Electronic Supplementary Material (ESI) for ChemComm.

Supplementary Information

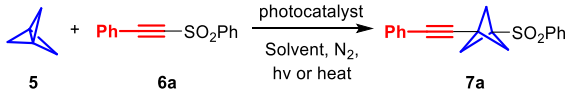
Radical-mediated sulfonyl alkynylation, allylation, and cyanation of propellane

Wu et al.

Supplementary methods

All reactions were maintained under a nitrogen atmosphere unless otherwise stated. Commercially available reagents were used without further purification. Infrared (FT-IR) spectra were recorded on a BRUKER VERTEX 70, νmax in cm^{-1}. ^{1}H-NMR spectra were recorded on a BRUKER AVANCE III HD (400 MHz) spectrometer. Chemical shifts are reported in ppm from tetramethylsilane with the solvent resonance as internal standard ($CDCl_3$: δ 7.26). Data are reported as follows: chemical shift, multiplicity (s = singlet, d = doublet, t = triplet, q = quadruplet, br = broad, m = multiplet), coupling constants (Hz) and integration. ^{13}C-NMR spectra were recorded on a BRUKER AVANCE III HD (100 MHz) spectrometer with complete proton decoupling. Chemical shifts are reported in ppm from tetramethylsilane with the solvent resonance as the internal standard ($CDCl_3$: δ 77.16). ^{19}F-NMR spectra were recorded on a BRUKER AVANCE III HD (376 MHz) spectrometer. Mass spectra were measured with an Agilent Technologies 6120 Quadrupole LC/MS. High resolution mass spectrometry (HRMS) were measured with a GCT Premier™ and BRUKER micrOTF-Q III. Melting points were measured using INESA WRR and values are uncorrected.

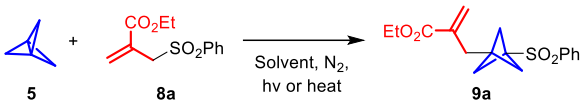
Reaction conditions survey



5 **6a** **7a**

Entry	Heat or hv	Photocatalyst	Solvent	Yield (%)
1	5 W Blue LEDs	-	CH_3CN	14
2	14 W Blue LEDs	-	CH_3CN	26
3	30 W Blue LEDs	-	CH_3CN	23
4	2 x 50 W Blue LEDs	-	CH_3CN	30
5	14 W CFL	-	CH_3CN	27
6	2 x 50 W Blue LEDs	-	DCM	< 10
7	2 x 50 W Blue LEDs	-	DMF	< 10
8	2 x 50 W Blue LEDs	-	DMSO	0
9	2 x 50 W Blue LEDs	-	EA	< 10
10	2 x 50 W Blue LEDs	-	acetone	30
11	2 x 50 W Blue LEDs	-	THF	45
12	2 x 50 W Blue LEDs	$Ir(ppy)_3$	THF	26
13	**2 x 50 W Blue LEDs**	**Eosin Y**	**THF**	**60**
14	2 x 50 W Blue LEDs	Eosin Y (2Na)	THF	58
15	40 °C	-	THF	39
16	50 °C	-	THF	57
17	60 °C	-	THF	52

18	80 °C	-	THF	40



5 8a 9a

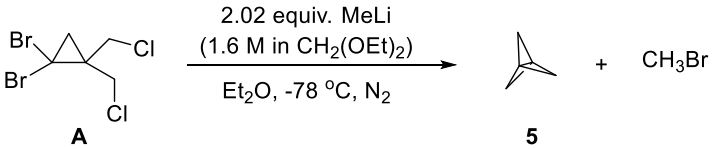
Entry	Heat or hv	Solvent	Yield (%)
1	14 W CFL	-	36
2	14 W CFL	CH_3CN	35
3	**2 x 50 W Blue LEDs**	**CH_3CN**	**40**
4	2 x 50 W Blue LEDs	THF	< 10
5	2 x 50 W Blue LEDs	DCM	< 10
6	2 x 50 W Blue LEDs	DMF	< 10
7	2 x 50 W Blue LEDs	MeOH	< 10
8	2 x 50 W Blue LEDs	PhMe	0
9	2 x 50 W Blue LEDs	EA	0
10	40 °C	-	0
11	60 °C	-	27
12	60 °C	CH_3CN	25
13	60 °C	THF	< 20
14	60 °C	MTBE	< 20
15	60 °C	DCE	< 20
16	60 °C	*i*-PrOH	20

General procedure for synthesis of starting materials

Propellane **5** was prepared according to the following general procedure **A**, alkynylation reagents **6** were prepared according to the following general procedure **B**, allylation reagents **8** were prepared according to the reported procedures[1] and **12** was prepared according to the reported procedures.[2]

1. H. Liu, L. Ge, D.-X. Wang, N. Chen, and C. Feng, *Angew. Chem. Int. Ed.*, 2019, **58**, 3918.
2. J. C. Namyslo, and C. Stanitzek, *Synthesis*, 2006, **20**, 3367.

General procedure A: Synthesis of Propellane **5**

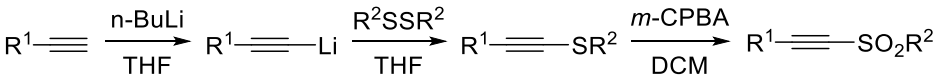


A 5

A 250 mL flame-dried round bottom flask under nitrogen (balloon) was charged with **A** (4.45 g, 15 mmol) and dry diethyl ether (10 mL). The reaction was cooled to -78 °C. MeLi (18.94 mL, 30.3 mmol, 1.6M in diethoxymethane) was added slowly via syringe and stirred at the same temperature for 15 min. Then the reaction temperature was allowed to warm to 0 °C and stirred for 2h in an ice bath to form propellane **5**. After reaction completion, the flip plug on the reaction bottle was replaced with a vacuum distillation unit and a vacuum was slowly applied to the system and the distillate collected, while maintaining the reaction/distillation flask below 0 °C. Approximately 30 mL of distillate was collected with an estimated concentration from following *Quantative ^{1}H NMR Experiment*.

Quantitative ^{1}H NMR Experiment: ^{1}H NMR spectrum analysis was done by adding a 50 μL aliquot of the distillate by syringe to a NMR tube, followed by a 50 μL addition of dichloromethane (internal standard) and then ca. 0.5 mL $CDCl_3$. ^{1}H NMR spectrum indicates a molar ratio of propellane:dichloromethane to be 1:14, which would correspond to a 0.371 M of propellane. The distillate was stored in a 0 °C freezer until use it.

General procedure B: Synthesis of alkynylation reagents **6**

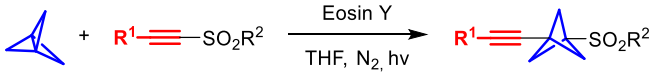


To a stirred solution of terminal alkyne (1.0 equiv.) in THF (20 mL) was added *n*-BuLi (2.4 M solution in THF, 1.0 equiv.) at -78 °C. The reaction mixture was stirred at -78 °C for 1 h. Then the corresponding disulfane (1.0 equiv.) was added and the reaction mixture continue to stir at -78 °C for 1 h. When the reaction was completed as determined by TLC, the mixture was quenched with a saturated aqueous NH_4Cl solution (10 mL) and then extracted with petroleum ether (3×15 mL). The organic phase was washed by brine, dried over Na_2SO_4 and concentrated in vacuo. The residue was dissolved in DCM (20 mL) without purification and *m*-CPBA (3.0 equiv.) was added into the mixture solution at 0 °C. The reaction mixture was stirred until completed. To the solution was added saturated aqueous $NaHCO_3$ solution and stirred for 1 h until no gas was produced. Then the mixture was extracted with DCM (3×15 mL) and the organic phase was washed by brine, dried over Na_2SO_4 and concentrated in vacuo. Purification of the residue by column chromatography gave the corresponding alkynylation reagents **6**.

General procedure for synthesis of alkynyl, allyl, and cyano functionalized BCPs

Alkynyl functionalized BCPs **7** were prepared according to the following general procedure **C**, allyl functionalized BCPs **9** were prepared according to the following general procedure **D**, and cyano functionalized BCPs **10** was prepared according to the following general procedure **E**.

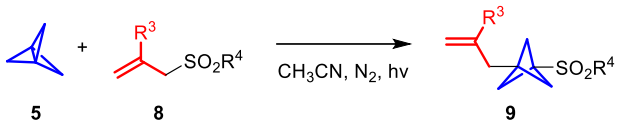
General procedure C: Synthesis of alkynyl functionalized BCPs **7**



5 **6** **7**

Propellane **5** (0.2 mmol, 1.0 equiv.), alkynylation reagents **6** (0.4 mmol, 2.0 equiv.), Eosin Y (0.004 mmol, 0.02 equiv.), and THF (1.0 mL) were loaded in a sealed tube under nitrogen atmosphere. Then the mixture was stirred at 2 x 50 W Blue LEDs until the reaction was completed. The resultant solution was concentrated, and purified by flash column chromatography on silica gel (ethyl acetate/ petroleum ether) to give the corresponding product **7**.

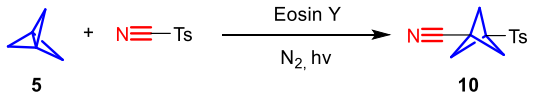
General procedure D: Synthesis of allyl functionalized BCPs **9**



5 8 9

Propellane **5** (0.2 mmol, 1.0 equiv.), allylation reagents **8** (0.3 mmol, 1.5 equiv.), and CH_3CN (1.0 mL) were loaded in a sealed tube under nitrogen atmosphere. Then the mixture was stirred at 2 x 50 W Blue LEDs until the reaction was completed. The resultant solution was concentrated, and purified by flash column chromatography on silica gel (ethyl acetate/ petroleum ether) to give the corresponding product **9**.

General procedure E: Synthesis of cyano functionalized BCPs **10**

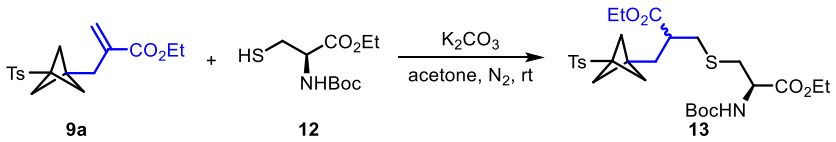


5 10

Propellane **5** (0.2 mmol, 1.0 equiv.), tosyl cyanide (0.4 mmol, 2.0 equiv.), and Eosin Y (0.004 mmol, 0.02 equiv.) were loaded in a sealed tube under nitrogen atmosphere. Then the mixture was stirred at 2 x 50 W Blue LEDs until the reaction was completed. The resultant solution was concentrated, and purified by flash column chromatography on silica gel (ethyl acetate/ petroleum ether) to give the corresponding product **10**.

Gram-scale preparation: Propellane **5** (5.0 mmol, 1.0 equiv.), tosyl cyanide (6.0 mmol, 1.2 equiv.), and Eosin Y (0.004 mmol, 0.02 equiv.) were loaded in a sealed tube under nitrogen atmosphere. Then the mixture was stirred at 2 x 50 W Blue LEDs until the reaction was completed. The resultant solution was concentrated, and purified by flash column chromatography on silica gel (ethyl acetate/ petroleum ether) to give the corresponding product **10** in the yield of 91% with 1.1237g.

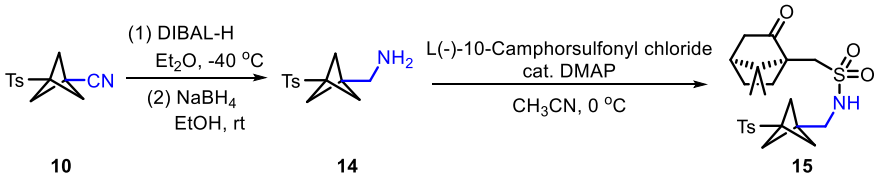
General procedure for product transformations



9a 12 13

To a solution of compound **9a** (0.15 mmol, 1.0 equiv.) and K_2CO_3 (0.072 mmol, 0.48 equiv.) in acetone (1.0 mL), **12** (0.165 mmol, 1.1 equiv.) was added. The reaction mixture was stirred at rt for 7 h under Ar atmosphere. After filtration to remove precipitate, the solvent was evaporated and

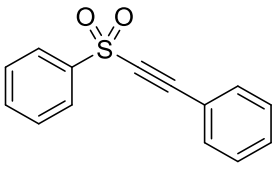
the residue was purified by flash column chromatography to give the corresponding product **13**.



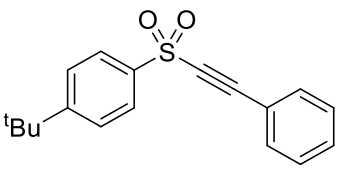
The DIBAL-H (1.5 M in toluene, 0.3 mmol, 1.5 equiv.) was added to the compound **10** in Et_2O (1.0 mL) at -40 °C. The reaction mixture was stirred for 3 h and then $NaBH_4$ (0.6 mmol, 3.0 equiv.) was added. After 10 min, the EtOH (1.0 mL) was added to the solution carefully. The reaction mixture was allowed to warm to room temperature and stirred overnight then diluted with Et_2O (10.0 mL), extracted with 1 M HCl. The combined acidic extracts were made basic (pH > 13) with 15% NaOH (aq.) and extracted with CH_2Cl_2. The combined organic extracts were dried over Na_2SO_4 and concentrated to give the crude amine **14**.

A solution of L(-)-10-Camphorsulfonyl chloride (0.2 mmol, 1.0 equiv.) in CH_3CN (0.5 mL) was added dropwise under N_2 to a stirred solution of the amine **14** (0.2 mmol, 1.0 equiv.) and DMAP (0.04 mmol, 0.2 equiv.) in CH_3CN (1.0 mL) at 0 °C. The solution was stirred for 1 h and water (5.0 mL) was then added, followed by 10% HCl (2 mL), and the resulting mixture was extracted with EtOAc (3 × 10 mL). The organic layers were combined, washed with 5% aqueous NaOH (5 mL) and dried over anhydrous $MgSO_4$. The solvent was evaporated and the residue was purified by flash column chromatography to give the corresponding product **15**.

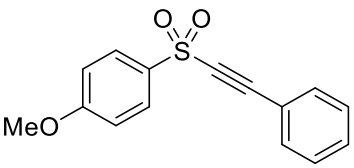
Characterization of starting materials



6a: yellow solid, m.p. 58-59 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.10-8.05 (m, 2H), 7.71-7.65 (m, 1H), 7.62-7.56 (m, 2H), 7.52-7.43 (m, 3H), 7.39-7.32 (m, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 141.8, 134.2, 132.7, 131.6, 129.4, 128.7, 127.4, 117.8, 93.5, 85.3. FT-IR: ν (cm^{-1}) 2977, 2930, 2899, 2179, 1446, 1328, 1228. HRMS [ESI] calcd for $C_{14}H_{10}O_2SNa$ $[M+Na]^+$ 265.0294, found 265.0298.

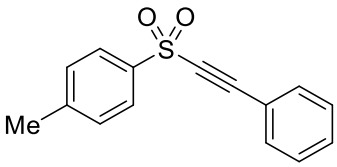


6b: yellow solid, m.p. 81-82 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.02-7.97 (m, 2H), 7.62-7.58 (m, 2H), 7.54-7.50 (m, 2H), 7.49-7.43 (m, 1H), 7.38-7.33 (m, 2H), 1.36 (s, 9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 158.3, 138.8, 132.8, 131.5, 128.7, 127.3, 126.5, 118.0, 93.0, 85.6, 35.4, 31.1. FT-IR: ν (cm^{-1}) 3061, 2963, 2870, 2174, 1590, 1488, 1444, 1366, 1293. HRMS [ESI] calcd for $C_{18}H_{18}O_2SNa$ $[M+Na]^+$ 321.0920, found 321.0928.

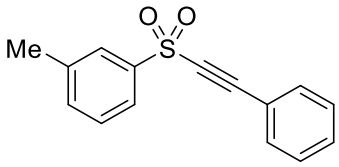


6c: yellow solid, m.p. 74-75 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.03-7.98 (m, 2H), 7.54-7.49 (m, 2H), 7.49-7.43 (m, 1H), 7.39-7.33 (m, 2H), 7.07-7.02 (m, 2H), 3.90 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 164.2, 133.4, 132.7, 131.4, 129.9, 128.7, 118.1, 114.6, 92.5, 85.9, 55.8. FT-IR: ν (cm^{-1}) 3096, 2971, 2182,

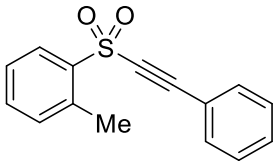
1592, 1574, 1489, 1443, 1417, 1328, 1230. HRMS [ESI] calcd for $C_{15}H_{12}O_3SNa$ $[M+Na]^+$ 295.0399, found 295.0401.



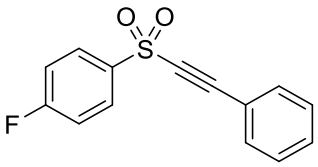
6d: white solid, m.p. 79-80 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.98-7.94 (m, 2H), 7.54-7.50 (m, 2H), 7.50-7.44 (m, 1H), 7.41-7.34 (m, 4H), 2.47 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 145.4, 139.0, 132.7, 131.5, 130.0, 128.7, 127.5, 118.0, 93.0, 85.6, 21.8. FT-IR: ν (cm^{-1}) 3071, 2958, 2865, 2179, 1594, 1486, 1444, 1323, 1291, 1229. HRMS [ESI] calcd for $C_{15}H_{12}O_2SNa$ $[M+Na]^+$ 279.0450, found 279.0457.



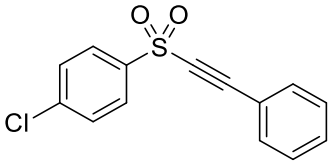
6e: brown solid, m.p. 46-47 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.89-7.84 (m, 2H), 7.52-7.41 (m, 5H), 7.38-7.30 (m, 2H), 2.44 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 141.6, 139.8, 135.1, 132.7, 131.6, 129.3, 128.7, 127.6, 124.6, 117.8, 93.3, 85.5, 21.4. FT-IR: ν (cm^{-1}) 2988, 2920, 2170, 1582, 1446, 1325, 1292, 1230. HRMS [ESI] calcd for $C_{15}H_{12}O_2SNa$ $[M+Na]^+$ 279.0450, found 279.0458.



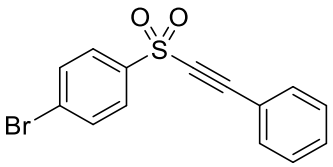
6f: yellow solid, m.p. 58-59 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.12 (d, J = 8.0 Hz, 1H), 7.58-7.44 (m, 4H), 7.43-7.34 (m, 4H), 2.83 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 139.7, 138.4, 134.2, 132.8, 132.8, 131.6, 128.8, 128.7, 126.6, 117.9, 92.0, 85.1, 20.1. FT-IR: ν (cm^{-1}) 3068, 2961, 2179, 1593, 1442, 1320, 1294, 1226. HRMS [ESI] calcd for $C_{15}H_{12}O_2SNa$ $[M+Na]^+$ 279.0450, found 279.0444.



6g: yellow solid, m.p. 64-65 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.14-8.07 (m, 2H), 7.56-7.45 (m, 3H), 7.42-7.34 (m, 2H), 7.32-7.23 (m, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 166.1 (d, $J_{C\text{-}F}$ = 255.7 Hz), 137.9 (d, $J_{C\text{-}F}$ = 3.1 Hz), 132.8, 131.7, 130.5 (d, $J_{C\text{-}F}$ = 9.9 Hz), 128.8, 117.7, 116.8 (d, $J_{C\text{-}F}$ = 22.6 Hz), 93.7, 85.2; ^{19}F NMR (376 MHz, $CDCl_3$) δ -102.2 (s). FT-IR: ν (cm^{-1}) 3041, 2948, 2178, 1587, 1486, 1442, 1405, 1328, 1287, 1225. HRMS [ESI] calcd for $C_{14}H_9FO_2SNa$ $[M+Na]^+$ 283.0199, found 283.0198.

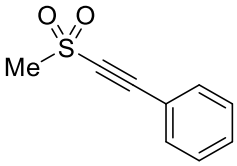


6h: yellow solid, m.p. 91-92 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.04-7.99 (m, 2H), 7.60-7.55 (m, 2H), 7.55-7.46 (m, 3H), 7.41-7.35 (m, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 141.0, 140.3, 132.8, 131.8, 129.8, 129.0, 128.8, 117.7, 94.0, 85.1. FT-IR: ν (cm^{-1}) 3092, 2988, 2179, 1559, 1488, 1471, 1394, 1327, 1229. HRMS [ESI] calcd for $C_{14}H_9ClO_2SNa$ $[M+Na]^+$ 298.9904, found 298.9895.

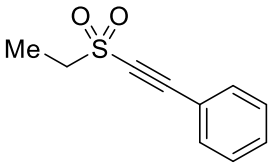


6i: white solid, m.p. 106-107 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.96-7.91 (m, 2H), 7.76-7.70 (m, 2H), 7.54-7.45 (m, 3H), 7.41-7.34 (m, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 140.8, 132.8, 132.8, 131.8, 129.6, 129.0, 128.8, 117.6, 94.1, 85.0. FT-IR: ν (cm^{-1}) 3082, 2971, 2902, 2182, 1570, 1467, 1442, 1388, 1334.

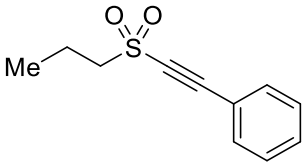
HRMS [ESI] calcd for $C_{14}H_9BrO_2SNa$ $[M+Na]^+$ 342.9399, found 342.9389.



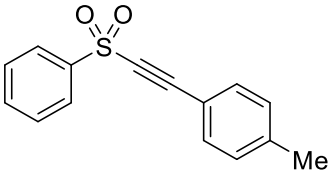
6j: yellow solid, m.p. 57-58 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.61-7.55 (m, 2H), 7.54-7.48 (m, 1H), 7.44-7.37 (m, 2H), 3.30 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 132.9, 131.8, 128.8, 117.5, 91.6, 84.4, 46.8. FT-IR: ν (cm^{-1}) 3025, 2923, 2184, 1694, 1488, 1445, 1411, 1306, 1262, 1232. HRMS [ESI] calcd for $C_9H_8O_2SNa$ $[M+Na]^+$ 203.0137, found 203.0133.



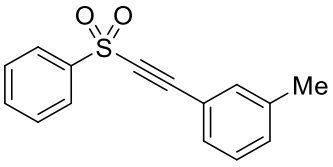
6k: yellow oil. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.56-7.52 (m, 2H), 7.51-7.45 (m, 1H), 7.41-7.35 (m, 2H), 3.27 (q, *J* = 7.6 Hz, 2H), 1.49 (t, *J* = 7.6 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 132.9, 131.8, 128.9, 117.5, 92.5, 82.7, 52.8, 7.8. FT-IR: ν (cm^{-1}) 2981, 2941, 2181, 1489, 1444, 1322, 1283, 1231. HRMS [ESI] calcd for $C_{10}H_{10}O_2SNa$ $[M+Na]^+$ 217.0294, found 217.0295.



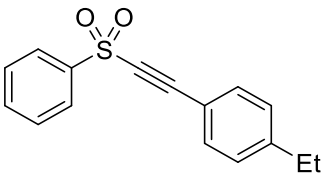
6l: yellow oil. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.59-7.54 (m, 2H), 7.53-7.47 (m, 1H), 7.43-7.36 (m, 2H), 3.28-3.21 (m, 2H), 2.06-1.95 (m, 2H), 1.12 (t, *J* = 7.6 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 132.9, 131.7, 128.8, 117.6, 92.3, 83.4, 60.0, 16.8, 12.8. FT-IR: ν (cm^{-1}) 3336, 2974, 2928, 2884, 1456, 1328, 1275. HRMS [ESI] calcd for $C_{11}H_{12}O_2SNa$ $[M+Na]^+$ 231.0450, found 231.0452.



6m: white solid, m.p. 81-82 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.10-8.05 (m, 2H), 7.71-7.65 (m, 1H), 7.62-7.56 (m, 2H), 7.44-7.39 (m, 2H), 7.19-7.15 (m, 2H), 2.37 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 142.5, 142.0, 134.1, 132.7, 129.5, 129.4, 127.4, 114.7, 94.3, 84.9, 21.8. FT-IR: ν (cm^{-1}) 3054, 2920, 2176, 1745, 1605, 1508, 1445, 1330, 1247. HRMS [ESI] calcd for $C_{15}H_{12}O_2SNa$ $[M+Na]^+$ 279.0450, found 279.0449.

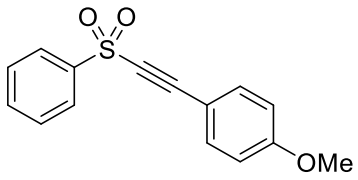


6n: yellow solid, m.p. 52-53 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.10-8.05 (m, 2H), 7.71-7.65 (m, 1H), 7.63-7.56 (m, 2H), 7.35-7.30 (m, 2H), 7.29-7.21 (m, 2H), 2.32 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 141.9, 138.7, 134.2, 133.2, 132.6, 129.9, 129.4, 128.6, 127.4, 117.6, 94.0, 85.0, 21.1. FT-IR: ν (cm^{-1}) 3063, 2920, 2170, 1582, 1447, 1325, 1292. HRMS [ESI] calcd for $C_{15}H_{12}O_2SNa$ $[M+Na]^+$ 279.0450, found 279.0456.

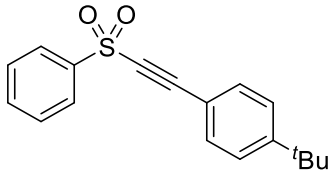


6o: yellow solid, m.p. 45-46 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.10-8.05 (m, 2H), 7.71-7.64 (m, 1H), 7.63-7.55 (m, 2H), 7.47-7.41 (m, 2H), 7.22-7.17 (m, 2H), 2.65 (q, *J* = 7.6 Hz, 2H), 1.21 (t, *J* = 7.6 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 148.7, 142.0, 134.1, 132.9, 129.4, 128.3, 127.3, 114.9, 94.3, 84.9, 29.0,

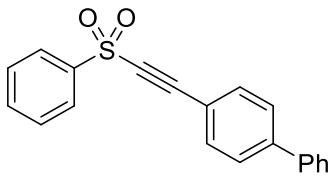
15.1. FT-IR: ν (cm^{-1}) 2988, 2972, 2901, 2171, 1604, 1501, 1446, 1331, 1310. HRMS [ESI] calcd for $C_{16}H_{14}O_2SNa$ $[M+Na]^+$ 293.0607, found 293.0601.



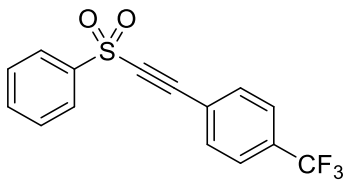
6p: yellow solid, m.p. 60-61 °C. ^1H NMR (400 MHz, $CDCl_3$) δ 8.09-8.03 (m, 2H), 7.69-7.63 (m, 1H), 7.62-7.54 (m, 2H), 7.48-7.42 (m, 2H), 6.89-6.83 (m, 2H), 3.81 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 162.2, 142.1, 134.7, 134.0, 129.4, 127.3, 114.5, 109.4, 94.7, 84.6, 55.5. FT-IR: ν (cm^{-1}) 2976, 2934, 2900, 2173, 1602, 1507, 1421, 1322, 1300, 1255. HRMS [ESI] calcd for $C_{15}H_{12}O_3SNa$ $[M+Na]^+$ 295.0399, found 295.0400.



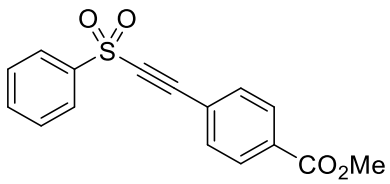
6q: yellow solid, m.p. 111-112 °C. ^1H NMR (400 MHz, $CDCl_3$) δ 8.10-8.05 (m, 2H), 7.71-7.64 (m, 1H), 7.62-7.56 (m, 2H), 7.48-7.43 (m, 2H), 7.41-7.36 (m, 2H), 1.29 (s, 9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 155.5, 142.0, 134.1, 132.7, 129.4, 127.3, 125.8, 114.7, 94.3, 84.9, 35.2, 31.0. FT-IR: ν (cm^{-1}) 3061, 2989, 2916, 2174, 1600, 1484, 1447, 1406, 1329, 1292. HRMS [ESI] calcd for $C_{18}H_{18}O_2SNa$ $[M+Na]^+$ 321.0920, found 321.0918.



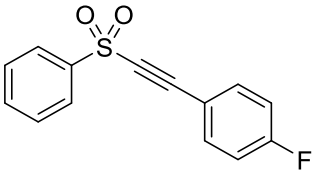
6r: yellow solid, m.p. 98-99 °C. ^1H NMR (400 MHz, $CDCl_3$) δ 8.14-8.09 (m, 2H), 7.73-7.67 (m, 1H), 7.65-7.54 (m, 8H), 7.49-7.42 (m, 2H), 7.42-7.36 (m, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 144.4, 141.9, 139.4, 134.2, 133.3, 129.5, 129.1, 128.5, 127.4, 127.3, 127.2, 116.5, 93.7, 85.9. FT-IR: ν (cm^{-1}) 3077, 2988, 2916, 2173, 1600, 1485, 1447, 1405, 1329, 1309. HRMS [ESI] calcd for $C_{20}H_{15}O_2S$ $[M+H]^+$ 319.0787, found 319.0789.



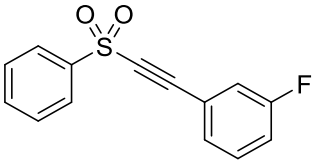
6s: yellow solid, m.p. 77-78 °C. ^1H NMR (400 MHz, $CDCl_3$) δ 8.11-8.06 (m, 2H), 7.75-7.69 (m, 1H), 7.67-7.59 (m, 6H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 141.3, 134.6, 133.1, 133.1 (q, J_{C-F} = 32.9 Hz), 129.5, 127.6, 125.7 (q, J_{C-F} = 3.7 Hz), 123.3 (q, J_{C-F} = 271.0 Hz), 121.7 (q, J_{C-F} = 1.2 Hz), 90.9, 87.1; ^{19}F NMR (376 MHz, $CDCl_3$) δ -63.3 (s). FT-IR: ν (cm^{-1}) 3071, 2971, 2185, 1449, 1407, 1318, 1243, 1225. HRMS [ESI] calcd for $C_{15}H_9F_3O_2SNa$ $[M+Na]^+$ 333.0168, found 333.0166.



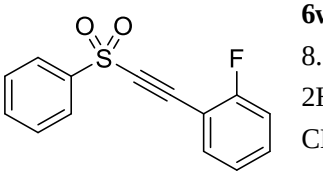
6t: yellow solid, m.p. 92-93 °C. ^1H NMR (400 MHz, $CDCl_3$) δ 8.10-8.05 (m, 2H), 8.05-7.99 (m, 2H), 7.73-7.67 (m, 1H), 7.64-7.55 (m, 4H), 3.91 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 165.8, 141.4, 134.5, 132.7, 132.5, 129.7, 129.5, 127.6, 122.2, 91.7, 87.3, 52.6. FT-IR: ν (cm^{-1}) 3068, 2923, 2855, 2177, 1718, 1434, 1404, 1330, 1281. HRMS [ESI] calcd for $C_{16}H_{12}O_4SNa$ $[M+Na]^+$ 323.0349, found 323.0347.



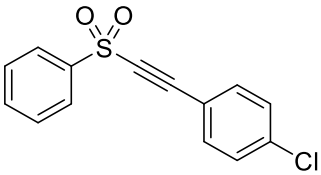
6u: yellow solid, m.p. 44-45 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.09-8.04 (m, 2H), 7.72-7.65 (m, 1H), 7.63-7.56 (m, 2H), 7.54-7.48 (m, 2H), 7.09-7.01 (m, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 164.4 (d, J_{C-F} = 253.6 Hz), 141.6, 135.1, 134.8 (d, J_{C-F} = 89.5 Hz), 129.5, 127.4, 116.4 (d, J_{C-F} = 22.4 Hz), 114.0 (d, J_{C-F} = 3.6 Hz), 92.4, 85.3 (d, J_{C-F} = 1.6 Hz); ^{19}F NMR (376 MHz, $CDCl_3$) δ -104.3 (s). FT-IR: ν (cm^{-1}) 3103, 3074, 2181, 1598, 1504, 1477, 1446, 1339, 1228, 1215. HRMS [ESI] calcd for $C_{14}H_9FO_2SNa$ $[M+Na]^+$ 283.0199, found 283.0208.



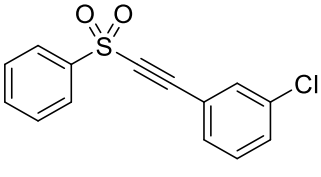
6v: white solid, m.p. 69-70 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.10-8.04 (m, 2H), 7.73-7.67 (m, 1H), 7.64-7.57 (m, 2H), 7.39-7.27 (m, 2H), 7.23-7.13 (m, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 162.1 (d, J_{C-F} = 247.5 Hz), 141.5, 134.5, 130.6 (d, J_{C-F} = 8.4 Hz), 129.5, 128.7 (d, J_{C-F} = 3.4 Hz), 127.5, 119.6 (d, J_{C-F} = 8.6 Hz), 119.5 (d, J_{C-F} = 23.6 Hz), 119.2 (d, J_{C-F} = 21.0 Hz), 91.5 (d, J_{C-F} = 3.5 Hz), 85.9; ^{19}F NMR (376 MHz, $CDCl_3$) δ -110.9 (s). FT-IR: ν (cm^{-1}) 3077, 3002, 2187, 1506, 1473, 1442, 1402, 1313, 1236. HRMS [ESI] calcd for $C_{14}H_9FO_2SNa$ $[M+Na]^+$ 283.0199, found 283.0206.



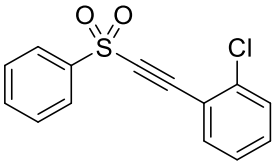
6w: white solid, m.p. 75-76 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.11-8.04 (m, 2H), 7.73-7.66 (m, 1H), 7.63-7.56 (m, 2H), 7.52-7.42 (m, 2H), 7.19-7.13 (m, 1H), 7.12-7.06 (m, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 163.5 (d, J_{C-F} = 255.6 Hz), 141.6, 134.4, 134.2, 133.8 (d, J_{C-F} = 8.4 Hz), 129.5, 127.5, 124.5 (d, J_{C-F} = 3.7 Hz), 116.1 (d, J_{C-F} = 19.7 Hz), 107.0 (d, J_{C-F} = 14.9 Hz), 89.8 (d, J_{C-F} = 3.5 Hz), 87.2; ^{19}F NMR (376 MHz, $CDCl_3$) δ -106.2 (s). FT-IR: ν (cm^{-1}) 3076, 2988, 2187, 1488, 1446, 1334, 1309, 1246. HRMS [ESI] calcd for $C_{14}H_9FO_2SNa$ $[M+Na]^+$ 283.0199, found 283.0199.



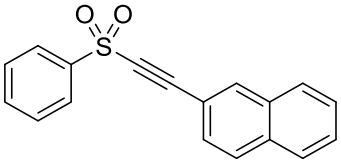
6x: white solid, m.p. 96-97 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.10-8.05 (m, 2H), 7.73-7.67 (m, 1H), 7.64-7.58 (m, 2H), 7.49-7.43 (m, 2H), 7.38-7.34 (m, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 141.6, 138.2, 134.3, 134.0, 129.5, 129.2, 127.5, 116.4, 92.1, 86.2. FT-IR: ν (cm^{-1}) 3089, 2949, 2184, 1589, 1488, 1446, 1330, 1222. HRMS [ESI] calcd for $C_{14}H_9ClO_2SNa$ $[M+Na]^+$ 298.9904, found 298.9893.



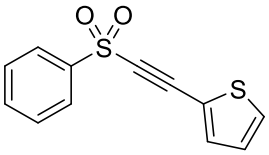
6y: yellow solid, m.p. 69-70 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.10-8.05 (m, 2H), 7.74-7.68 (m, 1H), 7.65-7.59 (m, 2H), 7.52-7.49 (m, 1H), 7.47-7.40 (m, 2H), 7.35-7.29 (m, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 141.5, 134.7, 134.4, 132.4, 131.9, 130.9, 130.1, 129.5, 127.5, 119.6, 91.3, 86.2. FT-IR: ν (cm^{-1}) 3069, 2925, 2189, 1561, 1508, 1473, 1408, 1325, 1292. HRMS [ESI] calcd for $C_{14}H_9ClO_2SNa$ $[M+Na]^+$ 298.9904, found 298.9892.



