *J* = 6.8 Hz, 3H, minor diastereoisomer), 0.09 (d, *J* = 6.7 Hz, 3H, major diastereoisomer). **^{13}C NMR** (126 MHz, $CDCl_3$) δ 195.87, 140.93, 140.54, 137.00, 134.49, 134.24, 133.22, 133.10, 129.17, 129.07, 128.76, 128.73, 128.65, 128.61, 128.58, 116.04, 115.90, 58.25, 57.77, 38.94, 38.47, 19.13, 17.99. **IR** (neat): 3061, 2972, 2928, 1678, 1447, 1270, 1001, 918, 748 cm^{-1}; **MS** (ES^+, *m/z*) Calculated for $C_{18}H_{18}NaOS$: 305.1; Found: 305.1 $[M+Na]^+$.

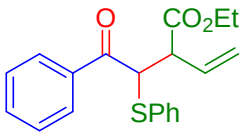
1,3-diphenyl-2-(phenylthio)pent-4-en-1-one (5i)



Purified by flash chromatography (hexanes/ethyl acetate, 20/1) to afford **5i** (57.8 mg, 84 %, dr =67/33) as a pale yellow oil. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.93 – 7.88 (m, 2H, minor diastereoisomer), 7.73 – 7.67 (m, 2H, major diastereoisomer), 7.59 – 6.99 (m,

13H), 6.38 (ddd, *J* = 17.0, 10.2, 8.2 Hz, 1H, major diastereoisomer), 5.96 (ddd, *J* = 17.0, 10.5, 7.5 Hz, 1H, minor diastereo-isomer), 5.32 – 5.12 (m, 2H, major diastereoisomer), 5.00 – 4.93 (m, 2H, minor diastereo -isomer), 4.86 (d, *J* = 11.1 Hz, 1H, major diastereoisomer), 4.81 (d, *J* = 11.0 Hz, 1H, minor diastereoisomer), 4.10 – 3.98 (m, 1H). **^{13}C NMR** (126 MHz, $CDCl_3$) δ 195.54, 194.71, 141.85, 140.63, 139.20, 138.75, 137.05, 136.89, 135.08, 133.24, 132.95, 129.22, 129.14, 129.00, 128.92, 128.85, 128.78, 128.76, 128.69, 128.60, 128.38, 128.19, 127.27, 126.91, 117.83, 117.19, 56.64, 56.45, 50.90, 50.26. **IR** (neat): 3061, 3028, 2920, 2850, 1678, 1447, 1267, 985, 749 cm^{-1}; **MS** (ES^+, *m/z*) Calculated for $C_{23}H_{20}NaOS$: 367.1; Found: 367.1 $[M+Na]^+$.

Ethyl 2-(2-oxo-2-phenyl-1-(phenylthio)ethyl)but-3-enoate (**5j**)



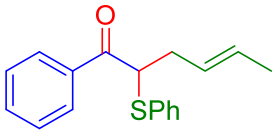
Work-up needed, then purified by flash chromatography (hexanes/ethyl acetate, 10/1) to afford **5j** (51.7 mg, 76 %, dr = 61/39) as a pale yellow oil, two diastereoisomers can be separated by PTLC (hexanes/DCM, 1/1).

Major diastereoisomer: **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.97 – 7.90 (m, 1H), 7.59 – 7.52 (m, 1H), 7.47 – 7.41 (m, 1H), 7.36 – 7.21 (m, 3H), 6.13 – 6.02 (m, 1H), 5.48 – 5.39 (m, 1H), 4.75 (d, *J* = 11.1 Hz, 1H), 4.11 – 3.98 (m, 1H), 3.64 (dd, *J* = 11.1, 8.3 Hz, 1H), 1.13 (t, *J* = 7.1 Hz, 2H). **^{13}C NMR** (126 MHz, $CDCl_3$) δ 194.97, 172.57, 136.06, 135.72, 133.46, 133.25, 130.30, 129.51, 129.21, 128.89, 128.75, 120.68, 61.38, 52.59, 50.00, 14.15. **IR** (neat): 3061, 2982, 2929, 1725, 1679, 1448, 1261, 1183, 1024, 750 cm^{-1}; **MS** (ES^+, *m/z*) Calculated for $C_{20}H_{20}NaO_3S$: 363.1; Found: 363.1 $[M+Na]^+$.

Minor diastereoisomer: **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.89 – 7.83 (m, 1H), 7.58 – 7.52 (m, 1H), 7.45 – 7.39 (m, 1H), 7.37 – 7.32 (m, 2H), 7.30 – 7.27 (m, 1H), 5.82 – 5.71 (m, 1H), 5.28 – 5.08 (m, 1H), 4.82 (d, *J* = 11.1 Hz, 1H), 4.41 – 4.23 (m, 1H), 3.83 (dd, *J* = 11.1, 8.2 Hz, 1H), 1.37 (t, *J* = 7.1 Hz, 2H). **^{13}C NMR** (126 MHz, $CDCl_3$) δ 192.67, 172.06, 136.36, 135.88, 133.39, 132.96, 130.78, 129.54, 129.20, 128.79, 128.76, 120.36, 120.25, 61.44, 52.58, 51.22, 14.49. **IR** (neat): 3060, 2982, 1732, 1679, 1447, 1268, 1154,

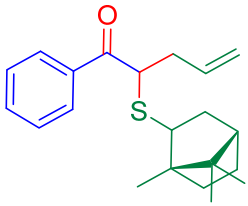
1025, 749 cm^{-1}; **MS** (ES^+, *m/z*) Calculated for $C_{20}H_{20}NaO_3S$: 363.1; Found: 363.1 $[M+Na]^+$.

1-phenyl-2-(phenylthio)hex-4-en-1-one (**5k**)



Purified by flash chromatography (hexanes/ethyl acetate, 20/1) to afford **5k** (35.5 mg, 63 %) as a pale yellow oil. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.95 – 7.89 (m, 2H), 7.55 (t, *J* = 7.4 Hz, 1H), 7.44 (t, *J* = 7.7 Hz, 2H), 7.38 – 7.33 (m, 2H), 7.32 – 7.24 (m, 3H), 5.60 – 5.43 (m, 2H), 4.47 (dd, *J* = 7.9, 6.6 Hz, 1H), 2.74 – 2.66 (m, 1H), 2.57 – 2.49 (m, 1H), 1.63 (dd, *J* = 6.0, 1.0 Hz, 3H). **^{13}C NMR** (126 MHz, $CDCl_3$) δ 195.71, 136.42, 134.77, 133.20, 132.07, 129.11, 128.80, 128.76, 128.75, 127.36, 51.64, 34.32, 18.20. **IR** (neat): 3059, 3025, 2916, 2854, 1679, 1447, 1234, 967, 748 cm^{-1}; **MS** (ES^+, *m/z*) Calculated for $C_{18}H_{18}NaOS$: 305.1; Found: 305.1 $[M+Na]^+$.

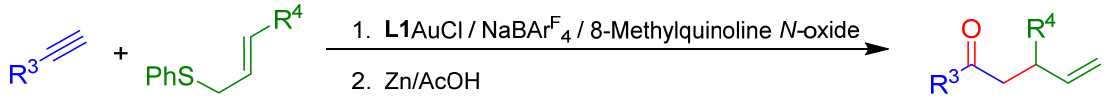
1-phenyl-2-(((1S,4S)-1,7,7-trimethylbicyclo[2.2.1]heptan-2-yl)thio)pent-4-en-1-one (**5l**)



Purified by flash chromatography (hexanes/ethyl acetate, 30/1) to afford **5l** (51.8 mg, 79 %, dr = 60/40) as a pale yellow oil. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 8.01 – 7.96 (m, 2H), 7.57 – 7.50 (m, 1H), 7.48 – 7.41 (m, 2H), 5.93 – 5.77 (m, 1H), 5.17 – 5.00 (m, 2H), 4.23 – 4.11 (m, 1H), 2.89 – 2.78 (m, 1H), 2.73 – 2.64 (m, 1H), 2.63 – 2.51 (m, 1H), 1.93 – 1.86 (m, 1H), 1.80 – 1.53 (m, 4H), 1.28 – 1.06 (m, 3H), 0.90 (s, 3H, minor diastereoisomer), 0.83 (s, 3H, major diastereoisomer), 0.81 (s, 3H, minor diastereoisomer), 0.77 (s, 3H, minor diastereoisomer), 0.74 (s, 3H, major diastereoisomer), 0.62 (s, 3H, major diastereoisomer). **^{13}C NMR** (126 MHz, $CDCl_3$) δ 196.53, 195.57, 147.83, 136.51, 136.49, 135.46, 135.39, 133.01, 133.01, 128.72, 128.70,

128.67, 128.65, 117.52, 117.50, 51.09, 51.03, 50.67, 50.63, 49.81, 49.79, 48.66, 48.64, 48.62, 48.58, 48.53, 48.53, 48.48, 47.36, 47.27, 46.44, 46.40, 46.26, 43.16, 42.14, 38.59, 38.56, 35.61, 35.53, 27.50, 27.47, 20.87, 20.84, 20.79, 20.75, 20.06, 20.02, 19.99, 19.96, 14.78, 14.75, 14.22, 14.21. **IR** (neat): 3077, 2953, 2878, 1674, 1448, 1236, 916 cm^{-1}; **MS** (ES^+, *m/z*) Calculated for $C_{21}H_{28}NaOS$: 351.2; Found: 351.2 $[M+Na]^+$.

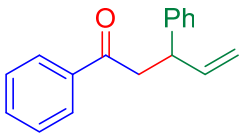
5. General Procedure for Synthesis of compound 6 and 7



To a 2 dram septum-capped vial were added sequentially alkyne (0.20 mmol), substituted allyllic sulfide (0.30 mmol, 1.5 *equiv*), **L1**AuCl (2.8 mg, 4 μmol, 0.02 *equiv*), $NaBAr^F_4$ (5.4 mg, 6 μmol, 0.03 *equiv*) and 1 mL dry DCE, then 8-methylquinoline N-oxide (19.7 mg, 0.26 mmol, 1.3 *equiv*) in 1 mL dry DCE was introduced into reaction by syringe pump at the rate of 0.1 mL per hour. After stirring at 60℃ for 10 h, cooled down to r.t. There is no need to purify for next step.

To above solution activated zinc powder (130 mg, 2 mmol) and acetic acid (0.5 mL) were added, the solution was stirred at 60℃ for 12 h. Cooled down to r.t., the precipitate was filtered and washed by chloroform. The filtrate was washed with saturated K_2CO_3 and brine, then dried over anhydrous Na_2SO_4. After removed the solvent, the residue was purified through flash chromatography on silica gel to afford compound **6** or **7** as following.

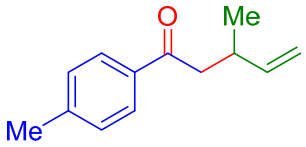
1, 3-Diphenylpent-4-en-1-one (6)



Purified by flash chromatography (hexanes/ethyl acetate, 20/1) to afford **7** (37 mg, 79 %) as a colorless oil. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.99 – 7.92 (m, 2H), 7.59 – 7.53 (m, 1H), 7.49 – 7.43 (m, 2H), 7.35 – 7.27 (m, 4H), 7.24 – 7.20 (m, 1H), 6.07 (ddd, *J* = 17.1, 10.3, 6.8 Hz, 1H), 5.12 – 5.01 (m, 2H), 4.21 – 4.12 (m, 1H), 3.46 (dd, *J* = 16.6, 7.7 Hz,

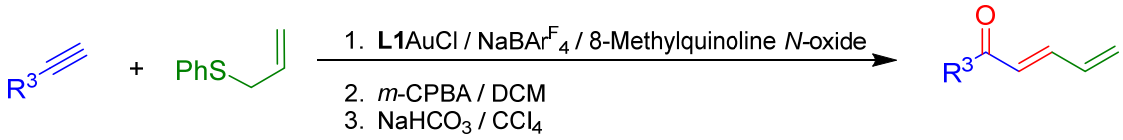
1H), 3.38 (dd, *J* = 16.6, 6.5 Hz, 1H). **^{13}C NMR** (126 MHz, $CDCl_3$) δ 198.43, 143.34, 140.86, 137.31, 133.22, 128.78, 128.77, 128.25, 127.91, 126.74, 114.91, 44.72, 44.21. **IR** (neat): 3062, 3029, 2979, 2898, 1686, 1598, 1449, 1205, 989, 916, 746 cm^{-1}; **MS** (ES^+, *m/z*) Calculated for $C_{17}H_{16}NaO$: 259.1; Found: 259.1 $[M+Na]^+$. Data was in accordance with that reported in the literature [8].

3-Methyl-1-(p-tolyl) pent-4-en-1-one (7)



Purified by flash chromatography (hexanes/ethyl acetate, 20/1) to afford **7** (31 mg, 82 %) as a colorless oil. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.85 (d, *J* = 8.2 Hz, 2H), 7.25 (d, *J* = 7.5 Hz, 2H), 5.85 (ddd, *J* = 13.9, 10.4, 6.5 Hz, 1H), 4.98 (ddt, *J* = 32.4, 10.3, 1.3 Hz, 2H), 3.05 – 2.95 (m, 1H), 2.93 – 2.81 (m, 2H), 2.41 (s, 3H), 1.09 (d, *J* = 6.6 Hz, 3H). **^{13}C NMR** (126 MHz, $CDCl_3$) δ 199.22, 143.91, 143.37, 135.06, 129.45, 128.45, 113.15, 45.24, 33.91, 21.83, 20.00. **IR** (neat): 3081, 2963, 2927, 1682, 1606, 1282, 1181, 914, 807 cm^{-1}; **MS** (ES^+, *m/z*) Calc. for $C_{13}H_{16}NaO$: 211.11; Found: 211.11 $[M+Na]^+$.

6. General procedure for synthesis of compound 8 and 9



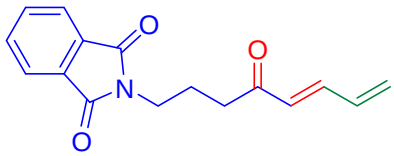
In a 8 mL septum-capped vial, alkyne (0.20 mmol), substituted allyl sulfide (0.30 mmol, 1.5 *equiv*), **L1**AuCl (2.8 mg, 4 μmol, 0.02 *equiv*), $NaBAr^F_4$ (5.4 mg, 6 μmol, 0.03 *equiv*) and 1 mL dry DCE were mixed and sealed, then 8-methylquinoline N-oxide (19.7 mg, 0.26 mmol, 1.3 *equiv*) in 1 mL DCE was introduced into reaction by syringe pump at the rate of 0.1 mL/hour. After stirring at 60℃ for 10 h, Removing the solvent under reduced pressure, the residue was purified through flash chromatography on silica gel to afford the intermediate (**4q** or **4m**, corresponding yields and spectral data, please see syntheses of compounds **4** series in details)

To a cooled (-78℃) solution of allylketo sulfide **4q**/**4m** (0.15 mmol) in DCM (4 mL), *m*-chloroperoxybenzoic acid (0.15 mmol) in DCM (2 mL) was added. After being stirred for 3 h, the mixture was hydrolysed with 5% sodium bisulfite, then extracted with DCM. The organic layers were washed with saturated $NaHCO_3$ solution and NaCl solution, dried over anhydrous $MgSO_4$ and evaporated under reduced pressure. The crude product in CCl_4 (2 mL) was refluxed for 5 h in the presence of $NaHCO_3$ (25 mg, 0.30 mmol). The reaction mixture was hydrolysed with water and extracted with ether. The organic layer was washed and dried. After concentration under reduced pressure the crude product was purified by flash column chromatography on silica gel to afford compound **8** or **9** as following.

(E)-9-(benzyloxy)nona-1,3-dien-5-one (8)

Synthesized from **4q** and Purified by flash chromatography (hexanes/ethyl acetate, 10/1) to afford **8** (28 mg, 76.5 %) as a colorless oil. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.37 – 7.31 (m, 4H), 7.31 – 7.26 (m, 1H), 7.12 (dd, *J* = 15.6, 10.8 Hz, 1H), 6.45 (dt, *J* = 16.9, 10.4 Hz, 1H), 6.17 (d, *J* = 15.7 Hz, 1H), 5.64 (d, *J* = 16.9 Hz, 1H), 5.53 (d, *J* = 10.8 Hz, 1H), 4.50 (s, 2H), 3.49 (t, *J* = 6.2 Hz, 2H), 2.60 (t, *J* = 7.3 Hz, 2H), 1.77 – 1.70 (m, 2H), 1.68 – 1.62 (m, 2H). **^{13}C NMR** (126 MHz, $CDCl_3$) δ 200.77, 142.57, 138.75, 135.49, 130.57, 128.57, 127.85, 127.73, 126.38, 70.23, 40.47, 29.46, 21.23. **IR** (neat): 3090, 3063, 3031, 2929, 2859, 1710, 1454, 1363, 1103, 736 cm^{-1}; **MS** (ES^+, *m/z*) Calc. for $C_{15}H_{18}NaO_2$: 267.13; Found: 267.15$[M+Na]^+$.

(E)-2-(4-oxoocta-5,7-dien-1-yl)isoindoline-1,3-dione (**9**)



Synthesized from **4m** and Purified by flash chromatography (hexanes/ethyl acetate, 5/1) to afford **9** (32 mg, 82.5 %) as a white solid. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.37 – 7.31

(m, 4H), 7.31 – 7.26 (m, 1H), 7.12 (dd, *J* = 15.6, 10.8 Hz, 1H), 6.45 (dt, *J* = 16.9, 10.4 Hz, 1H), 6.17 (d, *J* = 15.7 Hz, 1H), 5.64 (d, *J* = 16.9 Hz, 1H), 5.53 (d, *J* = 10.8 Hz, 1H), 4.50 (s, 2H), 3.49 (t, *J* = 6.2 Hz, 2H), 2.60 (t, *J* = 7.3 Hz, 2H), 1.77 – 1.70 (m, 2H), 1.68 – 1.62 (m, 2H). **^{13}C NMR** (126 MHz, $CDCl_3$) δ 200.77, 142.57, 138.75, 135.49, 130.57, 128.57, 127.85, 127.73, 126.38, 70.23, 40.47, 29.46, 21.23. **IR** (neat): 3063, 3029, 2927, 2851, 1770, 1709, 1590, 1390, 1361, 1009, 719 cm^{-1}; **MS** (ES^+, *m/z*) Calc. for $C_{15}H_{16}NaNO_3$: 292.09; Found: 292.09 $[M+Na]^+$.

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[2] Lukas H., *et al.* Aldol Synthesis by anti-Markovnikov hydration of propargyloxy substrates: feasibility, stereospecifity, and reiterative alkynylation-hydration. *Synlett*, **2009** (15), 2412-2416;

[3] Fu, J., *et al.* Gold-Catalyzed Rearrangement of Allylic Oxonium Ylides: Efficient Synthesis of Highly Functionalized Dihydrofuran-3-ones. *Angew. Chem. Int. Ed.*, **2013**, *52*(15): 4198-4202.

[4] Furuta, Kyoji *et al*. Selective condensation of [3-(alkylthio)allyl]titanium reagent with carbonyl compounds. *Bull. Chem. Soc. Japan*, **1984**, *57*(10), 2781-90

[5] Jiang, Yubo *et al.* Catalyst-free imidation of allyl sulfides with chloramine-T and subsequent [2,3]-sigmatropic rearrangement. *Chinese J. Chem.*, **2012**, *30*(9), 2029-2035;

[6] José M. Blanco *et al.* Synthesis of Chiral Sulfinic Acids: Sodium(1S-exo)-2-Bornanesulfinate. *Synthesis*, **1990**, (7), 584-586

[7] Liao Mingyi, *et al*. Highly efficient [2,3]-sigmatropic rearrangement of sulfur ylide derived from Rh(II) carbene and sulfides in water *Green Chemistry*, **2007**, *9*(2), 184-188.