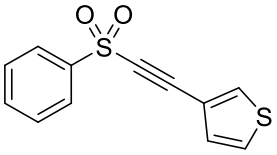
6z: yellow solid, m.p. 56-57 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.12-8.08 (m, 2H), 7.73-7.67 (m, 1H), 7.64-7.57 (m, 2H), 7.56-7.52 (m, 1H), 7.43-7.37 (m, 2H), 7.30-7.24 (m, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 141.7, 137.6, 134.3, 134.3, 132.6, 129.8, 129.4, 127.5, 126.8, 118.4, 90.0, 89.5. FT-IR: ν (cm^{-1}) 3066, 2954, 2183, 1584, 1469, 1446, 1324, 1228. HRMS [ESI] calcd for $C_{14}H_9ClO_2SNa$ $[M+Na]^+$ 298.9904, found 298.9895.



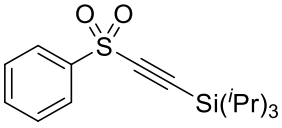
6aa: white solid, m.p. 98-99 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.16-8.11 (m, 2H), 8.05 (s, 1H), 7.83-7.74 (m, 3H), 7.72-7.66 (m, 1H), 7.65-7.58 (m, 2H), 7.58-7.49 (m, 2H), 7.45 (dd, *J* = 8.4, 1.6 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 141.9, 134.4, 134.3, 134.2, 132.4, 129.5, 128.6, 128.5, 128.3, 128.0, 127.4, 127.3, 114.9, 94.1, 85.5. FT-IR: ν (cm^{-1}) 3063, 2922, 2181, 1506, 1448, 1397, 1258, 1215. HRMS [ESI] calcd for $C_{18}H_{13}O_2S$ $[M+H]^+$ 293.0631, found 293.0627.



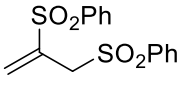
6ab: brown solid, m.p. 72-73 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.09-8.04 (m, 2H), 7.72-7.65 (m, 1H), 7.63-7.56 (m, 2H), 7.50 (dd, *J* = 4.8, 0.8 Hz, 1H), 7.48-7.45 (m, 1H), 7.04 (dd, *J* = 4.8, 3.6 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 141.7, 137.3, 134.3, 132.4, 129.4, 127.8, 127.4, 117.3, 89.0, 87.7. FT-IR: ν (cm^{-1}) 2971, 2902, 2159, 1446, 1411, 1327, 1231. HRMS [ESI] calcd for $C_{12}H_8O_2S_2Na$ $[M+Na]^+$ 270.9858, found 270.9863.



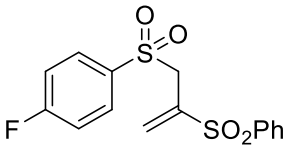
6ac: yellow solid, m.p. 58-59 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.08-8.03 (m, 2H), 7.75-7.71 (m, 1H), 7.70-7.64 (m, 1H), 7.61-7.54 (m, 2H), 7.33-7.28 (m, 1H), 7.16-7.12 (m, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 141.7, 134.9, 134.3, 129.8, 129.5, 127.4, 126.7, 117.0, 89.3, 85.3. FT-IR: ν (cm^{-1}) 3112, 2969, 2185, 2167, 1474, 1446, 1329, 1291. HRMS [ESI] calcd for $C_{12}H_8O_2S_2Na$ $[M+Na]^+$ 270.9858, found 270.9865.



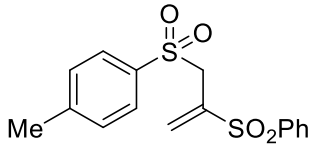
6ad: colorless oil. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.03-7.99 (m, 2H), 7.69-7.64 (m, 1H), 7.60-7.54 (m, 2H), 1.12-1.04 (m, 3H), 1.01 (d, *J* = 6.4 Hz, 18H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 142.1, 134.1, 129.3, 127.2, 100.9, 100.6, 18.3, 10.8. FT-IR: ν (cm^{-1}) 2946, 2867, 1730, 1584, 1463, 1448, 1334, 1284, 1259. HRMS [ESI] calcd for $C_{17}H_{26}O_2SSiNa$ $[M+Na]^+$ 345.1315, found 345.1309.



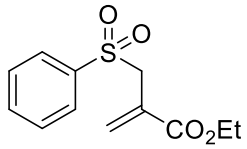
8a: yellow solid, m.p. 101-102 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.78-7.72 (m, 4H), 7.69-7.60 (m, 2H), 7.55-7.47 (m, 4H), 6.67 (d, *J* = 0.8 Hz, 1H), 6.52 (d, *J* = 1.2 Hz, 1H), 4.06 (s, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 139.5, 137.8, 137.8, 134.3, 134.1, 131.2, 129.5, 129.3, 128.5, 128.4, 54.2. FT-IR: ν (cm^{-1}) 3368, 2977, 2930, 2902, 2159, 2028, 1447, 1383, 1304. HRMS [ESI] calcd for $C_{15}H_{14}O_4S_2Na$ $[M+Na]^+$ 345.0226, found 345.0216.



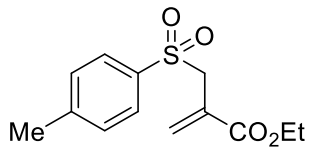
8b: yellow solid, m.p. 91-92 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.79-7.70 (m, 4H), 7.67-7.61 (m, 1H), 7.54-7.48 (m, 2H), 7.20-7.14 (m, 2H), 6.69 (d, J = 1.2 Hz, 1H), 6.57-6.54 (m, 1H), 4.05 (d, J = 1.2 Hz, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 166.2 (d, $J_{C\text{-}F}$ = 256.1 Hz), 139.5, 137.8, 134.1, 133.6 (d, $J_{C\text{-}F}$ = 3.0 Hz), 131.6, 131.5 (d, $J_{C\text{-}F}$ = 4.3 Hz), 129.5, 128.4, 116.7 (d, $J_{C\text{-}F}$ = 22.6 Hz), 54.4; ^{19}F NMR (376 MHz, $CDCl_3$) δ -102.0 (s). FT-IR: ν (cm^{-1}) 3369, 2977, 2929, 2902, 2160, 2029, 1976, 1508, 1489, 1383, 1327. HRMS [ESI] calcd for $C_{15}H_{13}FO_4S_2Na$ $[M+Na]^+$ 363.0131, found 363.0130.



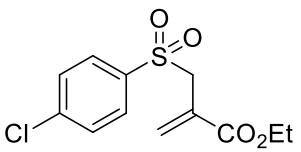
8c: white solid, m.p. 125-126 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.77-7.71 (m, 2H), 7.66-7.58 (m, 3H), 7.54-7.46 (m, 2H), 7.32-7.26 (m, 2H), 6.68 (s, 1H), 6.52 (s, 1H), 4.04 (s, 2H), 2.44 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 145.4, 139.6, 137.9, 134.8, 133.9, 131.1, 130.0, 129.4, 128.5, 128.5, 54.2, 21.7. FT-IR: ν (cm^{-1}) 2916, 2022, 1974, 1449, 1307, 1296. HRMS [ESI] calcd for $C_{16}H_{16}O_4S_2Na$ $[M+Na]^+$ 359.0382, found 359.0387.



8d: colorless oil. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.88-7.82 (m, 2H), 7.66-7.60 (m, 1H), 7.56-7.50 (m, 2H), 6.50 (s, 1H), 5.90 (s, 1H), 4.15 (s, 2H), 4.00 (q, J = 7.2 Hz, 2H), 1.16 (t, J = 7.2 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 164.7, 138.4, 133.9, 133.3, 129.1, 129.0, 128.8, 61.5, 57.5, 14.0. FT-IR: ν (cm^{-1}) 3065, 2986, 2938, 2180, 1716, 1630, 1447, 1415, 1369, 1308, 1247. HRMS [ESI] calcd for $C_{12}H_{14}O_4SNa$ $[M+Na]^+$ 277.0505, found 277.0514.

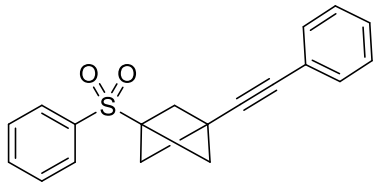


8e: white solid, m.p. 45-46 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.75-7.69 (m, 2H), 7.35-7.29 (m, 2H), 6.49 (s, 1H), 5.89 (s, 1H), 4.13 (s, 2H), 4.02 (q, J = 7.2 Hz, 2H), 2.43 (s, 3H), 1.17 (t, J = 7.2 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 164.8, 144.9, 135.5, 133.2, 129.6, 129.2, 128.8, 61.5, 57.6, 21.6, 14.0. FT-IR: ν (cm^{-1}) 2985, 2930, 1713, 1628, 1597, 1463, 1445, 1312, 1290, 1240. HRMS [ESI] calcd for $C_{13}H_{17}O_4S$ $[M+H]^+$ 269.0842, found 269.0848.

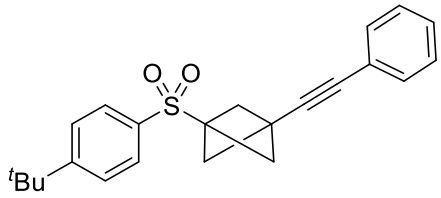


8f: white solid, m.p. 32-33 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.77-7.72 (m, 2H), 7.49-7.44 (m, 2H), 6.47 (s, 1H), 5.89 (s, 1H), 4.13 (s, 2H), 4.00 (q, J = 7.2 Hz, 2H), 1.14 (t, J = 7.2 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 164.6, 140.6, 136.8, 133.5, 130.3, 129.3, 128.9, 61.6, 57.5, 14.0. FT-IR: ν (cm^{-1}) 3398, 2977, 2935, 2159, 2033, 1975, 1704, 1572, 1475, 1328, 1247. HRMS [ESI] calcd for $C_{12}H_{13}ClO_4SNa$ $[M+Na]^+$ 311.0115, found 311.0123.

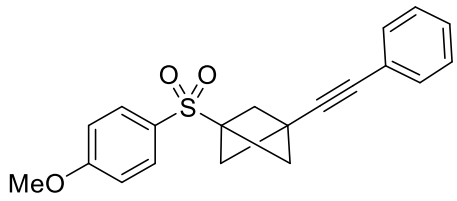
Characterization of products



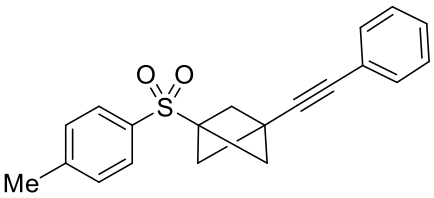
7a: 36.9 mg, 60% yield, yellow solid, m.p. 115-116 °C. Purification by flash column chromatography (eluent: EtOAc/Petroleum ether = 1/10). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.89-7.85 (m, 2H), 7.71-7.65 (m, 1H), 7.61-7.55 (m, 2H), 7.38-7.34 (m, 2H), 7.31-7.24 (m, 3H), 2.37 (s, 6H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 136.5, 133.9, 131.7, 129.3, 128.6, 128.6, 128.3, 122.2, 85.2, 82.4, 54.7, 53.1, 28.7. FT-IR: ν (cm^{-1}) 2988, 2972, 2901, 1445, 1406, 1394, 1301, 1250, 1230. HRMS [ESI] calcd for $C_{19}H_{16}O_2SNa$ $[M+Na]^+$ 331.0763, found 331.0762.



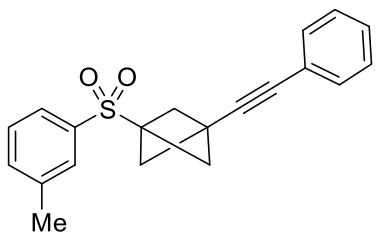
7b: 41.3 mg, 57% yield, white solid, m.p. 197-198 °C. Purification by flash column chromatography (eluent: EtOAc/Petroleum ether = 1/10). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.79-7.75 (m, 2H), 7.59-7.54 (m, 2H), 7.38-7.33 (m, 2H), 7.30-7.23 (m, 3H), 2.37 (s, 6H), 1.35 (s, 9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 157.8, 133.5, 131.7, 128.5, 128.5, 128.3, 126.2, 122.3, 85.4, 82.4, 54.7, 53.2, 35.3, 31.1, 28.6. FT-IR: ν (cm^{-1}) 2969, 2902, 1595, 1365, 1304, 1293, 1269. HRMS [ESI] calcd for $C_{23}H_{24}O_2SNa$ $[M+Na]^+$ 387.1389, found 387.1382.



7c: 32.4 mg, 48% yield, yellow solid, m.p. 130-131 °C. Purification by flash column chromatography (eluent: EtOAc/Petroleum ether = 1/10). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.81-7.75 (m, 2H), 7.39-7.34 (m, 2H), 7.31-7.24 (m, 3H), 7.05-7.00 (m, 2H), 3.89 (s, 3H), 2.35 (s, 6H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 163.9, 131.7, 130.8, 128.5, 128.3, 128.0, 122.3, 114.5, 85.4, 82.4, 55.7, 54.7, 53.3, 28.6. FT-IR: ν (cm^{-1}) 2988, 2972, 2901, 1593, 1490, 1407, 1394, 1292, 1250. HRMS [ESI] calcd for $C_{20}H_{18}O_3SNa$ $[M+Na]^+$ 361.0869, found 361.0871.

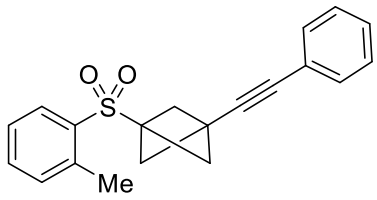


7d: 38.6 mg, 60% yield, white solid, m.p. 164-165 °C. Purification by flash column chromatography (eluent: EtOAc/Petroleum ether = 1/10). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.74-7.69 (m, 2H), 7.36-7.31 (m, 4H), 7.28-7.22 (m, 3H), 2.43 (s, 3H), 2.33 (s, 6H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 144.9, 133.6, 131.7, 129.9, 128.6, 128.5, 128.3, 122.3, 85.4, 82.4, 54.7, 53.2, 28.6, 21.7. FT-IR: ν (cm^{-1}) 2988, 2972, 2901, 1450, 1406, 1394, 1300, 1230. HRMS [ESI] calcd for $C_{20}H_{18}O_2SNa$ $[M+Na]^+$ 345.0920, found 345.0916.

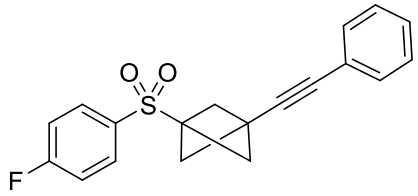


7e: 20.0 mg, 31% yield, yellow solid, m.p. 113-114 °C. Purification by flash column chromatography (eluent: EtOAc/Petroleum ether = 1/10). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.68-7.63 (m, 2H), 7.49-7.42 (m, 2H), 7.39-7.34 (m, 2H), 7.31-7.24 (m, 3H), 2.45 (s, 3H), 2.37 (s, 6H); ^{13}C NMR (100

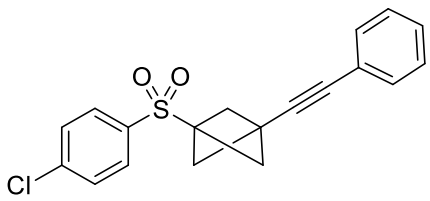
MHz, $CDCl_3$) δ 139.5, 136.4, 134.7, 131.7, 129.1, 128.8, 128.6, 128.3, 125.8, 122.3, 85.3, 82.4, 54.8, 53.1, 28.6, 21.4. FT-IR: ν (cm^{-1}) 2988, 2972, 2901, 1406, 1394, 1250, 1229. HRMS [ESI] calcd for $C_{20}H_{18}O_2SNa$ $[M+Na]^+$ 345.0920, found 345.0907.



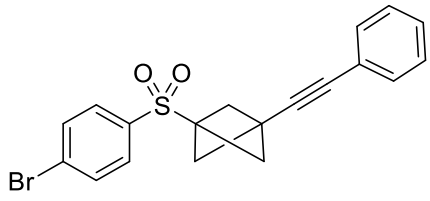
7f: 33.2 mg, 51% yield, white solid, m.p. 100-101 °C. Purification by flash column chromatography (eluent: EtOAc/Petroleum ether = 1/10). ^1H NMR (400 MHz, $CDCl_3$) δ 7.91 (dd, *J* = 7.6, 1.2 Hz, 1H), 7.50 (ddd, *J* = 7.2, 7.2, 1.2 Hz, 1H), 7.38-7.29 (m, 4H), 7.28-7.22 (m, 3H), 2.64 (s, 3H), 2.37 (s, 6H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 139.1, 134.7, 133.9, 132.8, 131.7, 131.0, 128.5, 128.3, 126.7, 122.2, 85.3, 82.3, 54.9, 53.6, 28.5, 20.9. FT-IR: ν (cm^{-1}) 2988, 2972, 2901, 1406, 1394, 1301, 1251, 1230. HRMS [ESI] calcd for $C_{20}H_{18}O_2SNa$ $[M+Na]^+$ 345.0920, found 345.0912.



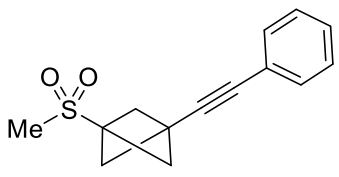
7g: 42.9 mg, 66% yield, white solid, m.p. 163-164 °C. Purification by flash column chromatography (eluent: EtOAc/Petroleum ether = 1/10). ^1H NMR (400 MHz, $CDCl_3$) δ 7.92-7.85 (m, 2H), 7.40-7.34 (m, 2H), 7.33-7.22 (m, 5H), 2.37 (s, 6H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 166.0 (d, J_{C-F} = 255.1 Hz), 132.6 (d, J_{C-F} = 3.2 Hz), 131.7, 131.4 (q, J_{C-F} = 9.5 Hz), 128.6, 128.3, 122.1, 116.7 (d, J_{C-F} = 22.5 Hz), 85.1, 82.6, 54.7, 53.2, 28.8; ^{19}F NMR (376 MHz, $CDCl_3$) δ -103.0 (s). FT-IR: ν (cm^{-1}) 2988, 2972, 2901, 1589, 1489, 1405, 1394, 1310, 1234. HRMS [ESI] calcd for $C_{19}H_{15}FO_2SNa$ $[M+Na]^+$ 349.0669, found 349.0684.



7h: 34.2 mg, 50% yield, white solid, m.p. 190-191 °C. Purification by flash column chromatography (eluent: EtOAc/Petroleum ether = 1/10). ^1H NMR (400 MHz, $CDCl_3$) δ 7.82-7.78 (m, 2H), 7.58-7.53 (m, 2H), 7.39-7.34 (m, 2H), 7.31-7.24 (m, 3H), 2.37 (s, 6H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 140.8, 135.1, 131.8, 130.1, 129.7, 128.6, 128.3, 122.2, 85.0, 82.6, 54.8, 53.1, 28.8. FT-IR: ν (cm^{-1}) 3075, 3014, 2927, 1582, 1474, 1392, 1306, 1276. HRMS [ESI] calcd for $C_{19}H_{15}ClO_2SNa$ $[M+Na]^+$ 365.0373, found 365.0379.

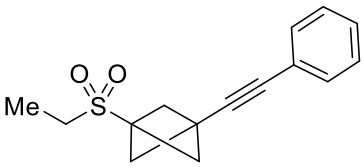


7i: 41.0 mg, 54% yield, white solid, m.p. 202-203 °C. Purification by flash column chromatography (eluent: EtOAc/Petroleum ether = 1/10). ^1H NMR (400 MHz, $CDCl_3$) δ 7.72 (s, 4H), 7.39-7.34 (m, 2H), 7.32-7.24 (m, 3H), 2.37 (s, 6H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 135.6, 132.6, 131.8, 130.1, 129.4, 128.6, 128.3, 122.1, 85.0, 82.6, 54.8, 53.1, 28.8. FT-IR: ν (cm^{-1}) 2988, 2972, 2901, 1406, 1394, 1385, 1306, 1250, 1230. HRMS [ESI] calcd for $C_{19}H_{15}BrO_2SNa$ $[M+Na]^+$ 408.9868, found 408.9869.

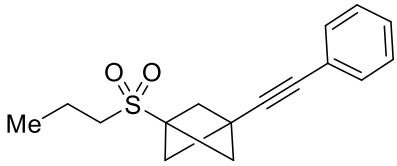


7j: 33.3 mg, 68% yield, white solid, m.p. 126-127 °C. Purification by flash column chromatography (eluent:

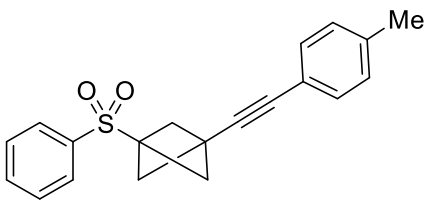
EtOAc/Petroleum ether = 1/5). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.44-7.38 (m, 2H), 7.34-7.26 (m, 3H), 2.85 (s, 3H), 2.54 (s, 6H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 131.8, 128.7, 128.4, 122.1, 85.0, 82.5, 54.9, 52.4, 37.7, 28.2. FT-IR: ν (cm^{-1}) 2988, 2972, 2901, 1407, 1394, 1291, 1251, 1230. HRMS [ESI] calcd for $C_{14}H_{14}O_2SNa$ $[M+Na]^+$ 269.0607, found 269.0605.



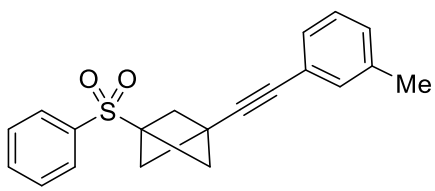
7k: 39.5 mg, 76% yield, white solid, m.p. 113-114 °C. Purification by flash column chromatography (eluent: EtOAc/Petroleum ether = 1/5). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.44-7.38 (m, 2H), 7.35-7.26 (m, 3H), 2.98 (q, *J* = 7.6 Hz, 2H), 2.55 (s, 6H), 1.40 (t, *J* = 7.6 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 131.8, 128.7, 128.4, 122.2, 85.1, 82.3, 55.3, 51.7, 44.8, 28.6, 6.1. FT-IR: ν (cm^{-1}) 2988, 2972, 2901, 1490, 1446, 1335, 1296, 1230, 1207. HRMS [ESI] calcd for $C_{15}H_{16}O_2SNa$ $[M+Na]^+$ 283.0763, found 283.0759.



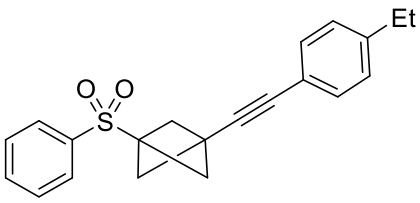
7l: 30.2 mg, 55% yield, white solid, m.p. 118-119 °C. Purification by flash column chromatography (eluent: EtOAc/Petroleum ether = 1/5). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.44-7.39 (m, 2H), 7.33-7.27 (m, 3H), 2.95-2.89 (m, 2H), 2.54 (s, 6H), 1.95-1.84 (m, 2H), 1.10 (t, *J* = 7.2 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 131.8, 128.6, 128.4, 122.2, 85.1, 82.3, 55.2, 52.0, 28.5, 15.2, 13.4. FT-IR: ν (cm^{-1}) 2968, 2926, 2876, 1489, 1449, 1336, 1313, 1276, 1209. HRMS [ESI] calcd for $C_{16}H_{18}O_2SNa$ $[M+Na]^+$ 297.0920, found 297.0911.



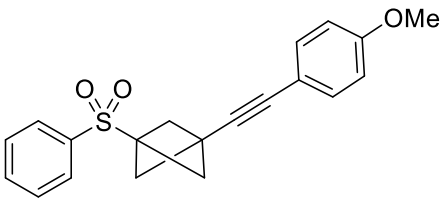
7m: 39.8 mg, 62% yield, white solid, m.p. 143-144 °C. Purification by flash column chromatography (eluent: EtOAc/Petroleum ether = 1/10). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.90-7.86 (m, 2H), 7.72-7.66 (m, 1H), 7.62-7.56 (m, 2H), 7.30-7.24 (m, 2H), 7.12-7.06 (m, 2H), 2.37 (s, 6H), 2.33 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 138.7, 136.6, 133.9, 131.6, 129.2, 129.1, 128.6, 119.1, 84.6, 82.6, 54.7, 53.1, 28.8, 21.5. FT-IR: ν (cm^{-1}) 2988, 2972, 2901, 1447, 1406, 1394, 1302, 1251, 1230. HRMS [ESI] calcd for $C_{20}H_{18}O_2SNa$ $[M+Na]^+$ 345.0920, found 345.0917.



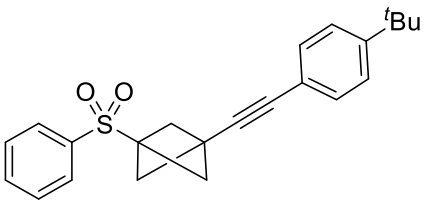
7n: 32.8 mg, 51% yield, yellow solid, m.p. 103-104 °C. Purification by flash column chromatography (eluent: EtOAc/Petroleum ether = 1/10). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.89-7.84 (m, 2H), 7.70-7.64 (m, 1H), 7.61-7.54 (m, 2H), 7.20 (s, 1H), 7.18-7.13 (m, 2H), 7.13-7.07 (m, 1H), 2.36 (s, 6H), 2.29 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 138.0, 136.6, 133.9, 132.3, 129.5, 129.3, 128.8, 128.6, 128.2, 122.0, 84.9, 82.6, 54.7, 53.1, 28.7, 21.2. FT-IR: ν (cm^{-1}) 2988, 2972, 2901, 1406, 1394, 1382, 1303, 1251, 1230. HRMS [ESI] calcd for $C_{20}H_{18}O_2SNa$ $[M+Na]^+$ 345.0920, found 345.0906.



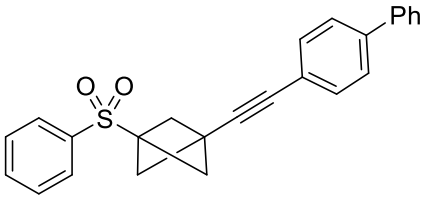
7o: 34.8 mg, 52% yield, yellow solid, m.p. 76-77 °C. Purification by flash column chromatography (eluent: EtOAc/Petroleum ether = 1/10). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.89-7.84 (m, 2H), 7.70-7.64 (m, 1H), 7.61-7.55 (m, 2H), 7.30-7.26 (m, 2H), 7.13-7.08 (m, 2H), 2.62 (q, *J* = 7.6 Hz, 2H), 2.36 (s, 6H), 1.20 (t, *J* = 7.6 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 145.0, 136.6, 133.9, 131.7, 129.2, 128.6, 127.9, 119.3, 84.5, 82.6, 54.7, 53.1, 28.8, 15.3. FT-IR: ν (cm^{-1}) 2988, 2971, 2901, 1447, 1406, 1394, 1304, 1250, 1230. HRMS [ESI] calcd for $C_{21}H_{20}O_2SNa$ $[M+Na]^+$ 359.1076, found 359.1074.



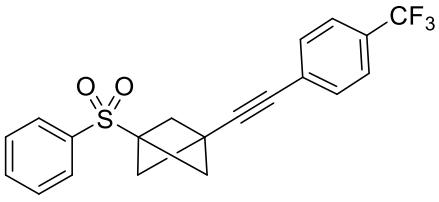
7p: 45.7 mg, 68% yield, white solid, m.p. 133-134 °C. Purification by flash column chromatography (eluent: EtOAc/Petroleum ether = 1/10). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.88-7.84 (m, 2H), 7.70-7.64 (m, 1H), 7.60-7.54 (m, 2H), 7.32-7.27 (m, 2H), 6.82-6.77 (m, 2H), 3.78 (s, 3H), 2.35 (s, 6H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 159.8, 136.6, 133.9, 133.2, 129.2, 128.6, 114.2, 114.0, 83.9, 82.4, 55.3, 54.7, 53.1, 28.8. FT-IR: ν (cm^{-1}) 2971, 2918, 1604, 1508, 1446, 1394, 1303, 1287, 1244. HRMS [ESI] calcd for $C_{20}H_{18}O_3SNa$ $[M+Na]^+$ 361.0869, found 361.0865.



7q: 45.7 mg, 63% yield, white solid, m.p. 177-178 °C. Purification by flash column chromatography (eluent: EtOAc/Petroleum ether = 1/10). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.89-7.84 (m, 2H), 7.70-7.63 (m, 1H), 7.60-7.54 (m, 2H), 7.29 (s, 4H), 2.36 (s, 6H), 1.28 (s, 9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 151.9, 136.6, 133.9, 131.5, 129.3, 128.6, 125.3, 119.2, 84.6, 82.6, 54.8, 53.1, 34.8, 31.1, 28.8. FT-IR: ν (cm^{-1}) 2988, 2972, 2901, 1448, 1406, 1394, 1305, 1251, 1230. HRMS [ESI] calcd for $C_{23}H_{24}O_2SNa$ $[M+Na]^+$ 387.1389, found 387.1392.

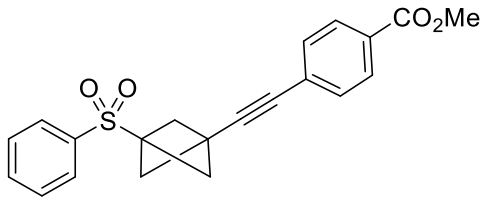


7r: 44.4 mg, 58% yield, white solid, m.p. 158-159 °C. Purification by flash column chromatography (eluent: EtOAc/Petroleum ether = 1/10). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.91-7.86 (m, 2H), 7.71-7.65 (m, 1H), 7.62-7.54 (m, 4H), 7.54-7.49 (m, 2H), 7.46-7.40 (m, 4H), 7.38-7.32 (m, 1H), 2.39 (s, 6H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 141.3, 140.2, 136.6, 133.9, 132.2, 129.3, 128.9, 128.6, 127.7, 127.0, 121.1, 85.9, 82.4, 54.8, 53.2, 28.8. FT-IR: ν (cm^{-1}) 2988, 2972, 2901, 1485, 1446, 1302, 1210. HRMS [ESI] calcd for $C_{25}H_{20}O_2SNa$ $[M+Na]^+$ 407.1076, found 407.1072.

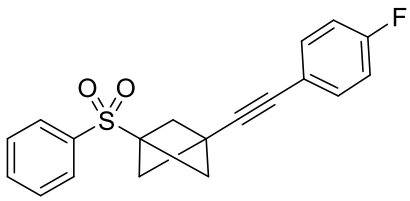


7s: 49.5 mg, 66% yield, white solid, m.p. 136-137 °C. Purification by flash column chromatography (eluent: EtOAc/Petroleum ether = 1/10). ^{1}H NMR (400 MHz,

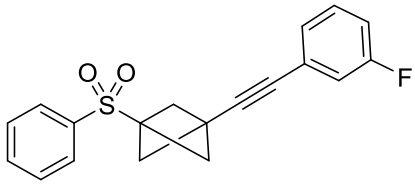
$CDCl_3$) δ 7.89-7.84 (m, 2H), 7.71-7.64 (m, 1H), 7.62-7.55 (m, 2H), 7.55-7.50 (m, 2H), 7.48-7.43 (m, 2H), 2.38 (s, 6H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 136.5, 134.0, 132.0, 130.2 (q, J_{C-F} = 32.5 Hz), 129.3, 128.6, 126.1, 125.2 (q, J_{C-F} = 3.6 Hz), 123.8 (q, J_{C-F} = 270.7 Hz), 87.7, 81.1, 54.7, 53.2, 28.5; ^{19}F NMR (376 MHz, $CDCl_3$) δ -62.9 (s). FT-IR: ν (cm^{-1}) 3073, 2929, 2852, 1611, 1448, 1322, 1305, 1210. HRMS [ESI] calcd for $C_{20}H_{15}F_3O_2SNa$ $[M+Na]^+$ 399.0637, found 399.0631.



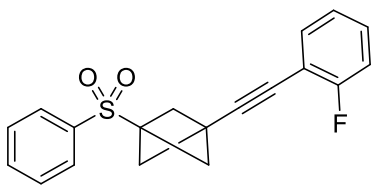
7t: 58.5 mg, 80% yield, white solid, m.p. 171-172 °C. Purification by flash column chromatography (eluent: EtOAc/Petroleum ether = 1/10). ^1H NMR (400 MHz, $CDCl_3$) δ 7.97-7.92 (m, 2H), 7.89-7.84 (m, 2H), 7.71-7.65 (m, 1H), 7.62-7.55 (m, 2H), 7.45-7.39 (m, 2H), 3.89 (s, 3H), 2.38 (s, 6H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 166.4, 136.5, 134.0, 131.7, 129.8, 129.5, 129.3, 128.6, 126.9, 88.2, 81.8, 54.7, 53.2, 52.3, 28.6. FT-IR: ν (cm^{-1}) 2988, 2972, 2901, 1718, 1405, 1394, 1304, 1273, 1252, 1230. HRMS [ESI] calcd for $C_{21}H_{18}O_4SNa$ $[M+Na]^+$ 389.0818, found 389.0818.



7u: 45.6 mg, 70% yield, white solid, m.p. 108-109 °C. Purification by flash column chromatography (eluent: EtOAc/Petroleum ether = 1/10). ^1H NMR (400 MHz, $CDCl_3$) δ 7.89-7.84 (m, 2H), 7.71-7.64 (m, 1H), 7.62-7.55 (m, 2H), 7.37-7.31 (m, 2H), 7.01-6.93 (m, 2H), 2.36 (s, 6H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 162.6 (d, J_{C-F} = 248.5 Hz), 136.5, 133.9, 133.7 (d, J_{C-F} = 8.4 Hz), 129.3, 128.6, 118.3 (d, J_{C-F} = 3.5 Hz), 115.6 (d, J_{C-F} = 22.0 Hz), 85.0 (d, J_{C-F} = 1.2 Hz), 81.4, 54.7, 53.1, 28.6; ^{19}F NMR (376 MHz, $CDCl_3$) δ -110.3 (s). FT-IR: ν (cm^{-1}) 2988, 2972, 2902, 1506, 1447, 1406, 1394, 1302, 1223. HRMS [ESI] calcd for $C_{19}H_{15}FO_2SNa$ $[M+Na]^+$ 349.0669, found 349.0666.

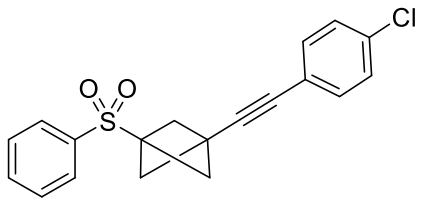


7v: 37.0 mg, 57% yield, white solid, m.p. 103-104 °C. Purification by flash column chromatography (eluent: EtOAc/Petroleum ether = 1/10). ^1H NMR (400 MHz, $CDCl_3$) δ 7.89-7.84 (m, 2H), 7.71-7.64 (m, 1H), 7.61-7.54 (m, 2H), 7.26-7.20 (m, 1H), 7.16-7.11 (m, 1H), 7.08-6.96 (m, 2H), 2.37 (s, 6H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 162.3 (d, J_{C-F} = 245.5 Hz), 136.5, 133.9, 129.9 (d, J_{C-F} = 8.7 Hz), 129.3, 128.6, 127.6 (d, J_{C-F} = 3.0 Hz), 124.1 (d, J_{C-F} = 9.4 Hz), 118.6 (d, J_{C-F} = 22.7 Hz), 116.0 (d, J_{C-F} = 21.0 Hz), 86.2, 81.2 (d, J_{C-F} = 3.5 Hz), 54.7, 53.1, 28.5; ^{19}F NMR (376 MHz, $CDCl_3$) δ -112.7 (s). FT-IR: ν (cm^{-1}) 3074, 2920, 2852, 1608, 1578, 1478, 1447, 1432, 1302, 1229. HRMS [ESI] calcd for $C_{19}H_{15}FO_2SNa$ $[M+Na]^+$ 349.0669, found 349.0672.

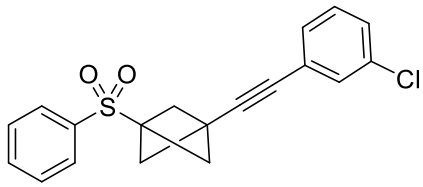


7w: 50.7 mg, 78% yield, white solid, m.p. 135-136 °C. Purification by flash column chromatography (eluent: EtOAc/Petroleum ether = 1/10). ^1H NMR (400 MHz, $CDCl_3$) δ 7.88-7.83 (m, 2H), 7.70-7.63 (m, 1H), 7.61-7.54 (m, 2H), 7.38-7.32 (m, 1H), 7.31-7.23 (m, 1H), 7.08-6.98 (m, 2H), 2.38 (s, 6H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 162.9 (d, J_{C-F} = 250.1 Hz), 136.5, 133.9, 133.7, 130.3 (d,

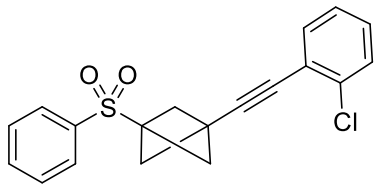
$J_{C\text{-}F}$ = 7.9 Hz), 129.3, 128.6, 124.0 (d, $J_{C\text{-}F}$ = 3.7 Hz), 115.5 (d, $J_{C\text{-}F}$ = 20.8 Hz), 110.8 (d, $J_{C\text{-}F}$ = 15.5 Hz), 90.3 (d, $J_{C\text{-}F}$ = 3.2 Hz), 75.9, 54.8, 53.2, 28.7; ^{19}F NMR (376 MHz, $CDCl_3$) δ -110.0 (s). FT-IR: ν (cm^{-1}) 2988, 2972, 2901, 1490, 1445, 1312, 1303, 1229. HRMS [ESI] calcd for $C_{19}H_{16}FO_2S$ $[M+H]^+$ 327.0850, found 327.0843.



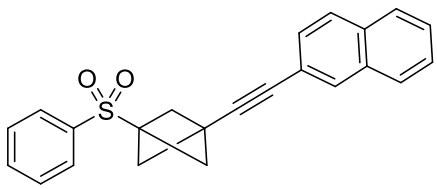
7x: 41.1 mg, 60% yield, white solid, m.p. 159-160 °C. Purification by flash column chromatography (eluent: EtOAc/Petroleum ether = 1/10). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.88-7.83 (m, 2H), 7.70-7.64 (m, 1H), 7.61-7.54 (m, 2H), 7.31-7.22 (m, 4H), 2.36 (s, 6H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 136.5, 134.6, 133.9, 133.0, 129.3, 128.7, 128.6, 120.7, 86.3, 81.4, 54.7, 53.1, 28.6. FT-IR: ν (cm^{-1}) 2988, 2972, 2901, 1485, 1447, 1406, 1394, 1303, 1250, 1230. HRMS [ESI] calcd for $C_{19}H_{15}ClO_2SNa$ $[M+Na]^+$ 365.0373, found 365.0374.



7y: 38.9 mg, 57% yield, yellow solid, m.p. 117-118 °C. Purification by flash column chromatography (eluent: EtOAc/Petroleum ether = 1/10). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.88-7.84 (m, 2H), 7.71-7.65 (m, 1H), 7.61-7.55 (m, 2H), 7.36-7.34 (m, 1H), 7.29-7.24 (m, 1H), 7.24-7.17 (m, 2H), 2.36 (s, 6H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 136.5, 134.2, 134.0, 131.6, 129.9, 129.6, 129.3, 128.9, 128.6, 124.0, 86.5, 81.1, 54.7, 53.2, 28.5. FT-IR: ν (cm^{-1}) 2988, 2972, 2901, 1445, 1406, 1314, 1251, 1230. HRMS [ESI] calcd for $C_{19}H_{15}ClO_2SNa$ $[M+Na]^+$ 365.0373, found 365.0379.

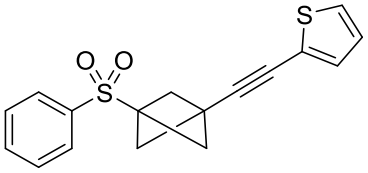


7z: 42.8 mg, 62% yield, white solid, m.p. 107-108 °C. Purification by flash column chromatography (eluent: EtOAc/Petroleum ether = 1/10). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.88-7.84 (m, 2H), 7.70-7.64 (m, 1H), 7.60-7.54 (m, 2H), 7.39 (dd, J = 7.6, 1.6 Hz, 1H), 7.34 (dd, J = 8.0, 0.8 Hz, 1H), 7.22 (ddd, J = 7.6, 7.6, 1.6 Hz, 1H), 7.16 (ddd, J = 7.6, 7.6, 1.2 Hz, 1H), 2.39 (s, 6H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 136.5, 136.0, 133.9, 133.5, 129.6, 129.3, 128.6, 126.5, 122.2, 90.4, 79.2, 54.8, 53.2, 28.7. FT-IR: ν (cm^{-1}) 2988, 2972, 2901, 1449, 1406, 1394, 1303, 1251, 1230. HRMS [ESI] calcd for $C_{19}H_{15}ClO_2SNa$ $[M+Na]^+$ 365.0373, found 365.0372.

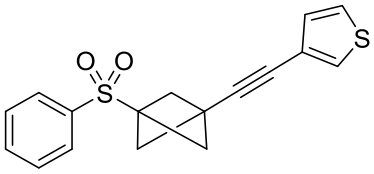


7aa: 21.3 mg, 30% yield, white solid, m.p. 142-143 °C. Purification by flash column chromatography (eluent: DCM/Petroleum ether = 1/2). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.92-7.86 (m, 3H), 7.81-7.72 (m, 3H), 7.71-7.65 (m, 1H), 7.63-7.56 (m, 2H), 7.51-7.44 (m, 2H), 7.40 (dd, J = 8.4, 1.2 Hz, 1H), 2.41 (s, 6H); ^{13}C NMR

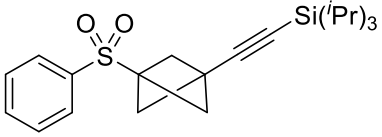
(100 MHz, $CDCl_3$) δ 136.6, 133.9, 132.9, 132.8, 131.8, 129.3, 128.6, 128.3, 128.0, 127.8, 127.7, 126.9, 126.6, 119.5, 85.6, 82.8, 54.8, 53.2, 28.8. FT-IR: ν (cm^{-1}) 3059, 2917, 1499, 1446, 1348, 1306, 1204. HRMS [ESI] calcd for $C_{23}H_{19}O_2S$ $[M+H]^+$ 359.1100, found 359.1104.



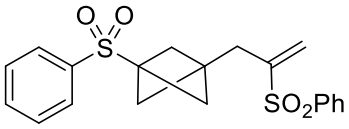
7ab: 30.2 mg, 48% yield, yellow solid, m.p. 130-131 °C. Purification by flash column chromatography (eluent: DCM/Petroleum ether = 1/2). ^1H NMR (400 MHz, $CDCl_3$) δ 7.89-7.83 (m, 2H), 7.71-7.64 (m, 1H), 7.61-7.54 (m, 2H), 7.22 (d, *J* = 5.2 Hz, 1H), 7.16-7.13 (m, 1H), 6.93 (dd, *J* = 4.8, 3.6 Hz, 1H), 2.36 (s, 6H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 136.5, 133.9, 132.5, 129.3, 128.6, 127.4, 127.0, 122.2, 89.1, 75.8, 54.8, 53.2, 28.7. FT-IR: ν (cm^{-1}) 2988, 2972, 2901, 1406, 1394, 1302, 1225. HRMS [ESI] calcd for $C_{17}H_{14}O_2S_2Na$ $[M+Na]^+$ 337.0327, found 337.0333.



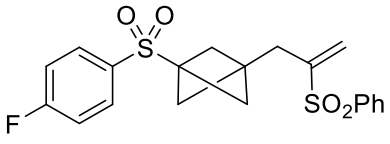
7ac: 19.4 mg, 31% yield, yellow solid, m.p. 135-136 °C. Purification by flash column chromatography (eluent: DCM/Petroleum ether = 1/2). ^1H NMR (400 MHz, $CDCl_3$) δ 7.89-7.84 (m, 2H), 7.71-7.64 (m, 1H), 7.61-7.54 (m, 2H), 7.39 (dd, *J* = 3.2, 1.2 Hz, 1H), 7.23 (dd, *J* = 5.2, 3.2 Hz, 1H), 7.03 (dd, *J* = 4.8, 0.8 Hz, 1H), 2.35 (s, 6H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 136.6, 133.9, 129.8, 129.3, 129.3, 128.6, 125.4, 121.2, 84.9, 77.7, 54.7, 53.1, 28.7. FT-IR: ν (cm^{-1}) 3107, 2921, 2851, 1446, 1356, 1301, 1214. HRMS [ESI] calcd for $C_{17}H_{14}O_2S_2Na$ $[M+Na]^+$ 337.0327, found 337.0325.



7ad: 32.9 mg, 42% yield, white solid, m.p. 60-61 °C. Purification by flash column chromatography (eluent: EtOAc/Petroleum ether = 1/10). ^1H NMR (400 MHz, $CDCl_3$) δ 7.86-7.81 (m, 2H), 7.69-7.62 (m, 1H), 7.59-7.51 (m, 2H), 2.29 (s, 6H), 1.03-0.97 (m, 21H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 136.6, 133.8, 129.2, 128.6, 103.3, 84.0, 54.8, 52.8, 28.6, 18.5, 11.1. FT-IR: ν (cm^{-1}) 2971, 2920, 1605, 1508, 1447, 1394, 1303, 1244. HRMS [ESI] calcd for $C_{22}H_{32}O_2SSiNa$ $[M+Na]^+$ 411.1784, found 411.1789.

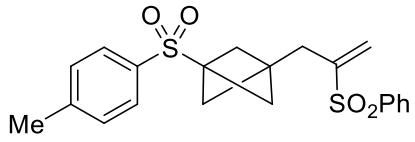


9a: 68.2 mg, 88% yield, yellow oil. Purification by flash column chromatography (eluent: DCM/Petroleum ether = 2/1). ^1H NMR (400 MHz, $CDCl_3$) δ 7.84-7.78 (m, 4H), 7.68-7.60 (m, 2H), 7.58-7.50 (m, 4H), 6.37 (s, 1H), 5.68 (s, 1H), 2.50 (s, 2H), 1.85 (s, 6H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 146.9, 138.4, 136.8, 133.8, 133.7, 129.3, 129.1, 128.6, 128.4, 125.9, 51.4, 50.8, 38.1, 31.1. FT-IR: ν (cm^{-1}) 3350, 2973, 2883, 1448, 1380, 1305. HRMS [ESI] calcd for $C_{20}H_{20}O_4S_2Na$ $[M+Na]^+$ 411.0695, found 411.0689.

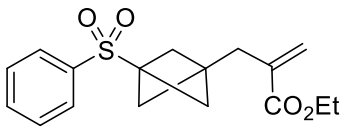


9b: 59.9 mg, 74% yield, yellow oil. Purification by flash column chromatography (eluent: DCM/Petroleum ether = 2/1). ^1H NMR (400 MHz, $CDCl_3$) δ 7.84-7.79 (m, 4H), 7.66-7.60 (m, 1H), 7.56-7.50 (m, 2H), 7.25-7.19 (m, 2H), 6.37 (d, *J* = 0.8 Hz, 1H), 5.69-5.66 (m, 1H), 2.50 (s, 2H), 1.86 (s, 6H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 165.9 (d, $J_{C\text{-}F}$ = 254.9 Hz), 146.9, 138.4, 133.8, 132.8 (d, $J_{C\text{-}F}$ = 3.4 Hz), 131.4 (d, $J_{C\text{-}F}$ = 9.4 Hz), 129.4, 128.4, 126.0, 116.5 (d, $J_{C\text{-}F}$ = 22.5 Hz), 51.5, 50.8, 38.1, 31.2; ^{19}F NMR (376 MHz,

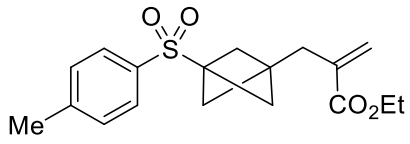
$CDCl_3$) δ -103.4 (s). FT-IR: ν (cm^{-1}) 3376, 2976, 2920, 2159, 2027, 1976, 1590, 1493, 1447, 1306, 1288, 1236. HRMS [ESI] calcd for $C_{20}H_{19}FO_4S_2Na$ $[M+Na]^+$ 429.0601, found 429.0595.



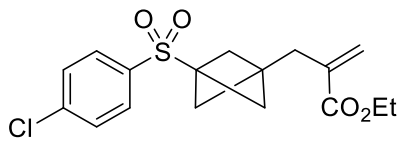
9c: 48.9 mg, 61% yield, yellow oil. Purification by flash column chromatography (eluent: DCM/Petroleum ether = 2/1). ^1H NMR (400 MHz, $CDCl_3$) δ 7.83-7.78 (m, 2H), 7.69-7.65 (m, 2H), 7.65-7.59 (m, 1H), 7.56-7.49 (m, 2H), 7.35-7.30 (m, 2H), 6.36 (d, *J* = 0.8 Hz, 1H), 5.67 (d, *J* = 0.4 Hz, 1H), 2.49 (s, 2H), 2.44 (s, 3H), 1.83 (s, 6H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 146.9, 144.7, 138.4, 133.8, 133.7, 129.8, 129.3, 128.6, 128.4, 125.9, 51.4, 50.7, 38.0, 31.1, 21.7. FT-IR: ν (cm^{-1}) 2998, 2918, 2882, 1596, 1447, 1300, 1287. HRMS [ESI] calcd for $C_{21}H_{23}O_4S_2$ $[M+H]^+$ 403.1032, found 403.1036.



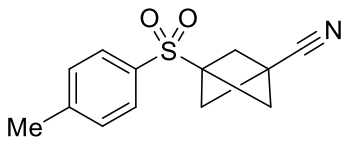
9d: 25.6 mg, 40% yield, colorless oil. Purification by flash column chromatography (eluent: EtOAc/Petroleum ether = 1/10). ^1H NMR (400 MHz, $CDCl_3$) δ 7.85-7.80 (m, 2H), 7.67-7.60 (m, 1H), 7.57-7.50 (m, 2H), 6.16 (s, 1H), 5.47 (s, 1H), 4.16 (q, *J* = 7.2 Hz, 2H), 2.54 (s, 2H), 1.88 (s, 6H), 1.27 (t, *J* = 7.2 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 166.6, 137.0, 136.8, 133.6, 129.1, 128.6, 127.1, 60.9, 51.5, 50.7, 38.6, 34.0, 14.2. FT-IR: ν (cm^{-1}) 3379, 2977, 2930, 2902, 2159, 2022, 1975, 1457, 1384, 1304, 1240. HRMS [ESI] calcd for $C_{17}H_{20}O_4SNa$ $[M+Na]^+$ 343.0975, found 343.0966.



9e: 13.9 mg, 21% yield, colorless oil. Purification by flash column chromatography (eluent: EtOAc/Petroleum ether = 1/10). ^1H NMR (400 MHz, $CDCl_3$) δ 7.72-7.68 (m, 2H), 7.35-7.30 (m, 2H), 6.16 (d, *J* = 1.2 Hz, 1H), 5.47 (s, 1H), 4.16 (q, *J* = 7.2 Hz, 2H), 2.54 (s, 2H), 2.44 (s, 3H), 1.87 (s, 6H), 1.27 (t, *J* = 7.2 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 166.6, 144.5, 136.9, 134.0, 129.7, 128.6, 127.0, 60.9, 51.5, 50.7, 38.5, 34.0, 21.6, 14.2. FT-IR: ν (cm^{-1}) 2988, 2919, 1713, 1631, 1597, 1448, 1300, 1238. HRMS [ESI] calcd for $C_{18}H_{22}O_4SNa$ $[M+Na]^+$ 357.1131, found 357.1132.

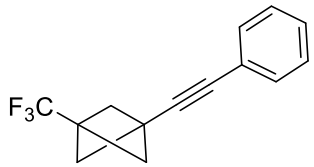


9f: 29.6 mg, 42% yield, yellow oil. Purification by flash column chromatography (eluent: EtOAc/Petroleum ether = 1/10). ^1H NMR (400 MHz, $CDCl_3$) δ 7.78-7.73 (m, 2H), 7.54-7.48 (m, 2H), 6.17 (s, 1H), 5.47 (s, 1H), 4.16 (q, *J* = 7.2 Hz, 2H), 2.54 (s, 2H), 1.88 (s, 6H), 1.27 (t, *J* = 7.2 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 166.5, 140.4, 136.7, 135.5, 130.0, 129.4, 127.2, 60.9, 51.5, 50.8, 38.7, 33.9, 14.2. FT-IR: ν (cm^{-1}) 2990, 2917, 2881, 1713, 1631, 1583, 1477, 1394, 1310, 1237. HRMS [ESI] calcd for $C_{17}H_{19}ClO_4SNa$ $[M+Na]^+$ 377.0585, found 377.0578.

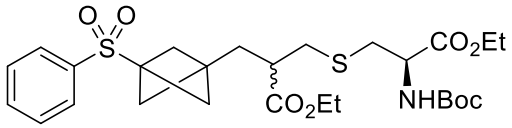


10: 43.5 mg, 88% yield, white solid, m.p. 194-195 °C. Purification by flash column chromatography (eluent: EtOAc/Petroleum ether = 1/10). ^1H NMR (400 MHz, $CDCl_3$) δ 7.72-7.67 (m, 2H), 7.40-7.34 (m, 2H), 2.46 (s, 6H), 2.46 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 145.7, 132.6, 130.2, 128.6, 115.6, 54.1, 53.9, 23.5, 21.7. FT-IR: ν

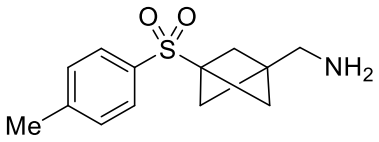
(cm^{-1}) 2988, 2972, 2901, 2233, 1449, 1394, 1301, 1263, 1230. HRMS [ESI] calcd for $C_{13}H_{13}NO_2SNa$ $[M+Na]^+$ 270.0559, found 270.0560.



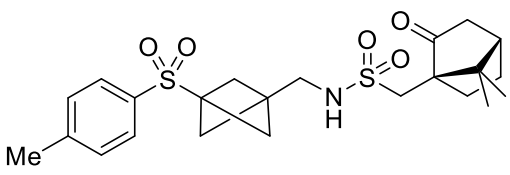
11: 15.9 mg, 34% yield, yellow solid, m.p. 54-55 °C. Purification by flash column chromatography (eluent: EtOAc/Petroleum ether = 1/10). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.44-7.39 (m, 2H), 7.33-7.27 (m, 3H), 2.32 (s, 6H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 131.8, 128.4, 128.3, 122.5, 122.4 (q, $J_{C\text{-}F}$ = 273.5 Hz), 86.6, 81.3, 53.0 (q, $J_{C\text{-}F}$ = 2.0 Hz), 39.0 (q, $J_{C\text{-}F}$ = 38.4 Hz), 28.7 (q, $J_{C\text{-}F}$ = 1.7 Hz); ^{19}F NMR (376 MHz, $CDCl_3$) δ -73.0 (s). FT-IR: ν (cm^{-1}) 2975, 2925, 2890, 1453, 1443, 1405, 1318, 1212. HRMS [CI] calcd for $C_{14}H_{11}F_3$ [M] 236.0813, found 236.0813.



13 (*d.r.* = 1:2): 79.1 mg, 93% yield, colorless oil. Purification by flash column chromatography (eluent: EtOAc/Petroleum ether = 1/3). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.84-7.78 (m, 2H, two isomers), 7.66-7.59 (m, 1H, two isomers), 7.56-7.49 (m, 2H, two isomers), 5.40-5.24 (m, 1H, two isomers), 4.49-4.39 (m, 1H, two isomers), 4.17 (q, *J* = 7.2 Hz, 2H, two isomers), 4.13-4.02 (m, 2H, two isomers), 2.98-2.84 (m, 2H, two isomers), 2.74-2.65 (m, 1H, two isomers), 2.62-2.53 (m, 1H, two isomers), 2.50-2.41 (m, 1H, two isomers), 1.96-1.83 (m, 7H, two isomers), 1.78-1.70 (m, 1H, two isomers), 1.41 (s, 9H, two isomers), 1.28-1.18 (m, 6H, two isomers); ^{13}C NMR (100 MHz, $CDCl_3$) δ 173.7 (two isomers, overlap), 170.7 (two isomers, overlap), 155.1 (two isomers, overlap), 136.8 (two isomers, overlap), 133.6 (two isomers, overlap), 129.1 (two isomers, overlap), 128.6 (two isomers, overlap), 80.1 & 77.3 (two isomers), 61.8 (two isomers, overlap), 61.0 (two isomers, overlap), 53.4 (two isomers, overlap), 51.4 (two isomers, overlap), 50.9 (two isomers, overlap), 43.6 & 43.5 (two isomers), 38.0 (two isomers, overlap), 35.3 & 35.1 (two isomers), 35.1 & 34.9 (two isomers), 32.6 & 32.6 (two isomers), 28.3 (two isomers, overlap), 14.1 (two isomers, overlap), 14.1 (two isomers, overlap). FT-IR: ν (cm^{-1}) 3369, 2979, 2918, 2881, 1712, 1500, 1447, 1368, 1303, 1250. HRMS [ESI] calcd for $C_{27}H_{39}NO_8S_2Na$ $[M+Na]^+$ 592.2009, found 592.2013.



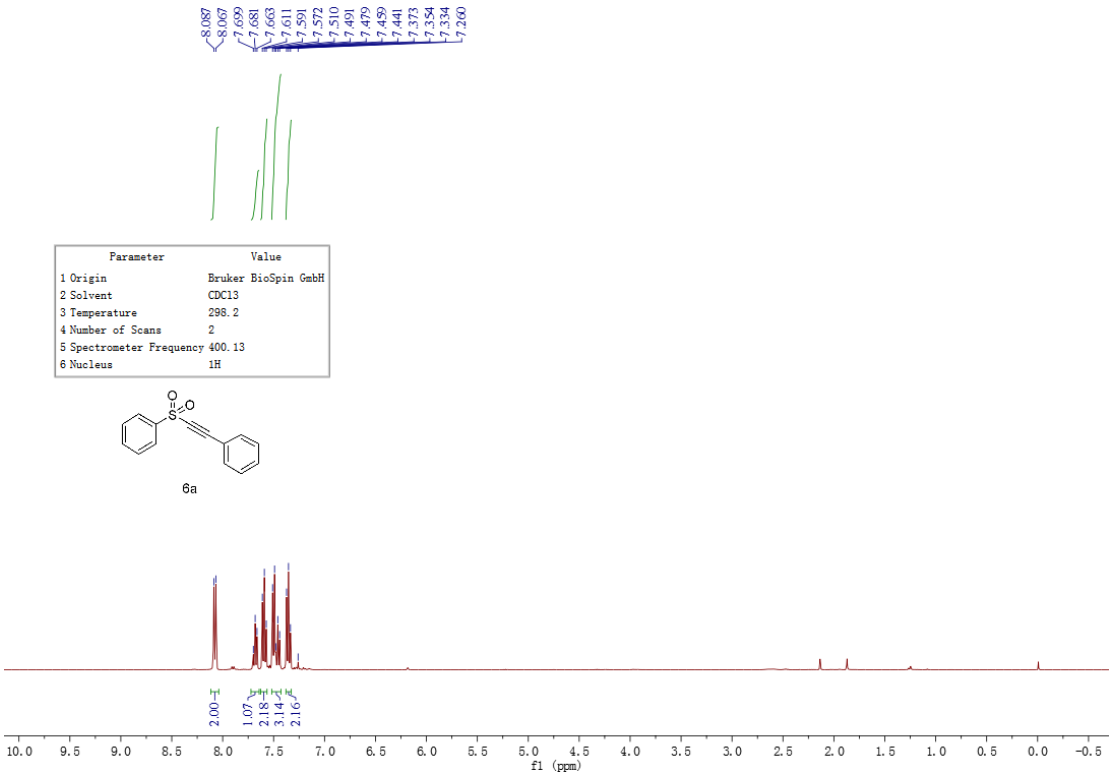
14: 28.6 mg, 57% yield, yellow solid, m.p. 79-80 °C. Purification by flash column chromatography (eluent: MeOH/DCM = 1/3). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.75-7.70 (m, 2H), 7.37-7.31 (m, 2H), 2.78 (s, 2H), 2.45 (s, 3H), 1.92 (s, 6H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 144.6, 133.9, 129.7, 128.7, 51.7, 49.9, 49.1, 42.6, 21.7. FT-IR: ν (cm^{-1}) 3344, 2974, 2919, 2881, 1596, 1449, 1296, 1230. HRMS [ESI] calcd for $C_{13}H_{18}NO_2S$ $[M+H]^+$ 252.1053, found 252.1056.

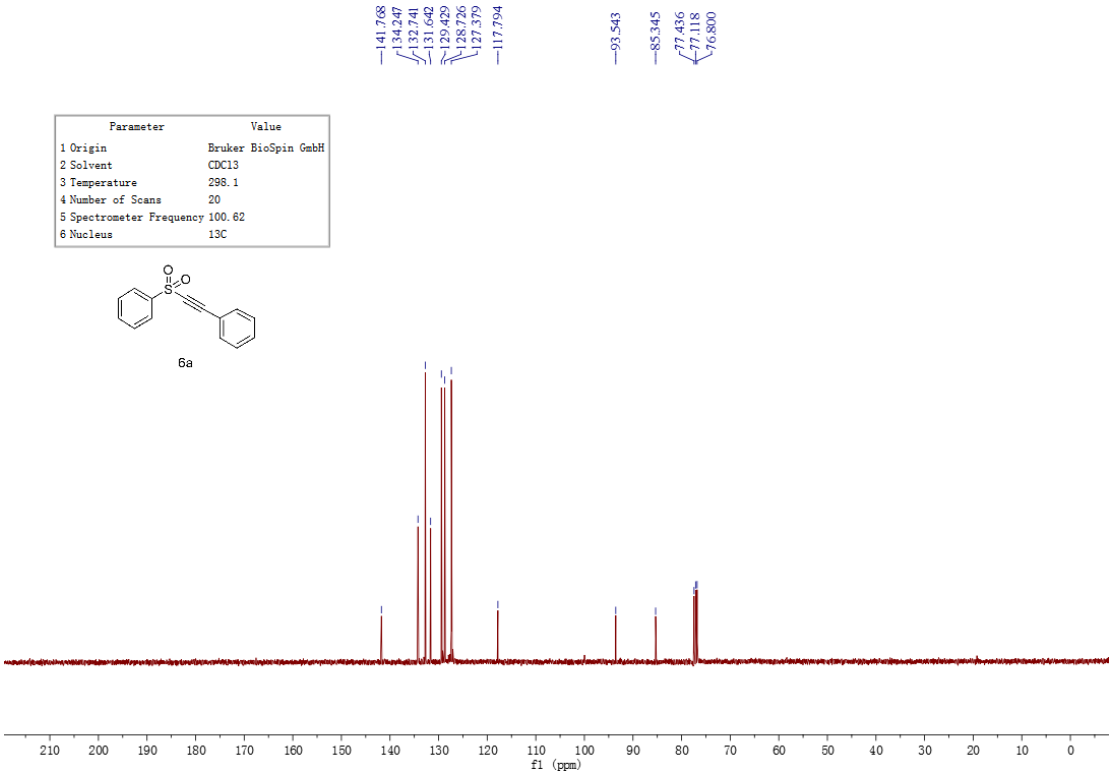


15: 44.3 mg, 48% yield, white solid, m.p. 84-85 °C. Purification by flash column chromatography (eluent: MeOH/DCM = 1/40). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.73-7.67 (m, 2H), 7.36-7.30 (m, 2H), 5.39-5.31 (m, 1H), 3.32-3.17 (m, 3H), 2.90-2.83 (1H), 2.44 (s, 3H), 2.40-2.31 (m, 1H), 2.20-2.09 (m, 2H), 2.06-1.95 (m, 1H), 1.99 (s,

6H), 1.94-1.83 (m, 2H), 1.47-1.38 (m, 1H), 0.98 (s, 3H), 0.87 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 217.4, 144.7, 133.7, 129.8, 128.6, 59.2, 51.9, 49.8, 49.7, 49.0, 44.0, 43.0, 42.8, 38.0, 27.0, 26.7, 21.7, 19.9, 19.4. FT-IR: ν (cm^{-1}) 3288, 2960, 2921, 2884, 1740, 1596, 1450, 1310, 1287. HRMS [ESI] calcd for $C_{23}H_{31}NO_5S_2Na$ $[M+Na]^+$ 488.1536, found 488.1538.

^{1}H, ^{13}C, and ^{19}F NMR spectra

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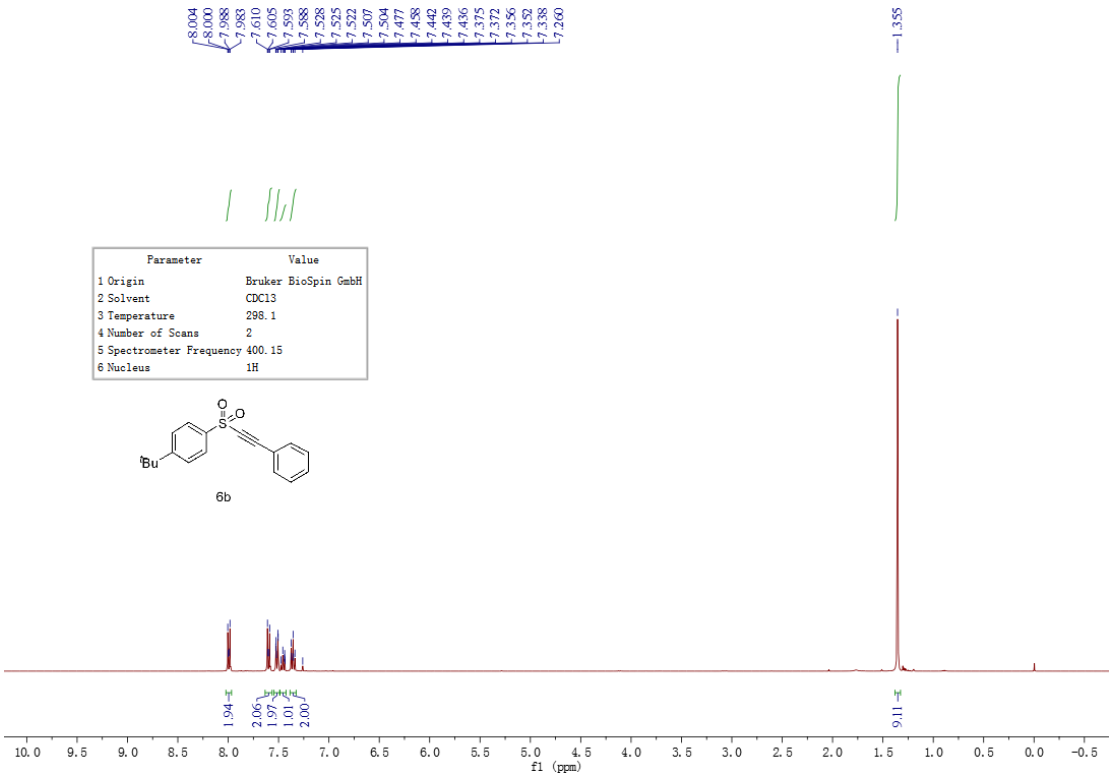
5 Spectrometer Frequency 100.62
6 Nucleus 13C
6a
f1 (ppm)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6b
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1.97
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f1 (ppm)

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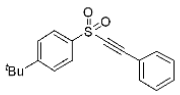
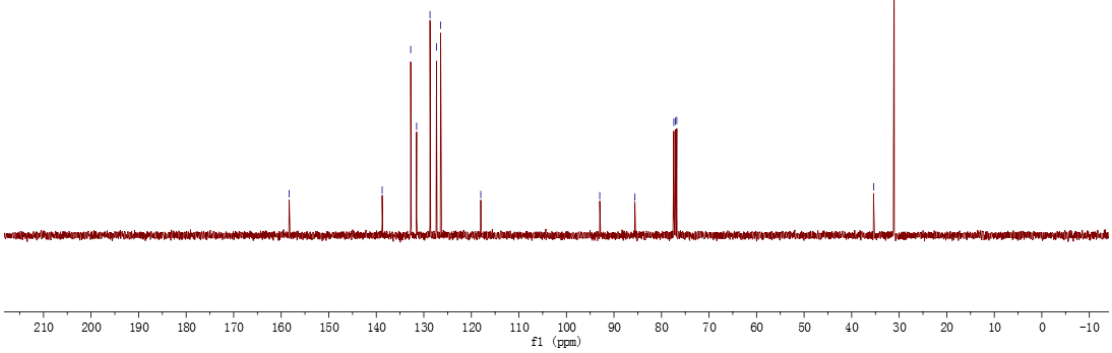


6b



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7.053
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7.036
3.903

Parameter	Value
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5 Spectrometer Frequency	400.15
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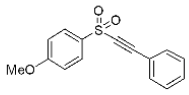
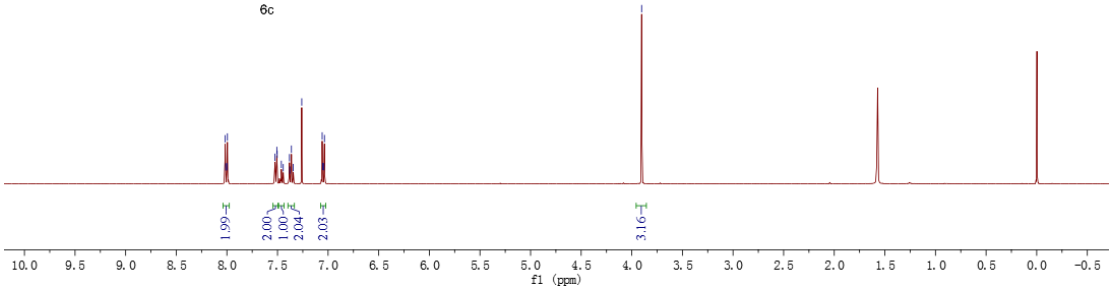
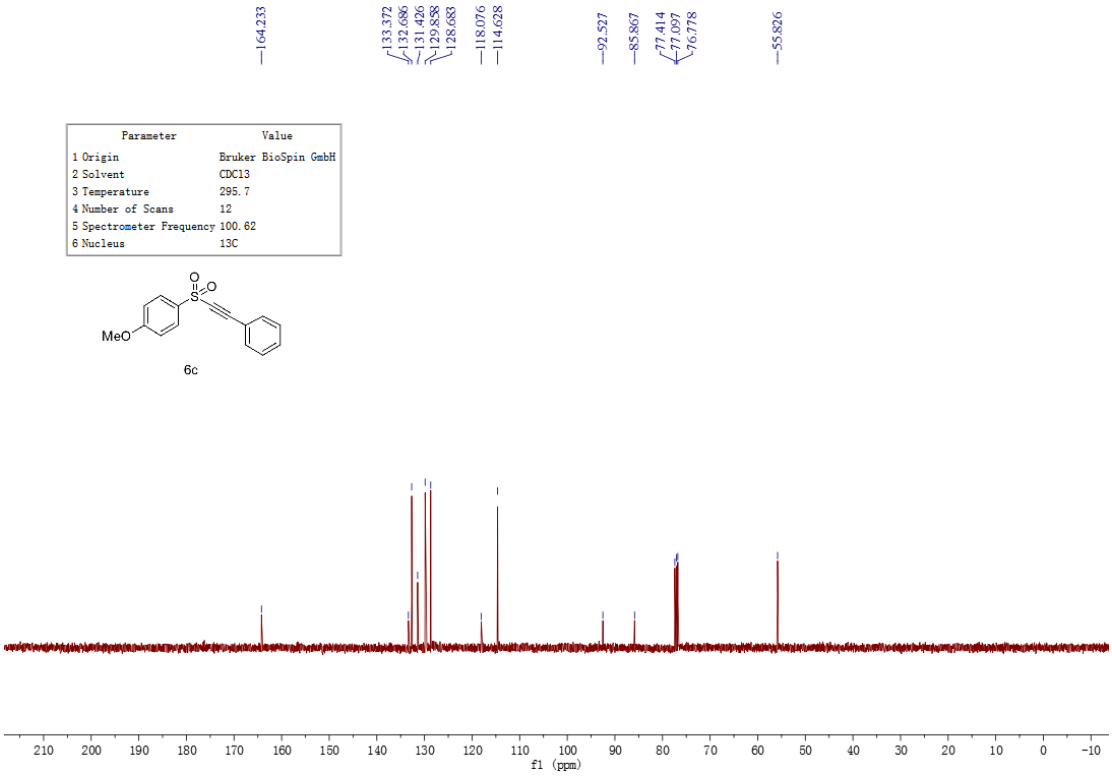