[8] Evans P. Andrew, *et al*. Regioselective and Enantiospecific Rhodium-Catalyzed Allylic Alkylation Reactions Using Copper(I) Enolates: Synthesis of (-)-Sugiresinol Dimethyl Ether. *J. Am. Chem. Soc.,* **2003**, *125*(30), 8974-8975.

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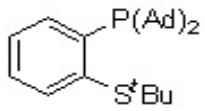

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29.1518
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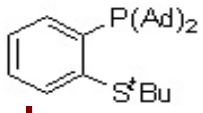

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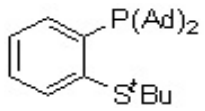

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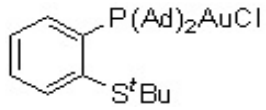

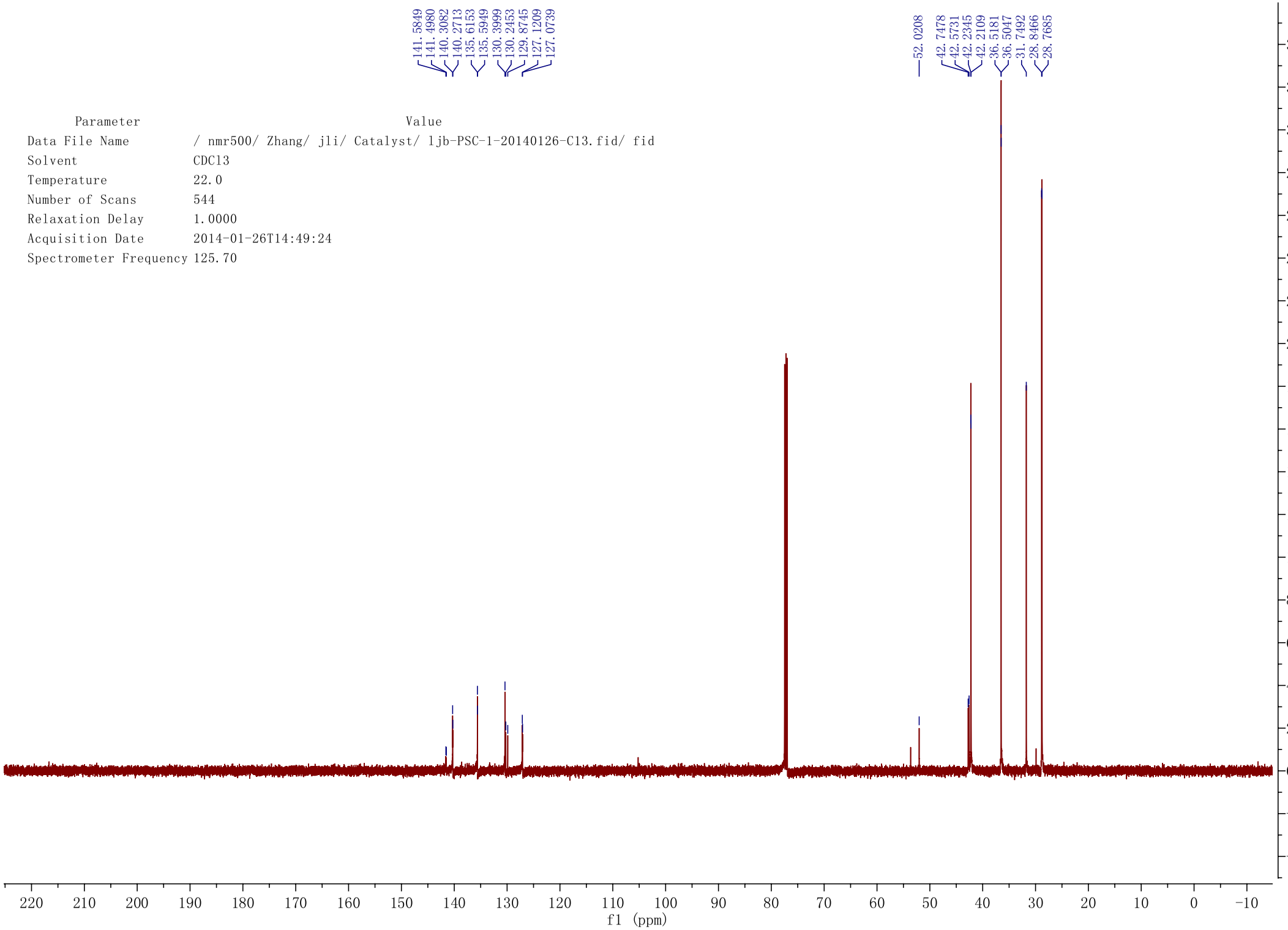
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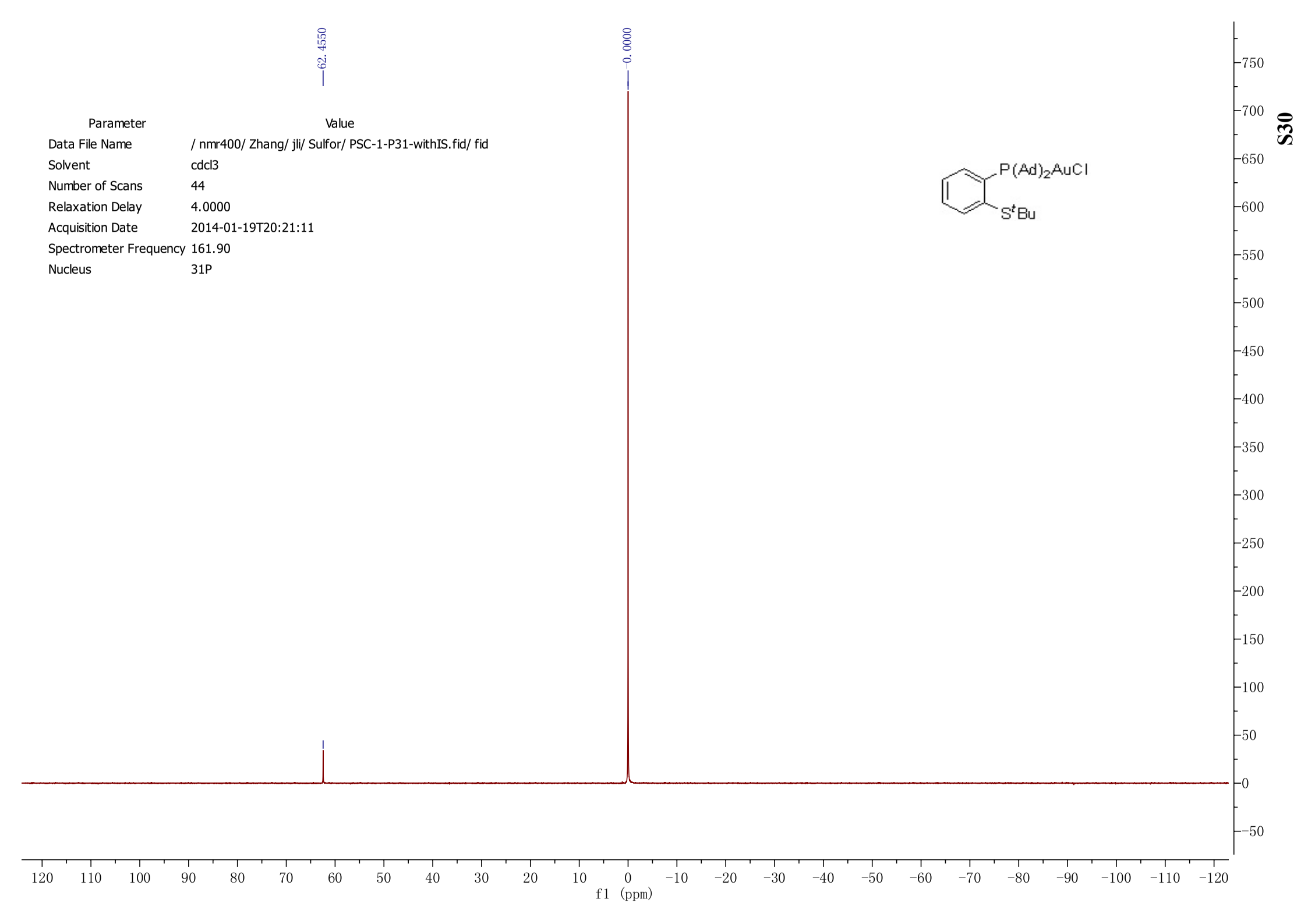
f1 (ppm)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Nucleus 31P
P(Ad)2AuCl
StBu
f1 (ppm)

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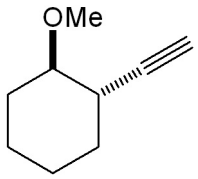

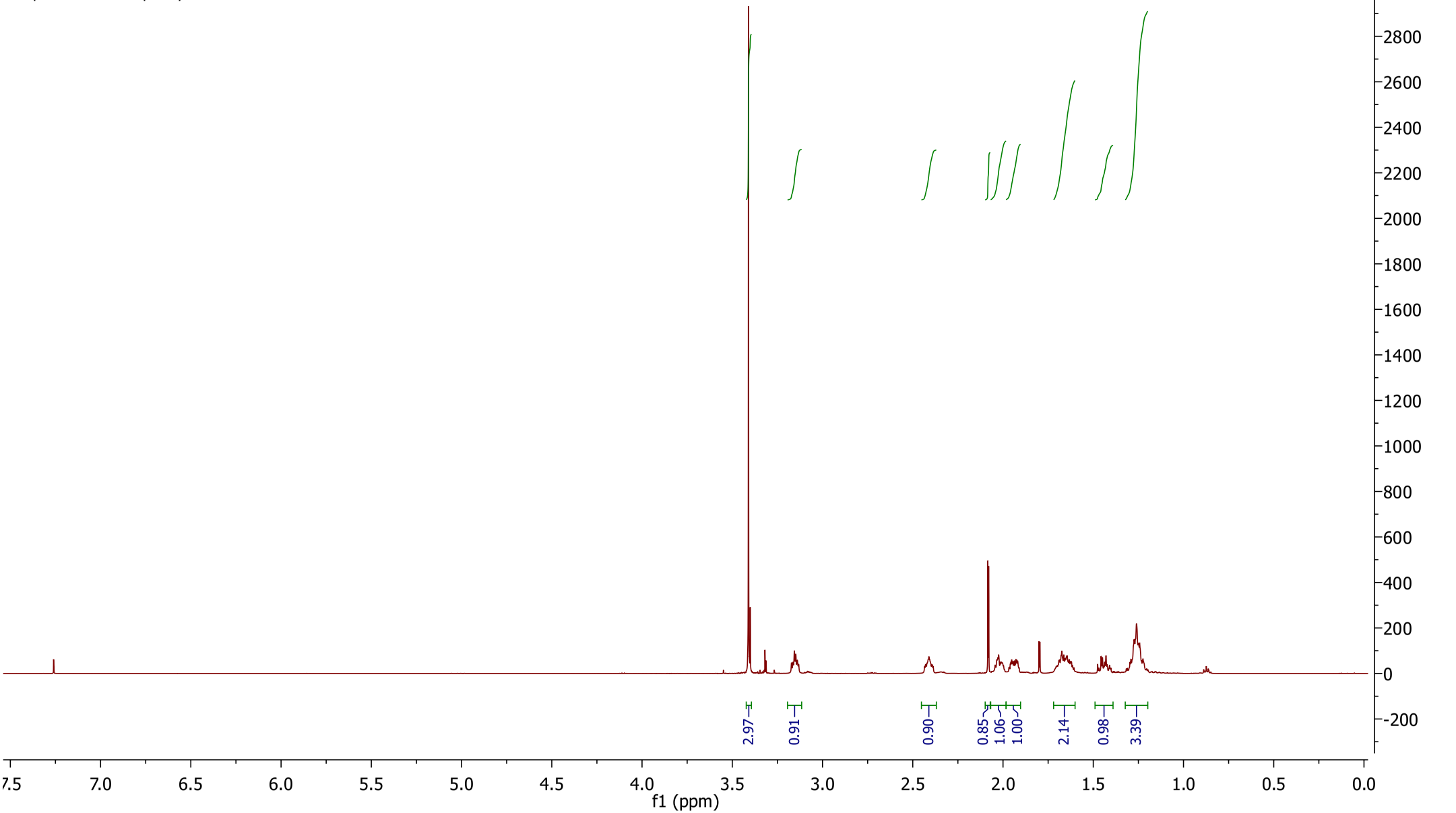

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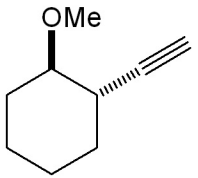

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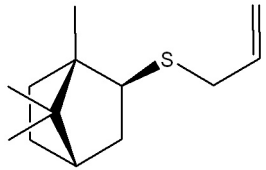

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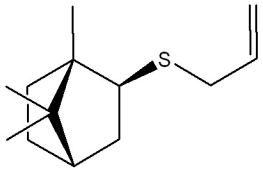

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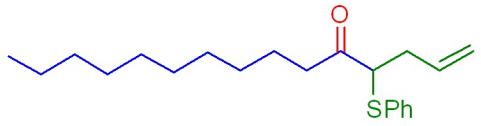

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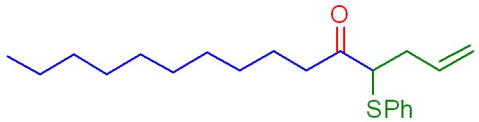

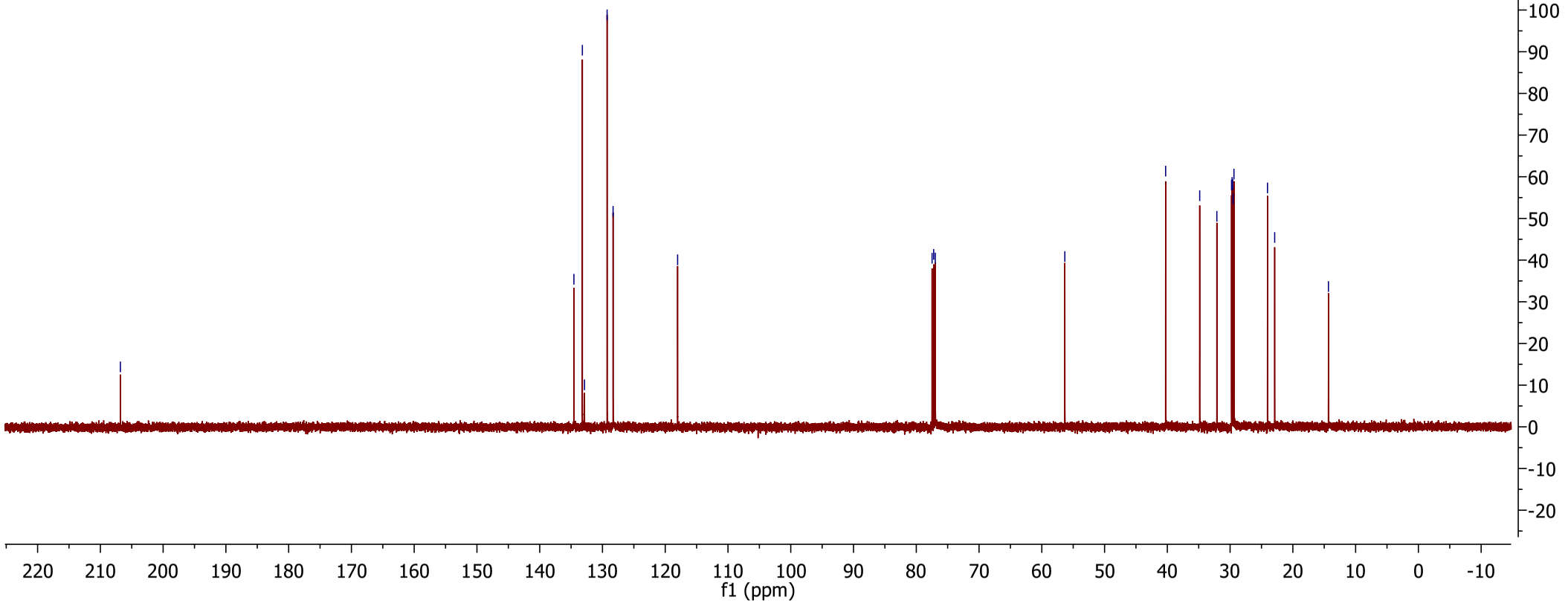

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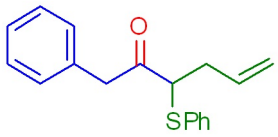