6c

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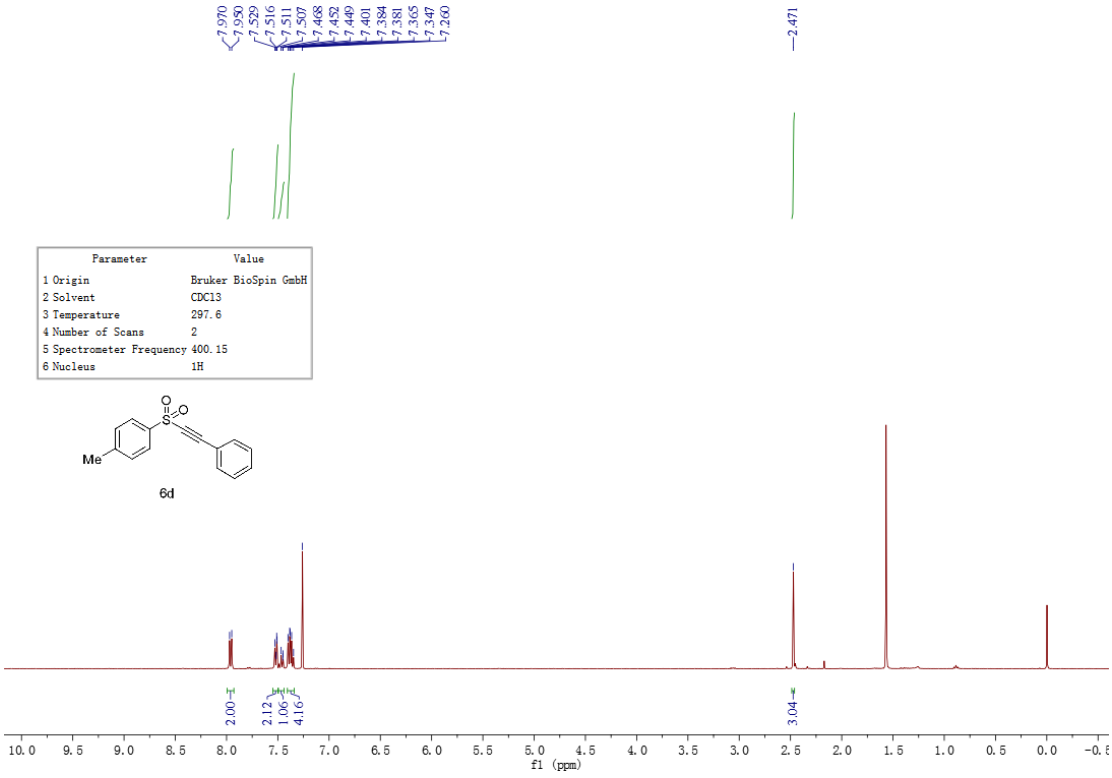
f1 (ppm)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6d
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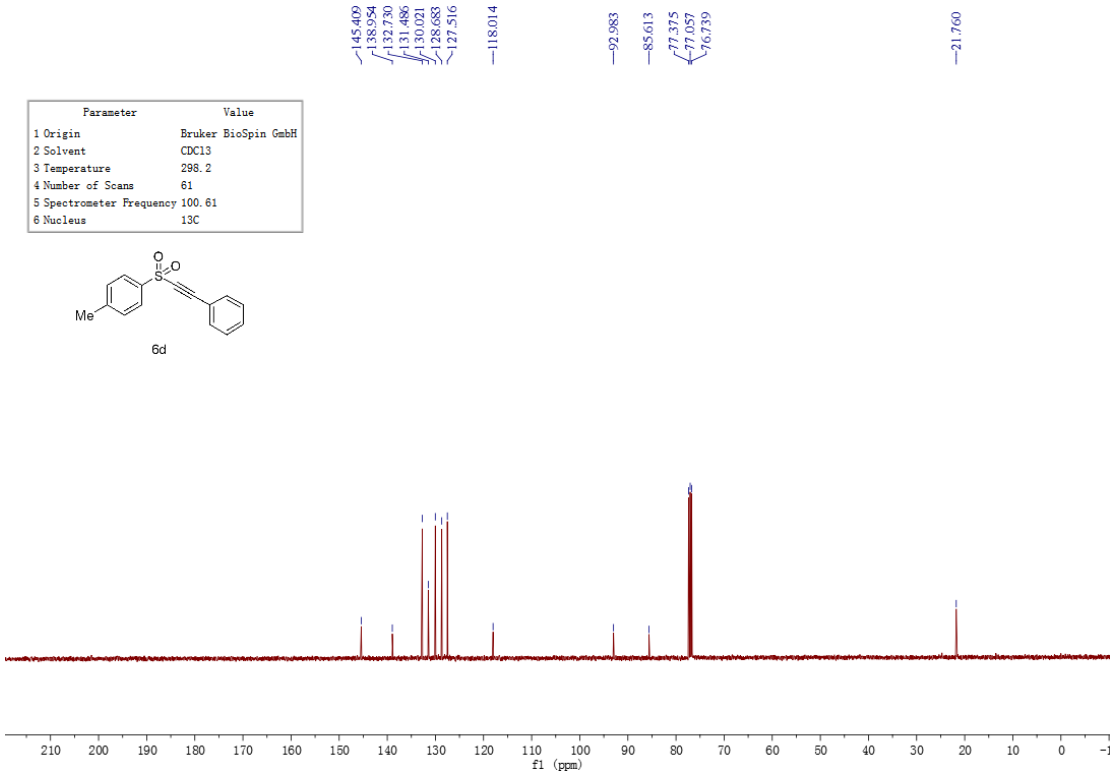
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Parameter Value
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O
S
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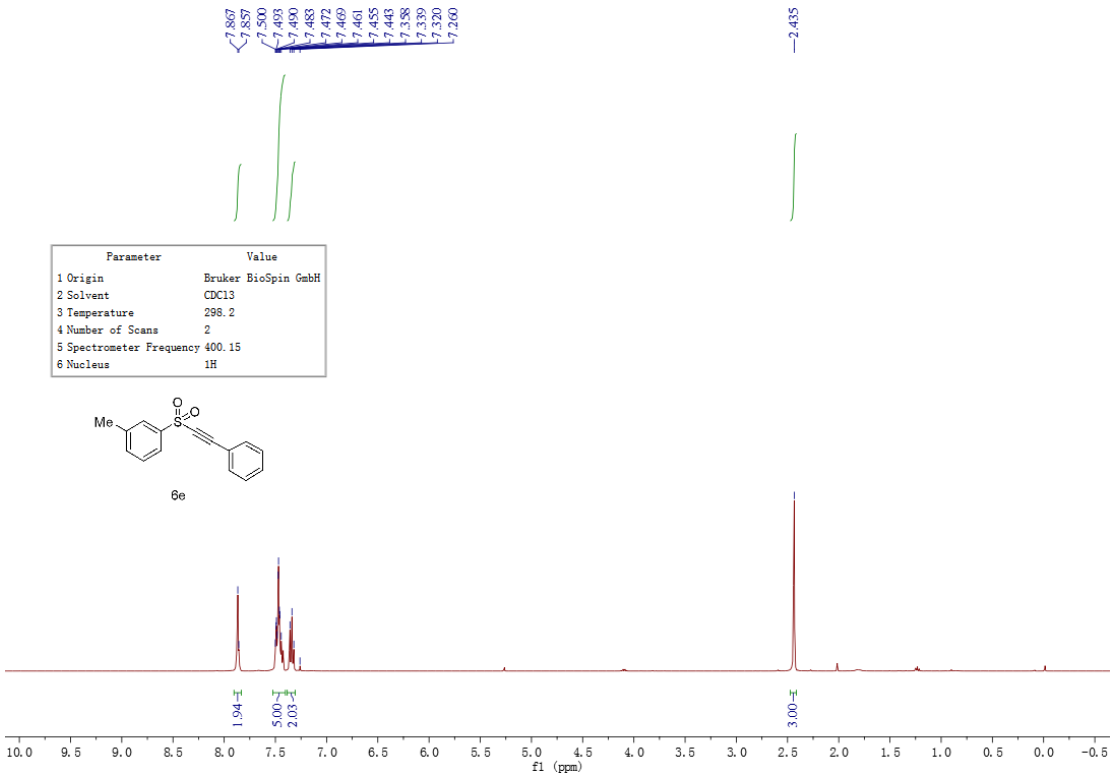
Me
6d
f1 (ppm)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3 Temperature 298.2
4 Number of Scans 2
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S
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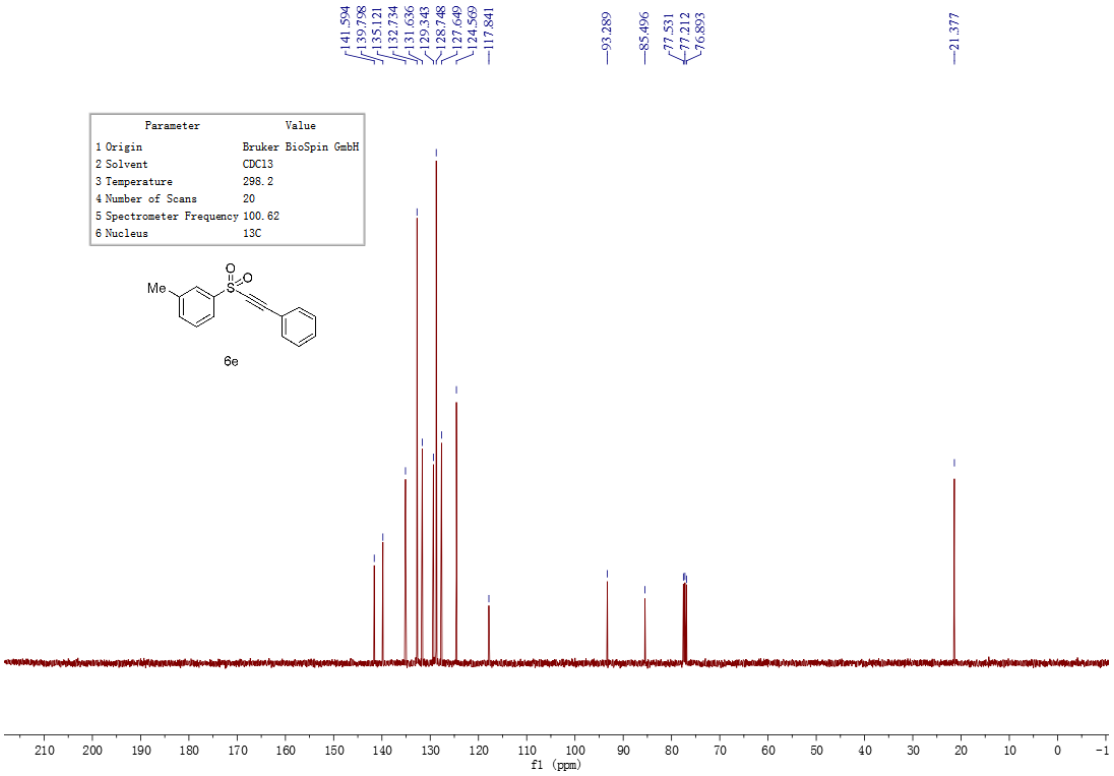
3.00
f1 (ppm)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Parameter Value
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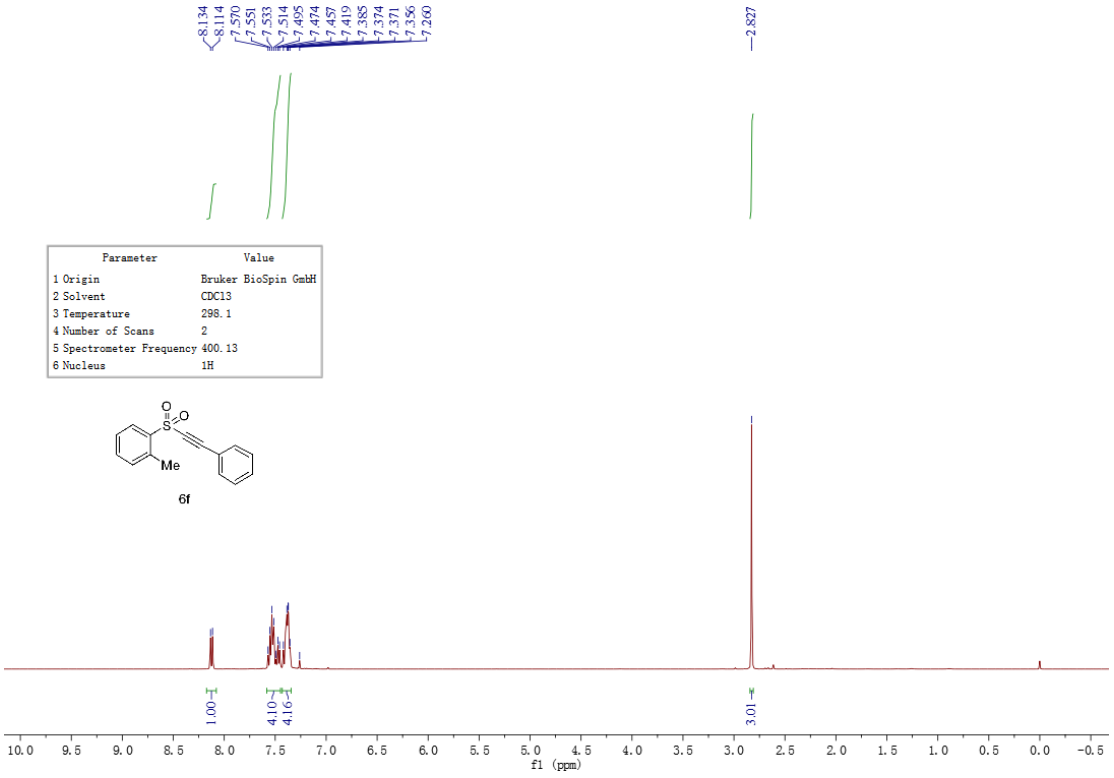
Me
6e
f1 (ppm)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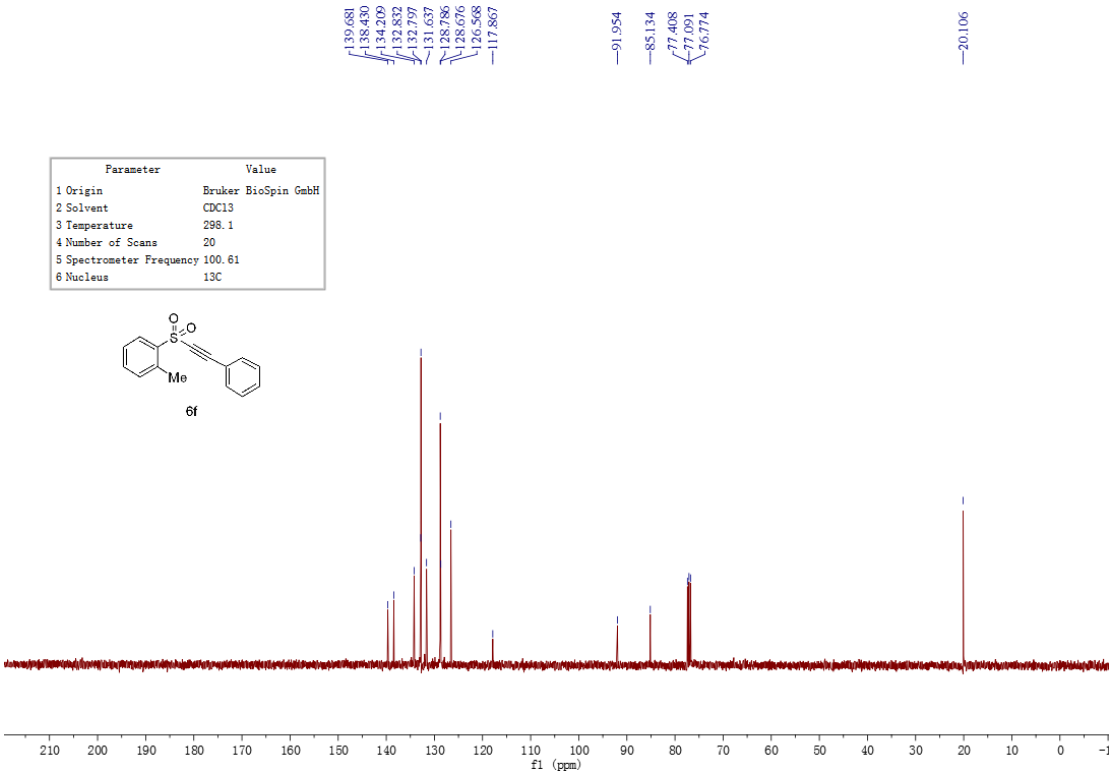
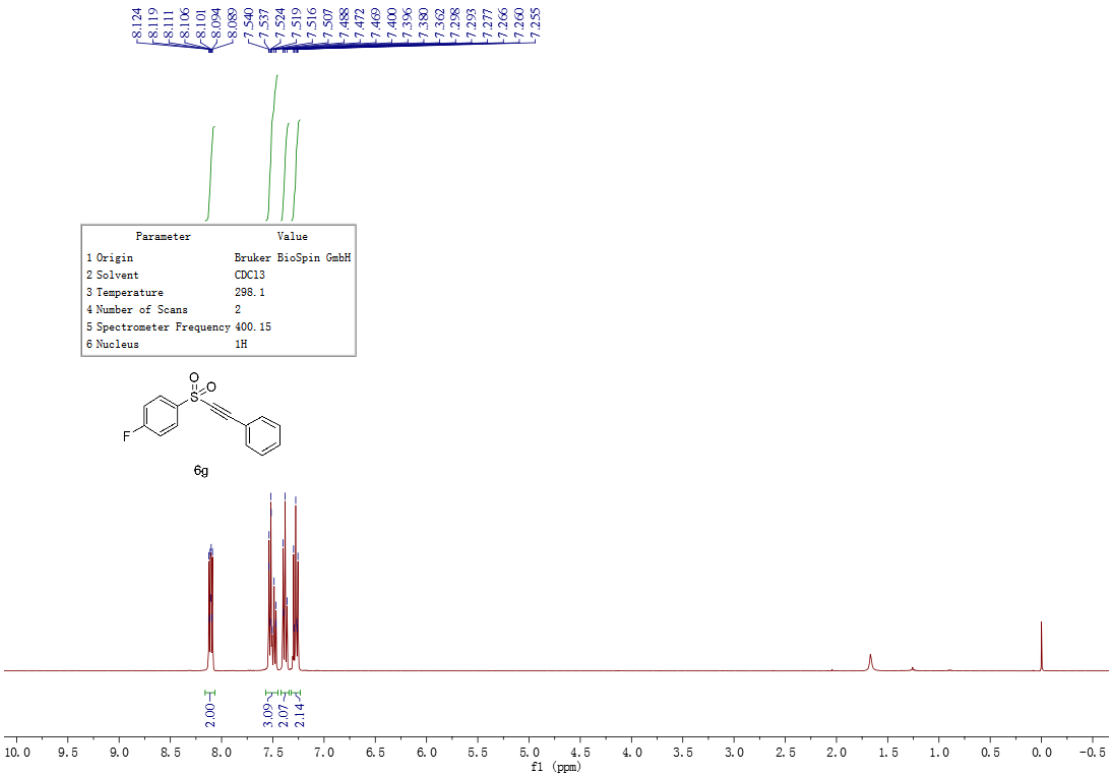
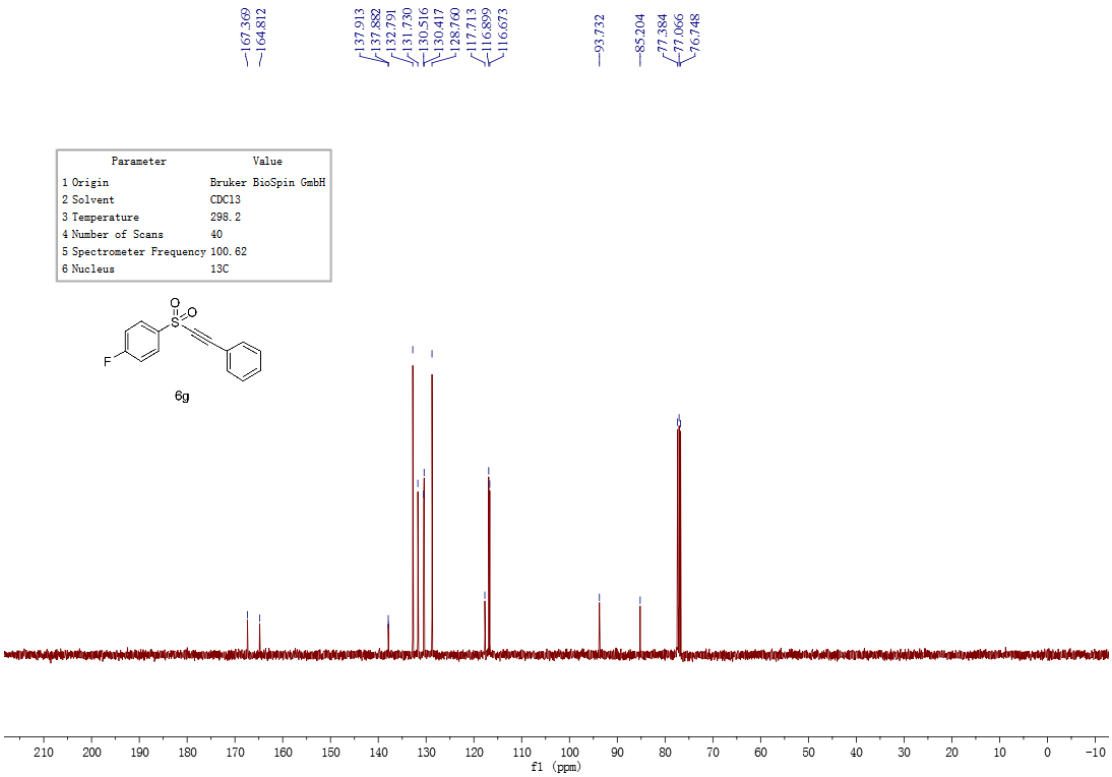
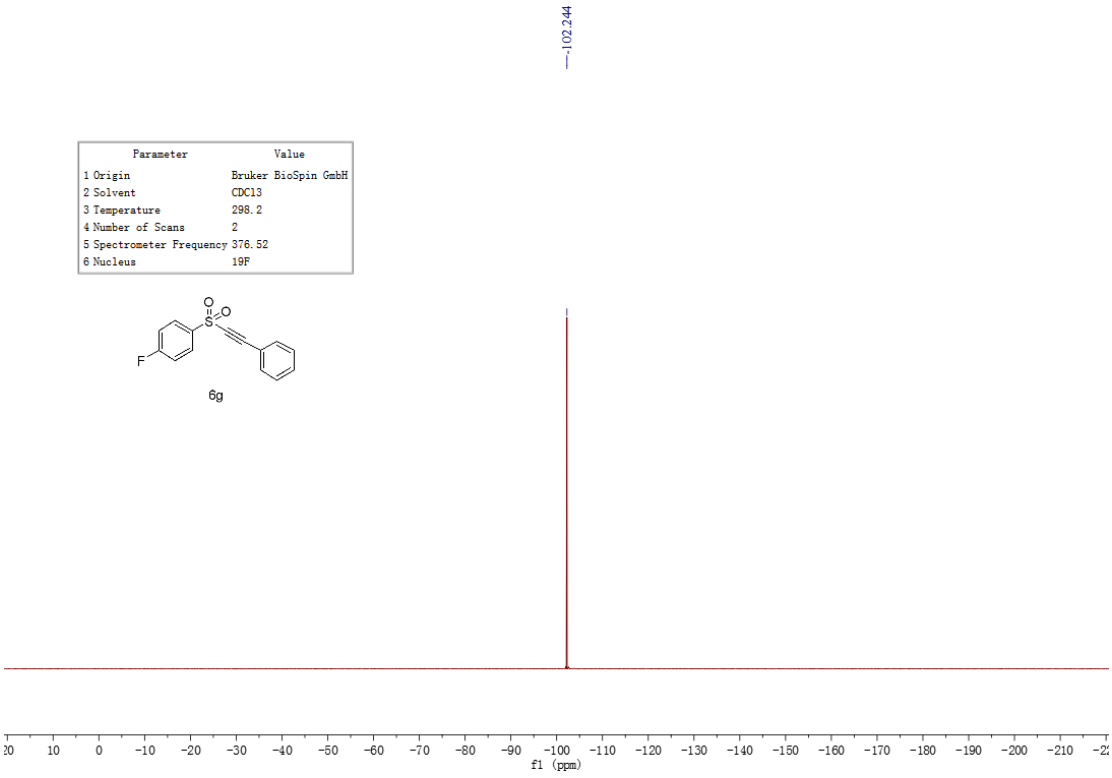
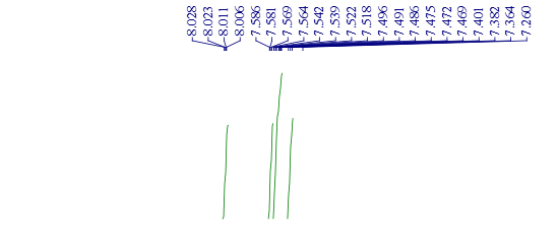
7.474
7.457
7.419
7.385
7.374
7.371
7.356
7.260
2.827
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.1
4 Number of Scans 2
5 Spectrometer Frequency 400.13
6 Nucleus 1H
Me
6f
1.00
4.10
4.16
3.01
f1 (ppm)


139.681
138.430
134.209
132.832
132.797
131.637
128.786
128.676
126.568
117.867
91.954
85.134
77.408
77.091
76.774
20.106
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.1
4 Number of Scans 20
5 Spectrometer Frequency 100.61
6 Nucleus 13C
Me
6f
f1 (ppm)

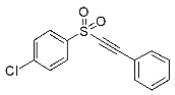

8.124
8.119
8.111
8.106
8.101
8.094
8.089
7.540
7.537
7.524
7.519
7.516
7.507
7.488
7.472
7.469
7.400
7.396
7.380
7.362
7.298
7.293
7.277
7.266
7.260
7.255
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.1
4 Number of Scans 2
5 Spectrometer Frequency 400.15
6 Nucleus 1H
F
6g
2.00
3.09
2.07
2.14
f1 (ppm)


167.369
164.812
137.913
137.882
132.791
131.730
130.516
130.417
128.760
117.713
116.899
116.673
93.732
85.204
77.384
77.066
76.748
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.2
4 Number of Scans 40
5 Spectrometer Frequency 100.62
6 Nucleus 13C
6g
f1 (ppm)

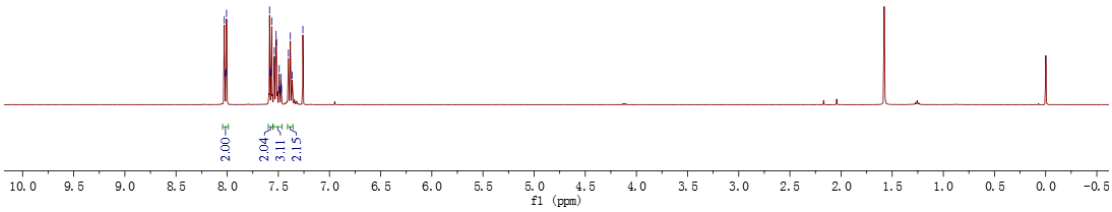

-102.244
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.2
4 Number of Scans 2
5 Spectrometer Frequency 376.52
6 Nucleus 19F
6g
f1 (ppm)



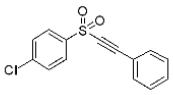
Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	297.9
4 Number of Scans	2
5 Spectrometer Frequency	400.15
6 Nucleus	1H



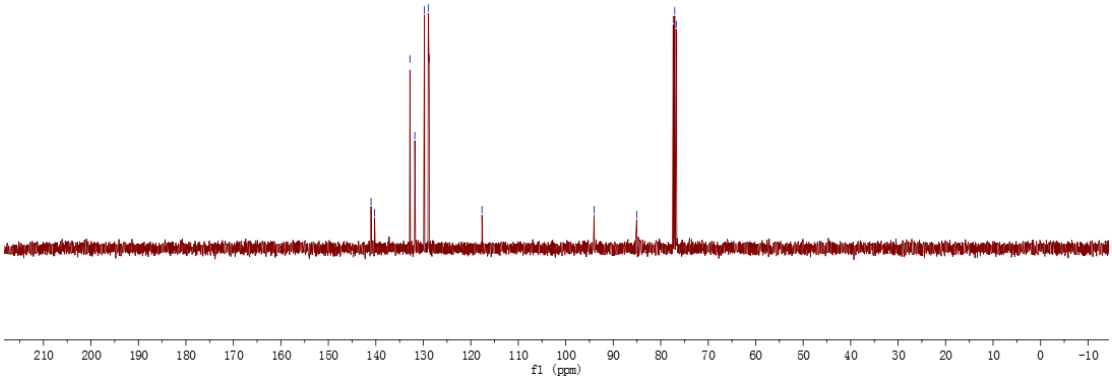
6h

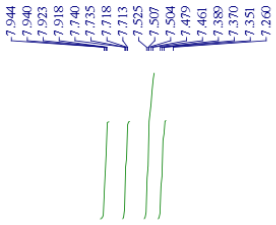


Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	295.8
4 Number of Scans	28
5 Spectrometer Frequency	100.62
6 Nucleus	13C

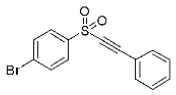


6h

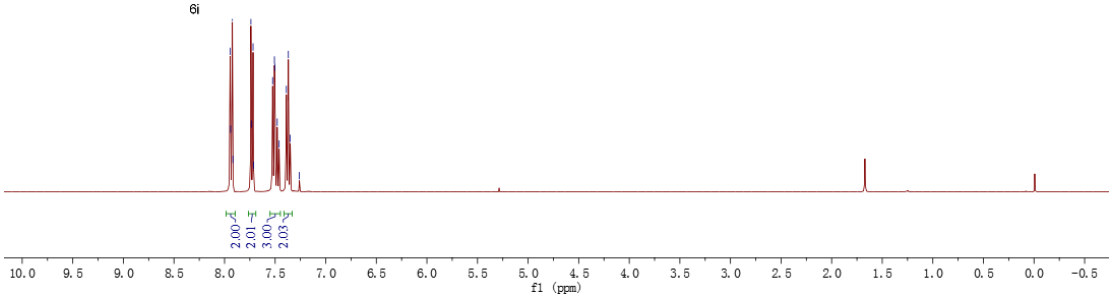




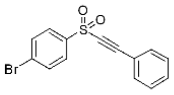
Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	298.1
4 Number of Scans	2
5 Spectrometer Frequency	400.15
6 Nucleus	1H



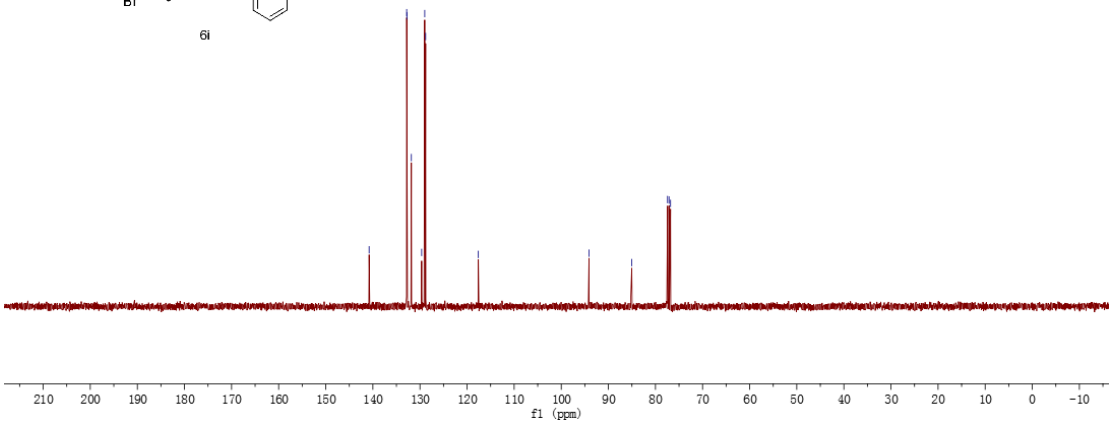
6i

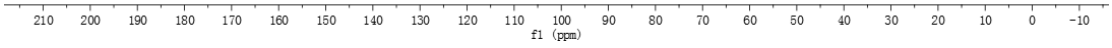


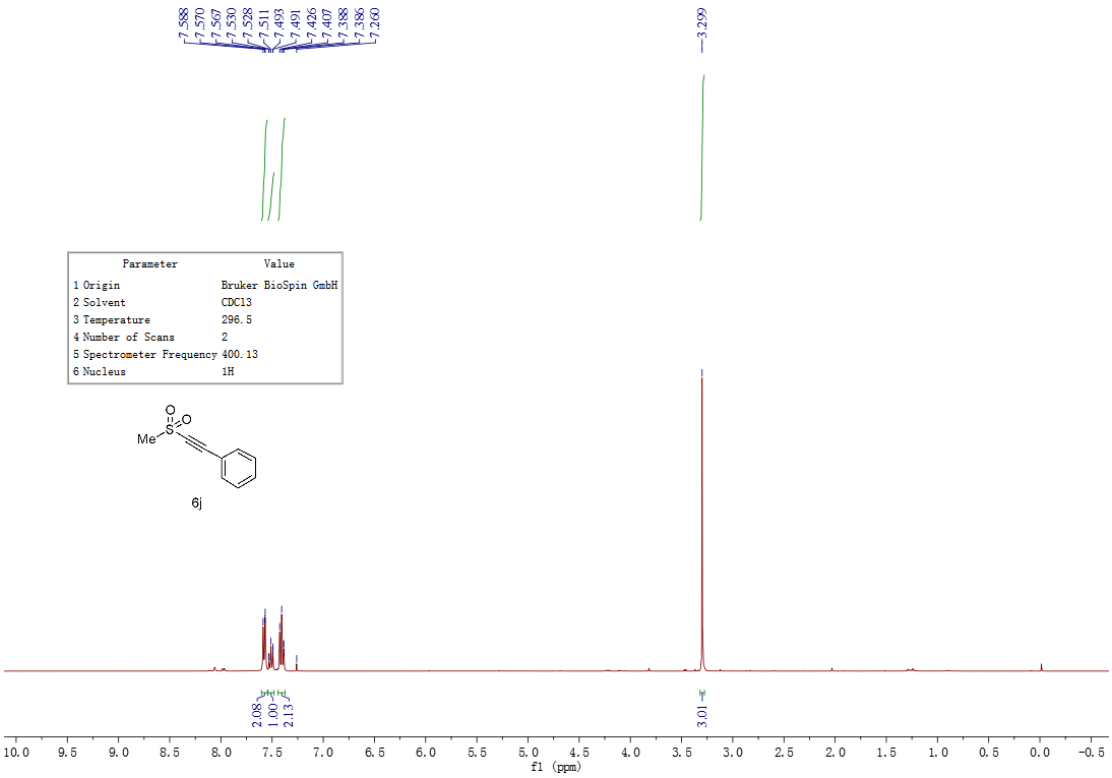
Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	298.2
4 Number of Scans	20
5 Spectrometer Frequency	100.62
6 Nucleus	13C

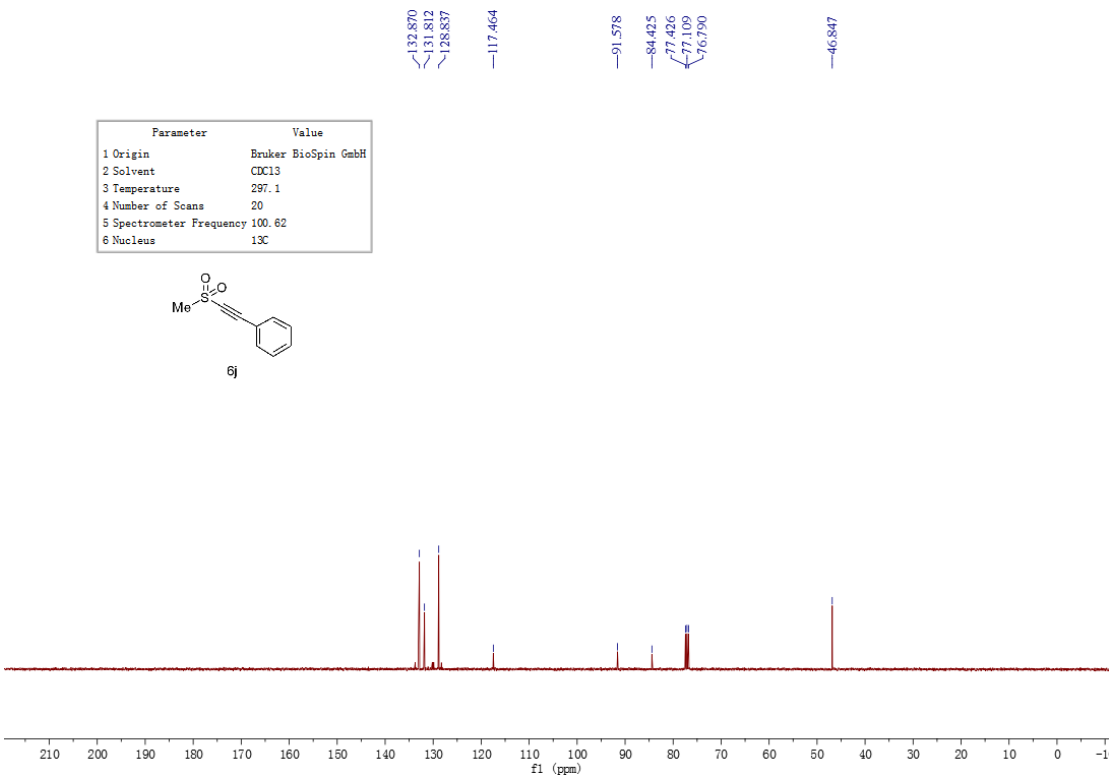


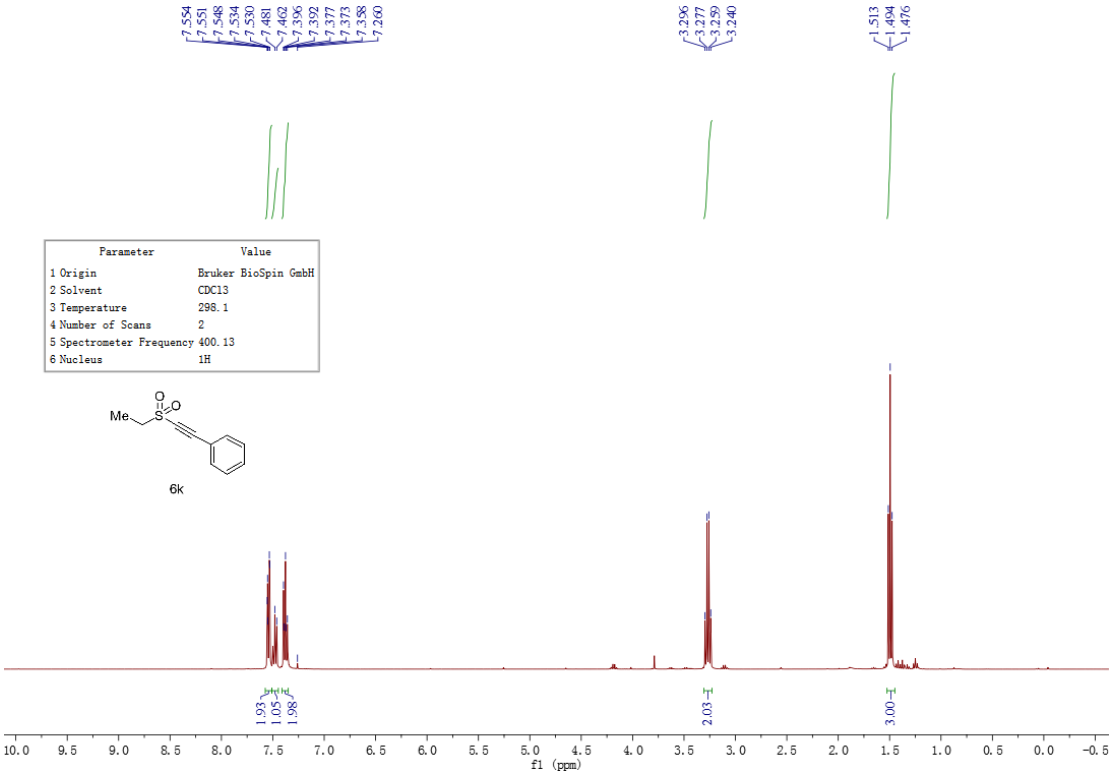
6i

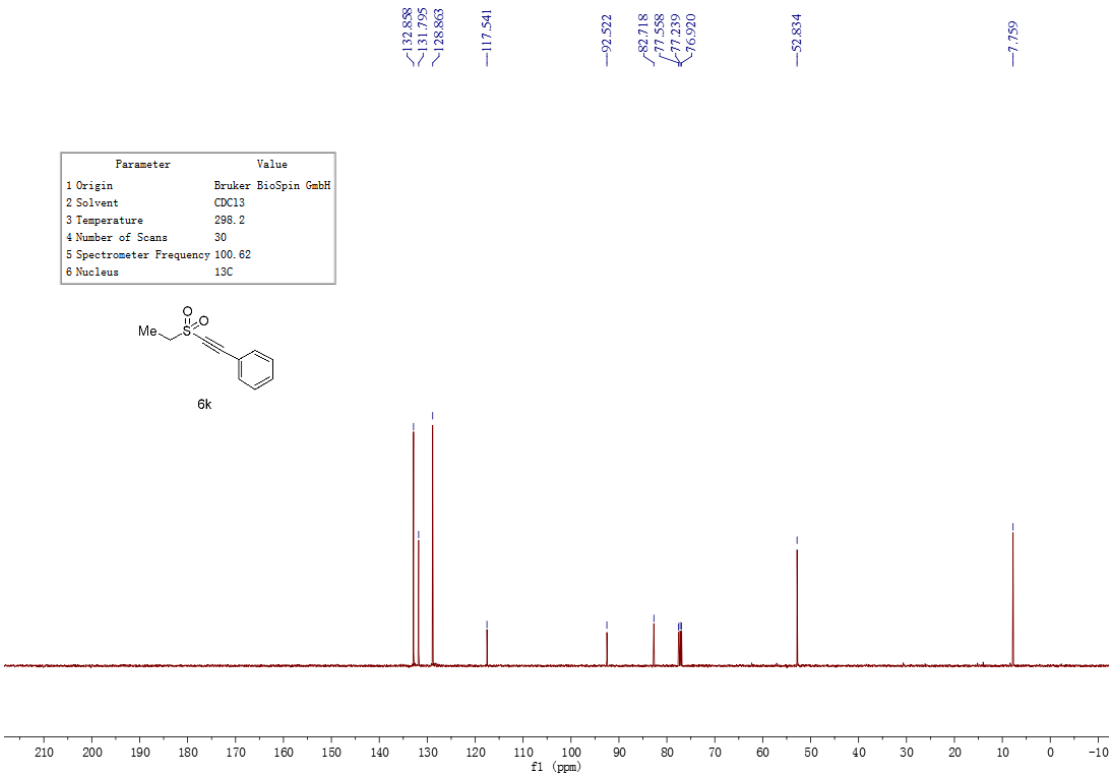


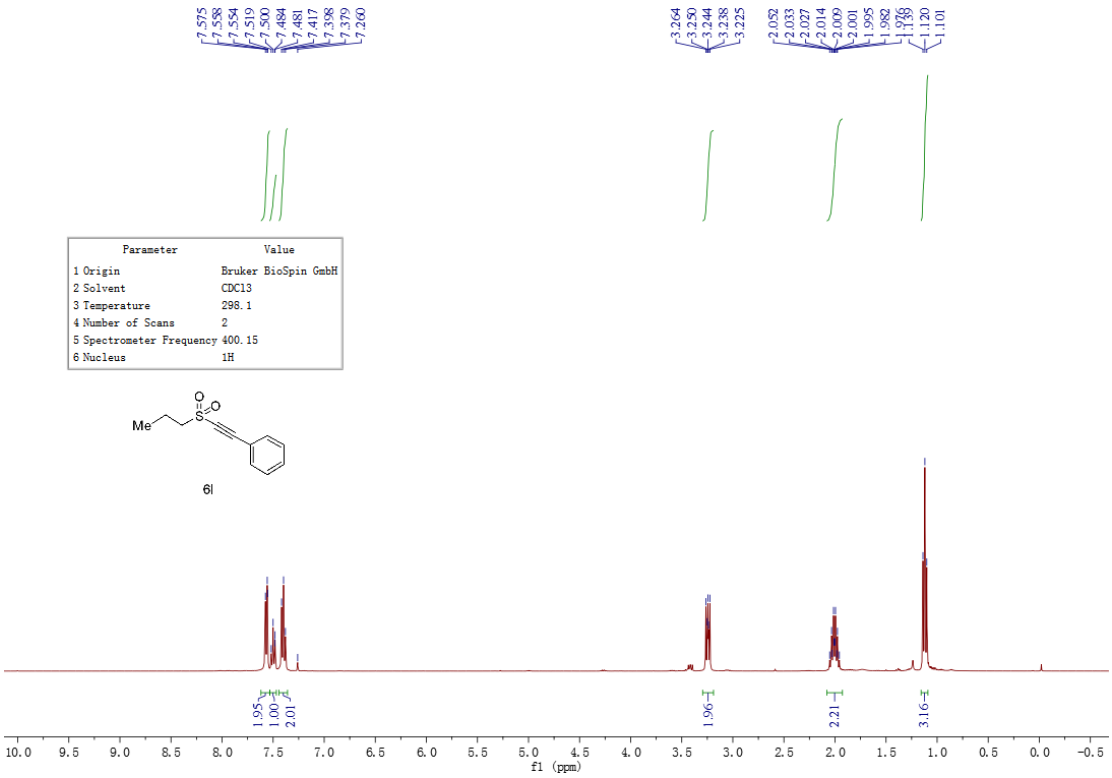


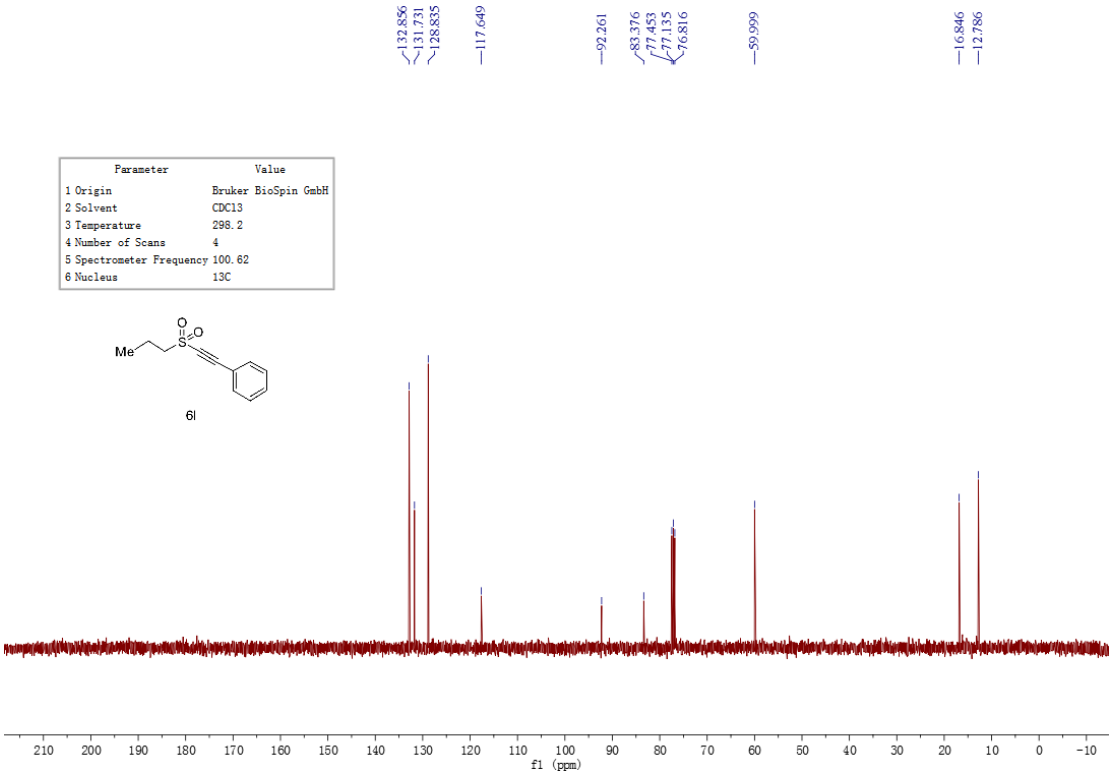

7.588
7.570
7.567
7.530
7.528
7.511
7.493
7.491
7.426
7.407
7.388
7.386
7.260
3.299
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 296.5
4 Number of Scans 2
5 Spectrometer Frequency 400.13
6 Nucleus 1H
Me
6j
2.08
1.00
2.13
3.01
f1 (ppm)

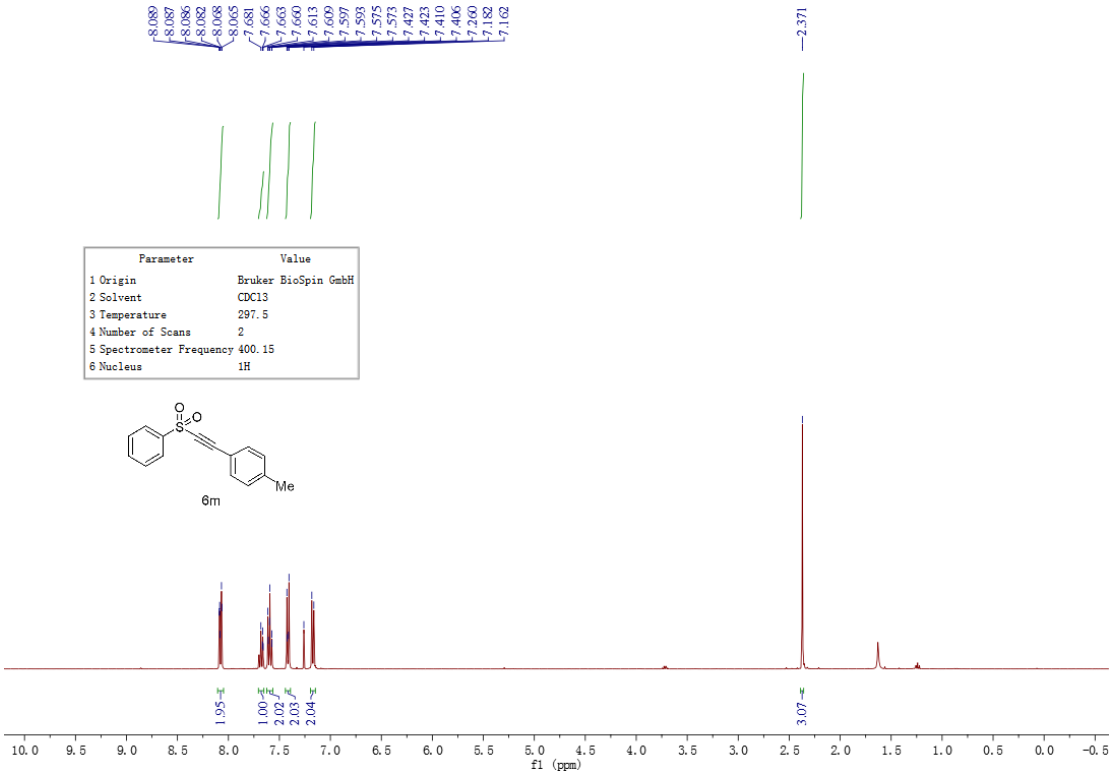

132.870
131.812
128.837
117.464
91.578
84.425
77.426
77.109
76.790
46.847
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 297.1
4 Number of Scans 20
5 Spectrometer Frequency 100.62
6 Nucleus 13C
Me
6j
f1 (ppm)

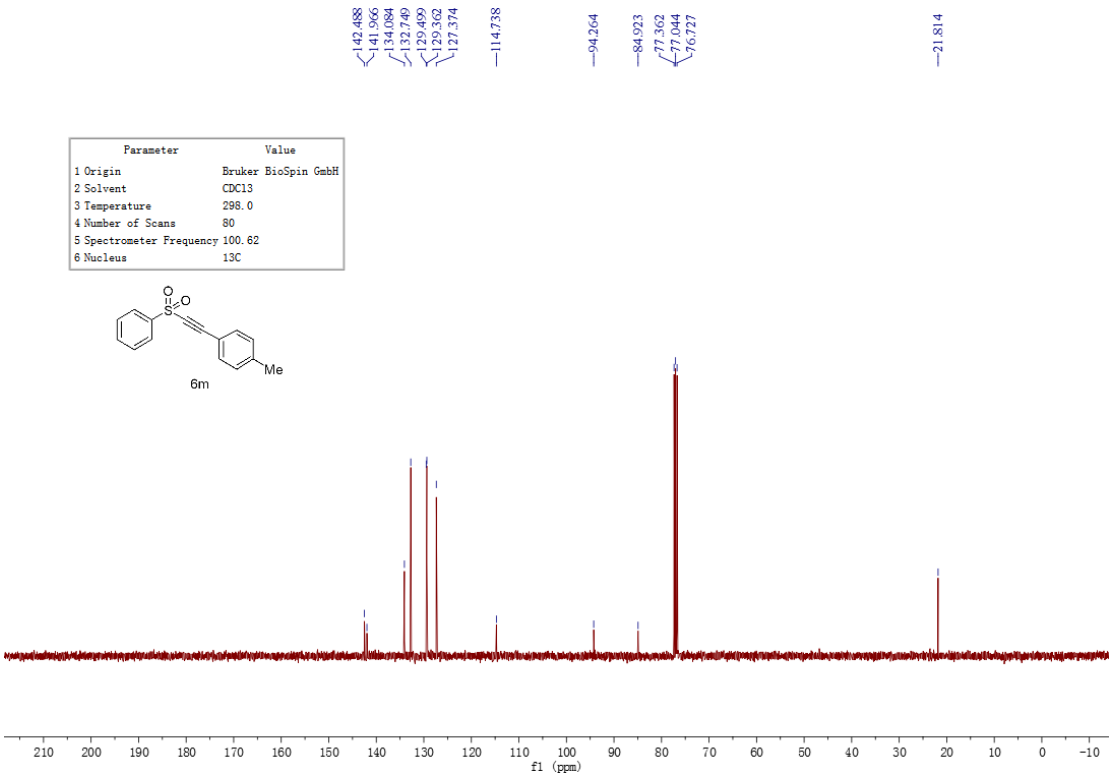

7.554
7.551
7.548
7.534
7.530
7.481
7.462
7.396
7.392
7.377
7.373
7.358
7.260
3.296
3.277
3.259
3.240
1.513
1.494
1.476
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.1
4 Number of Scans 2
5 Spectrometer Frequency 400.13
6 Nucleus 1H
Me
6k
1.93
1.05
1.98
2.03
3.00
f1 (ppm)

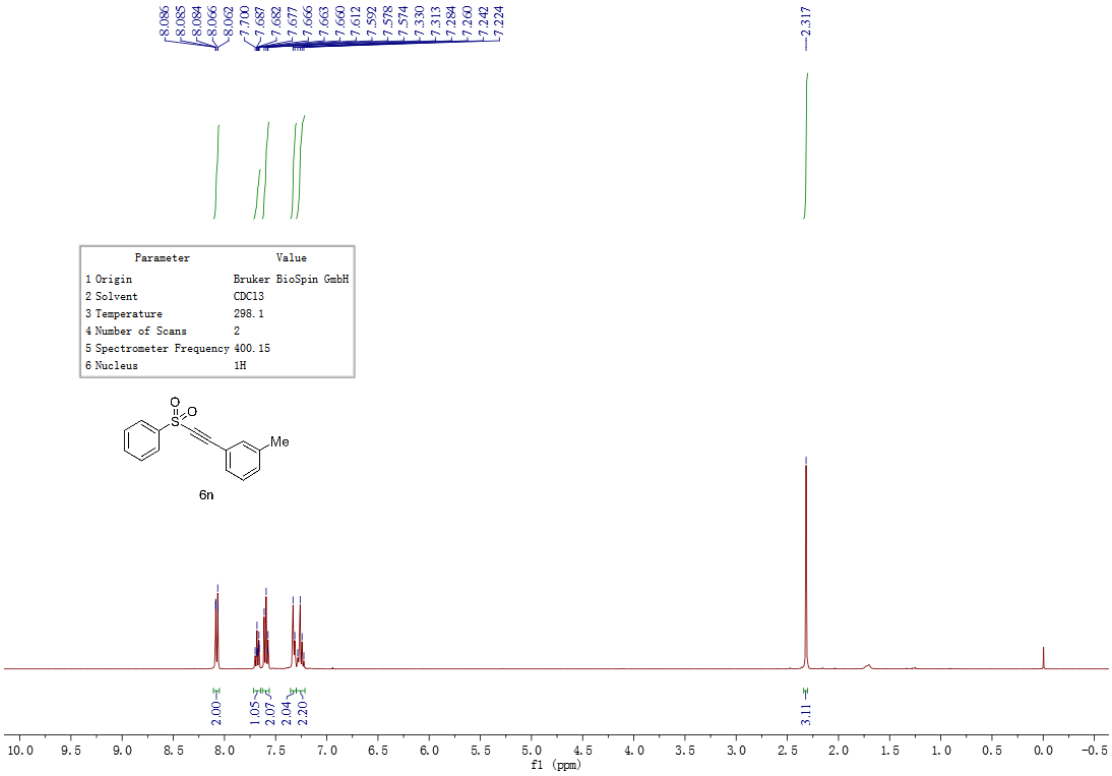

132.858
131.795
128.863
117.541
92.522
82.718
77.558
77.239
76.920
52.834
7.759
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.2
4 Number of Scans 30
5 Spectrometer Frequency 100.62
6 Nucleus 13C
Me
6k
f1 (ppm)

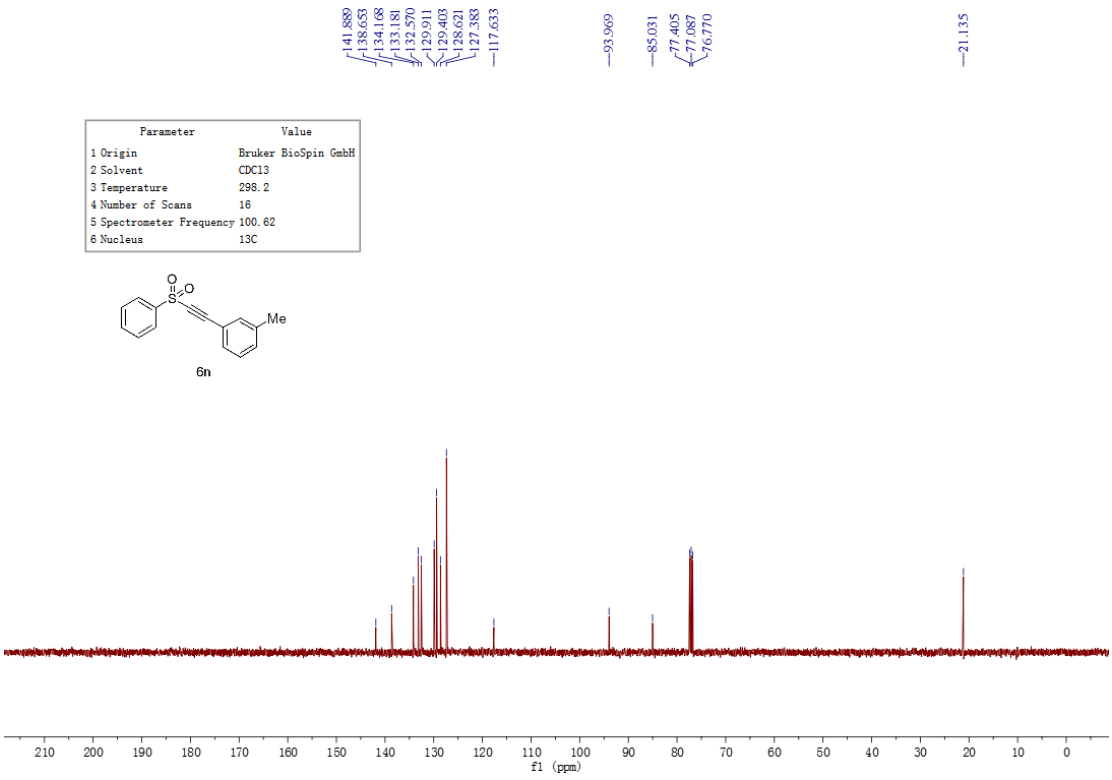

7.575
7.558
7.554
7.519
7.500
7.484
7.481
7.417
7.398
7.379
7.260
3.264
3.250
3.244
3.238
3.225
2.052
2.033
2.027
2.014
2.009
2.001
1.995
1.982
1.120
1.101
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.1
4 Number of Scans 2
5 Spectrometer Frequency 400.15
6 Nucleus 1H
Me
6l
1.95
1.00
2.01
1.96
2.21
3.16
f1 (ppm)

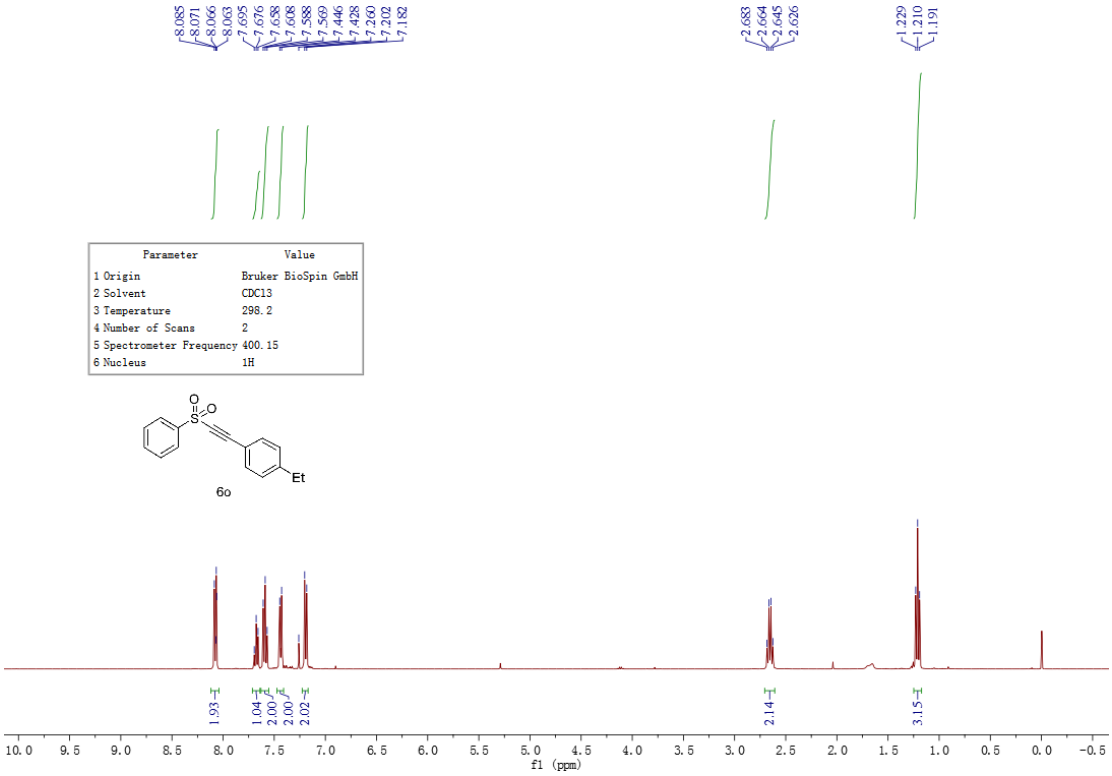

132.856
131.731
128.835
117.649
92.261
83.376
77.453
77.135
76.816
59.999
16.846
12.786
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.2
4 Number of Scans 4
5 Spectrometer Frequency 100.62
6 Nucleus 13C
Me
6l
f1 (ppm)


8.089
8.087
8.086
8.082
8.068
8.065
7.681
7.666
7.663
7.660
7.613
7.609
7.597
7.593
7.575
7.573
7.427
7.423
7.410
7.406
7.260
7.182
7.162
2.371
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 297.5
4 Number of Scans 2
5 Spectrometer Frequency 400.15
6 Nucleus 1H
Me
6m
1.95
1.00
2.02
2.03
2.04
3.07
f1 (ppm)


142.488
141.966
134.084
132.749
129.499
129.362
127.374
114.738
94.264
84.923
77.362
77.044
76.727
21.814
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.0
4 Number of Scans 80
5 Spectrometer Frequency 100.62
6 Nucleus 13C
Me
6m
f1 (ppm)


8.086
8.085
8.084
8.066
8.062
7.700
7.687
7.682
7.677
7.666
7.663
7.660
7.612
7.592
7.578
7.574
7.330
7.313
7.284
7.260
7.242
7.224
2.317
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.1
4 Number of Scans 2
5 Spectrometer Frequency 400.15
6 Nucleus 1H
O
S
O
Me
6n
2.00
1.05
2.07
2.04
2.20
3.11
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)