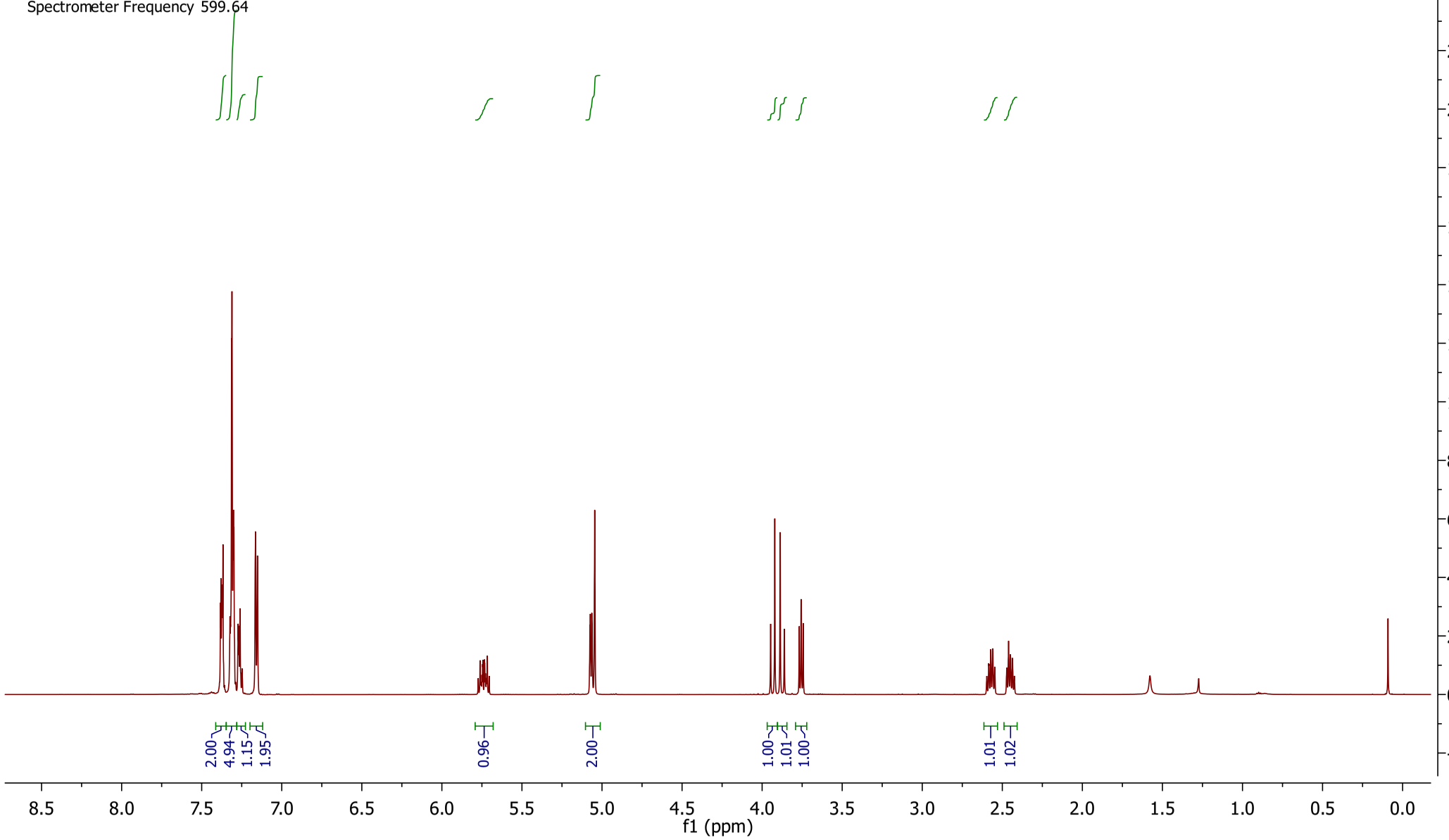

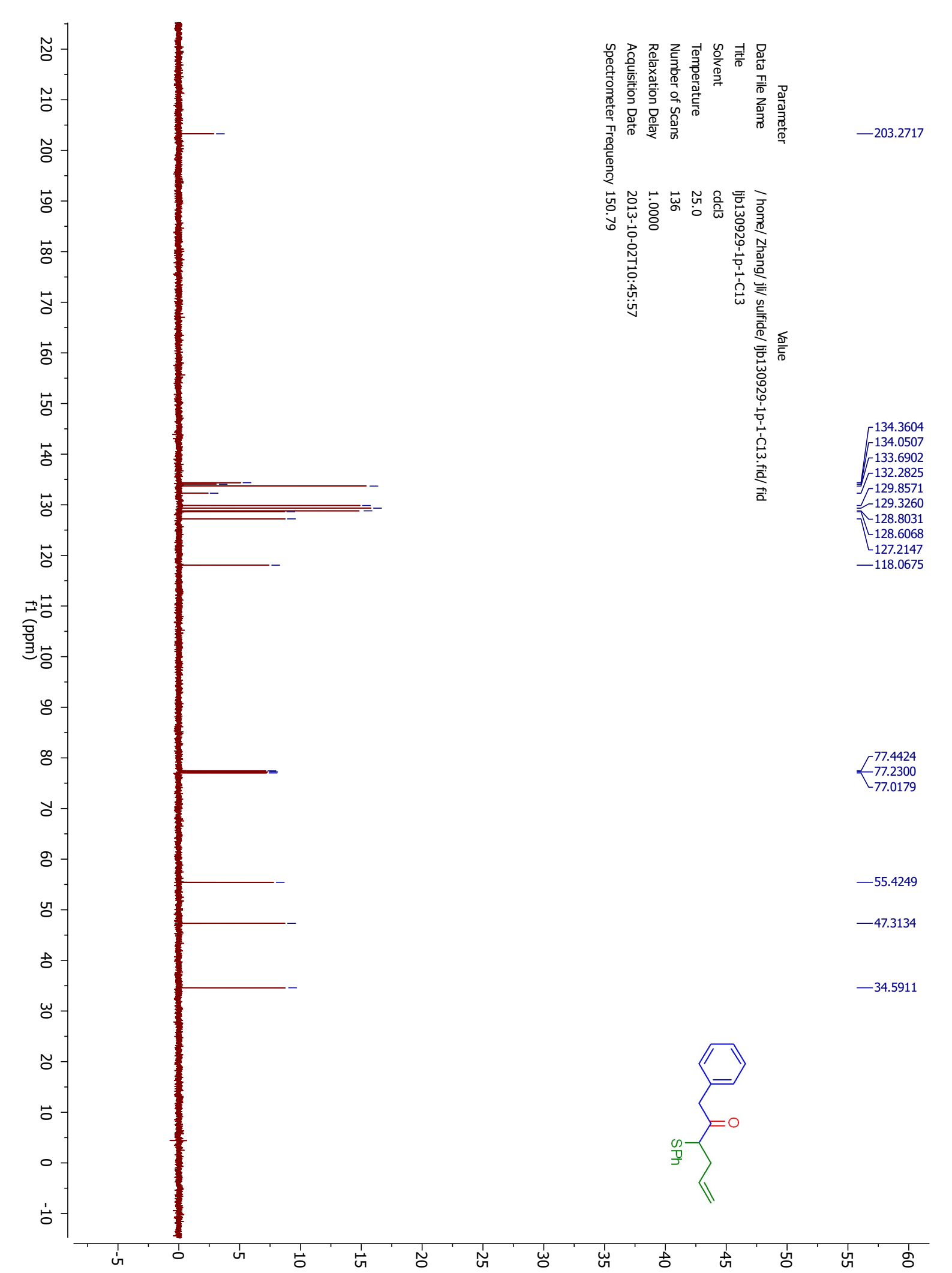
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Temperature
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Number of Scans
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Relaxation Delay
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SPh
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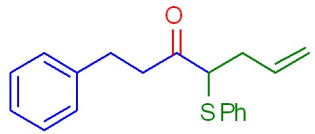

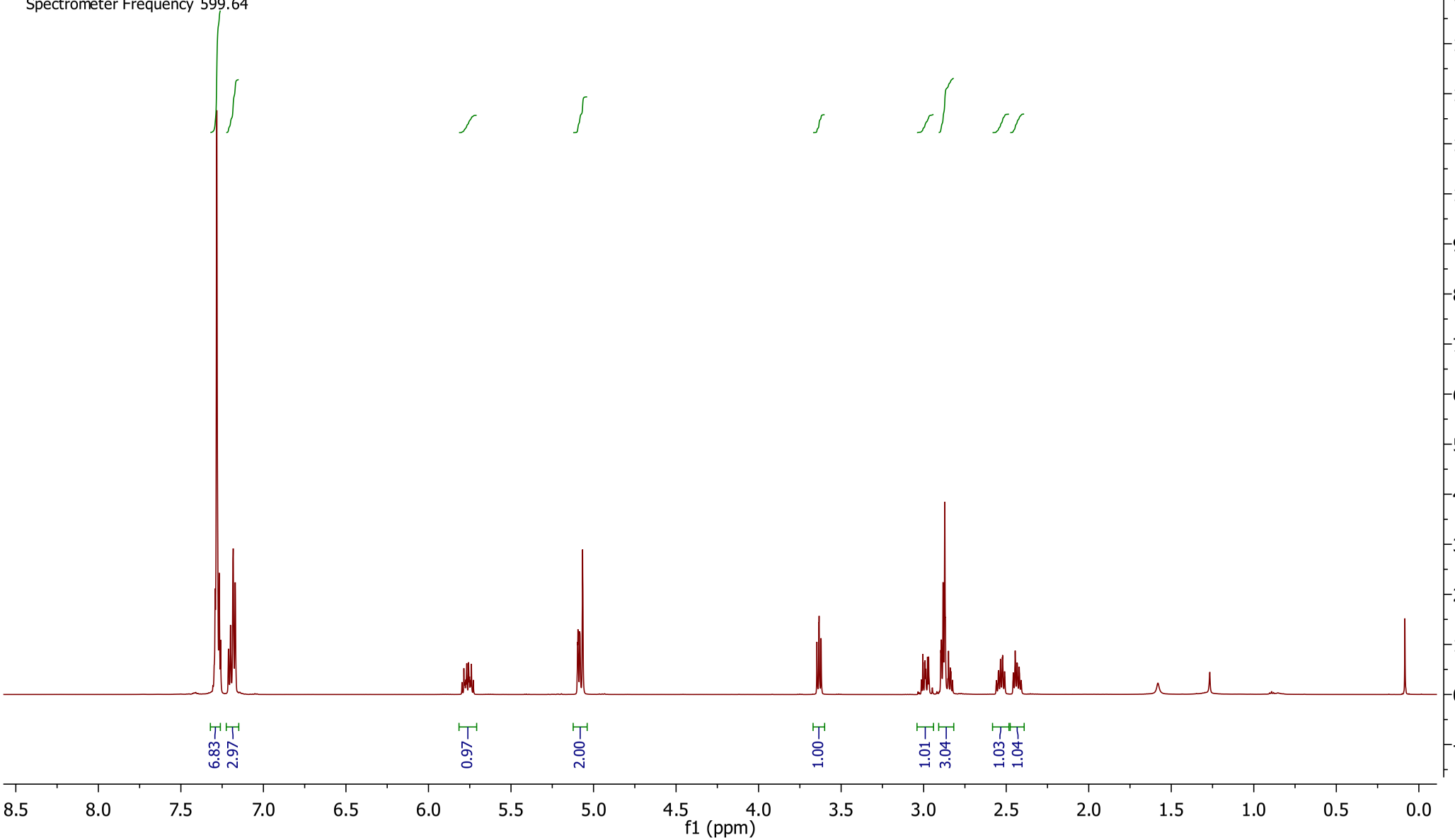

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Parameter	Value
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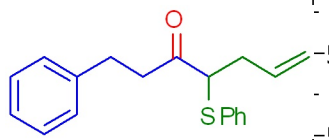

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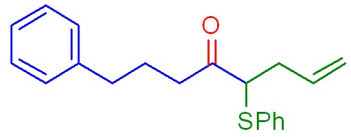

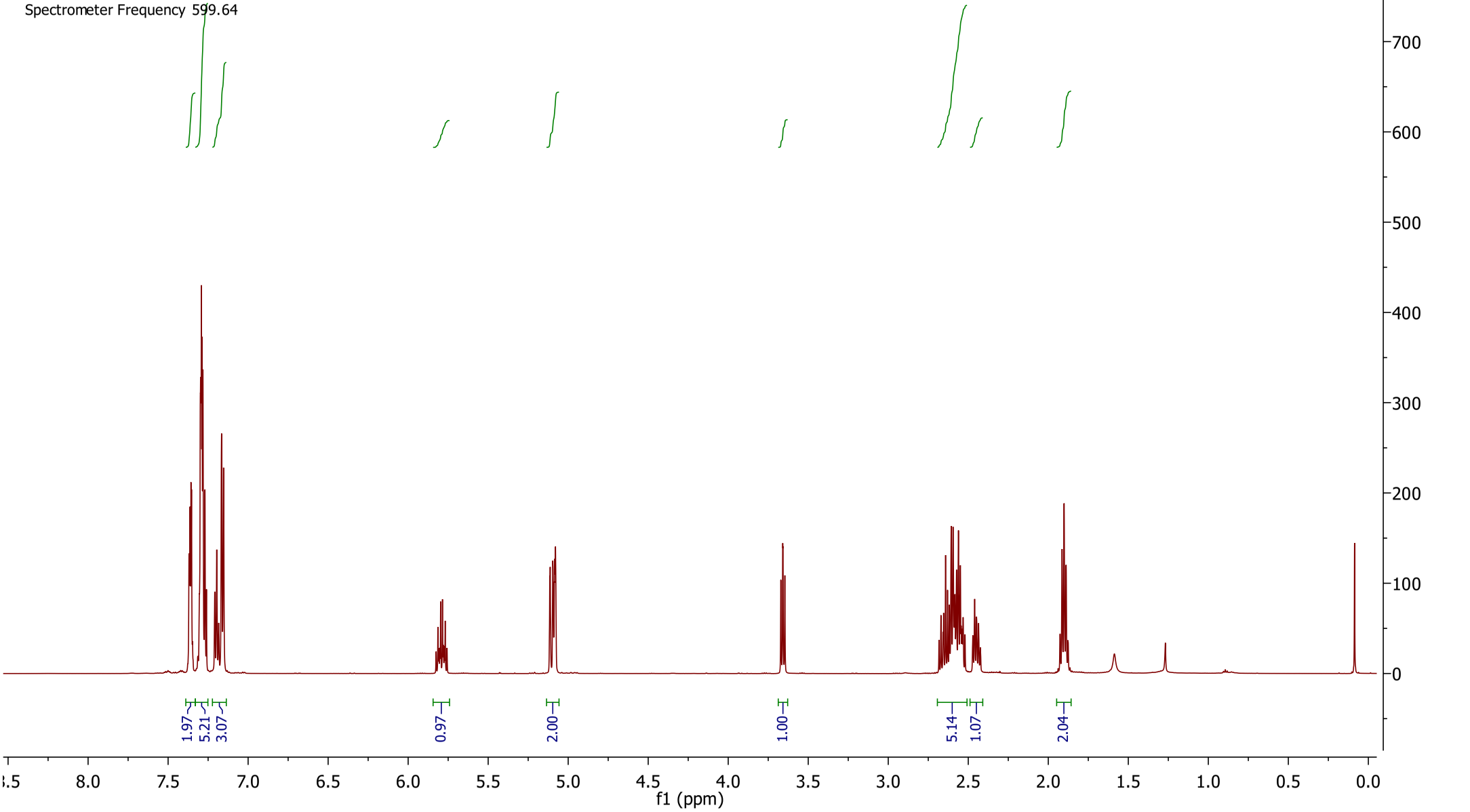

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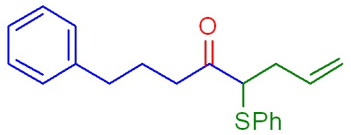

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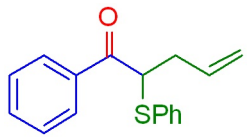

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Parameter	Value
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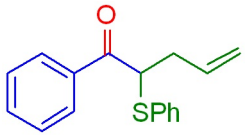
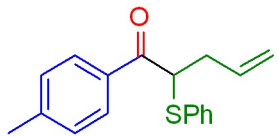
Title	ljb131001-1p-1-C13
Solvent	CDCl3
Temperature	80.0
Number of Scans	120
Relaxation Delay	1.0000
Acquisition Date	2013-10-11T13:22:01
Spectrometer Frequency	125.70



f1 (ppm)

Parameter	Value
Data File Name	/ nmr500/ Zhang/ jli/ sulfide/ ljb130926-6p-11.fid/ fid
Title	ljb130926-6p-11
Solvent	CDCl3
Temperature	25.0
Number of Scans	16
Relaxation Delay	10.0000
Acquisition Date	2013-10-01T09:31:49
Spectrometer Frequency	499.86

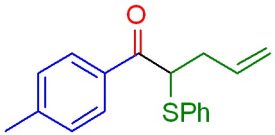


2.00 1.92 2.88 2.03 0.96 2.00 1.00 1.00 1.02 3.01

f1 (ppm)

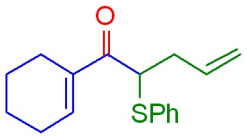
195.1135
144.1596
135.0672
134.8721
133.6997
129.4923
129.1294
128.9045
128.8637
117.8514
77.4831
77.2300
76.9766
50.9504
35.3622
21.8648

Parameter	Value
Data File Name	/ nmr500/ Zhang/ jli/ sulfide/ ljb130926-6p-11-C13.fid/ fid
Title	ljb130926-6p-11-C13
Solvent	CDCl3
Temperature	25.0
Number of Scans	144
Relaxation Delay	1.0000
Acquisition Date	2013-10-01T09:32:55
Spectrometer Frequency	125.70



f1 (ppm)

Parameter	Value
Data File Name	/ nmr500/ Zhang/ jli/ sulfide/ ljb130926-5p-11.fid/ fid
Title	ljb130926-5p-11
Solvent	CDCl3
Temperature	25.0
Number of Scans	16
Relaxation Delay	10.0000
Acquisition Date	2013-10-01T09:19:21
Spectrometer Frequency	499.86

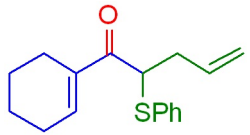


1.90 2.90 0.98 0.91 1.99 1.00 1.01 1.03 1.06 3.08 4.47

f1 (ppm)

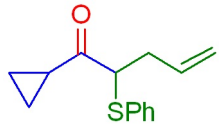
197.0099
140.4517
138.6384
135.1806
134.6832
133.0002
129.0709
128.5985
117.6411
77.4851
77.2300
76.9781
49.7930
35.6501
26.3247
23.7921
22.1291
21.6180

Parameter	Value
Data File Name	/ nmr500/ Zhang/ jli/ sulfide/ ljb130926-5p-11-C13.fid/ fid
Title	ljb130926-5p-11-C13
Solvent	CDCl3
Temperature	25.0
Number of Scans	124
Relaxation Delay	1.0000
Acquisition Date	2013-10-01T09:20:20
Spectrometer Frequency	125.70



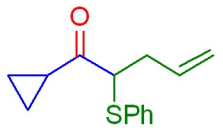
f1 (ppm)

Parameter	Value
Data File Name	/ nmr500/ Zhang/ jli/ sulfide/ ljb130918-1p.fid/ fid
Title	ljb130918-1p
Solvent	CDCl3
Temperature	25.0
Number of Scans	16
Relaxation Delay	10.0000
Acquisition Date	2013-09-26T12:57:42
Spectrometer Frequency	499.86

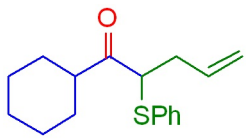


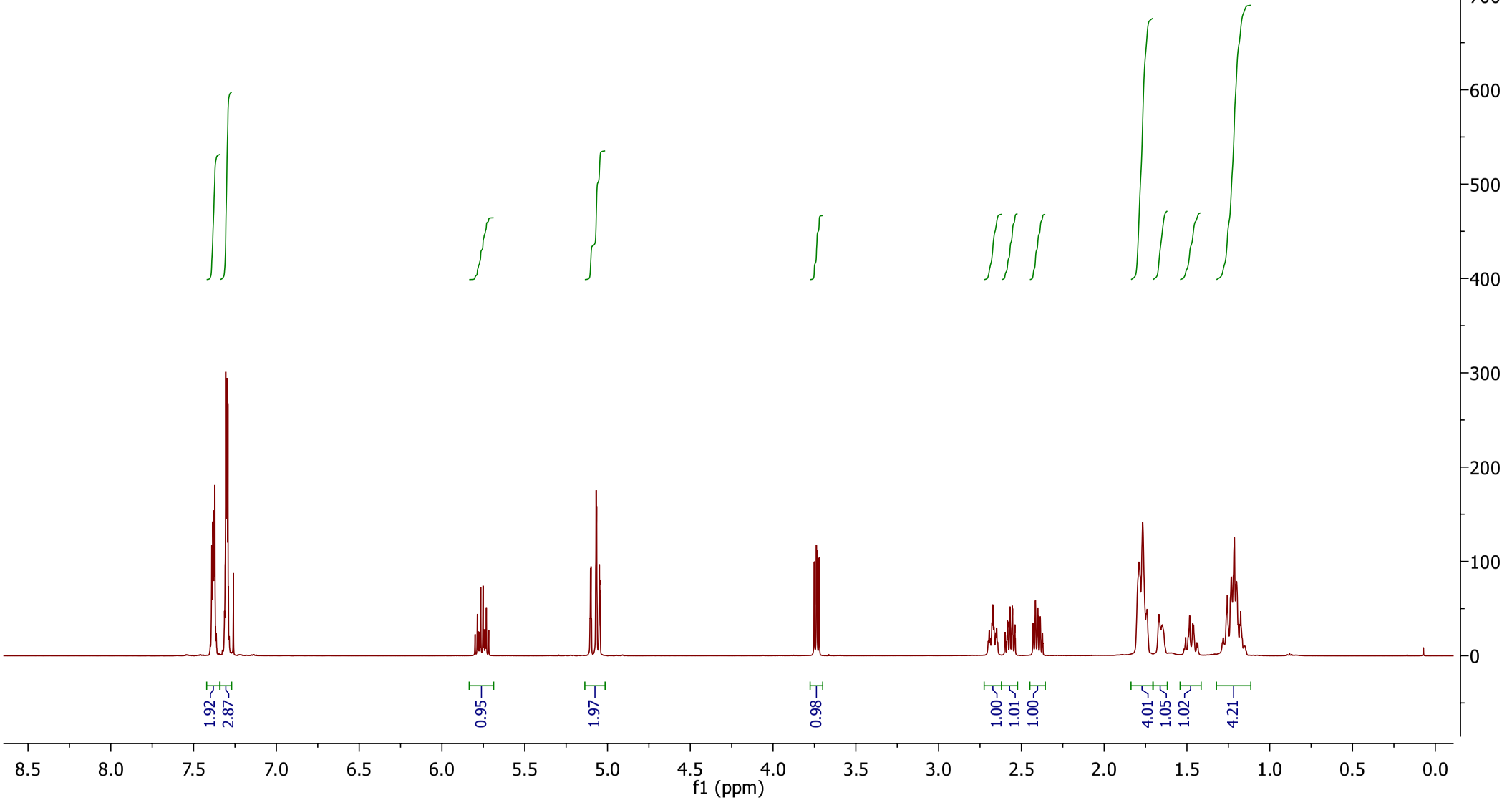
206.6073
134.5335
133.3295
132.7450
129.1784
128.2632
117.9644
77.4814
77.2300
76.9743
57.5393
34.8625
19.0008
11.8337
11.7156