141.889
138.653
134.168
133.181
132.570
129.911
129.403
128.621
127.383
117.633
93.969
85.031
77.405
77.087
76.770
21.135
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.2
4 Number of Scans 16
5 Spectrometer Frequency 100.62
6 Nucleus 13C
O
S
O
Me
6n
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)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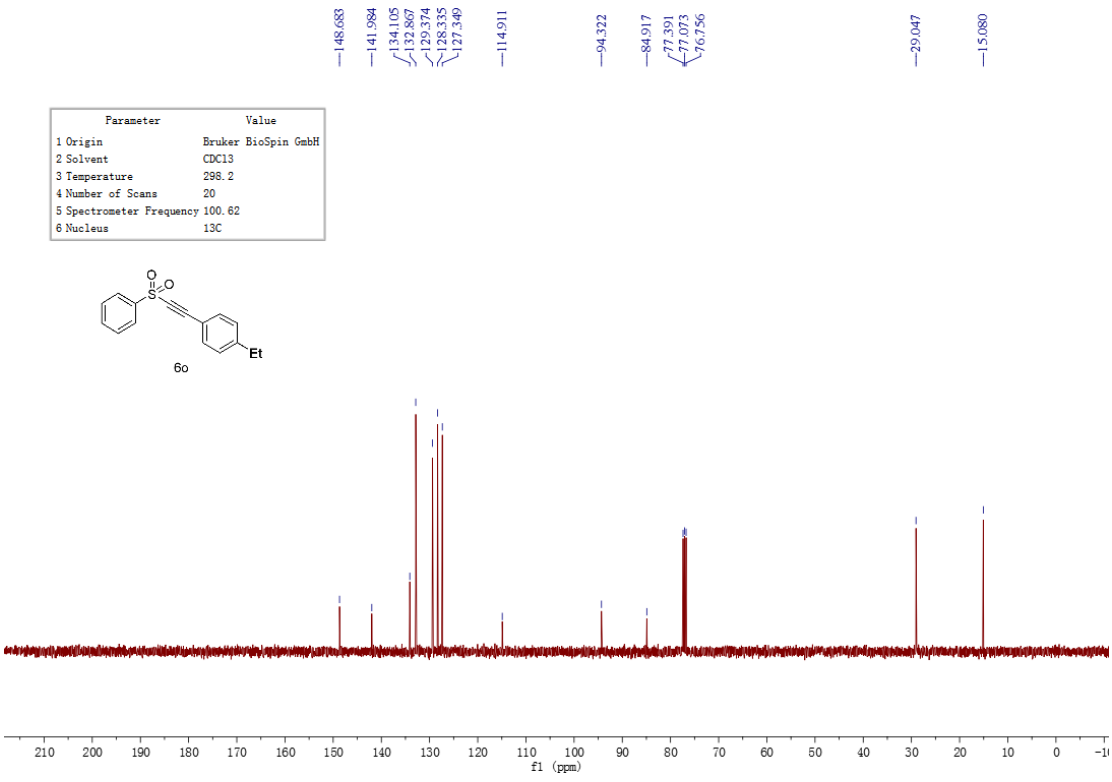
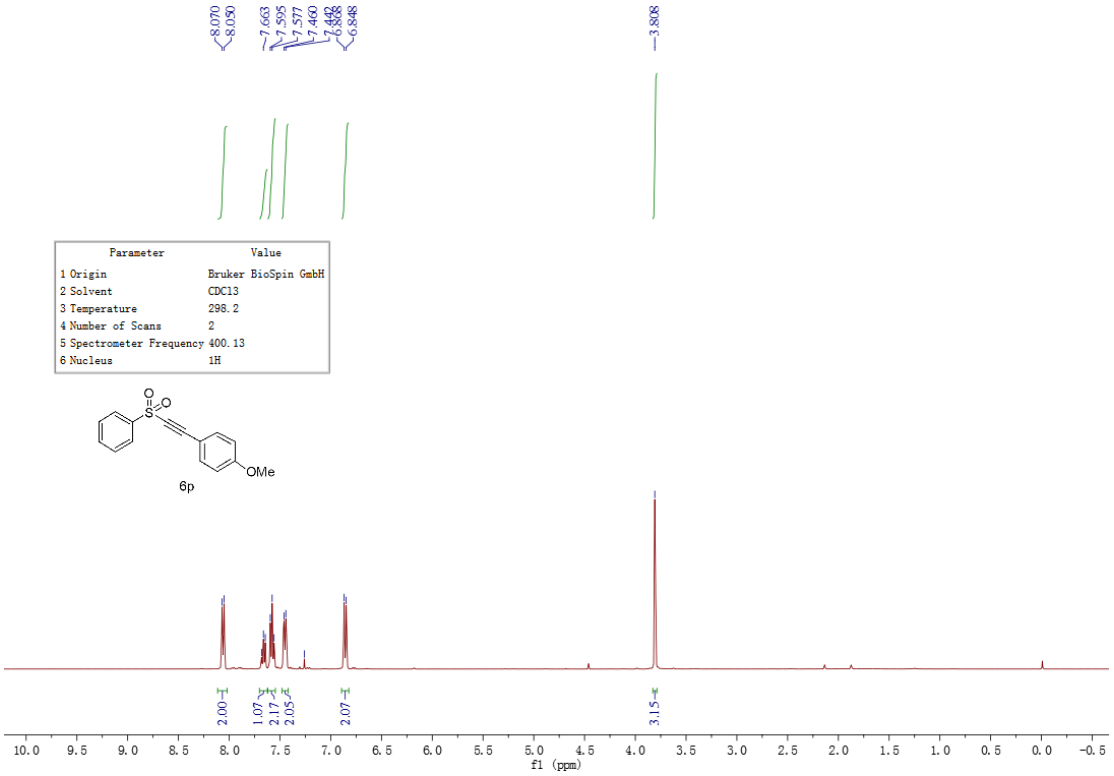
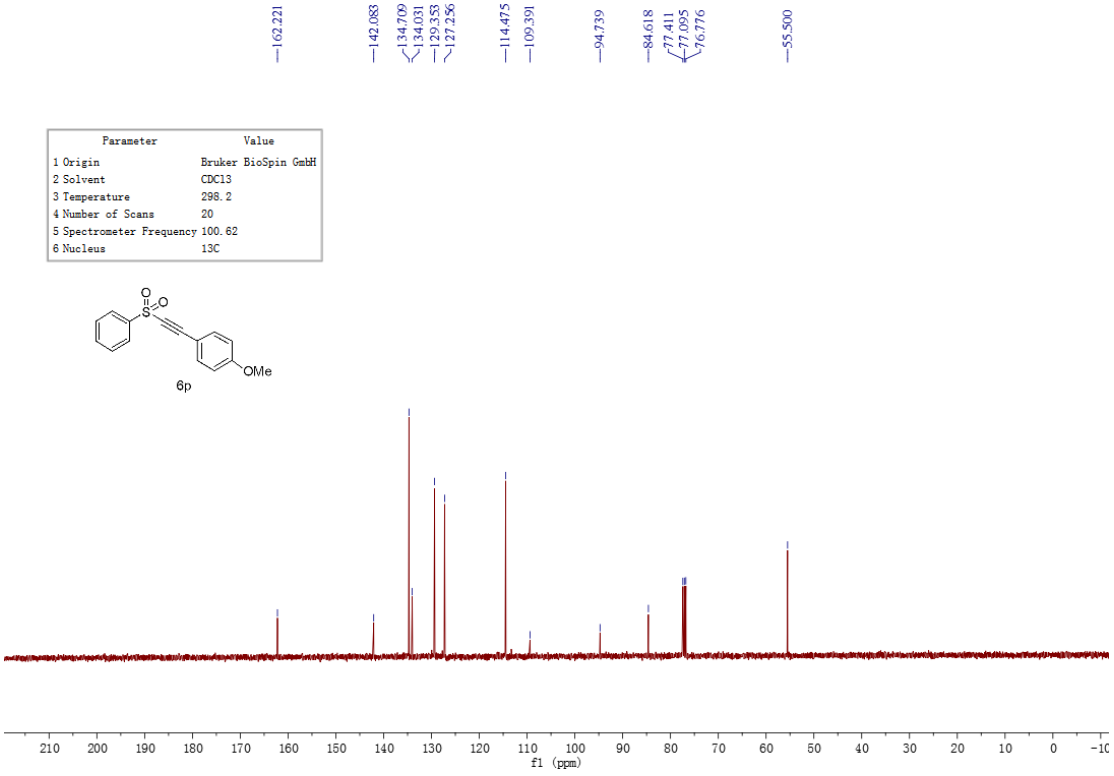
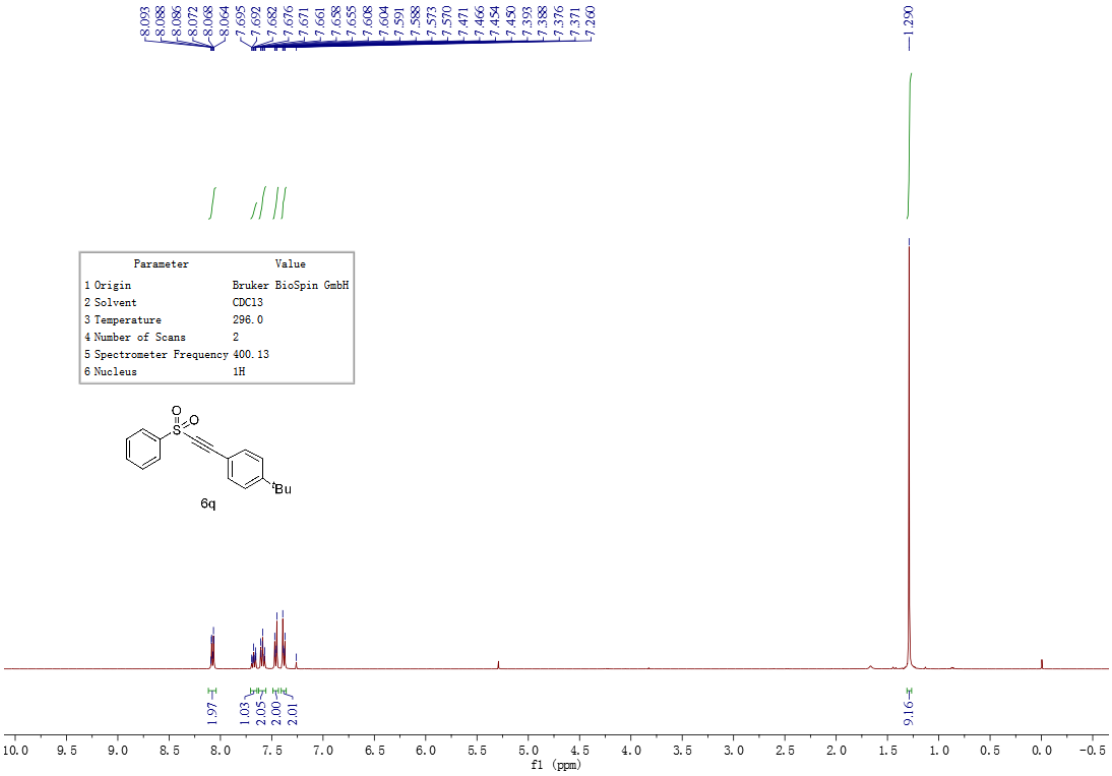
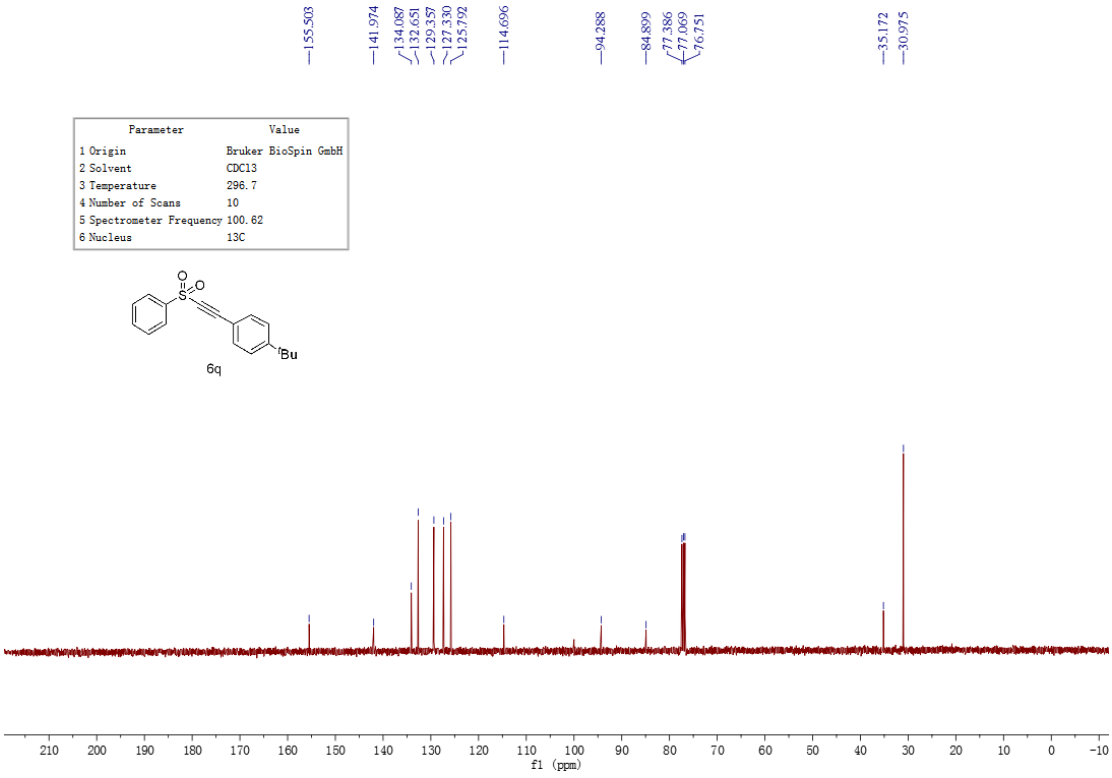
8.071
8.066
8.063
7.695
7.676
7.658
7.608
7.588
7.569
7.446
7.428
7.260
7.202
7.182
2.683
2.664
2.645
2.626
1.229
1.210
1.191
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.2
4 Number of Scans 2
5 Spectrometer Frequency 400.15
6 Nucleus 1H
O
S
O
Et
6o
1.93
1.04
2.00
2.00
2.02
2.14
3.15
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)

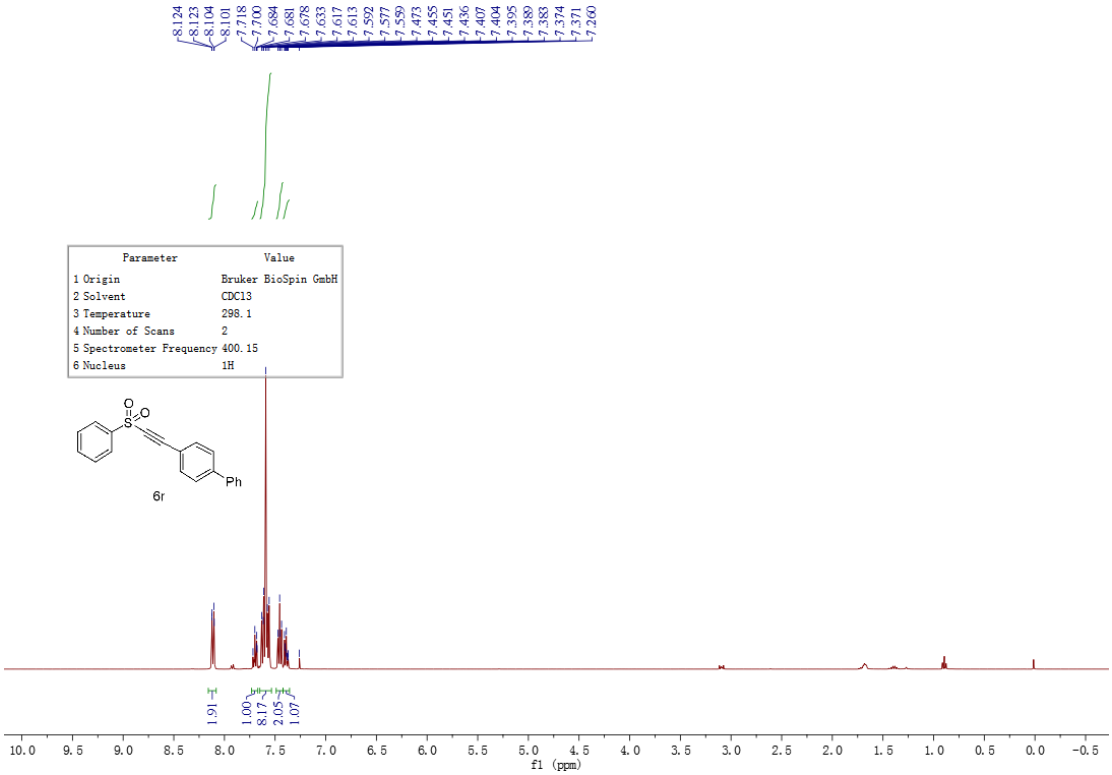

148.683
141.984
134.105
132.867
129.374
128.335
127.349
114.911
94.322
84.917
77.391
77.073
76.756
29.047
15.080
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.2
4 Number of Scans 20
5 Spectrometer Frequency 100.62
6 Nucleus 13C
O
S
O
Et
6o
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

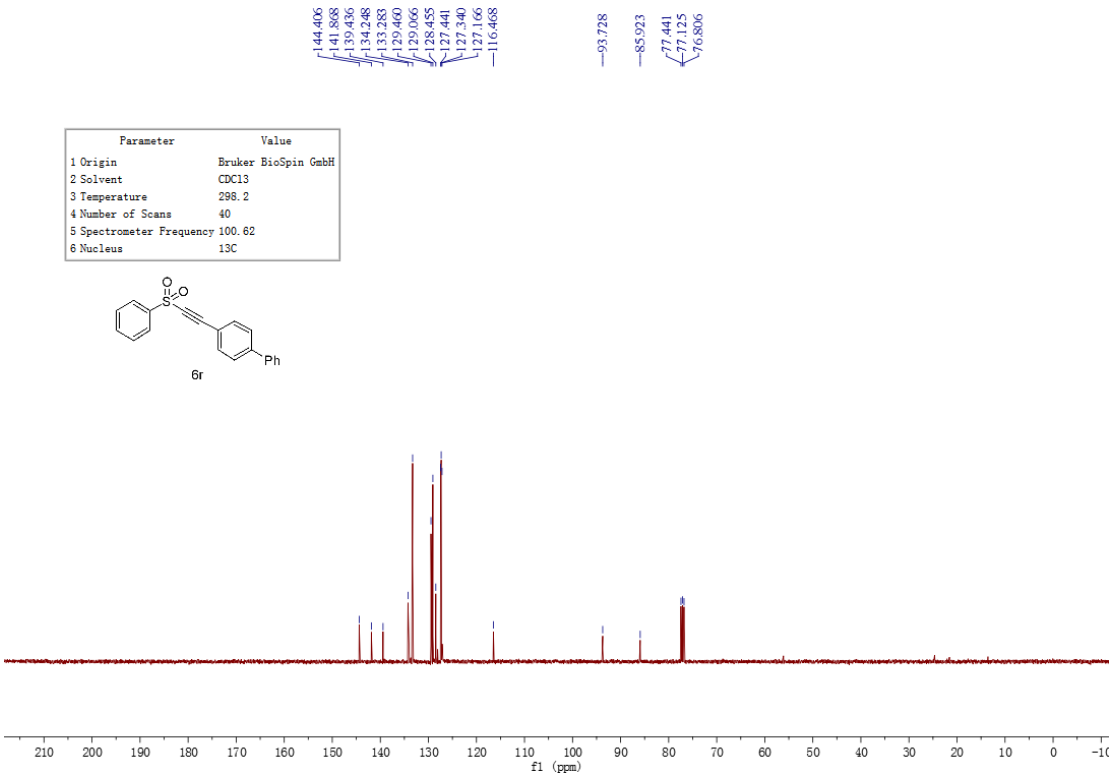

8.070
8.050
7.663
7.595
7.577
7.460
7.442
6.868
6.848
3.808
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.2
4 Number of Scans 2
5 Spectrometer Frequency 400.13
6 Nucleus 1H
OMe
6p
2.00
1.07
2.17
2.05
2.07
3.15
f1 (ppm)

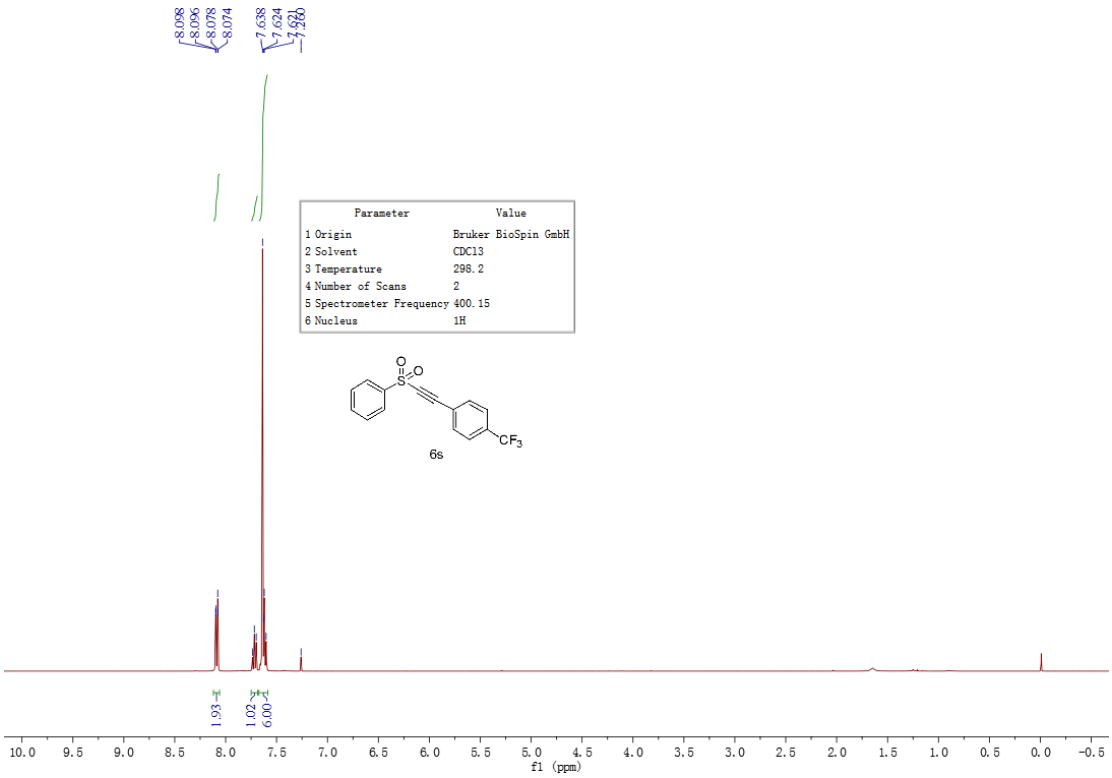

162.221
142.083
134.709
134.031
129.353
127.256
114.475
109.391
94.739
84.618
77.411
77.095
76.776
55.500
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.2
4 Number of Scans 20
5 Spectrometer Frequency 100.62
6 Nucleus 13C
OMe
6p
f1 (ppm)

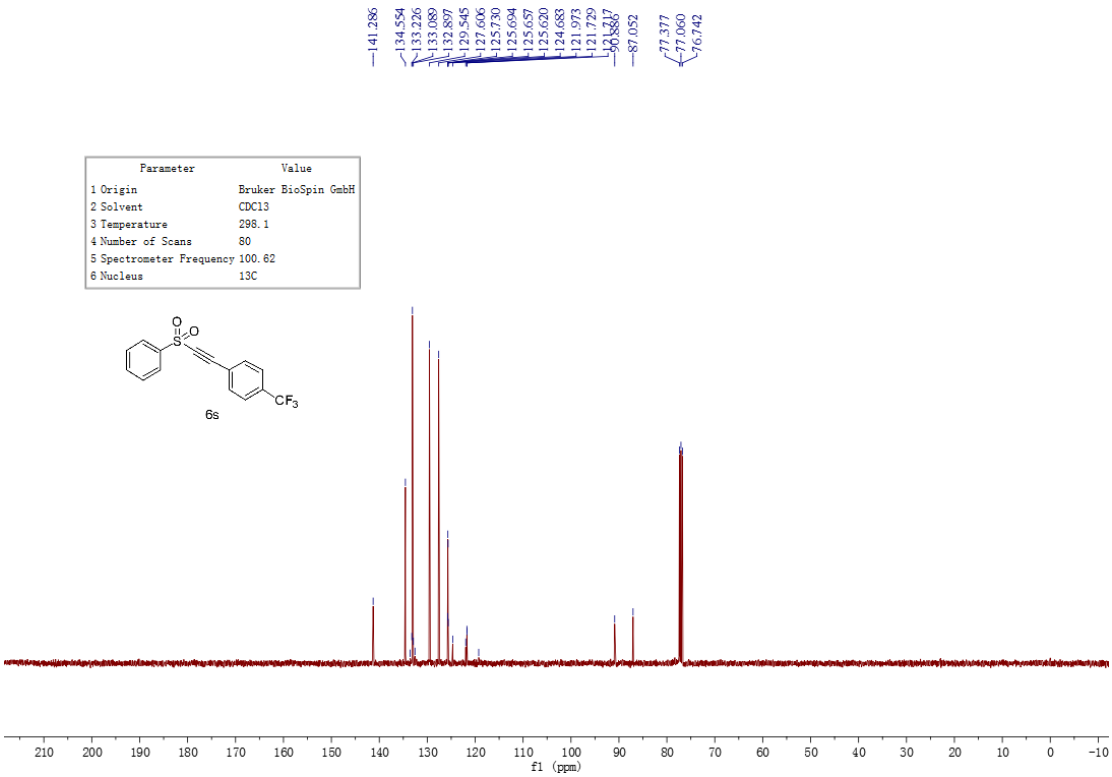

8.093
8.088
8.086
8.072
8.068
8.064
7.695
7.692
7.682
7.676
7.671
7.661
7.658
7.655
7.608
7.604
7.591
7.588
7.573
7.570
7.471
7.466
7.454
7.450
7.393
7.388
7.376
7.371
7.260
1.290
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 296.0
4 Number of Scans 2
5 Spectrometer Frequency 400.13
6 Nucleus 1H
tBu
6q
1.97
1.03
2.05
2.00
2.01
9.16
f1 (ppm)

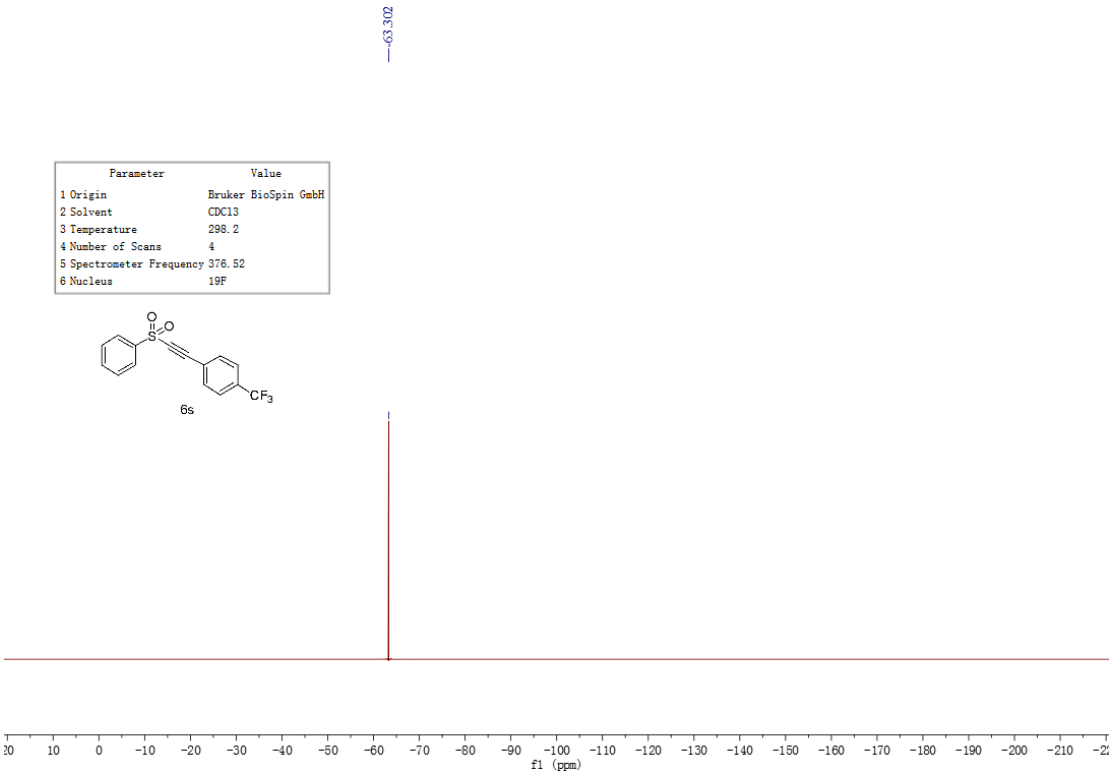

155.503
141.974
134.087
132.651
129.357
127.330
125.792
114.696
94.288
84.899
77.386
77.069
76.751
35.172
30.975
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 296.7
4 Number of Scans 10
5 Spectrometer Frequency 100.62
6 Nucleus 13C
tBu
6q
f1 (ppm)

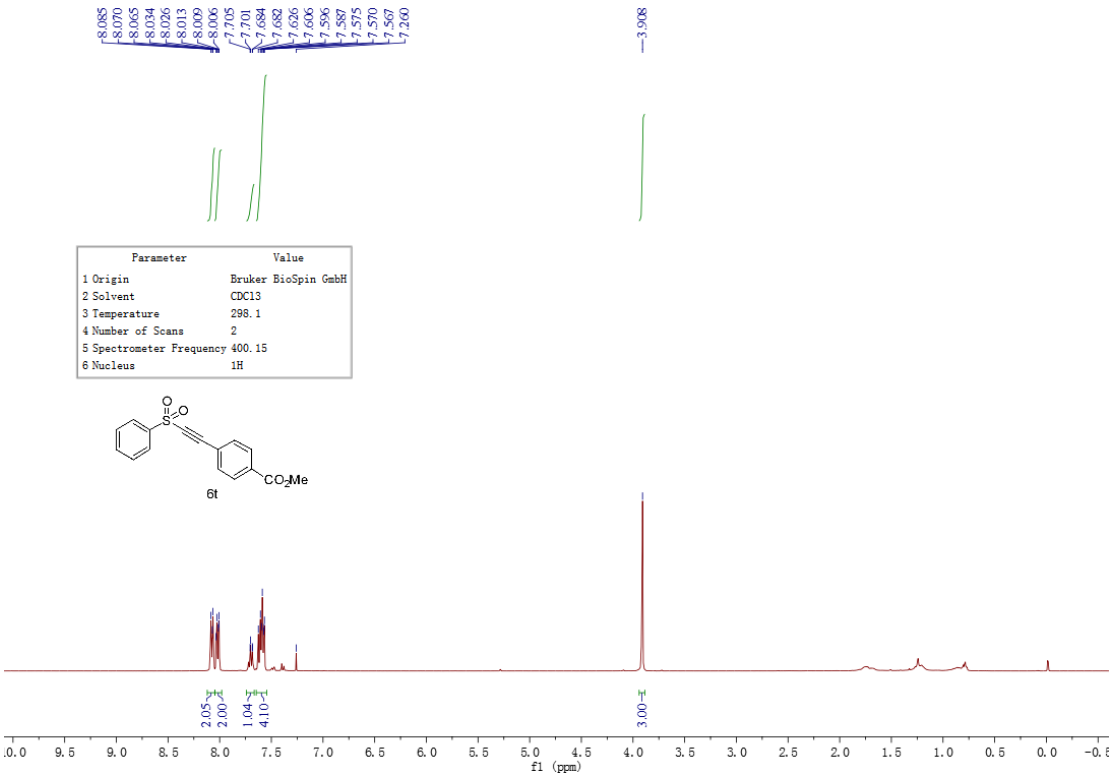

8.124
8.123
8.104
8.101
7.718
7.700
7.684
7.681
7.678
7.633
7.617
7.613
7.592
7.577
7.559
7.473
7.455
7.451
7.436
7.407
7.404
7.395
7.389
7.383
7.374
7.371
7.260
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.1
4 Number of Scans 2
5 Spectrometer Frequency 400.15
6 Nucleus 1H
O
S
O
Ph
6r
1.91
1.00
8.17
2.05
1.07
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)

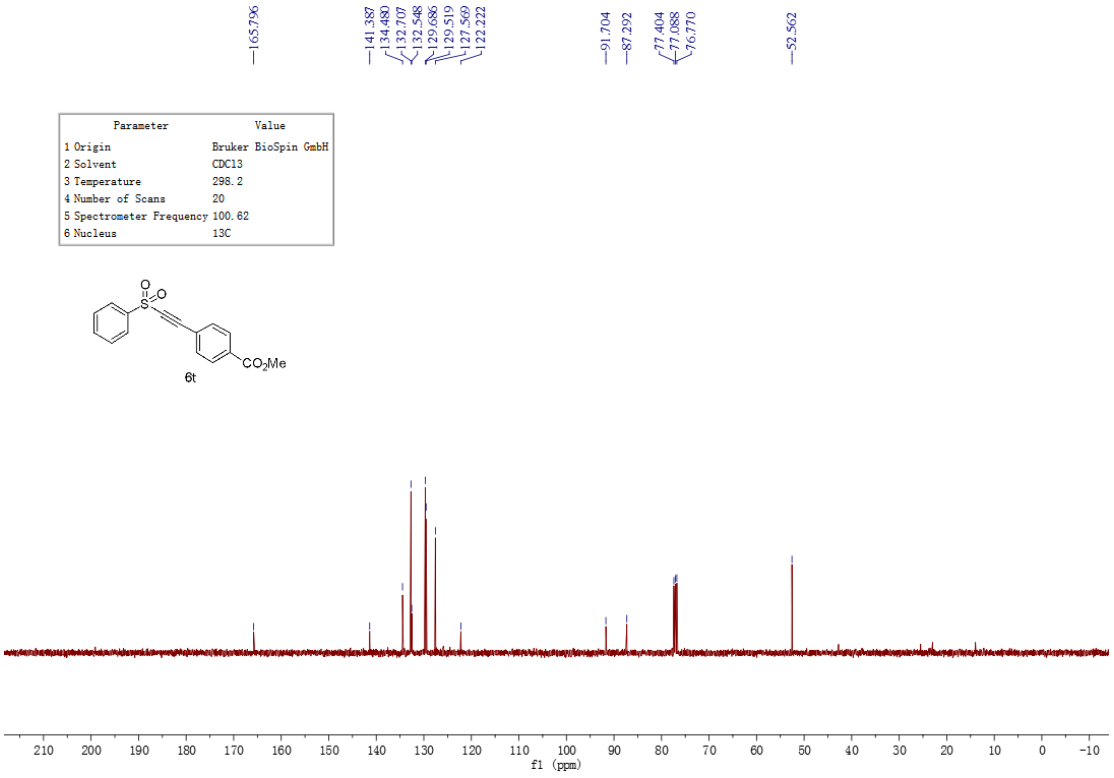

144.406
141.868
139.436
134.248
133.283
129.460
129.066
128.455
127.441
127.340
127.166
116.468
93.728
85.923
77.441
77.125
76.806
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.2
4 Number of Scans 40
5 Spectrometer Frequency 100.62
6 Nucleus 13C
O
S
O
Ph
6r
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

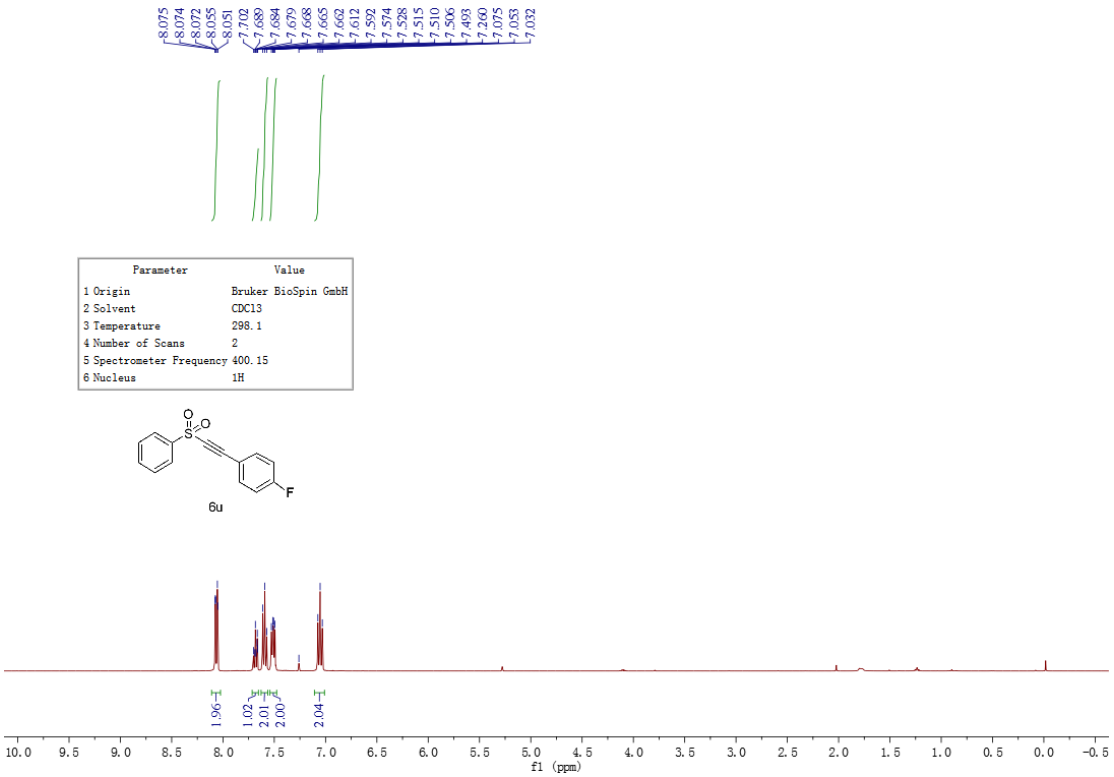

8.098
8.096
8.078
8.074
7.638
7.624
7.621
7.260
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.2
4 Number of Scans 2
5 Spectrometer Frequency 400.15
6 Nucleus 1H
6s
1.93
1.02
6.00
f1 (ppm)

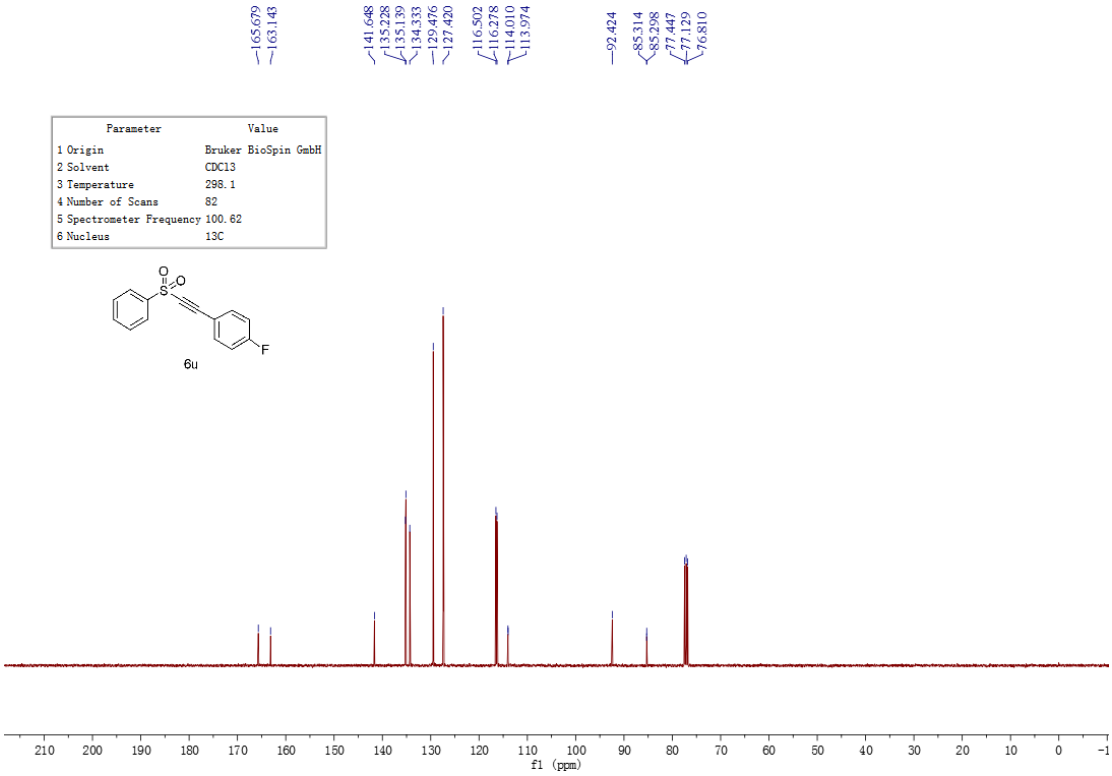

141.286
134.554
133.226
133.089
132.897
129.545
127.606
125.730
125.694
125.657
125.620
124.683
121.973
121.729
87.052
77.377
77.060
76.742
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.1
4 Number of Scans 80
5 Spectrometer Frequency 100.62
6 Nucleus 13C
6s
f1 (ppm)