Parameter	Value
Data File Name	/ nmr500/ Zhang/ jli/ sulfide/ ljb130918-1p-C13.fid/ fid
Title	ljb130918-1p-C13
Solvent	CDCl3
Temperature	25.0
Number of Scans	120
Relaxation Delay	1.0000
Acquisition Date	2013-09-26T12:58:12
Spectrometer Frequency	125.70



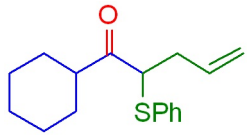
Parameter	Value
Data File Name	/ nmr500/ Zhang/ jli/ sulfide/ ljb130918-2p.fid/ fid
Title	ljb130918-2p
Solvent	CDCl3
Temperature	25.0
Number of Scans	16
Relaxation Delay	10.0000
Acquisition Date	2013-09-25T22:18:53
Spectrometer Frequency	499.86

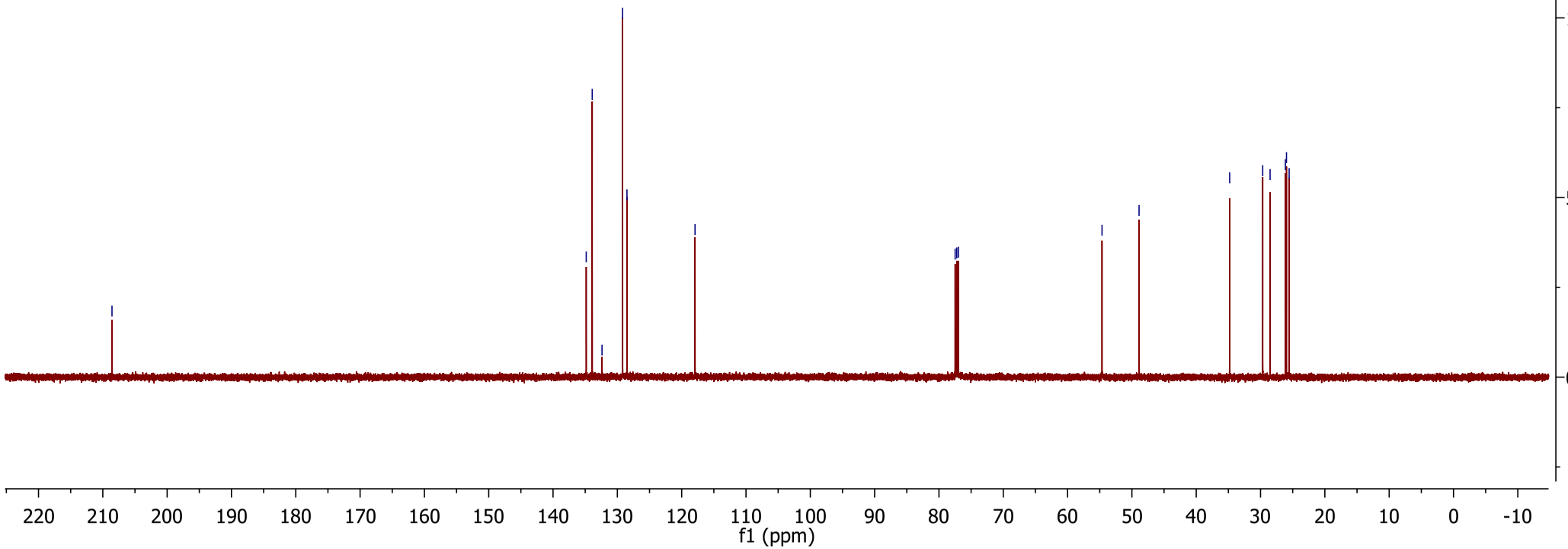




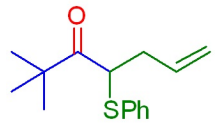
208.5741
134.8397
133.9092
132.3868
129.1879
128.5067
117.9245
77.4836
77.2298
76.9752
54.6456
48.8868
34.7981
29.6619
28.5145
26.1361
25.9656
25.5521

Parameter	Value
Data File Name	/ nmr500/ Zhang/ jli/ sulfide/ ljb130918-2p-C13.fid/ fid
Title	ljb130918-2p-C13
Solvent	CDCl3
Temperature	25.0
Number of Scans	88
Relaxation Delay	1.0000
Acquisition Date	2013-09-25T22:19:43
Spectrometer Frequency	125.70



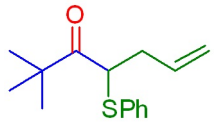


Parameter	Value
Data File Name	/ nmr500/ Zhang/ jli/ sulfide/ ljb130929-4p-1.fid/ fid
Title	ljb130929-4p-1
Solvent	CDCl3
Temperature	24.0
Number of Scans	16
Relaxation Delay	10.0000
Acquisition Date	2013-10-05T17:41:44
Spectrometer Frequency	499.86



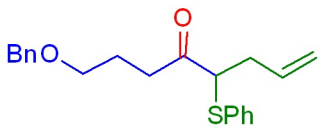
210.4589
134.9453
134.4115
132.5945
129.1180
128.6233
118.1161
77.4840
77.2299
76.9773
49.8196
44.2439
36.8954
27.0619

Parameter	Value
Data File Name	/ nmr500/ Zhang/ jli/ sulfide/ ljb130929-4p-1-C13.fid/ fid
Title	ljb130929-4p-1-C13
Solvent	CDCl3
Temperature	24.0
Number of Scans	120
Relaxation Delay	1.0000
Acquisition Date	2013-10-05T17:43:44
Spectrometer Frequency	125.70



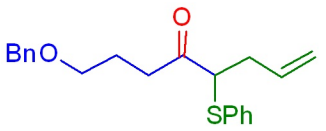
f1 (ppm)

Parameter	Value
Data File Name	/ nmr500/ Zhang/ jli/ sulfide/ ljb131028-2p-1st.fid/ fid
Title	ljb131028-2p-1st
Solvent	CDCl3
Temperature	22.0
Number of Scans	16
Relaxation Delay	10.0000
Acquisition Date	2013-11-02T22:52:39
Spectrometer Frequency	499.86



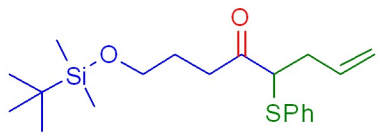
206.3640
138.6006
134.5316
133.2186
132.7830
129.2752
128.5609
128.3297
127.8253
127.7580
118.0470
77.4853
77.2300
76.9781
73.0380
69.4529
56.4153
36.9074
34.7433
24.1970

Parameter	Value
Data File Name	/ nmr500/ Zhang/ jli/ sulfide/ ljb131028-2p-1st-C13.fid/ fid
Title	ljb131028-2p-1st-C13
Solvent	CDCl3
Temperature	22.0
Number of Scans	188
Relaxation Delay	1.0000
Acquisition Date	2013-11-02T22:53:03
Spectrometer Frequency	125.70



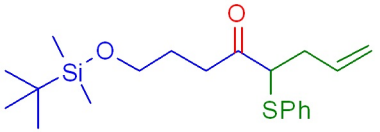
f1 (ppm)

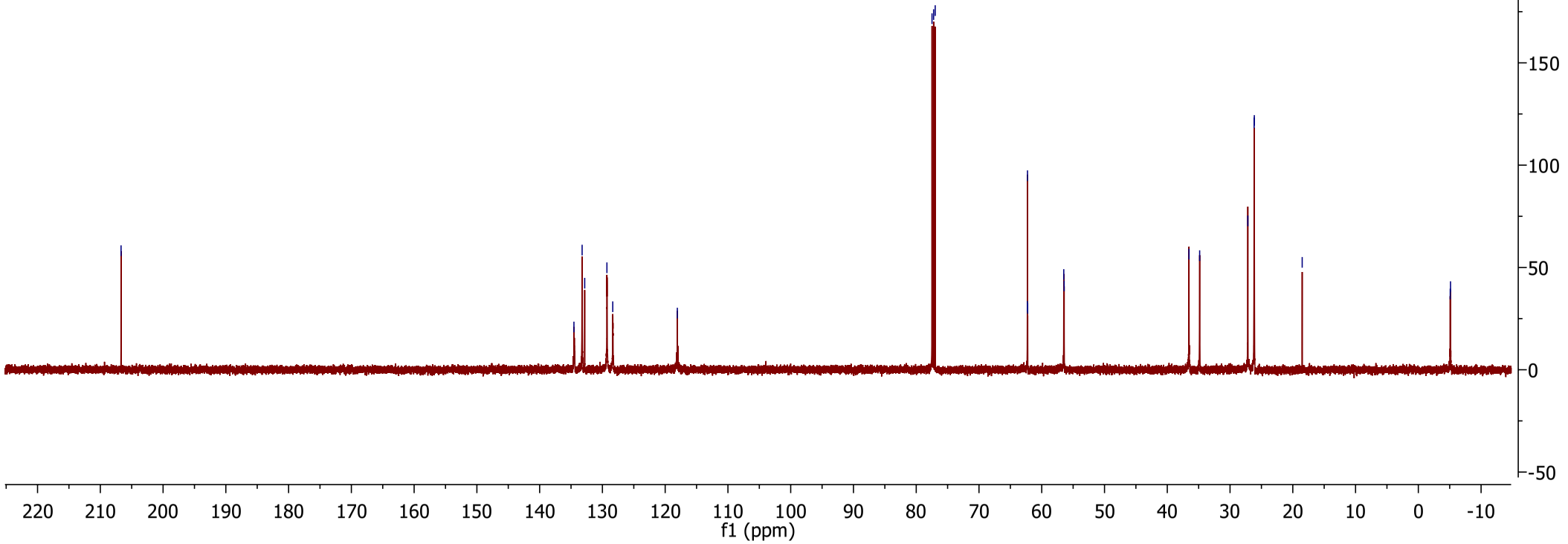
Parameter	Value
Data File Name	/ nmr500/ Zhang/ jli/ sulfide/ ljb131028-1p-1st.fid/ fid
Title	ljb131028-1p-1st
Solvent	CDCl3
Temperature	22.0
Number of Scans	16
Relaxation Delay	10.0000
Acquisition Date	2013-11-02T22:11:53
Spectrometer Frequency	499.86



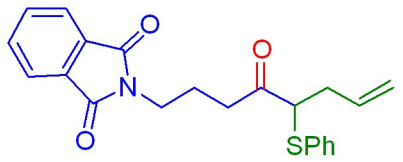
206.6962
134.5376
133.2336
132.8211
129.2824
128.3509
118.0624
77.4843
77.2300
76.9762
62.2970
62.2695
62.2404
56.4901
56.4345
36.5386
34.8408
27.1630
26.1617
26.1311
18.5033
-5.0818
-5.1294

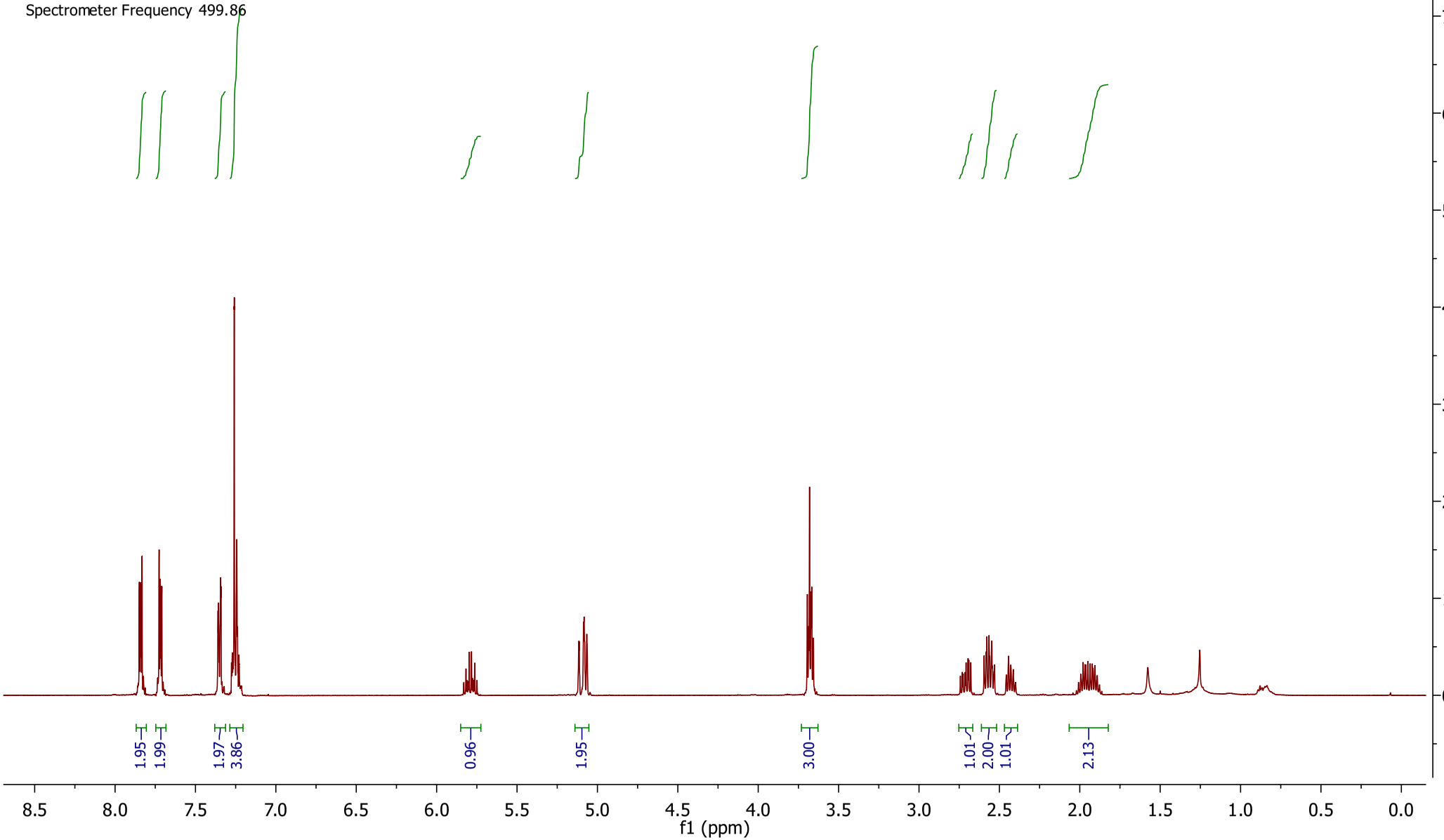
Parameter	Value
Data File Name	/ nmr500/ Zhang/ jli/ sulfide/ ljb131028-1p-1st-C13.fid/ fid
Title	ljb131028-1p-1st-C13
Solvent	CDCl3
Temperature	22.0
Number of Scans	364
Relaxation Delay	1.0000
Acquisition Date	2013-11-02T22:15:24
Spectrometer Frequency	125.70





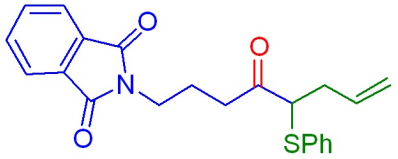
Parameter	Value
Data File Name	/ nmr500/ Zhang/ jli/ sulfide/ ljb131011-1p-1st-1.fid/ fid
Title	ljb131011-1p-1st-1
Solvent	CDCl3
Temperature	80.0
Number of Scans	16
Relaxation Delay	10.0000
Acquisition Date	2013-10-17T18:10:09
Spectrometer Frequency	499.86



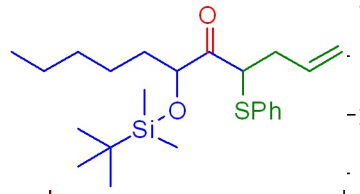


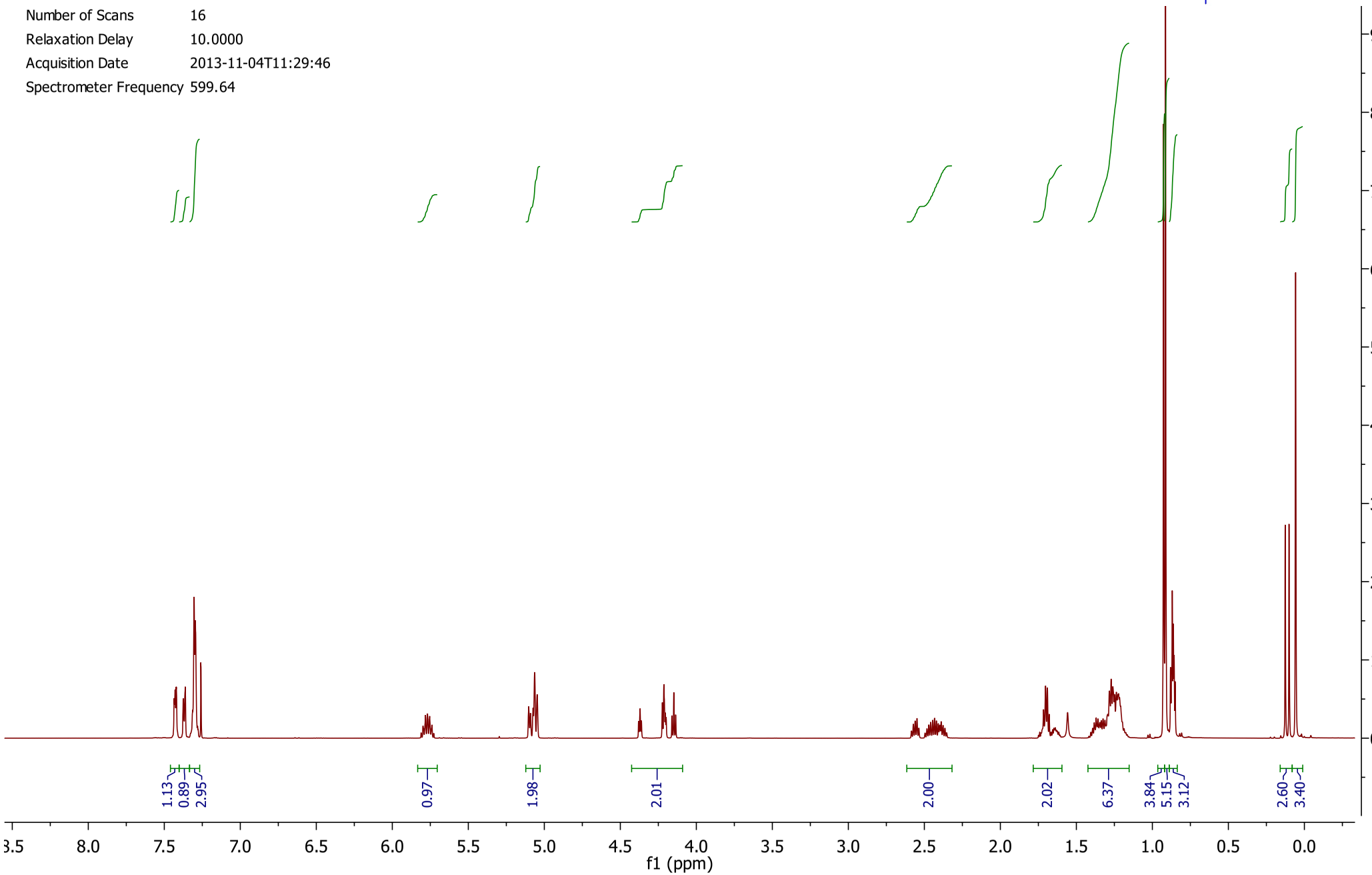
205.4003
168.5541
134.4729
134.1676
133.3878
132.5743
132.3035
129.3041
128.4498
123.4657
118.1536
77.4846
77.2300
76.9763
56.3239
37.6588
37.5543
34.6450
23.2188

Parameter	Value
Data File Name	/ nmr500/ Zhang/ jli/ sulfide/ ljb131011-1p-1st-1-C13.fid/ fid
Title	ljb131011-1p-1st-1-C13
Solvent	CDCl3
Temperature	80.0
Number of Scans	360
Relaxation Delay	1.0000
Acquisition Date	2013-10-17T18:10:55
Spectrometer Frequency	125.70

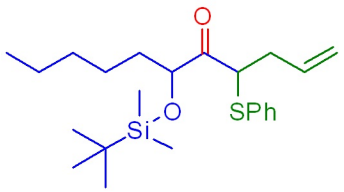


Parameter	Value
Data File Name	/ nmr600/ Zhang/ jli/ sulfide/ ljb131024-2p-1.fid/ fid
Title	ljb131024-2p-1
Solvent	cdcl3
Temperature	25.0
Number of Scans	16
Relaxation Delay	10.0000
Acquisition Date	2013-11-04T11:29:46
Spectrometer Frequency	599.64

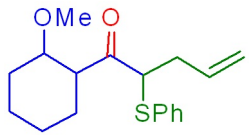


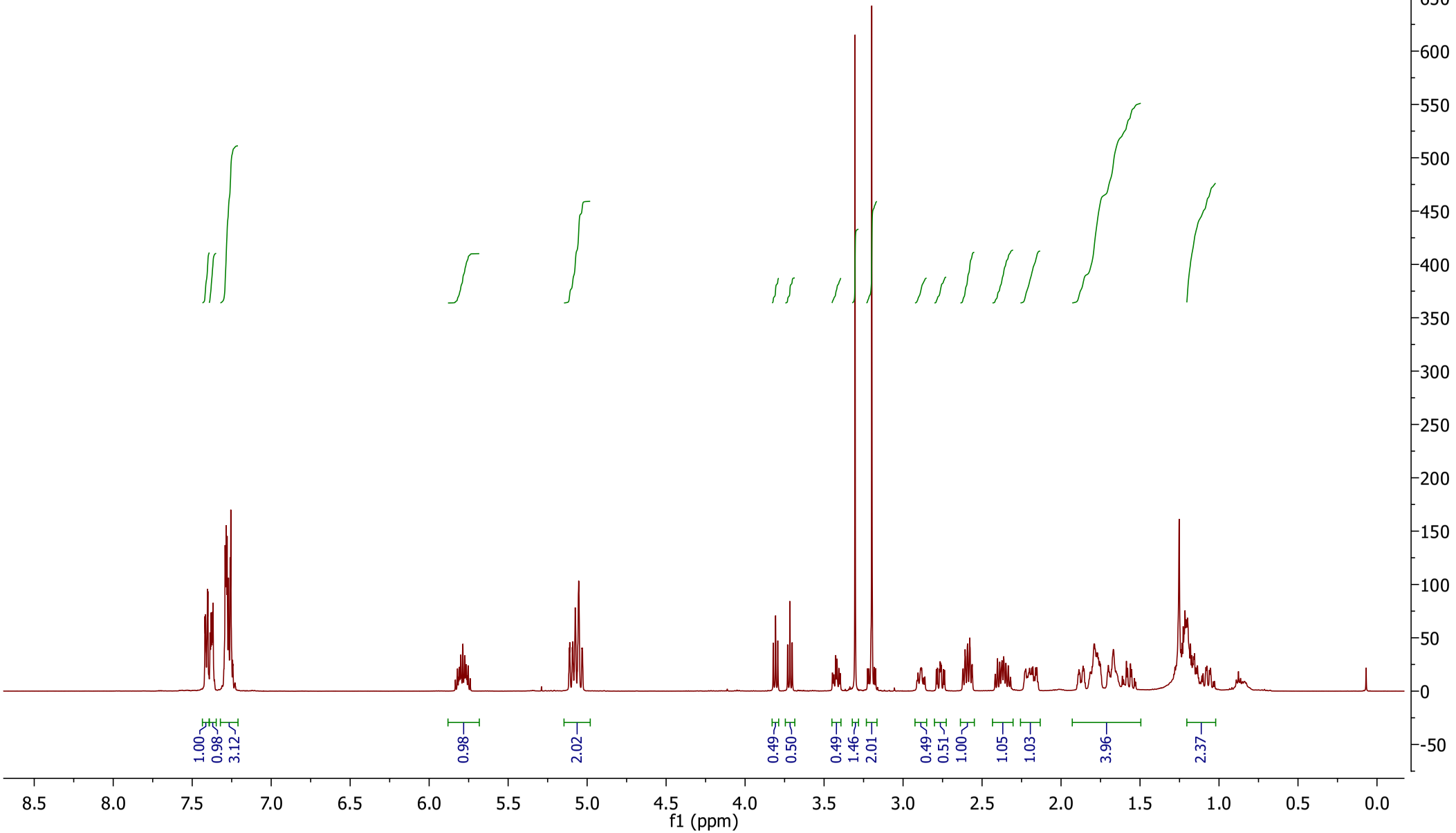


Parameter	Value
Data File Name	/ nmr600/ Zhang/ jli/ sulfide/ ljb131024-2p-1-C13.fid/ fid
Title	ljb131024-2p-1-C13
Solvent	cdcl3
Temperature	25.0
Number of Scans	456
Relaxation Delay	1.0000
Acquisition Date	2013-11-04T11:30:48
Spectrometer Frequency	150.79



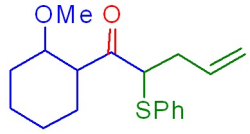
Parameter	Value
Data File Name	/ nmr500/ Zhang/ jli/ sulfide/ ljb131217-1p-1st.fid/ fid
Solvent	CDCl3
Temperature	25.0
Number of Scans	16
Relaxation Delay	10.0000
Acquisition Date	2013-12-20T15:52:13
Spectrometer Frequency	499.86





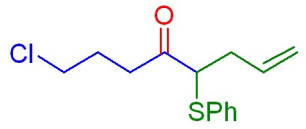
208.6994
207.8920
135.3462
134.7879
133.8254
133.1071
132.8471
132.3148
129.1101
128.9673
128.3541
127.9037
117.8191
117.1313
83.1493
80.0002
77.4847
77.2300
76.9773
57.7034
56.6484
56.4454
55.9357
55.1803
53.6209
34.4053
33.9952
30.7105
30.1073
29.6186
28.9803
25.3875
24.9670
24.3460
24.3353

Parameter	Value
Data File Name	/ nmr500/ Zhang/ jli/ sulfide/ ljb131217-1p-1st-C13.fid/ fid
Solvent	CDCl3
Temperature	25.0
Number of Scans	176
Relaxation Delay	1.0000
Acquisition Date	2013-12-20T15:57:55
Spectrometer Frequency	125.70



f1 (ppm)

Parameter	Value
Data File Name	/ nmr600/ Zhang/ jli/ ljb130917-4p.fid/ fid
Title	ljb130917-4p
Solvent	cdcl3
Temperature	25.0
Number of Scans	16
Relaxation Delay	10.0000
Acquisition Date	2013-09-26T13:00:14
Spectrometer Frequency	599.64

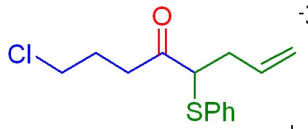


1.99 2.97 0.97 2.03 1.00 2.04 1.02 1.03 1.04 1.04 2.06

f1 (ppm)

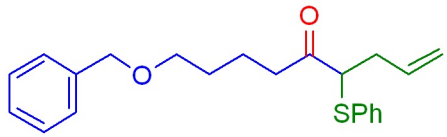
205.6098
134.2731
133.2510
132.6099
129.3537
128.4949
118.2585
77.4405
77.2300
77.0188
56.4706
44.5484
36.8225
34.8058
26.7241

Parameter	Value
Data File Name	/ nmr600/ Zhang/ jli/ ljb130917-4p-C13.fid/ fid
Title	ljb130917-4p-C13
Solvent	cdcl3
Temperature	25.0
Number of Scans	104
Relaxation Delay	1.0000
Acquisition Date	2013-09-26T13:05:02
Spectrometer Frequency	150.79



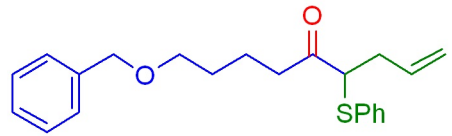
f1 (ppm)

Parameter	Value
Data File Name	/ nmr500/ Zhang/ rzheng/ zrh20131218-1.fid/ fid
Solvent	CDCl3
Temperature	22.0
Number of Scans	12
Relaxation Delay	10.0000
Acquisition Date	2013-12-18T12:22:59
Spectrometer Frequency	499.86



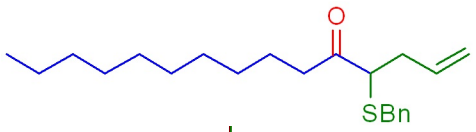
206.4474
138.7269
134.4711
133.1803
132.7860
129.2641
128.5503
128.3204
127.8186
127.7118
118.0647
77.4838
77.2297
76.9751
73.0941
70.1650
56.2736
39.8913
34.7876
29.3282
20.7921

Parameter	Value
Data File Name	/ nmr500/ Zhang/ rzheng/ zrh20131218-1C13-1.fid/ fid
Solvent	CDCl3
Temperature	22.0
Number of Scans	24
Relaxation Delay	10.0000
Acquisition Date	2013-12-18T12:27:39
Spectrometer Frequency	125.70



f1 (ppm)

Parameter	Value
Data File Name	/ home/ Zhang/ jli/ sulfide/ ljb131008-2p-1.fid/ fid
Solvent	cdcl3
Temperature	25.0
Number of Scans	16
Relaxation Delay	10.0000
Acquisition Date	2013-10-16T10:54:18
Spectrometer Frequency	599.64

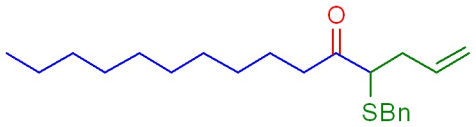


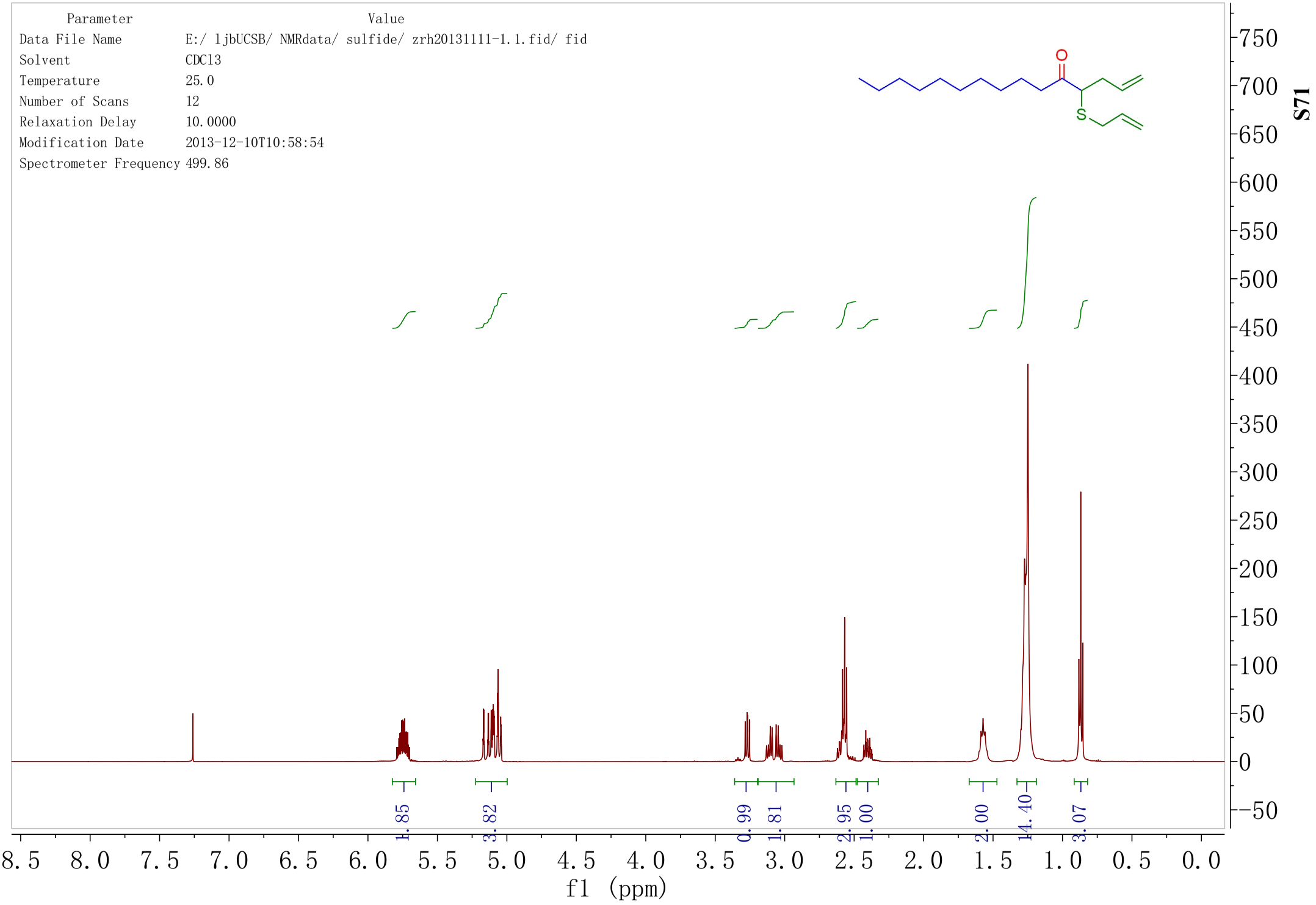
4.02 0.97 0.99 2.04 1.03 1.02 1.00 1.04 2.02 1.04 2.17 15.97 3.33

f1 (ppm)

206.5497
137.5354
134.6746
129.3447
128.7552
127.4460
117.7142
77.4422
77.2300
77.0191
52.5339
39.3624
34.9259
34.4469
32.1219
29.8035
29.7281
29.6329
29.5469
29.4203
24.1970
22.9099
14.3409

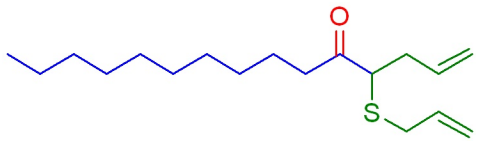
Parameter	Value
Data File Name	/ nmr600/ Zhang/ jli/ sulfide/ ljb131008-2p-1-C13.fid/ fid
Title	ljb131008-2p-1-C13
Solvent	cdcl3
Temperature	25.0
Number of Scans	120
Relaxation Delay	1.0000
Acquisition Date	2013-10-16T10:54:52
Spectrometer Frequency	150.79




Parameter Value
Data File Name E:/ ljbUCSB/ NMRdata/ sulfide/ zrh20131111-1.1.fid/ fid
Solvent CDCl3
Temperature 25.0
Number of Scans 12
Relaxation Delay 10.0000
Modification Date 2013-12-10T10:58:54
Spectrometer Frequency 499.86
O
S
1.85
3.82
0.99
1.81
2.95
1.00
2.00
14.40
3.07
f1 (ppm)
S71

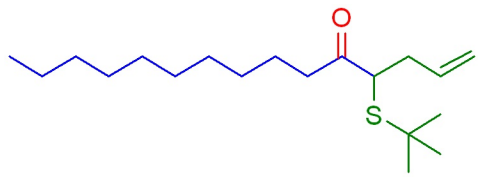
206.7066
134.6856
133.6413
118.2788
117.7110
77.4835
77.2300
76.9753
52.0363
39.3237
32.0911
29.7690
29.6939
29.6082
29.5122
29.3845
22.8786
14.3131

Parameter	Value
Data File Name	E:/ ljbUCSB/ NMRdata/ sulfide/ zrh20131111-1.1C13.fid/ fid
Solvent	CDCl3
Temperature	25.0
Number of Scans	60
Relaxation Delay	5.0000
Modification Date	2013-12-10T11:06:32
Spectrometer Frequency	125.70



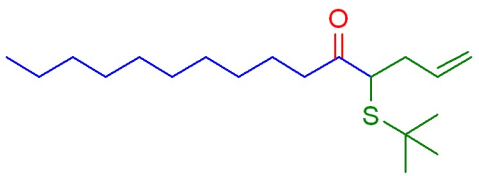
f1 (ppm)

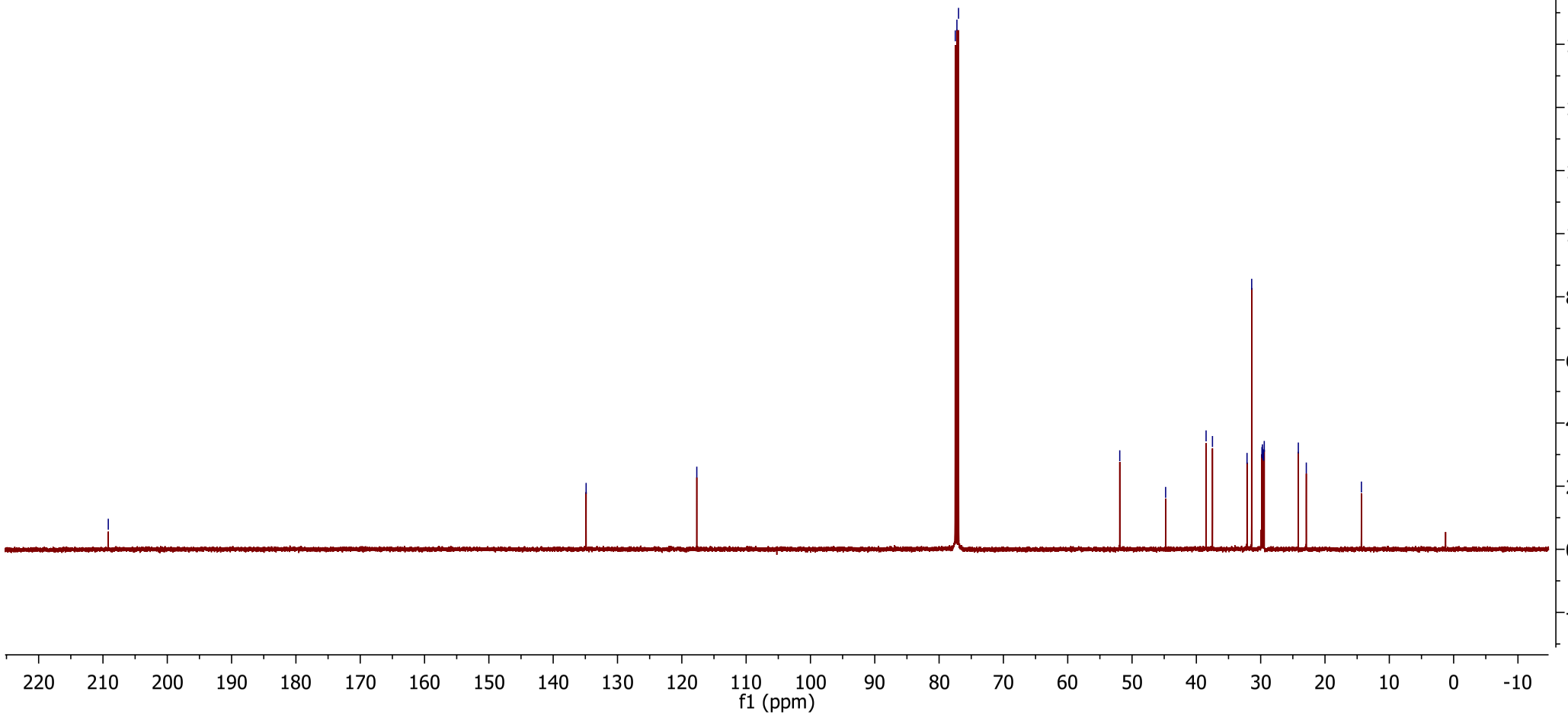
Parameter	Value
Data File Name	/ nmr500/ Zhang/ jli/ sulfide/ ljb130926-7.fid/ fid
Title	ljb130926-7
Solvent	CDCl3
Temperature	25.0
Number of Scans	16
Relaxation Delay	10.0000
Acquisition Date	2013-09-29T20:21:08
Spectrometer Frequency	499.86