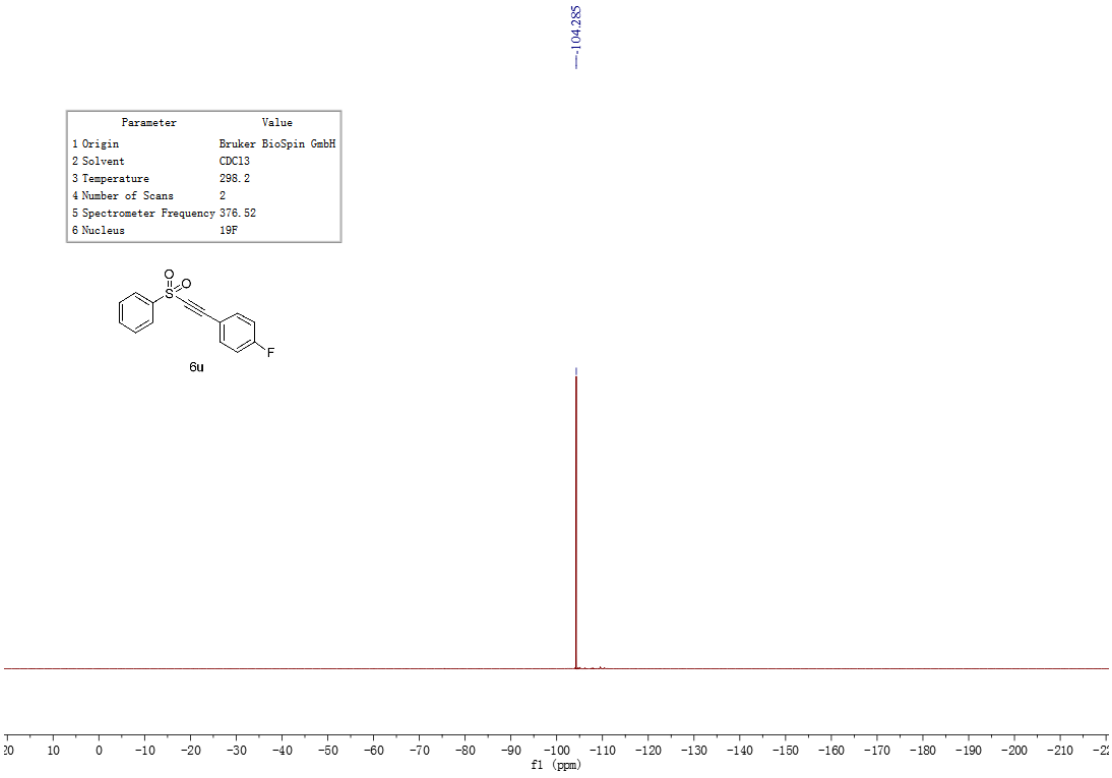

-63.302
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.2
4 Number of Scans 4
5 Spectrometer Frequency 376.52
6 Nucleus 19F
6s
f1 (ppm)

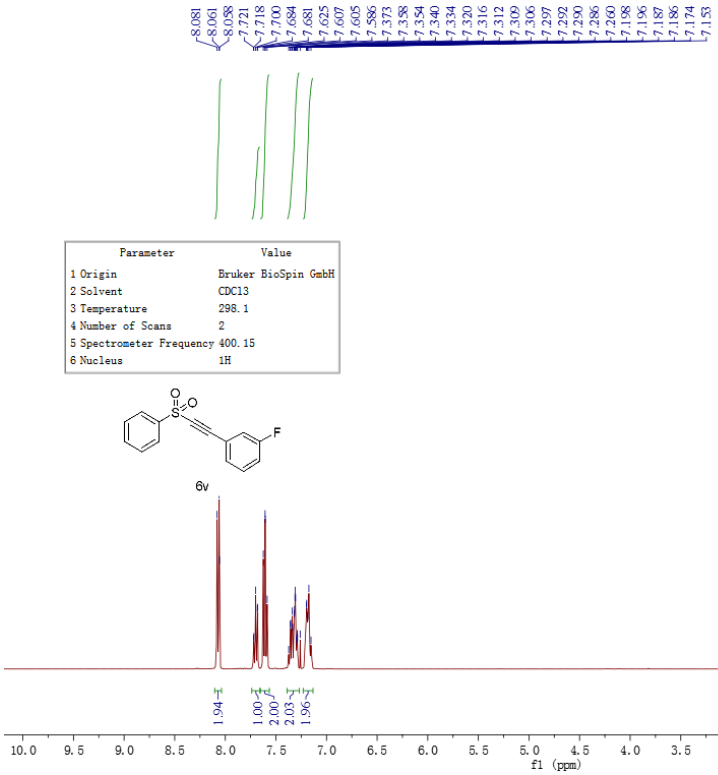

8.085
8.070
8.065
8.034
8.026
8.013
8.009
8.006
7.705
7.701
7.684
7.682
7.626
7.606
7.596
7.587
7.575
7.570
7.567
7.260
3.908
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.1
4 Number of Scans 2
5 Spectrometer Frequency 400.15
6 Nucleus 1H
6t
2.05
2.00
1.04
4.10
3.00
f1 (ppm)

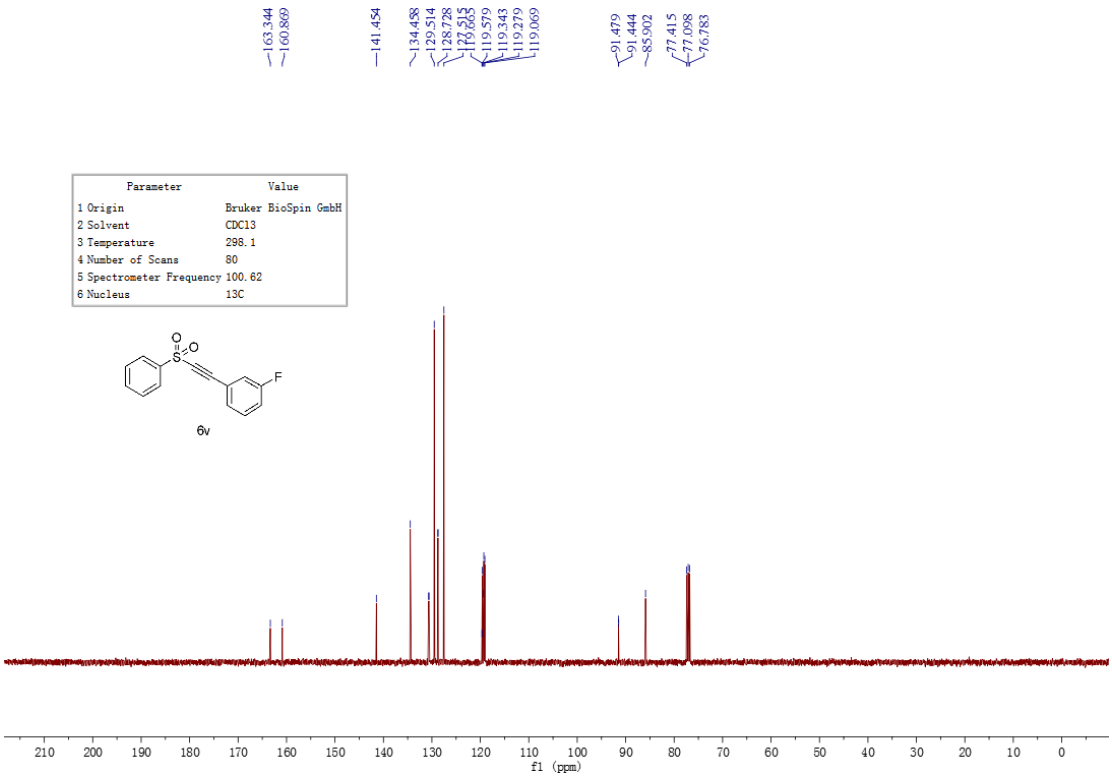

165.796
141.387
134.480
132.707
132.548
129.686
129.519
127.569
122.222
91.704
87.292
77.404
77.088
76.770
52.562
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.2
4 Number of Scans 20
5 Spectrometer Frequency 100.62
6 Nucleus 13C
CO2Me
6t
f1 (ppm)


8.075
8.074
8.072
8.055
8.051
7.702
7.689
7.684
7.679
7.668
7.665
7.662
7.612
7.592
7.574
7.528
7.515
7.510
7.506
7.493
7.260
7.075
7.053
7.032
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.1
4 Number of Scans 2
5 Spectrometer Frequency 400.15
6 Nucleus 1H
F
6u
1.96
1.02
2.01
2.00
2.04
f1 (ppm)


165.679
163.143
141.648
135.228
135.139
134.333
129.476
127.420
116.502
116.278
114.010
113.974
92.424
85.314
85.298
77.447
77.129
76.810
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.1
4 Number of Scans 82
5 Spectrometer Frequency 100.62
6 Nucleus 13C
6u
f1 (ppm)

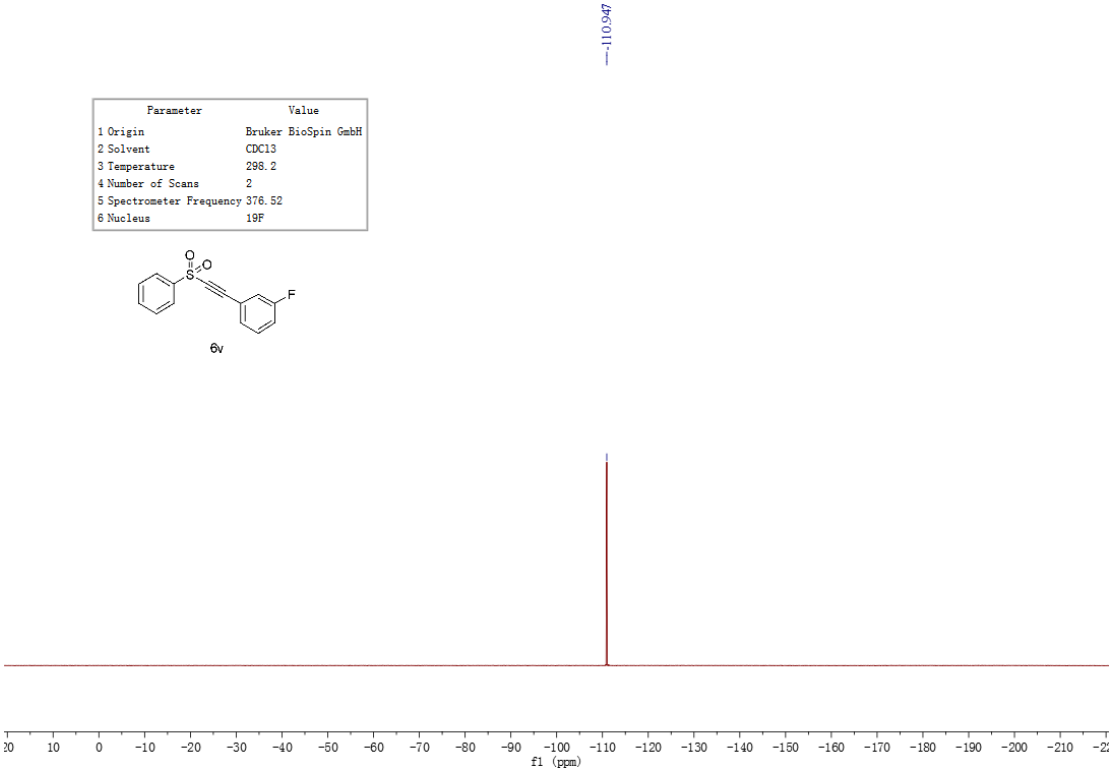

104.285
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.2
4 Number of Scans 2
5 Spectrometer Frequency 376.52
6 Nucleus 19F
6u
f1 (ppm)

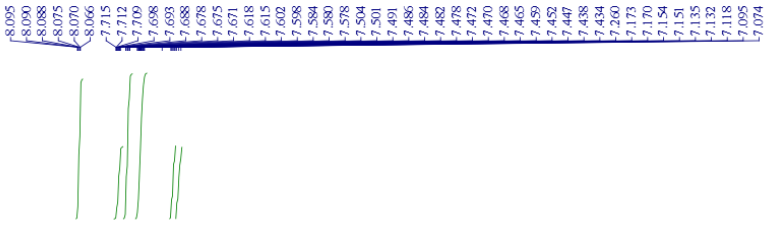

8.081
8.061
8.038
7.721
7.718
7.700
7.684
7.681
7.625
7.607
7.605
7.586
7.373
7.358
7.354
7.340
7.334
7.320
7.316
7.312
7.309
7.306
7.297
7.292
7.290
7.286
7.260
7.198
7.196
7.187
7.186
7.174
7.153
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.1
4 Number of Scans 2
5 Spectrometer Frequency 400.15
6 Nucleus 1H
O
S
O
F
6v
1.94
1.00
2.00
2.03
1.96
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)


163.344
160.869
141.454
134.458
129.514
128.728
127.515
119.665
119.579
119.343
119.279
119.069
91.479
91.444
85.502
77.415
77.098
76.783
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.1
4 Number of Scans 80
5 Spectrometer Frequency 100.62
6 Nucleus 13C
O
S
O
F
6v
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	298.2
4 Number of Scans	2
5 Spectrometer Frequency	376.52
6 Nucleus	19F

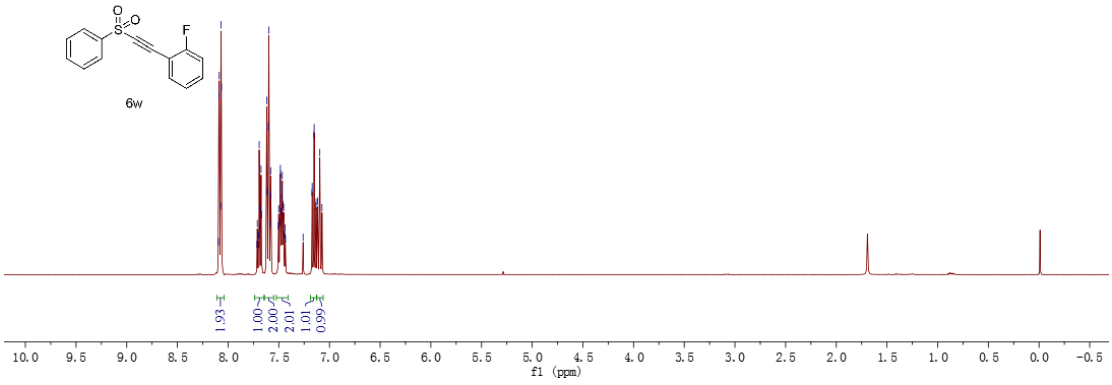
6v

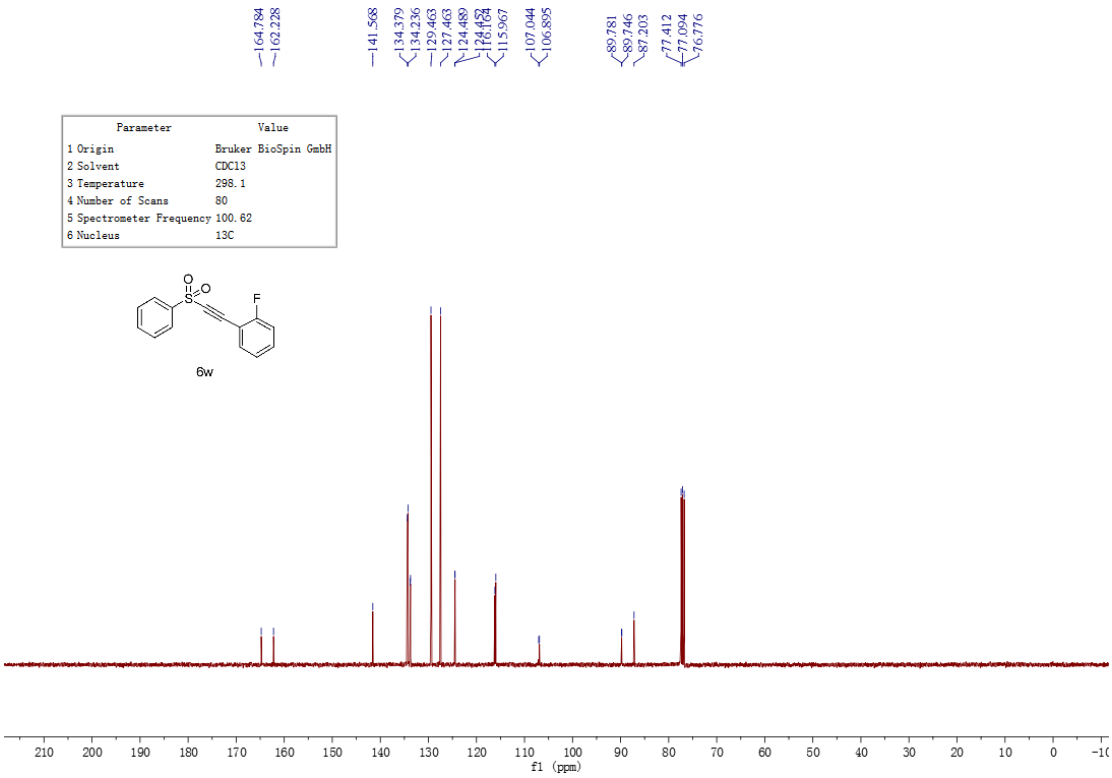


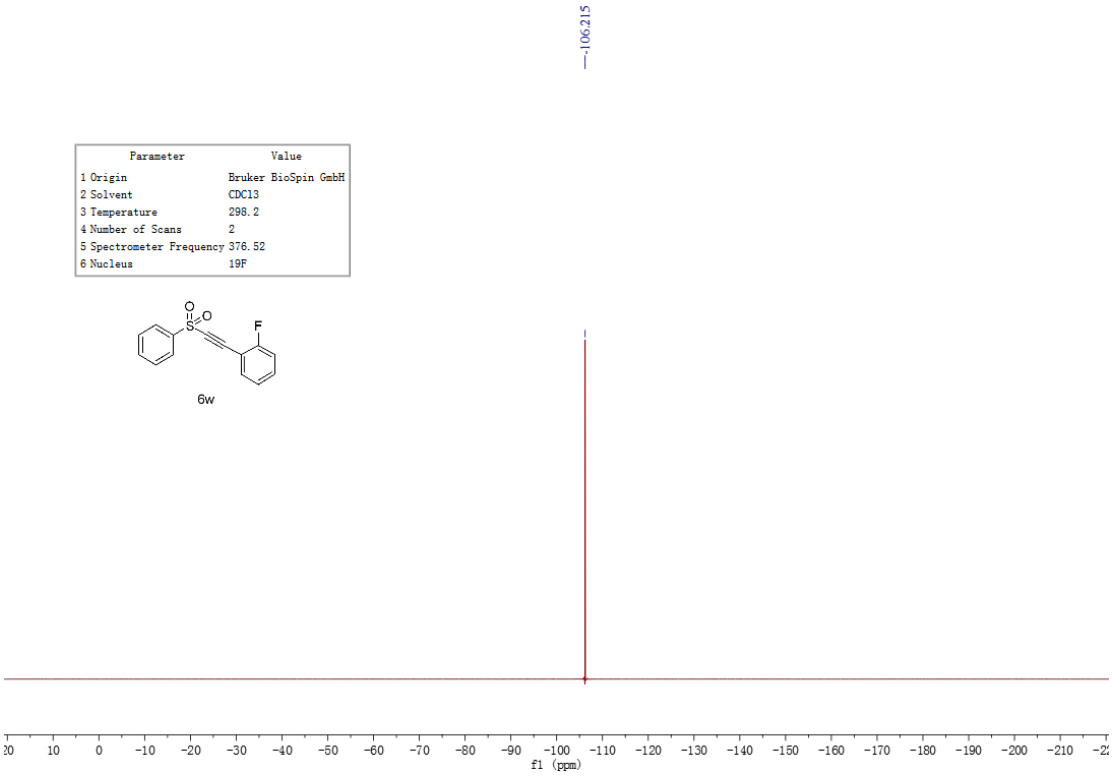


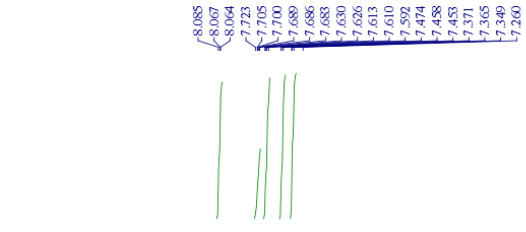
Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	298.2
4 Number of Scans	2
5 Spectrometer Frequency	400.15
6 Nucleus	1H

6w

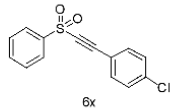



164.784
162.228
141.568
134.379
134.236
129.463
127.463
124.489
118.454
118.424
115.967
107.044
106.895
89.781
89.746
87.203
77.412
77.094
76.776
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.1
4 Number of Scans 80
5 Spectrometer Frequency 100.62
6 Nucleus 13C
O
S
O
F
6w
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)

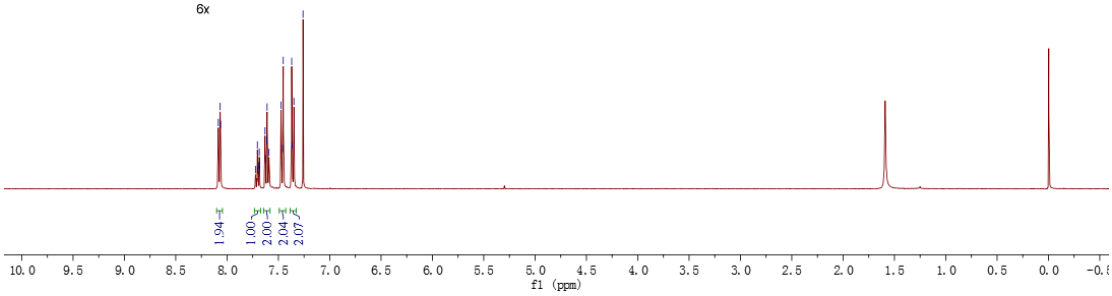

-106.215
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.2
4 Number of Scans 2
5 Spectrometer Frequency 376.52
6 Nucleus 19F
O
S
O
F
6w
20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210 -22
f1 (ppm)



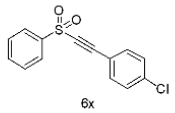
Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	296.2
4 Number of Scans	2
5 Spectrometer Frequency	400.13
6 Nucleus	1H



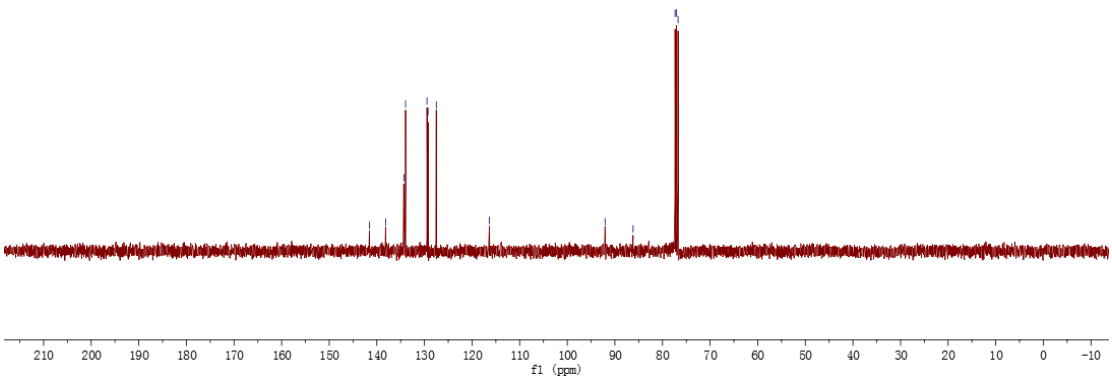
6x

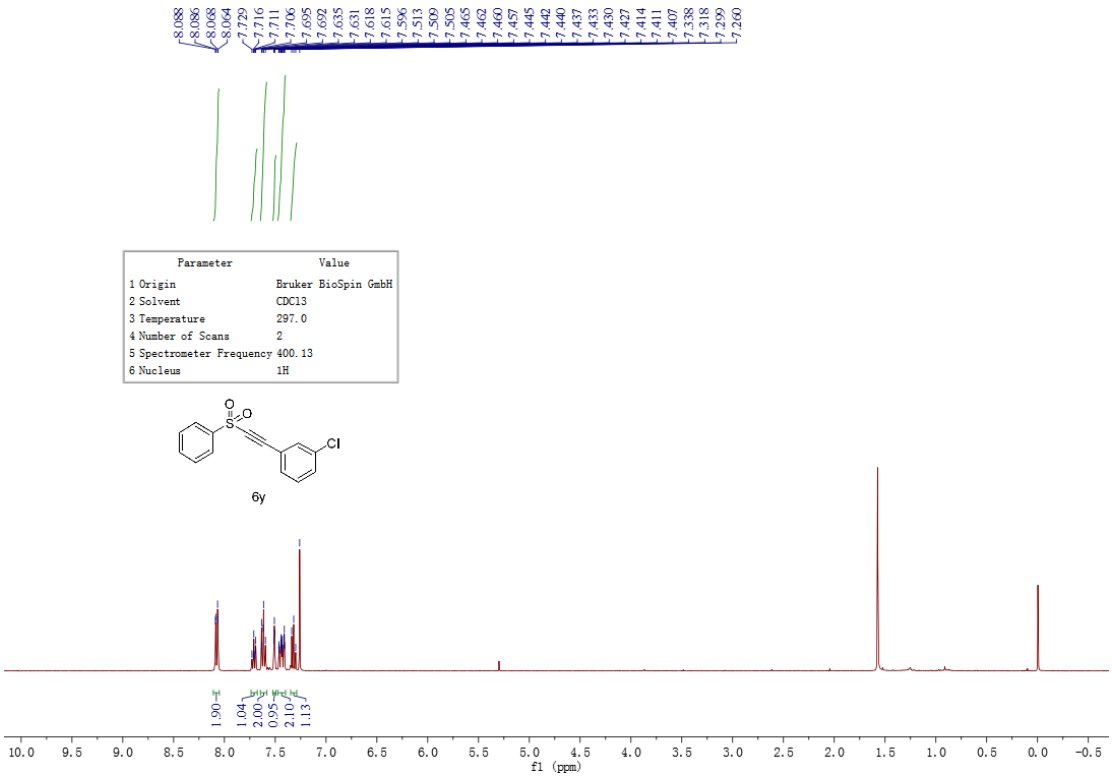


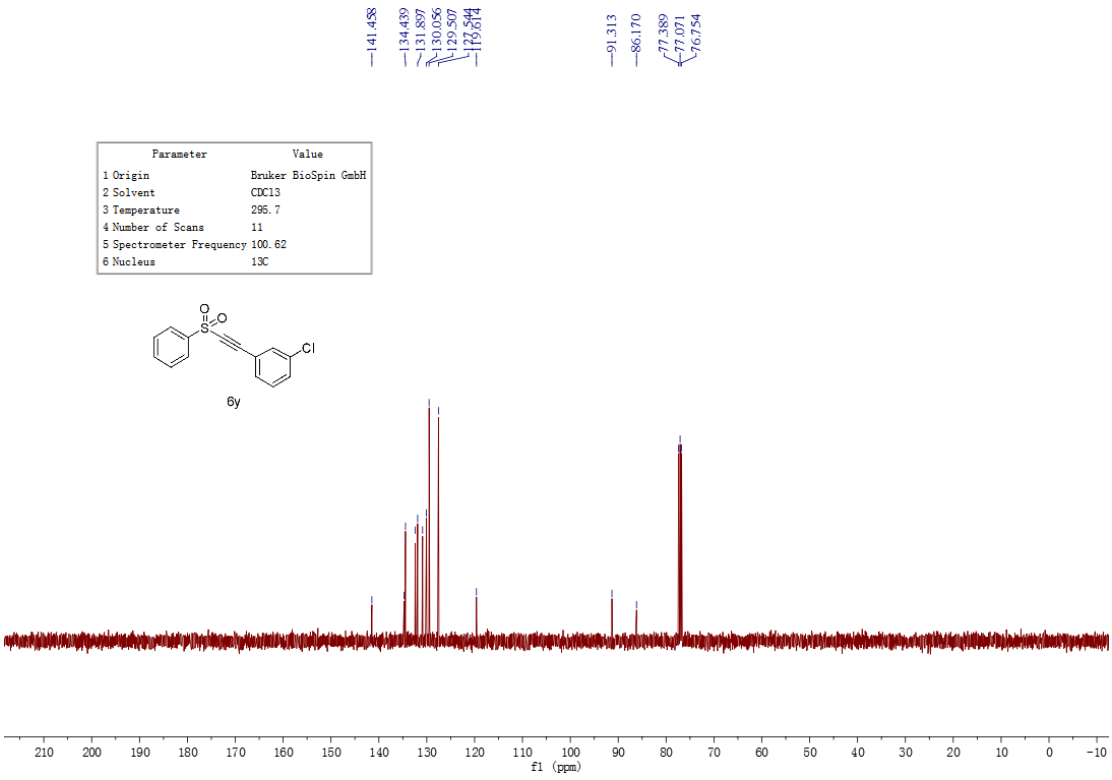
Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	295.9
4 Number of Scans	35
5 Spectrometer Frequency	100.62
6 Nucleus	13C



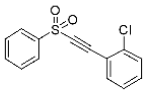
6x



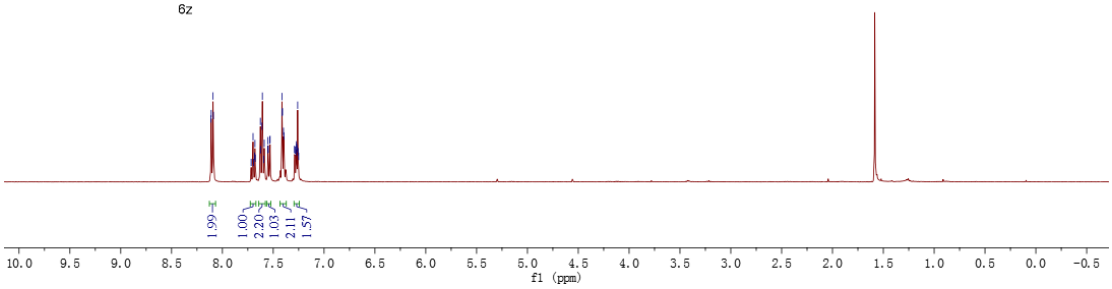

8.088
8.086
8.068
8.064
7.729
7.716
7.711
7.706
7.695
7.692
7.635
7.631
7.618
7.615
7.596
7.513
7.509
7.505
7.465
7.462
7.460
7.457
7.445
7.442
7.440
7.437
7.433
7.430
7.427
7.414
7.411
7.407
7.338
7.318
7.299
7.260
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 297.0
4 Number of Scans 2
5 Spectrometer Frequency 400.13
6 Nucleus 1H
O
S
O
Cl
6y
1.90
1.04
2.00
0.95
2.10
1.13
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)


141.458
134.439
131.897
130.056
129.507
123.544
119.614
91.313
86.170
77.389
77.071
76.754
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 295.7
4 Number of Scans 11
5 Spectrometer Frequency 100.62
6 Nucleus 13C
O
S
O
Cl
6y
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

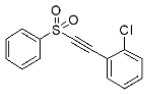
Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	298.2
4 Number of Scans	2
5 Spectrometer Frequency	400.13
6 Nucleus	1H



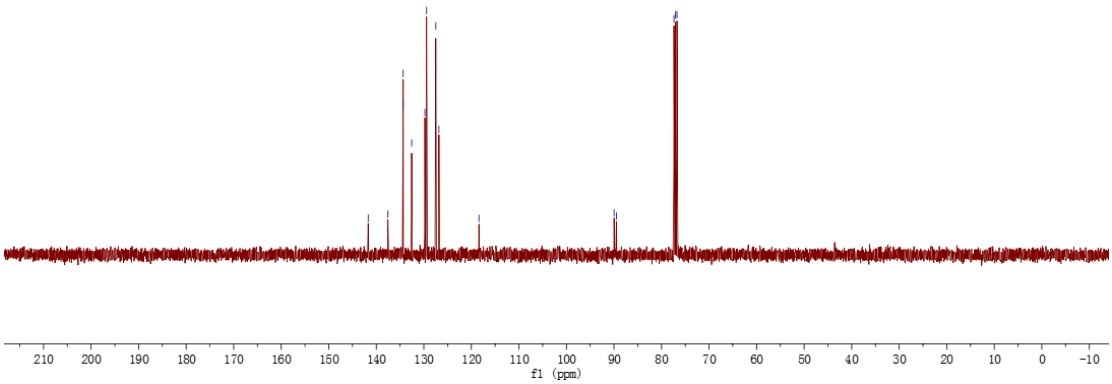
6z

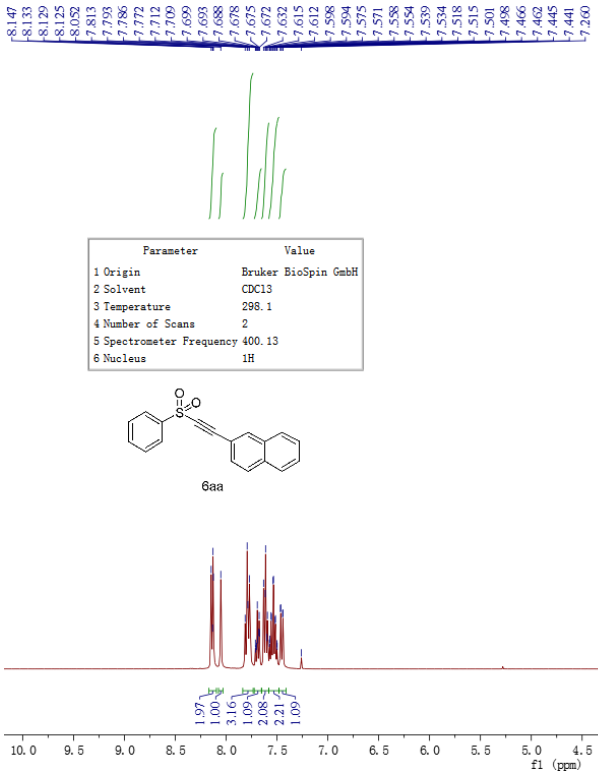


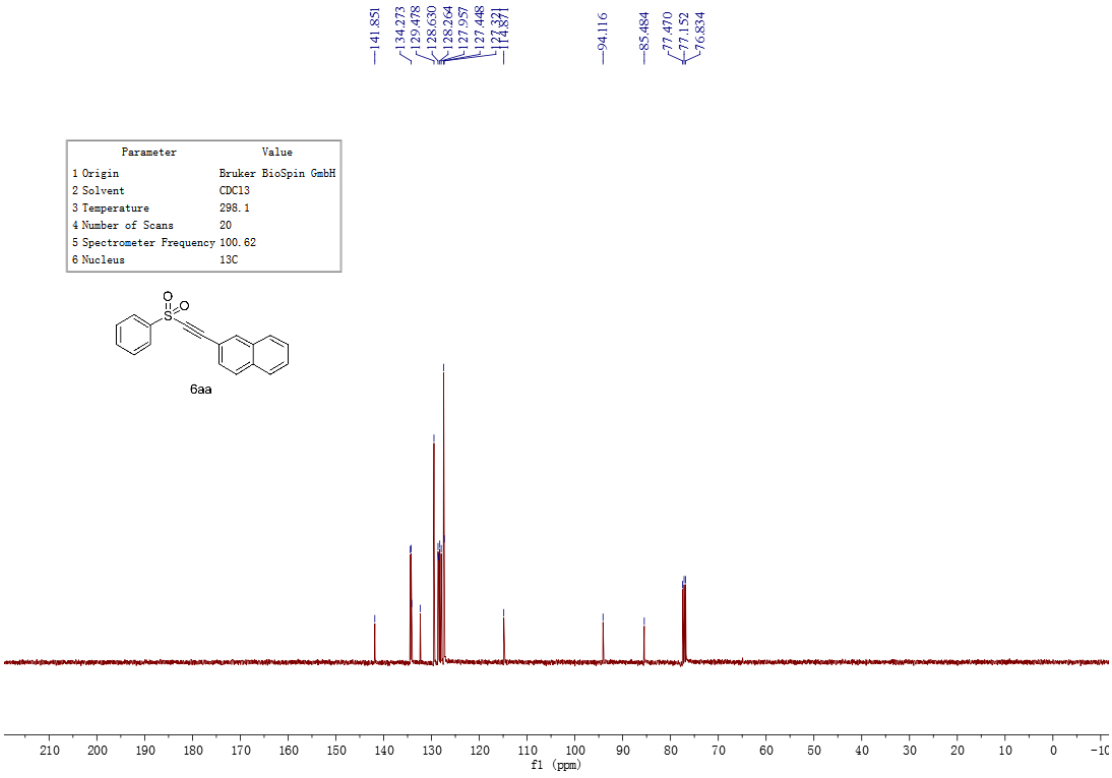
Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	295.7
4 Number of Scans	21
5 Spectrometer Frequency	100.62
6 Nucleus	13C