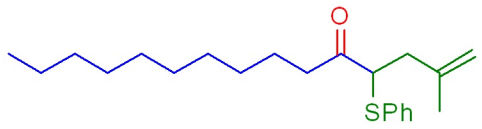
209.1728
134.8786
117.6710
77.4837
77.2300
76.9765
51.9115
44.7783
38.4872
37.4967
31.3982
29.8056
29.7232
29.6459
29.5435
29.4437
24.1466
14.3379

Parameter	Value
Data File Name	/ nmr500/ Zhang/ jli/ sulfide/ ljb130926-7-C13.fid/ fid
Title	ljb130926-7-C13
Solvent	CDCl3
Temperature	25.0
Number of Scans	4696
Relaxation Delay	1.0000
Acquisition Date	2013-09-29T20:21:52
Spectrometer Frequency	125.70





Parameter	Value
Data File Name	/ home/ Zhang/ jli/ sulfide/ ljb131008-1p-1.fid/ fid
Title	ljb131008-1p-1
Solvent	cdcl3
Temperature	25.0
Number of Scans	16
Relaxation Delay	10.0000
Acquisition Date	2013-10-16T10:32:27
Spectrometer Frequency	599.64

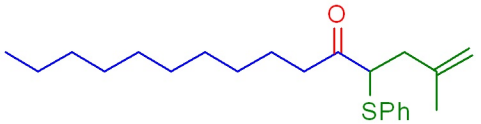


1.96 2.89 1.02 1.02 1.00 3.02 1.03 3.05 2.08 15.87 3.30

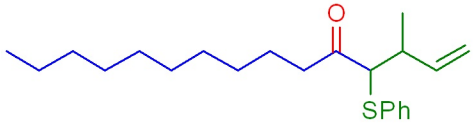
f1 (ppm)

206.9492
141.8381
133.1487
132.8890
129.2427
128.1737
113.4653
77.4418
77.2300
77.0185
55.0176
39.7155
38.7049
29.7731
29.6871
29.5926
29.5283
29.3782
23.9895
14.3323

Parameter	Value
Data File Name	/ home/ Zhang/ jli/ sulfide/ ljb131008-1p-1-C13.fid/ fid
Solvent	cdcl3
Temperature	25.0
Number of Scans	264
Relaxation Delay	1.0000
Acquisition Date	2013-10-16T10:33:06
Spectrometer Frequency	150.79

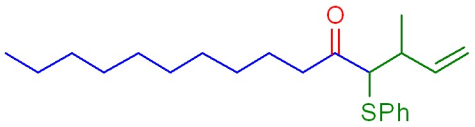


Parameter	Value
Data File Name	/ home/ Zhang/ jli/ sulfide/ ljb131006-1p-1.fid/ fid
Title	ljb131006-1p-1
Solvent	cdcl3
Temperature	25.0
Number of Scans	16
Relaxation Delay	10.0000
Acquisition Date	2013-10-10T15:46:23
Spectrometer Frequency	599.64

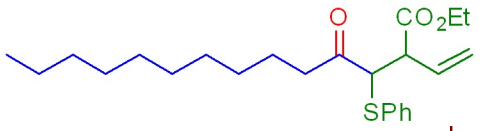


207.3232
207.0647
140.4346
140.3491
132.4612
132.3684
129.3248
129.2545
127.9067
127.8962
116.0926
116.0437
77.4848
77.2734
77.0617
63.7993
63.0850
40.6112
40.5144
38.9741
38.9481
32.1502
29.8094
29.7130
29.6247
29.5643
29.4033
24.0201
23.9190
22.9373
19.1880
18.5025
14.3732

Parameter	Value
Data File Name	/ home/ Zhang/ jli/ sulfide/ ljb131006-1p-1-C13.fid/ fid
Title	ljb131006-1p-1-C13
Solvent	cdcl3
Temperature	25.0
Number of Scans	196
Relaxation Delay	1.0000
Acquisition Date	2013-10-10T15:46:52
Spectrometer Frequency	150.79

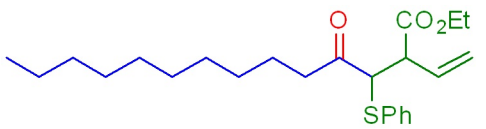


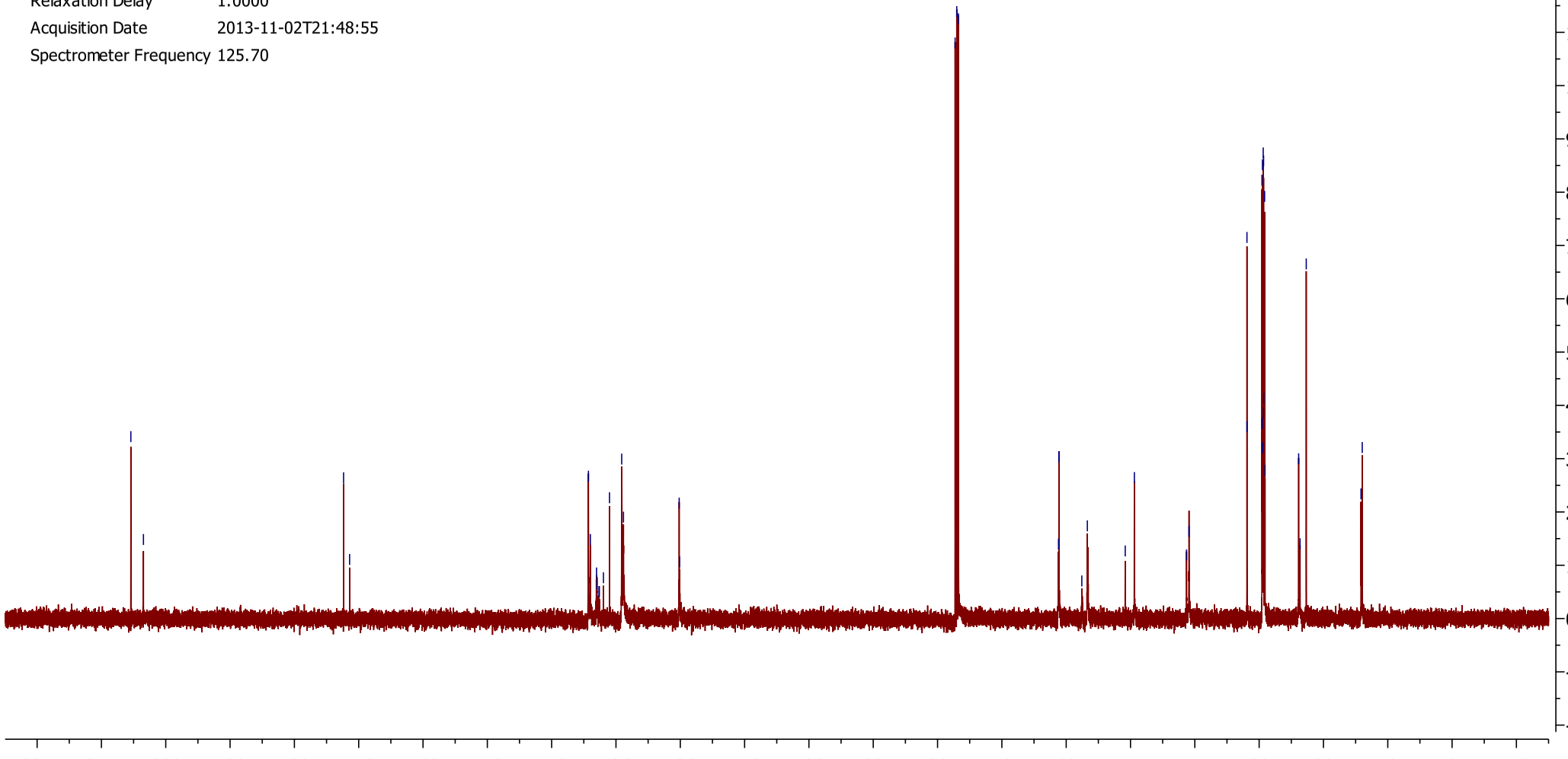
Parameter	Value
Data File Name	/ nmr500/ Zhang/ jli/ sulfide/ ljb131030-1p-1st.fid/ fid
Title	ljb131030-1p-1st
Solvent	CDCl3
Temperature	22.0
Number of Scans	16
Relaxation Delay	10.0000
Acquisition Date	2013-11-02T21:46:44
Spectrometer Frequency	499.86



205.4264
203.4677
172.3502
171.4142
134.2818
133.9852
133.0185
132.9581
132.6395
132.5827
131.9485
131.0051
129.1087
128.8342
120.1725
120.1084
77.2684
77.0145
76.7623
61.1872
61.1393
57.5704
56.7115
50.8203
49.3991
41.2861
40.9042
31.8943
29.5624
29.4841
29.3661
29.3069
29.1494
14.1661
13.9695

Parameter	Value
Data File Name	/ nmr500/ Zhang/ jli/ sulfide/ ljb131030-1p-1st-C13.fid/ fid
Title	ljb131030-1p-1st-C13
Solvent	CDCl3
Temperature	22.0
Number of Scans	240
Relaxation Delay	1.0000
Acquisition Date	2013-11-02T21:48:55
Spectrometer Frequency	125.70



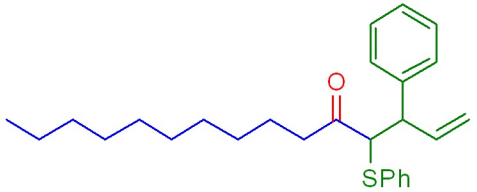


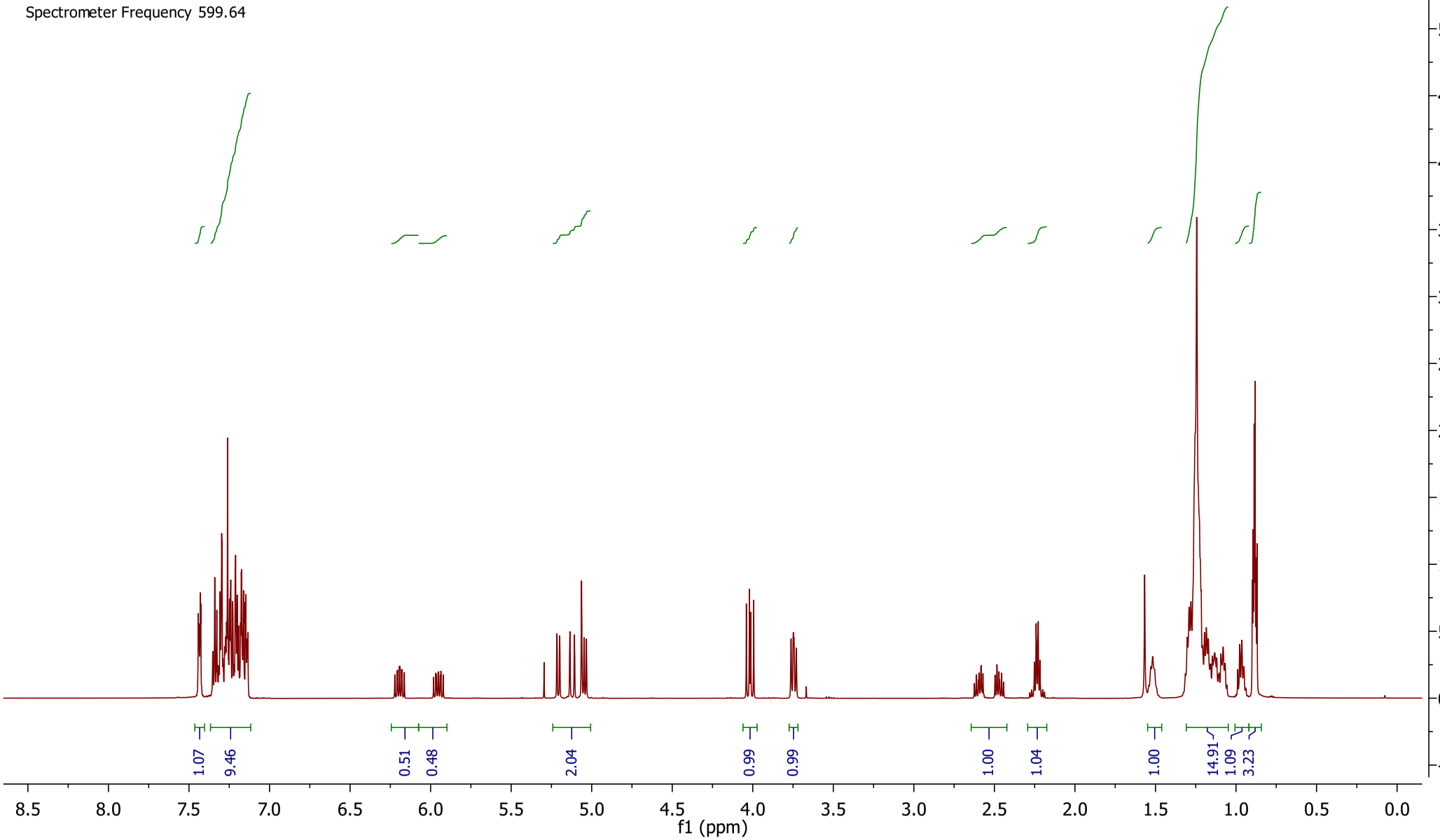
180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10 -20

220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10

f1 (ppm)

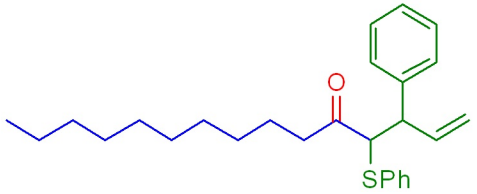
Parameter	Value
Data File Name	/ home/ Zhang/ jli/ sulfide/ ljb131006-2p-1.fid/ fid
Title	ljb131006-2p-1
Solvent	cdcl3
Temperature	25.0
Number of Scans	16
Relaxation Delay	10.0000
Acquisition Date	2013-10-10T16:08:24
Spectrometer Frequency	599.64

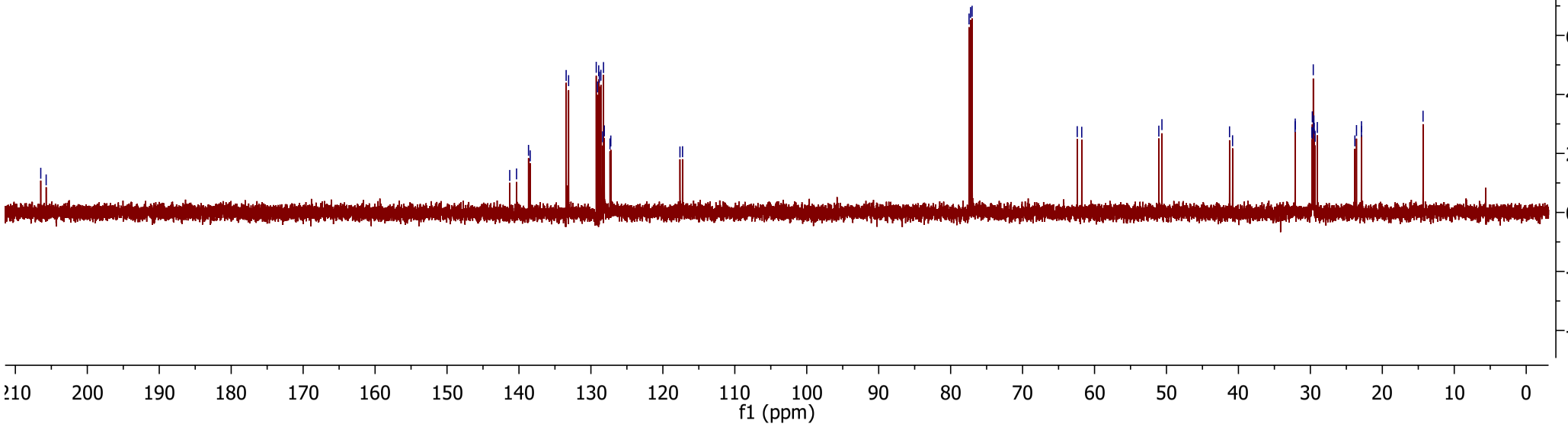




206.4693
205.7170
141.2850
140.3372
138.6737
138.4405
133.4424
133.1010
129.2605
129.0966
128.9180
128.8241
128.6156
128.3646
128.2501
128.1364
127.3492
127.2363
117.6257
117.2642
77.4417
77.2300
77.0178
62.4039
61.7780
51.0637
50.6324
41.2350
40.8141
32.1196
32.1048
29.7305
29.5958
29.5379
29.5136
29.0366
22.8960
14.3376

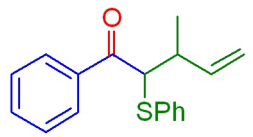
Parameter	Value
Data File Name	/ home/ Zhang/ jli/ sulfide/ ljb131006-2p-1-C13.fid/ fid
Title	ljb131006-2p-1-C13
Solvent	cdcl3
Temperature	25.0
Number of Scans	136
Relaxation Delay	1.0000
Acquisition Date	2013-10-10T16:08:43
Spectrometer Frequency	150.79





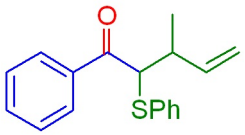
f1 (ppm)

Parameter	Value
Data File Name	/ nmr500/ Zhang/ jli/ sulfide/ ljb131017-2p-1.1.fid/ fid
Solvent	CDCl3
Temperature	24.0
Number of Scans	16
Relaxation Delay	10.0000
Acquisition Date	2013-10-29T10:25:46
Spectrometer Frequency	499.86



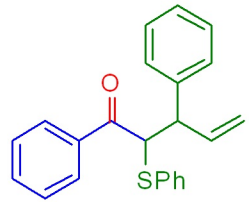
195.8696
140.9280
140.5412
137.0030
134.4885
134.2433
133.2176
133.1019
129.1740
129.0675
128.7627
128.7288
128.6537
128.6121
128.5807
116.0370
115.9034
77.4856
77.2300
76.9767
58.2457
57.7742
38.9398
38.4747
19.1287
17.9906

Parameter	Value
Data File Name	/ nmr500/ Zhang/ jli/ sulfide/ ljb131017-2p-1.1-C13.fid/ fid
Title	ljb131017-2p-1.1-C13
Solvent	CDCl3
Temperature	24.0
Number of Scans	108
Relaxation Delay	1.0000
Acquisition Date	2013-10-29T10:26:04
Spectrometer Frequency	125.70



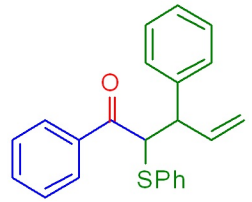
f1 (ppm)

Parameter	Value
Data File Name	/ nmr500/ Zhang/ jli/ sulfide/ ljb131017-3p-11111_1204-2-1.fid/ fid
Solvent	CDCl3
Temperature	22.0
Number of Scans	16
Relaxation Delay	10.0000
Acquisition Date	2013-12-18T17:25:52
Spectrometer Frequency	499.86



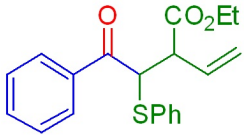
195.5411
194.7122
141.8446
140.6299
139.1991
138.7508
137.0480
136.8888
135.0816
133.2367
132.9525
132.1653
129.2153
129.1386
129.0049
128.9173
128.8469
128.7797
128.7641
128.6885
128.5966
128.3809
128.1921
127.2706
126.9107
117.8255
117.1868
77.4835
77.2300
76.9760
56.6401
56.4464
50.8985
50.2653
29.9118

Parameter	Value
Data File Name	/ nmr500/ Zhang/ jli/ sulfide/ ljb131017-3p-11111_1204-2-1-C13.fid/ fid
Solvent	CDCl3
Temperature	22.0
Number of Scans	208
Relaxation Delay	1.0000
Acquisition Date	2013-12-18T17:27:39
Spectrometer Frequency	125.70



Parameter	Value
Data File Name	/ nmr500/ Zhang/ jli/ sulfide/ ljb131030-2p-1.1.fid/ fid
Title	ljb131030-2p-1.1
Solvent	CDCl3
Temperature	22.0
Number of Scans	16
Relaxation Delay	10.0000
Acquisition Date	2013-11-04T10:26:07
Spectrometer Frequency	499.86

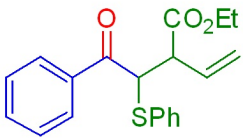
major
diastereoisomer



194.9723
172.5658
136.0577
135.7180
133.4625
133.2509
130.3017
129.5133
129.2117
128.8860
128.7524
120.6800
77.4836
77.2300
76.9765
61.3822
52.5855
50.0011
14.1456

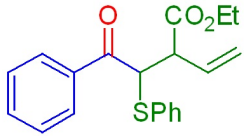
Parameter	Value
Data File Name	/ nmr500/ Zhang/ jli/ sulfide/ ljb131030-2p-1.1-C13.fid/ fid
Title	ljb131030-2p-1.1-C13
Solvent	CDCl3
Temperature	22.0
Number of Scans	248
Relaxation Delay	1.0000
Acquisition Date	2013-11-04T10:27:15
Spectrometer Frequency	125.70

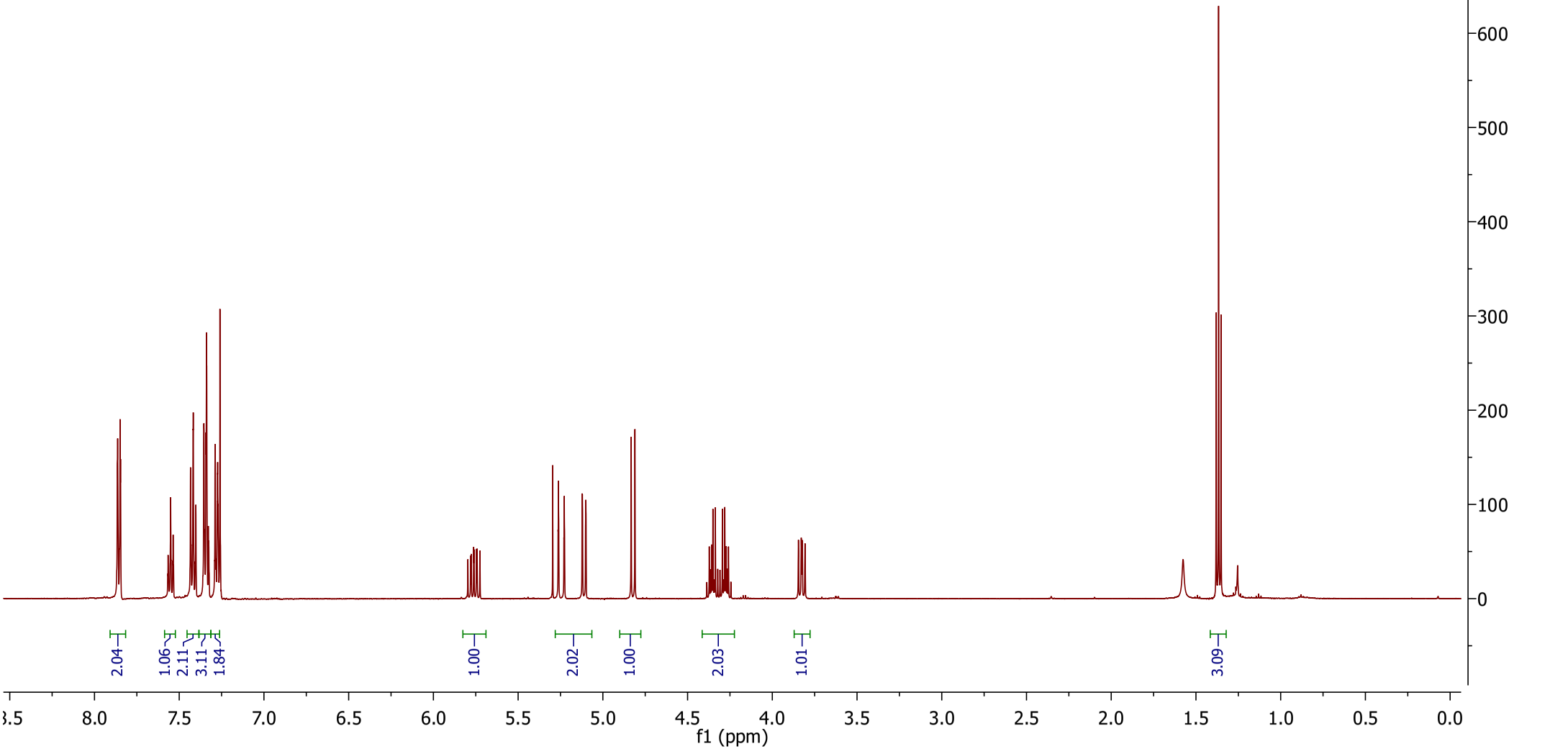
major
diastereoisomer



Parameter	Value
Data File Name	/ nmr500/ Zhang/ jli/ sulfide/ ljb131030-2p-1.2.fid/ fid
Title	ljb131030-2p-1.2
Solvent	CDCl3
Temperature	22.0
Number of Scans	16
Relaxation Delay	10.0000
Acquisition Date	2013-11-04T10:43:05
Spectrometer Frequency	499.86

minor
diastereoisomer

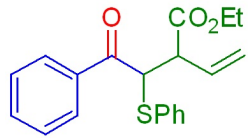


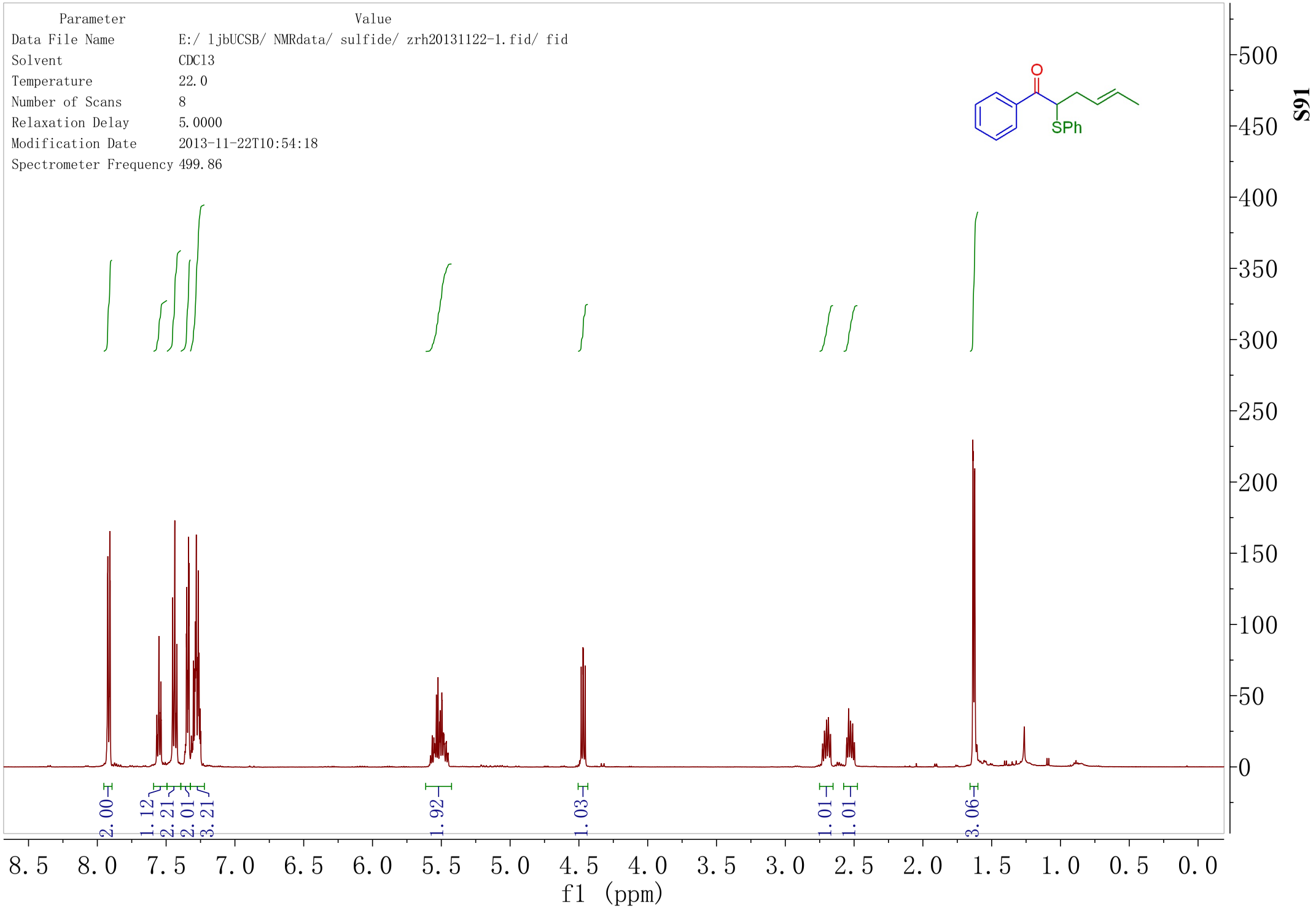


192.6688
172.0645
136.3618
135.8786
133.3914
132.9626
130.7753
129.5382
129.2013
128.7911
128.7603
120.3697
77.4840
77.2300
76.9766
61.4362
52.5798
51.2161
14.4901

Parameter	Value
Data File Name	/ nmr500/ Zhang/ jli/ sulfide/ ljb131030-2p-1.2-C13.fid/ fid
Title	ljb131030-2p-1.2-C13
Solvent	CDCl3
Temperature	22.0
Number of Scans	392
Relaxation Delay	1.0000
Acquisition Date	2013-11-04T10:43:27
Spectrometer Frequency	125.70

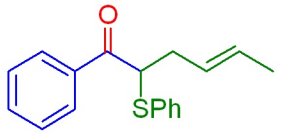
minor
diastereoisomer




Parameter Value
Data File Name E:/ ljbUCSB/ NMRdata/ sulfide/ zrh20131122-1.fid/ fid
Solvent CDCl3
Temperature 22.0
Number of Scans 8
Relaxation Delay 5.0000
Modification Date 2013-11-22T10:54:18
Spectrometer Frequency 499.86
O
SPh
2.00
1.12
2.21
2.01
3.21
1.92
1.03
1.01
1.01
3.06
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)
500 450 400 350 300 250 200 150 100 50 0

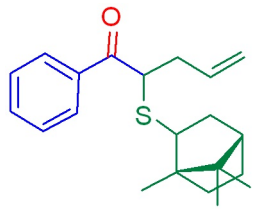
195.7072
136.4175
134.7671
133.1979
132.0730
129.1148
128.7981
128.7603
128.7482
127.3628
77.2300
51.6432
34.3168
18.2038

Parameter	Value
Data File Name	E:/ ljbUCSB/ NMRdata/ sulfide/ zrh20131122-1-C13.fid/ fid
Solvent	CDCl3
Temperature	22.0
Number of Scans	64
Relaxation Delay	2.0000
Modification Date	2013-11-22T10:58:58
Spectrometer Frequency	125.70



f1 (ppm)

Parameter	Value
Data File Name	/ nmr500/ Zhang/ jli/ sulfide/ ljb131107-1p-1.fid/ fid
Title	ljb131107-1p-1
Solvent	CDCl3
Temperature	26.0
Number of Scans	16
Relaxation Delay	10.0000
Acquisition Date	2013-11-11T12:07:19
Spectrometer Frequency	499.86

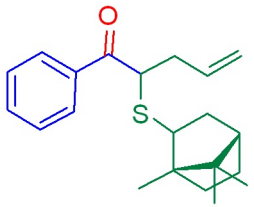


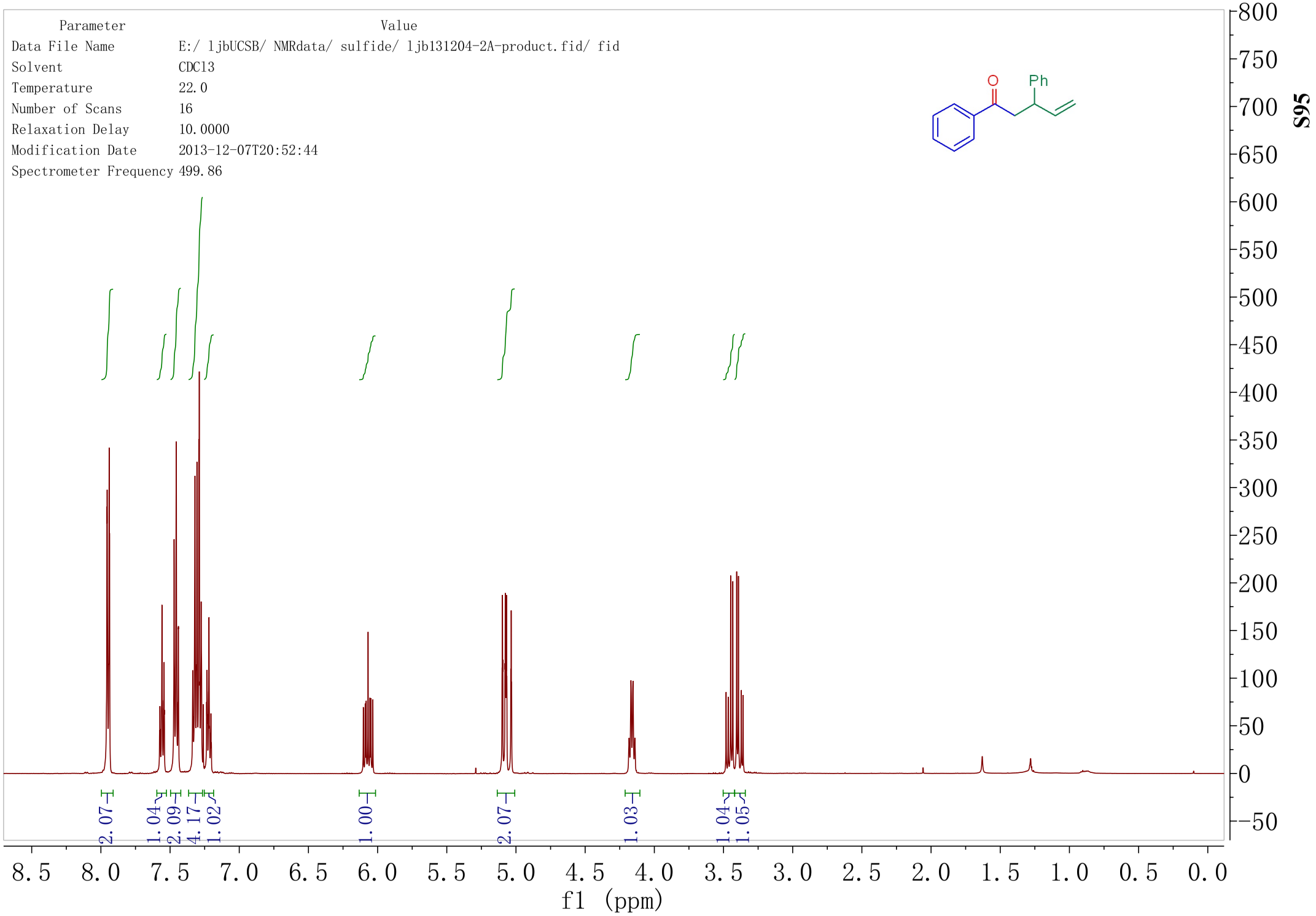
2.02 1.01 2.03 1.00 2.02 0.59 0.41 0.99 1.00 1.02 1.18 4.04 2.16 1.22 1.91 1.25 1.22 1.87 1.85

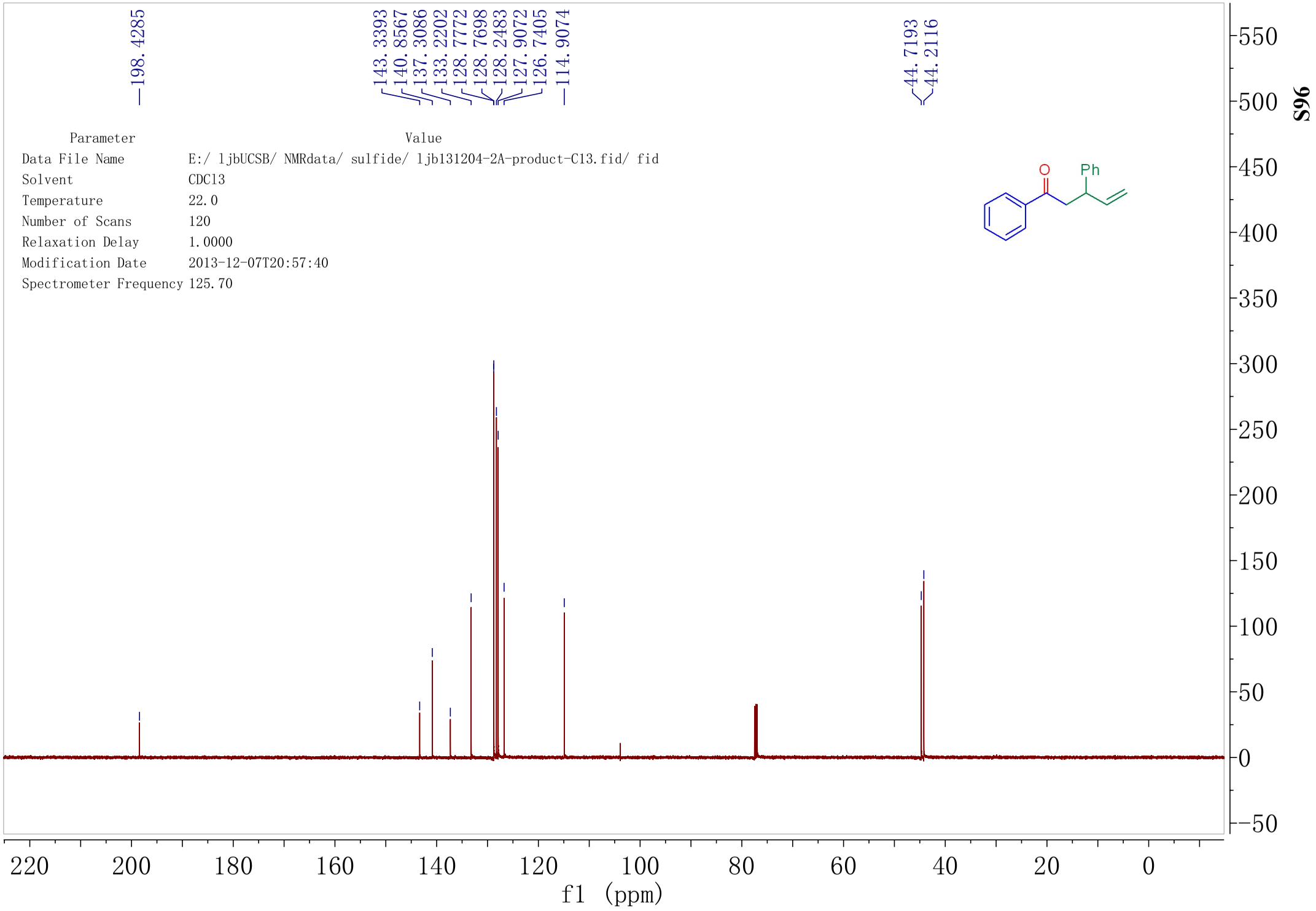
f1 (ppm)

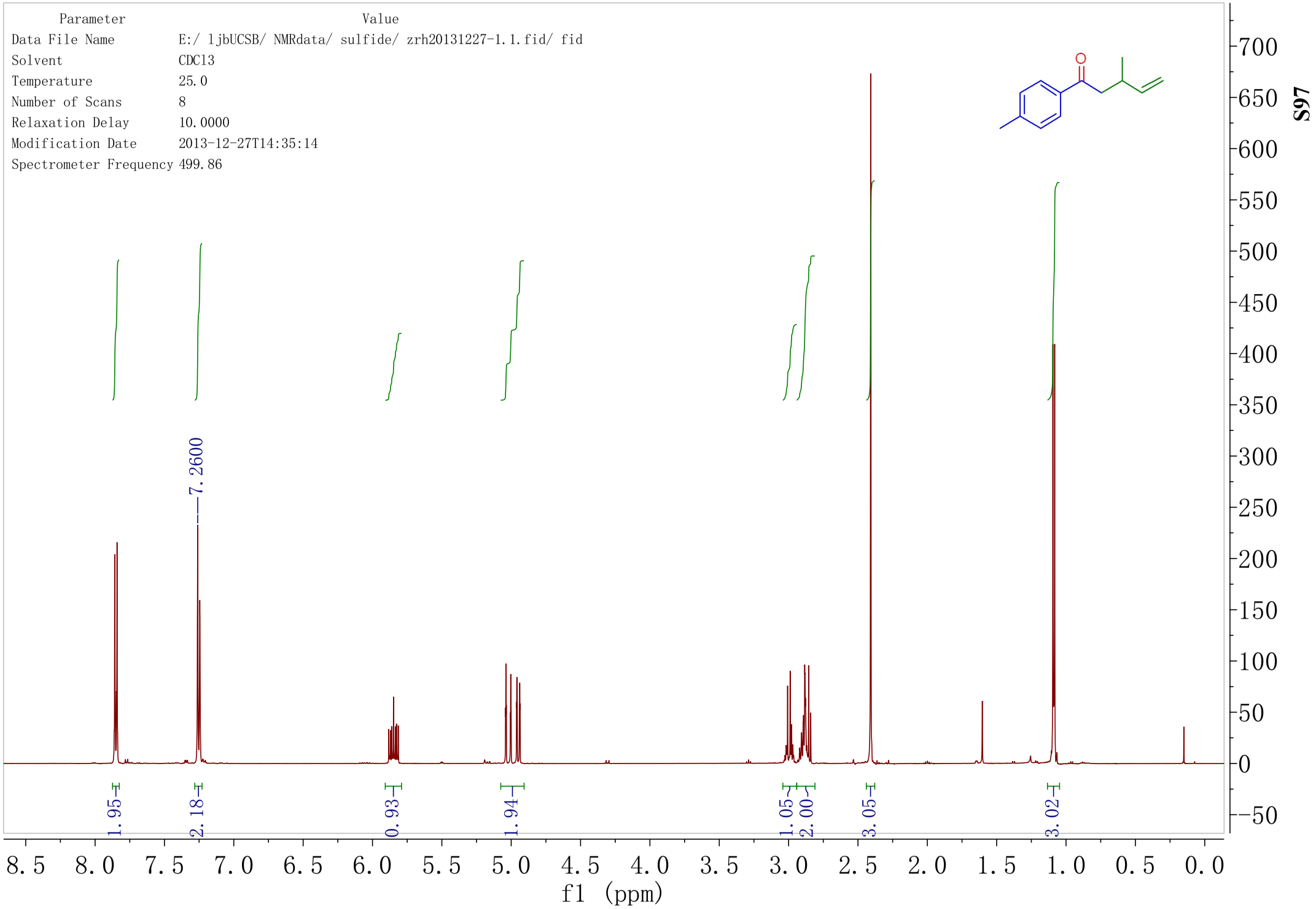
196.5276
195.5708
147.8294
136.5098
136.4865
133.0113
133.0051
128.7184
128.7045
128.6673
128.6532
117.5216
117.4965
77.4853
77.2300
76.9763
49.8114
49.7864
48.6159
48.5803
48.5272
47.3624
47.2677
46.4417
43.1585
42.1380
38.5879
38.5618
35.5270
27.5000
27.4700
20.8735
20.8363
20.7888
20.7510
20.0558
20.0206
19.9949
19.9621
14.7845
14.7451
14.2223
14.2055

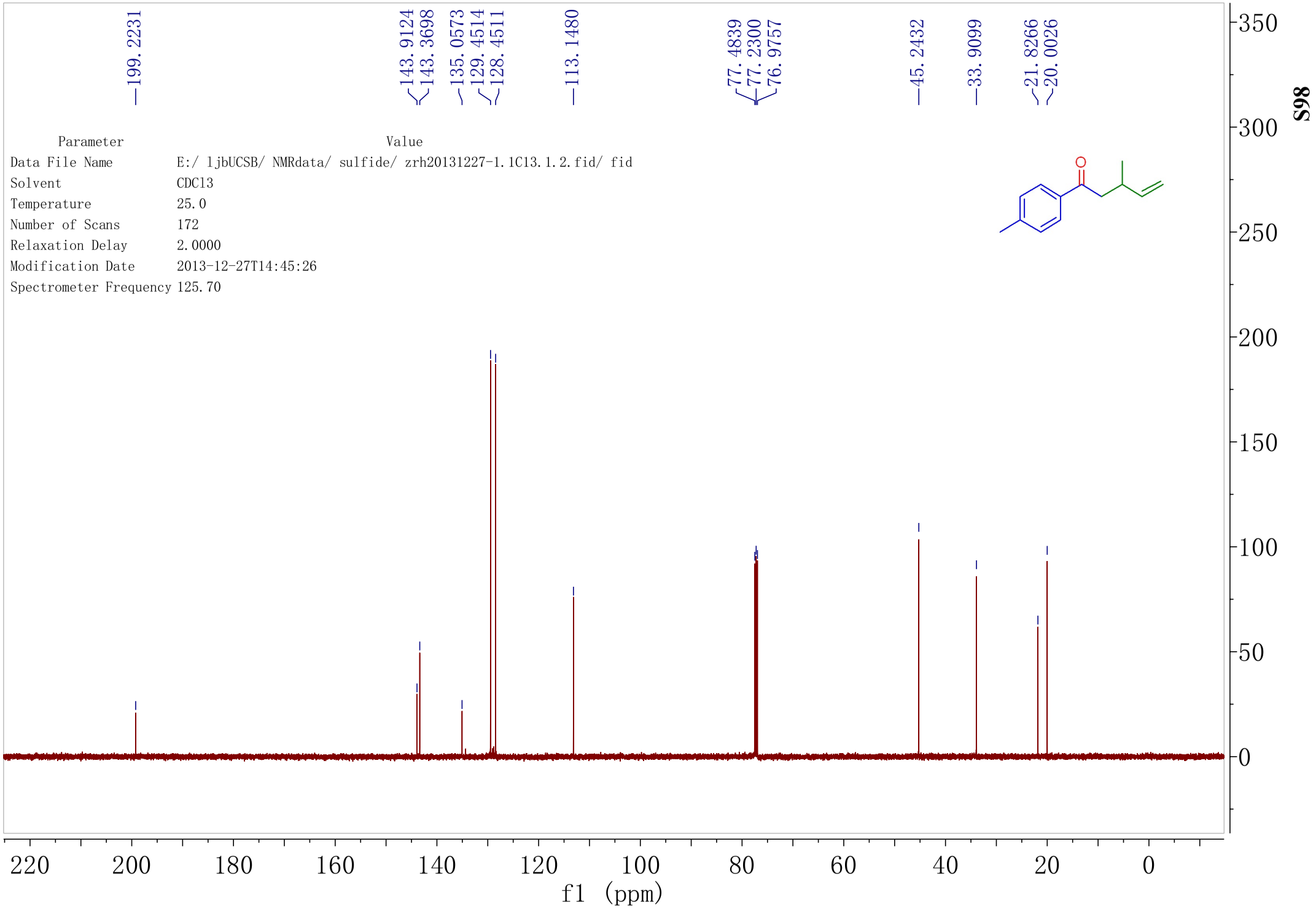
Parameter	Value
Data File Name	/ nmr500/ Zhang/ jli/ sulfide/ ljb131107-1p-1-C13.fid/ fid
Title	ljb131107-1p-1-C13
Solvent	CDCl3
Temperature	26.0
Number of Scans	320
Relaxation Delay	1.0000
Acquisition Date	2013-11-11T12:07:48
Spectrometer Frequency	125.70



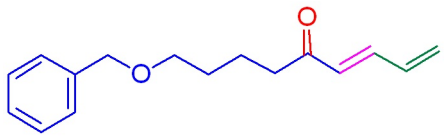

Parameter Value
Data File Name E:/ ljbUCSB/ NMRdata/ sulfide/ ljb131204-2A-product.fid/ fid
Solvent CDCl3
Temperature 22.0
Number of Scans 16
Relaxation Delay 10.0000
Modification Date 2013-12-07T20:52:44
Spectrometer Frequency 499.86
O
Ph
2.07
1.04
2.09
4.17
1.02
1.00
2.07
1.03
1.04
1.05
f1 (ppm)

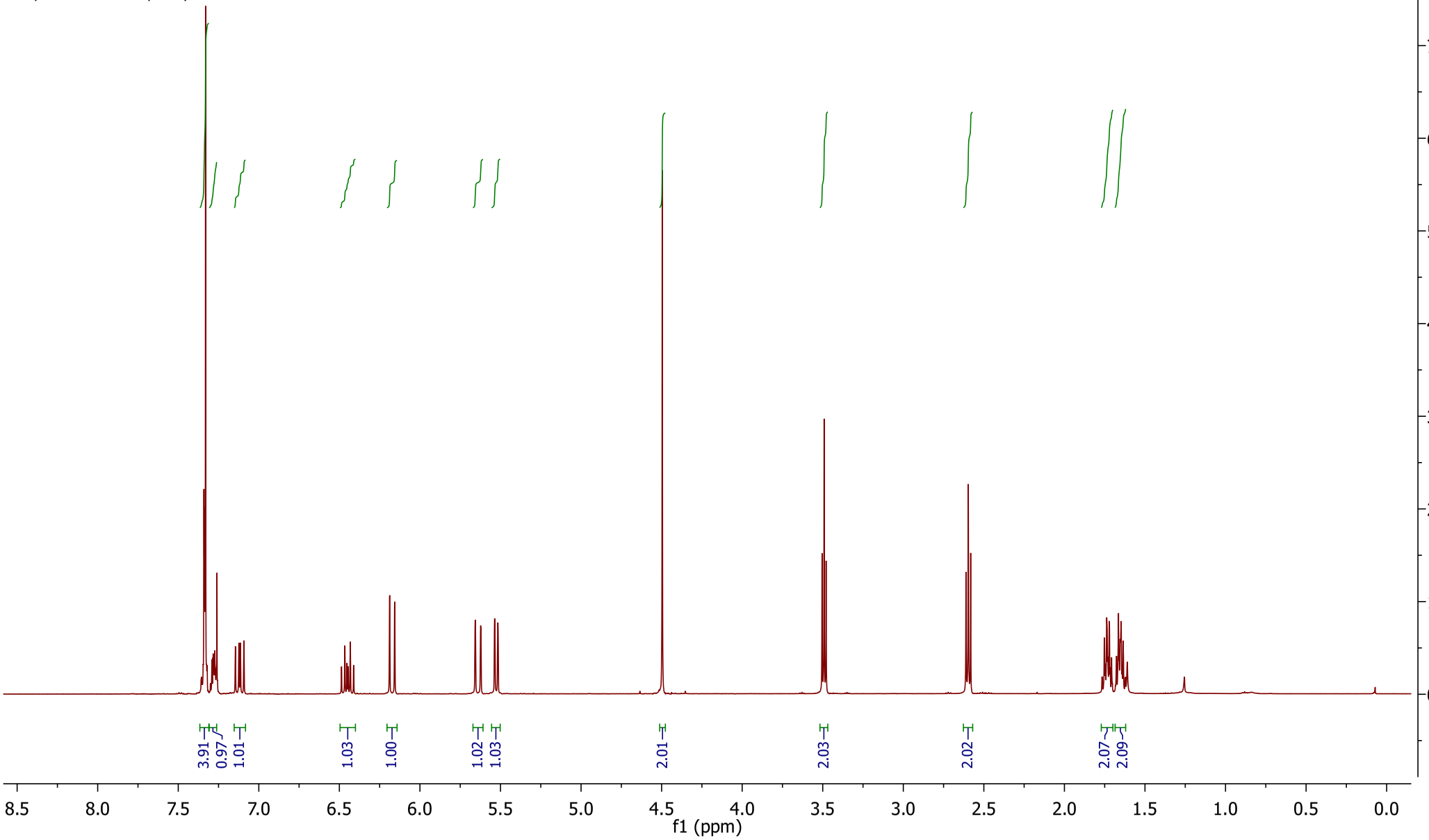

198.4285
143.3393
140.8567
137.3086
133.2202
128.7772
128.7698
128.2483
127.9072
126.7405
114.9074
44.7193
44.2116
Parameter
Value
Data File Name
E:/ ljbUCSB/ NMRdata/ sulfide/ ljb131204-2A-product-C13.fid/ fid
Solvent
CDCl3
Temperature
22.0
Number of Scans
120
Relaxation Delay
1.0000
Modification Date
2013-12-07T20:57:40
Spectrometer Frequency
125.70
O
Ph
f1 (ppm)


Parameter Value
Data File Name E:/ ljbUCSB/ NMRdata/ sulfide/ zrh20131227-1.1.fid/ fid
Solvent CDCl3
Temperature 25.0
Number of Scans 8
Relaxation Delay 10.0000
Modification Date 2013-12-27T14:35:14
Spectrometer Frequency 499.86
7.2600
1.95
2.18
0.93
1.94
1.05
2.00
3.05
3.02
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)
700 650 600 550 500 450 400 350 300 250 200 150 100 50 0 -50


199.2231
143.9124
143.3698
135.0573
129.4514
128.4511
113.1480
77.4839
77.2300
76.9757
45.2432
33.9099
21.8266
20.0026
Parameter
Value
Data File Name
E:/ ljbUCSB/ NMRdata/ sulfide/ zrh20131227-1.1C13.1.2.fid/ fid
Solvent
CDCl3
Temperature
25.0
Number of Scans
172
Relaxation Delay
2.0000
Modification Date
2013-12-27T14:45:26
Spectrometer Frequency
125.70
350
300
250
200
150
100
50
0
220
200
180
160
140
120
100
80
60
40
20
0
f1 (ppm)

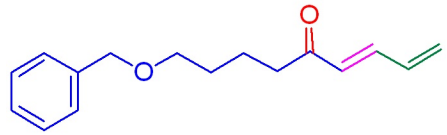
Parameter	Value
Data File Name	/ nmr500/ Zhang/ rzheng/ zrh20131220-1.fid/ fid
Solvent	CDCl3
Temperature	25.0
Number of Scans	12
Relaxation Delay	10.0000
Acquisition Date	2013-12-20T16:53:09
Spectrometer Frequency	499.86

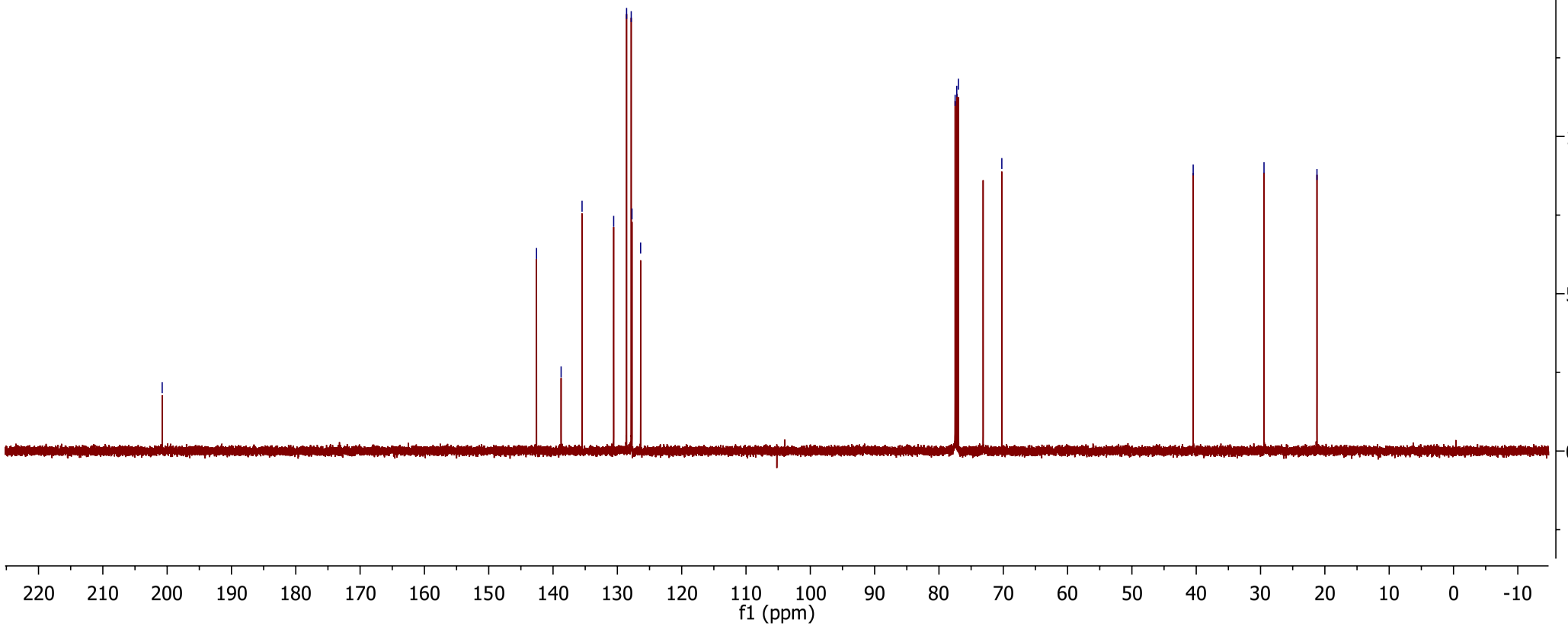




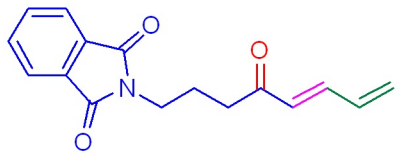
200.7681
142.5712
138.7463
135.4893
130.5736
128.5659
127.8476
127.7258
126.3848
77.4844
77.2302
76.9757
70.2254
40.4714
29.4611
21.2267

Parameter	Value
Data File Name	/ nmr500/ Zhang/ rzheng/ zrh20131220-1C13-1.2.fid/ fid
Solvent	CDCl3
Temperature	25.0
Number of Scans	212
Relaxation Delay	2.0000
Acquisition Date	2013-12-20T16:57:41
Spectrometer Frequency	125.70





Parameter	Value
Data File Name	/ nmr500/ Zhang/ rzheng/ zrh20131219-2.fid/ fid
Solvent	CDCl3
Temperature	22.0
Number of Scans	12
Relaxation Delay	10.0000
Acquisition Date	2013-12-19T15:55:45
Spectrometer Frequency	499.86



2.07 2.11 0.95 0.95 0.94 0.96 0.99 2.00 1.97 2.04

f1 (ppm)

199.2395
168.6251
142.7831
135.4096
134.1563
132.3007
130.2481
126.6408
123.4642
77.4833
77.2300
76.9758
37.9738
37.6347
23.2591

Parameter	Value
Data File Name	/ nmr500/ Zhang/ rzheng/ zrh20131219-2-1C13-1.fid/ fid
Solvent	CDCl3
Temperature	22.0
Number of Scans	188
Relaxation Delay	2.0000
Acquisition Date	2013-12-19T17:19:20
Spectrometer Frequency	125.70