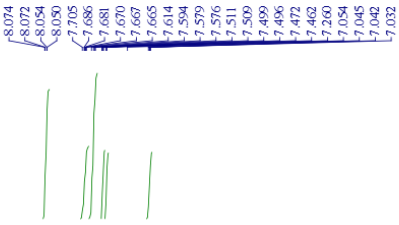


6z

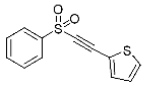



8.147
8.133
8.129
8.125
8.052
7.813
7.793
7.786
7.772
7.712
7.709
7.699
7.693
7.688
7.678
7.675
7.672
7.632
7.615
7.612
7.598
7.594
7.575
7.571
7.558
7.554
7.539
7.534
7.518
7.515
7.501
7.498
7.466
7.462
7.445
7.441
7.260
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.1
4 Number of Scans 2
5 Spectrometer Frequency 400.13
6 Nucleus 1H
6aa
1.97
1.00
3.16
1.09
2.08
2.21
1.09
f1 (ppm)

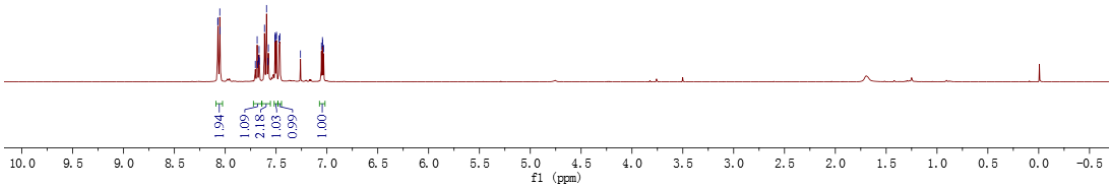

141.851
134.273
129.478
128.630
128.264
127.957
127.448
94.116
85.484
77.470
77.152
76.834
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.1
4 Number of Scans 20
5 Spectrometer Frequency 100.62
6 Nucleus 13C
6aa
f1 (ppm)



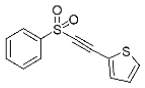
Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	298.1
4 Number of Scans	2
5 Spectrometer Frequency	400.13
6 Nucleus	1H



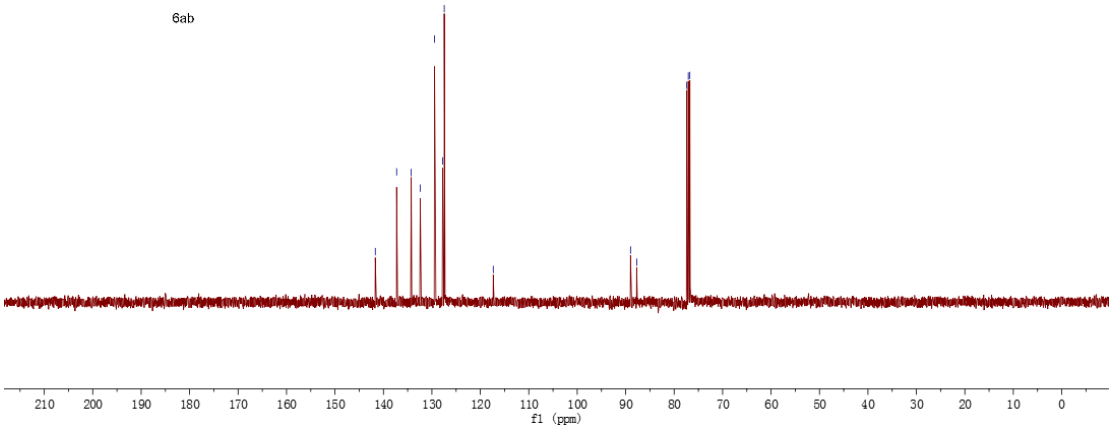
6ab

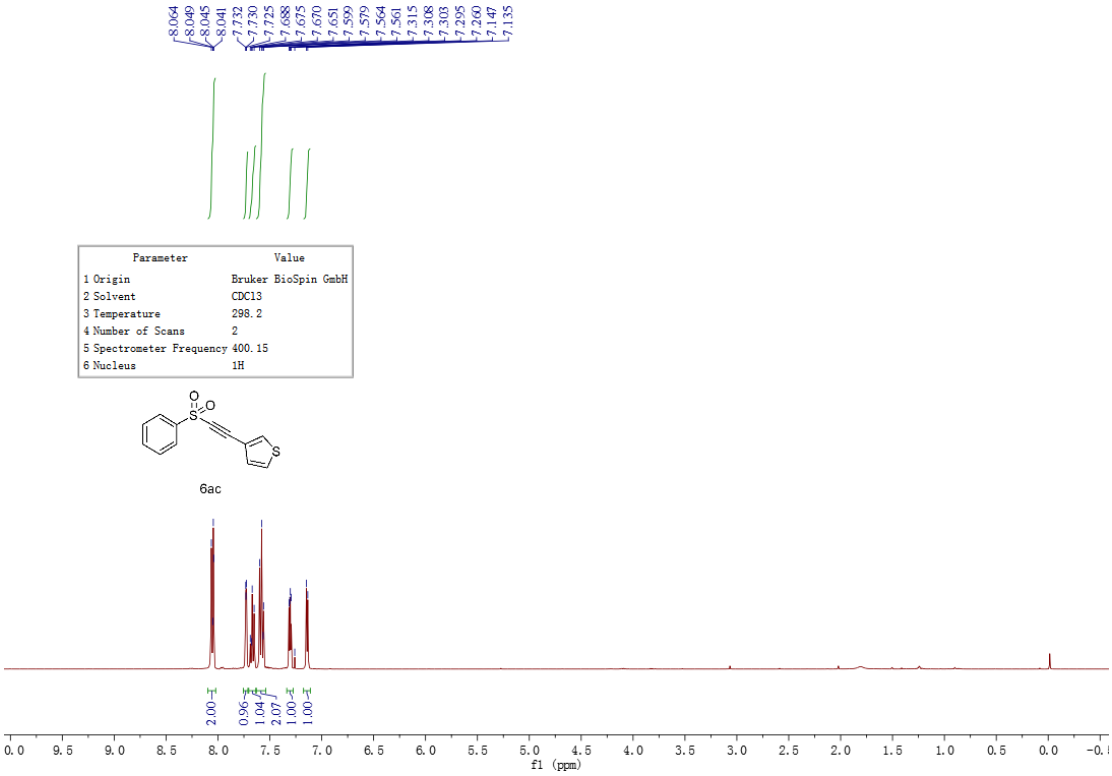


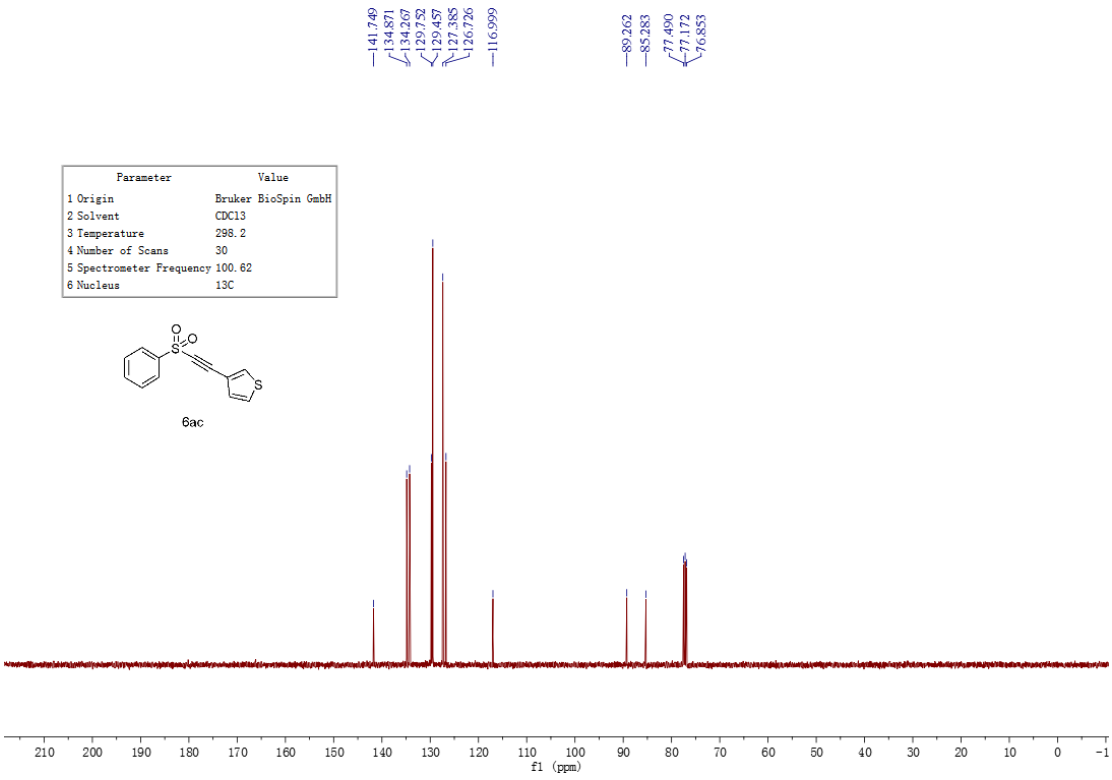
Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	298.2
4 Number of Scans	30
5 Spectrometer Frequency	100.62
6 Nucleus	13C

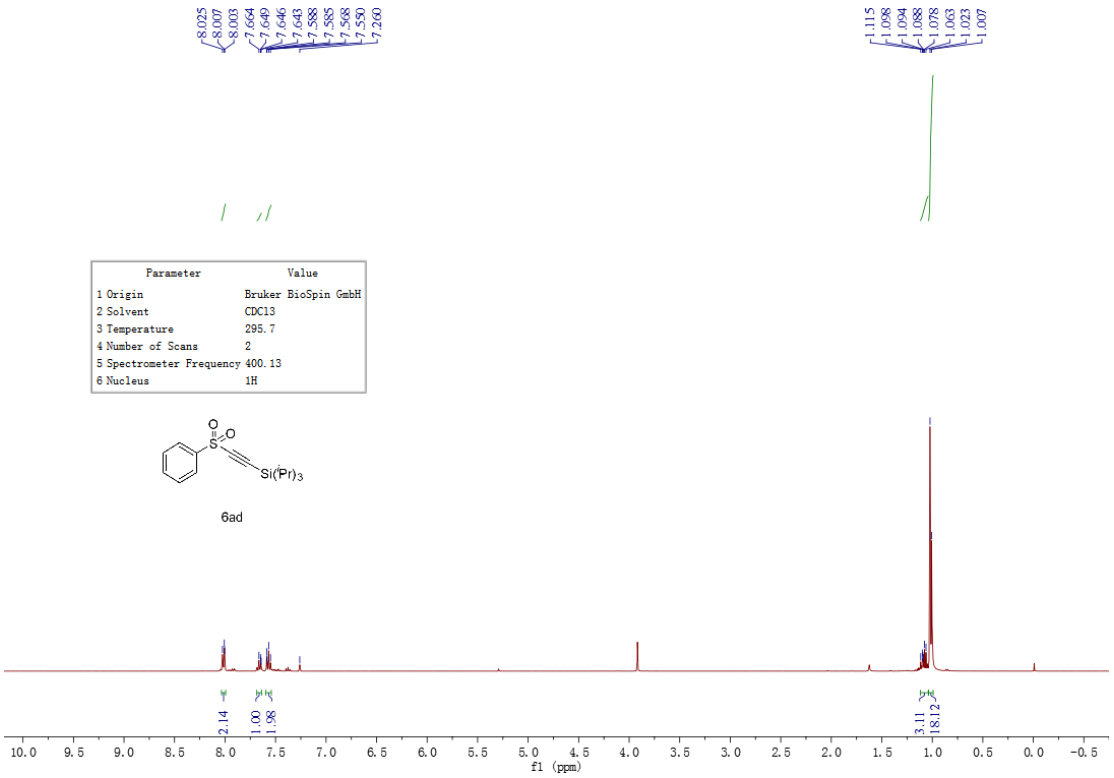


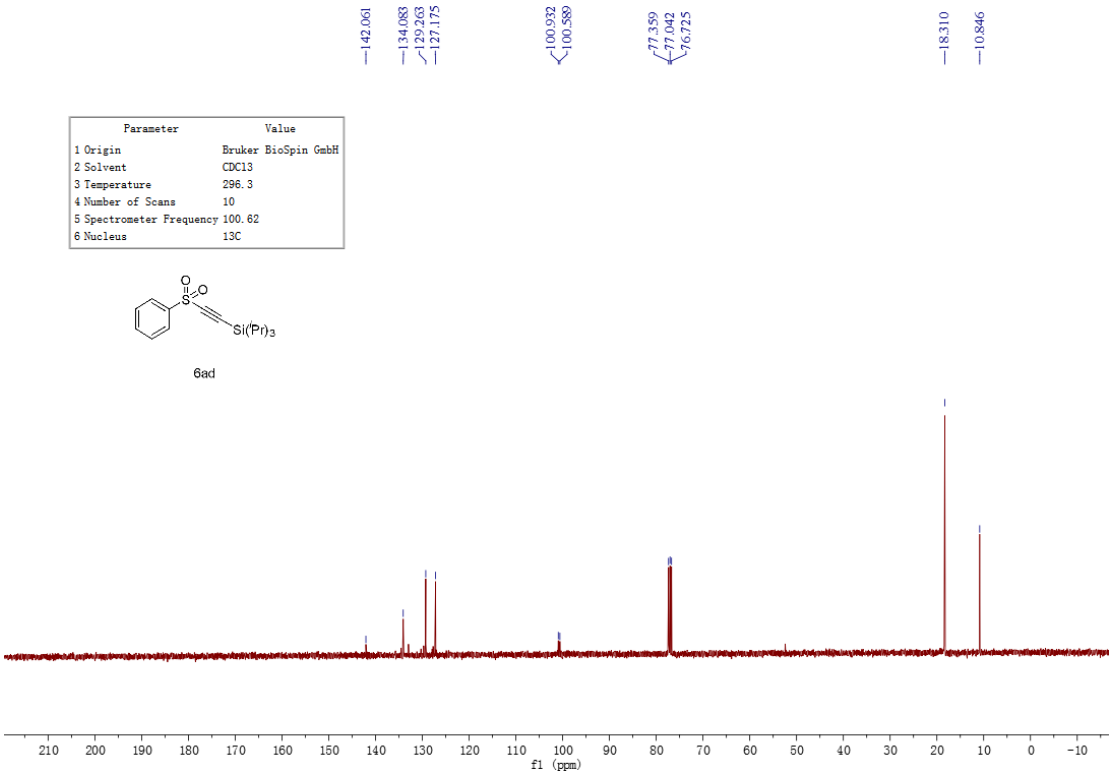
6ab

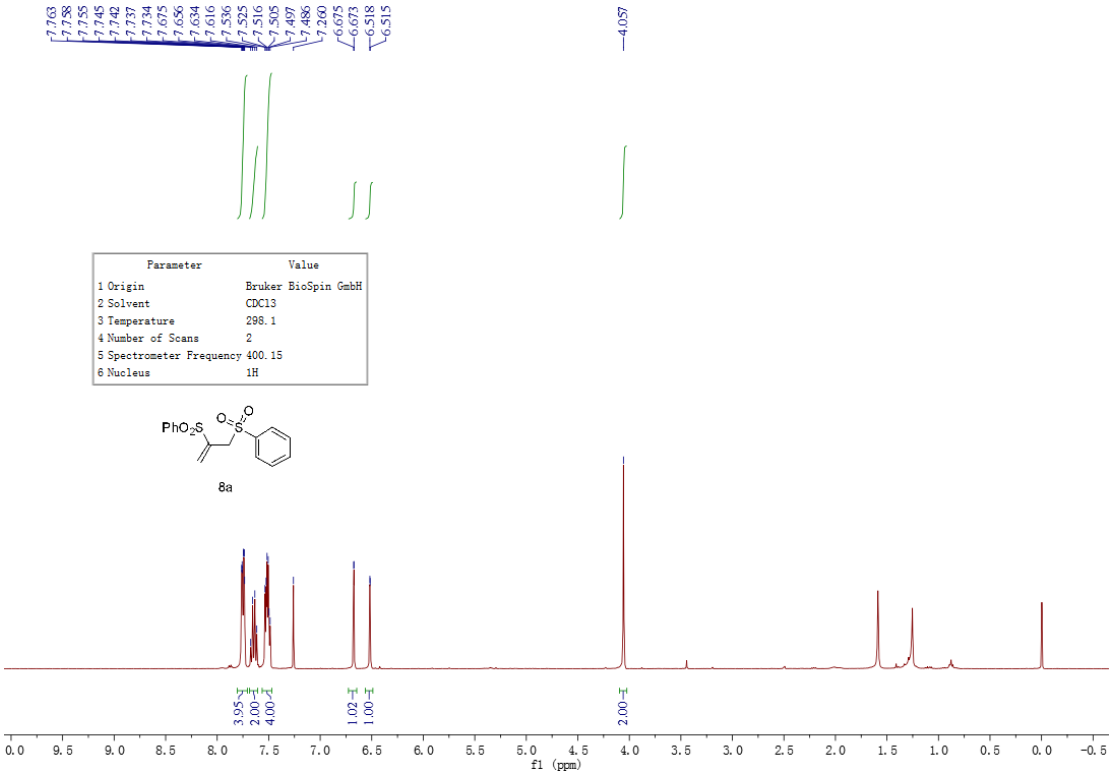


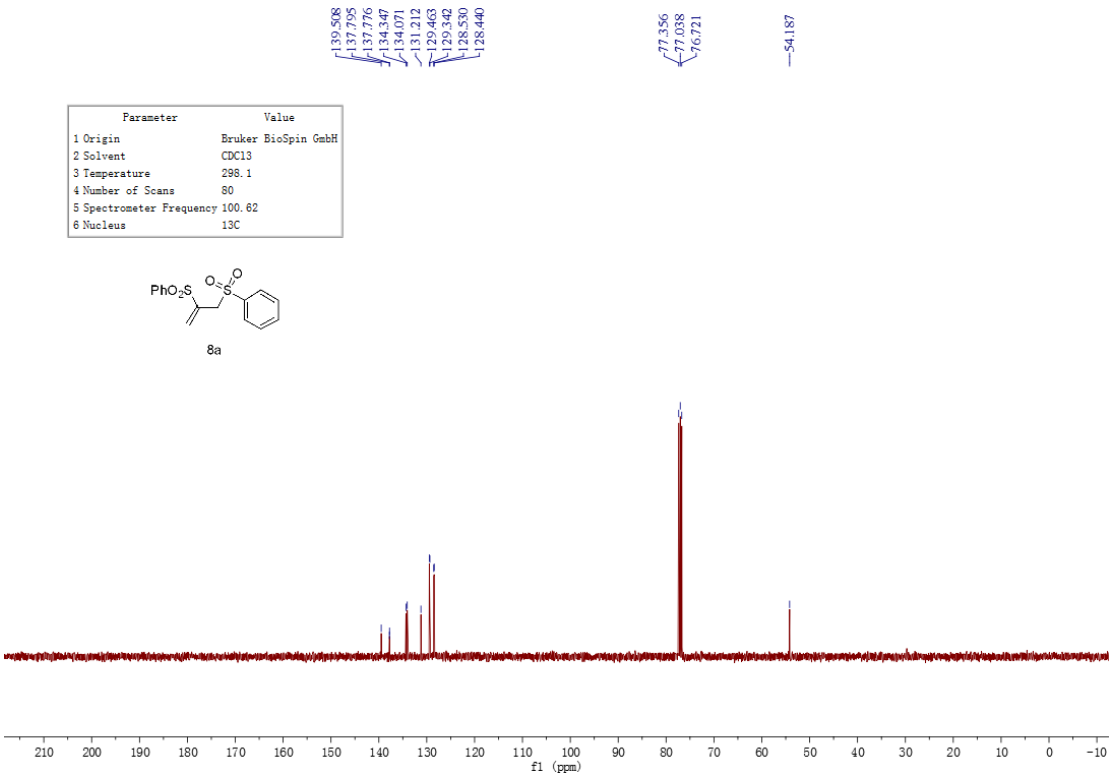

8.064
8.049
8.045
8.041
7.732
7.730
7.725
7.688
7.675
7.670
7.651
7.599
7.579
7.564
7.561
7.315
7.308
7.303
7.295
7.260
7.147
7.135
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.2
4 Number of Scans 2
5 Spectrometer Frequency 400.15
6 Nucleus 1H
6ac
2.00
0.96
1.04
2.07
1.00
1.00
f1 (ppm)

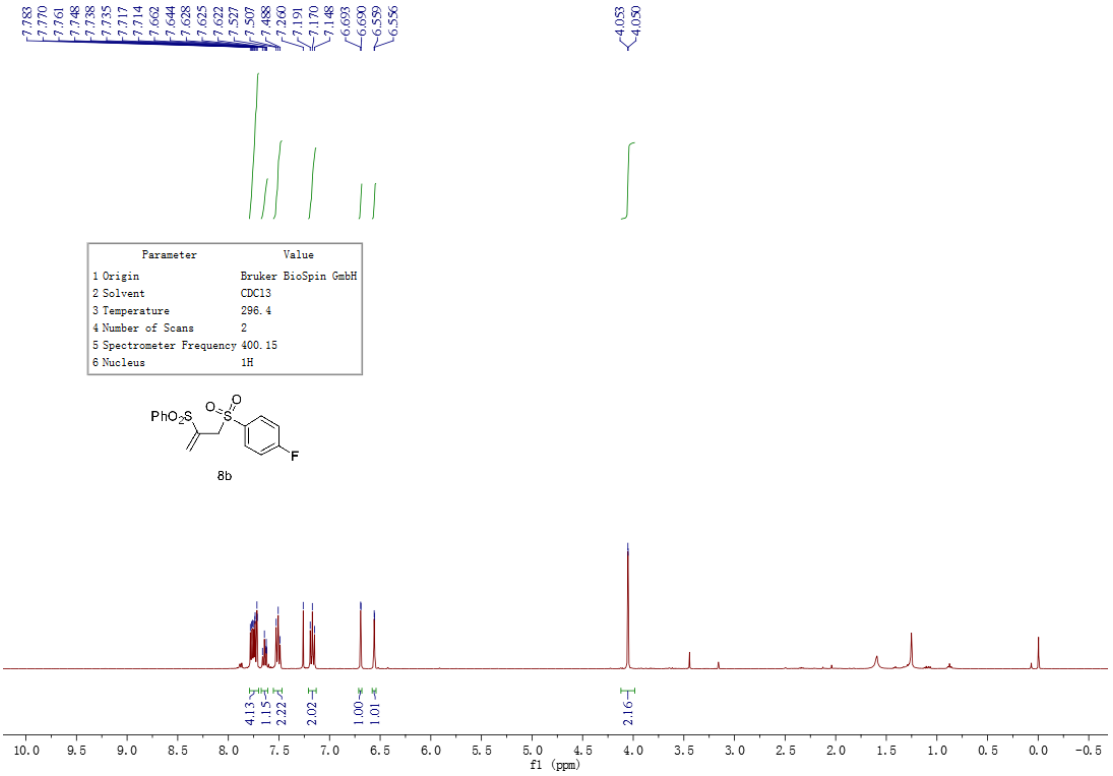

141.749
134.871
134.267
129.752
129.457
127.385
126.726
116.999
89.262
85.283
77.490
77.172
76.853
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.2
4 Number of Scans 30
5 Spectrometer Frequency 100.62
6 Nucleus 13C
6ac
f1 (ppm)

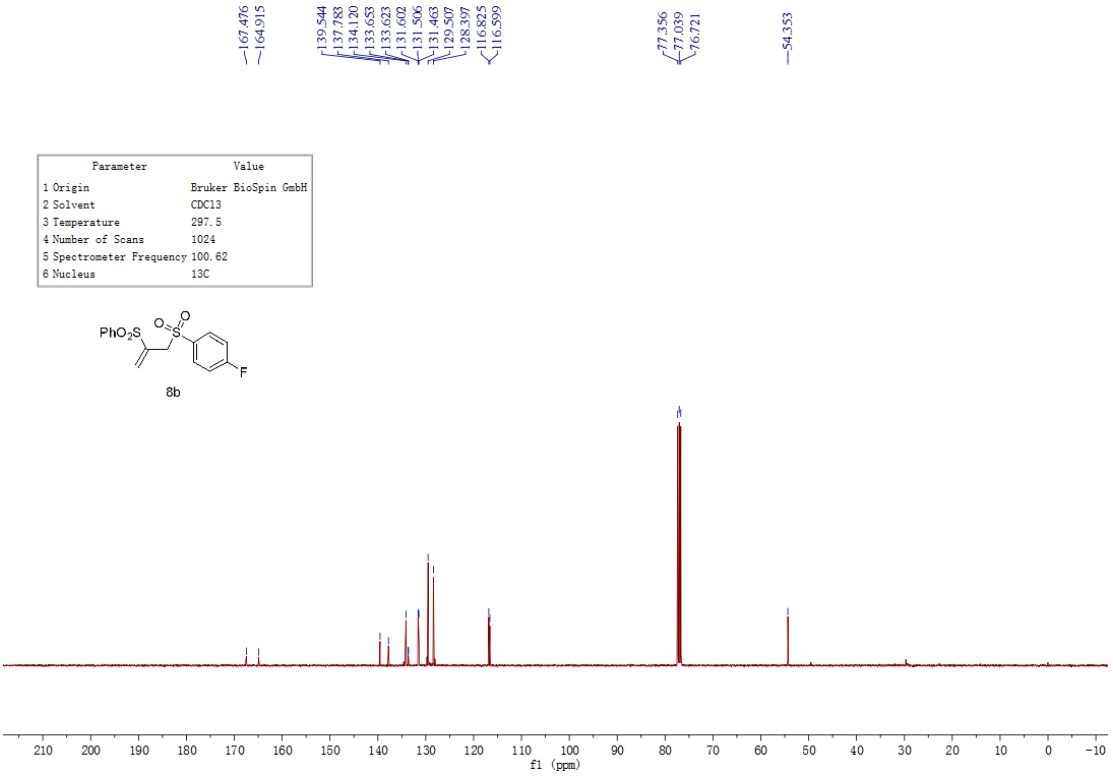

8.025
8.007
8.003
7.664
7.649
7.646
7.643
7.588
7.585
7.568
7.550
7.260
1.115
1.098
1.094
1.088
1.078
1.063
1.023
1.007
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 295.7
4 Number of Scans 2
5 Spectrometer Frequency 400.13
6 Nucleus 1H
Si(iPr)3
6ad
2.14
1.00
1.98
3.11
18.12
f1 (ppm)


142.061
134.083
129.263
127.175
100.932
100.589
77.359
77.042
76.725
18.310
10.846
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 296.3
4 Number of Scans 10
5 Spectrometer Frequency 100.62
6 Nucleus 13C
Si(iPr)3
6ad
f1 (ppm)


7.763
7.758
7.755
7.745
7.742
7.737
7.734
7.675
7.656
7.634
7.616
7.536
7.525
7.516
7.505
7.497
7.486
7.260
6.675
6.673
6.518
6.515
4.057
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.1
4 Number of Scans 2
5 Spectrometer Frequency 400.15
6 Nucleus 1H
PhO2S
8a
3.95
2.00
4.00
1.02
1.00
2.00
f1 (ppm)


139.508
137.795
137.776
134.347
134.071
131.212
129.463
129.342
128.530
128.440
77.356
77.038
76.721
54.187
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.1
4 Number of Scans 80
5 Spectrometer Frequency 100.62
6 Nucleus 13C
PhO2S
8a
f1 (ppm)


7.783
7.770
7.761
7.748
7.738
7.735
7.717
7.714
7.662
7.644
7.628
7.625
7.622
7.527
7.507
7.488
7.260
7.191
7.170
7.148
6.693
6.690
6.559
6.556
4.053
4.050
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 296.4
4 Number of Scans 2
5 Spectrometer Frequency 400.15
6 Nucleus 1H
PhO2S
O
S
O
F
8b
4.13
1.15
2.22
2.02
1.00
1.01
2.16
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)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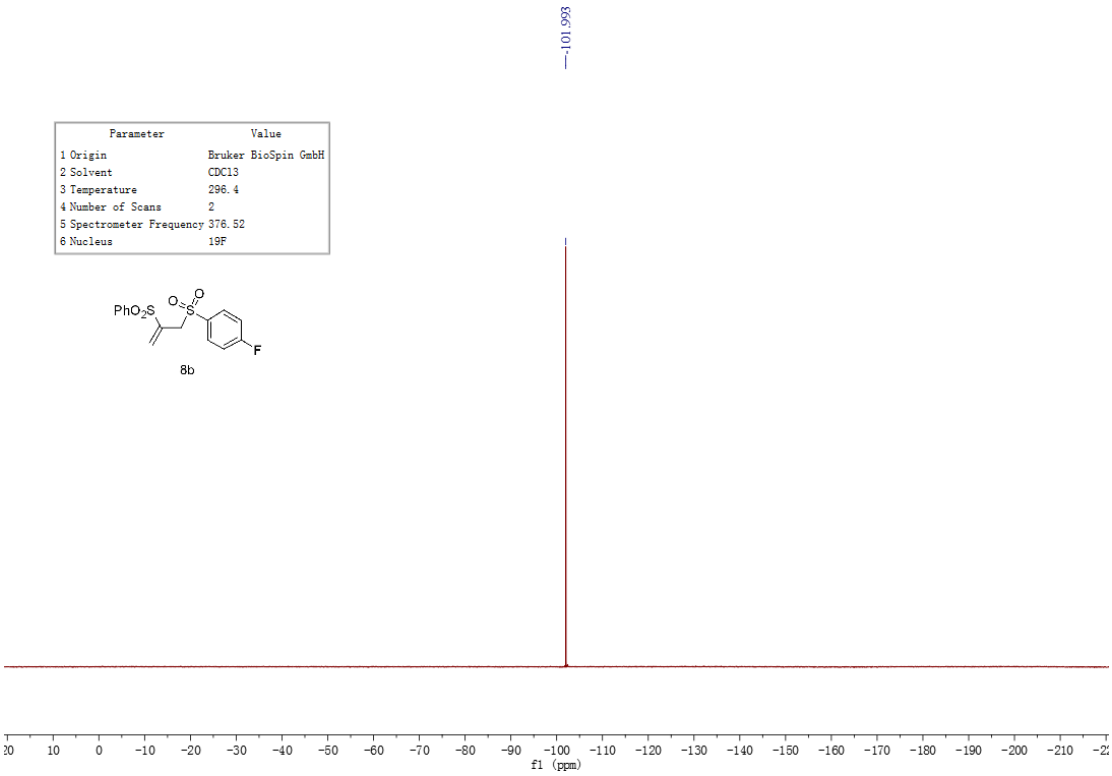
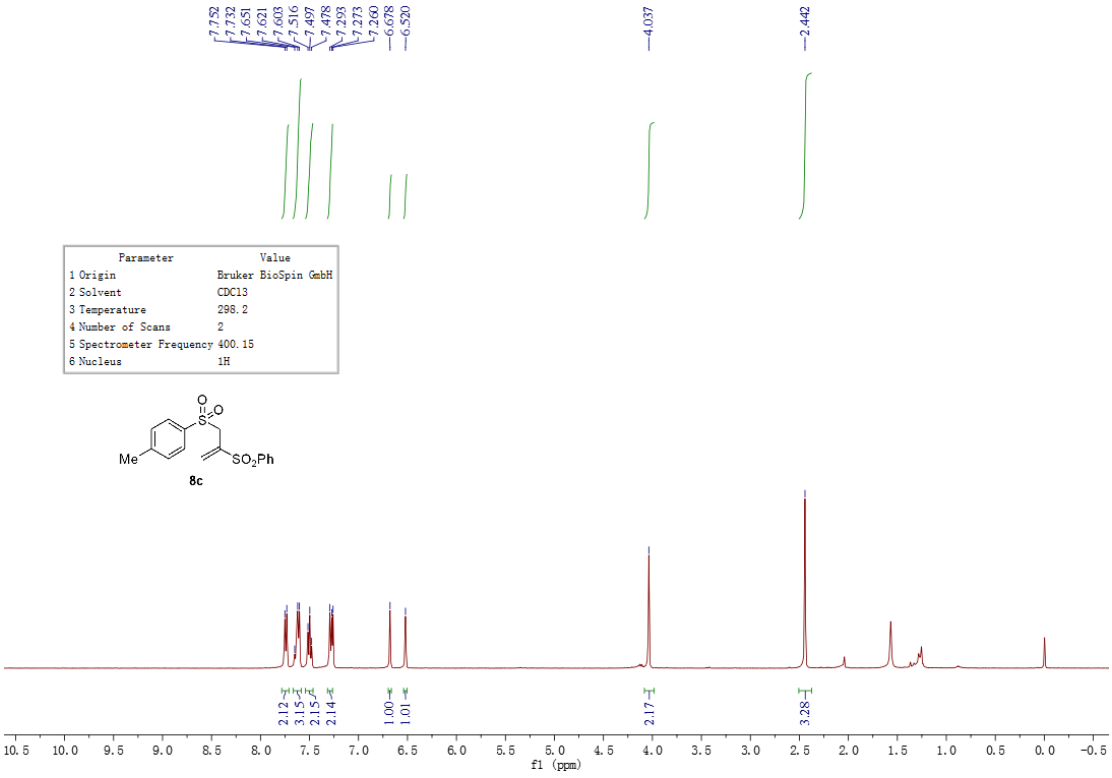
164.915
139.544
137.788
134.120
133.653
133.623
131.602
131.506
131.463
129.507
128.397
116.825
116.599
77.356
77.039
76.721
54.353
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 297.5
4 Number of Scans 1024
5 Spectrometer Frequency 100.62
6 Nucleus 13C
PhO2S
O
S
O
F
8b
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)



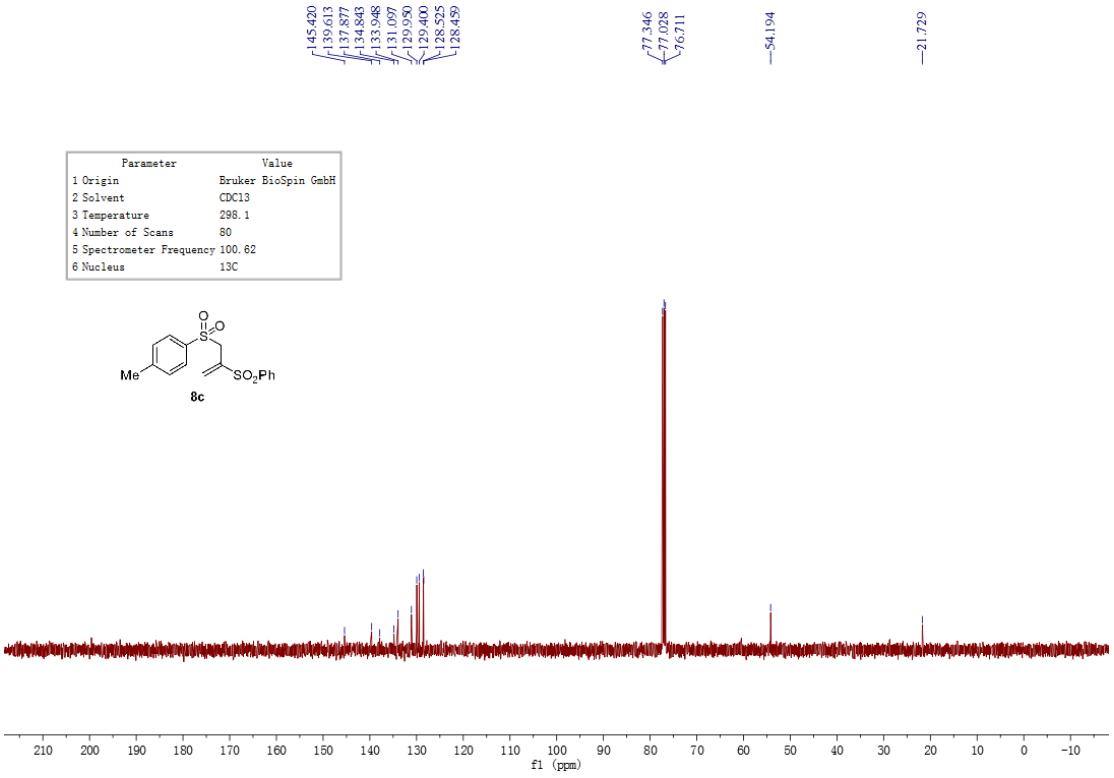
Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	296.4
4 Number of Scans	2
5 Spectrometer Frequency	376.52
6 Nucleus	19F

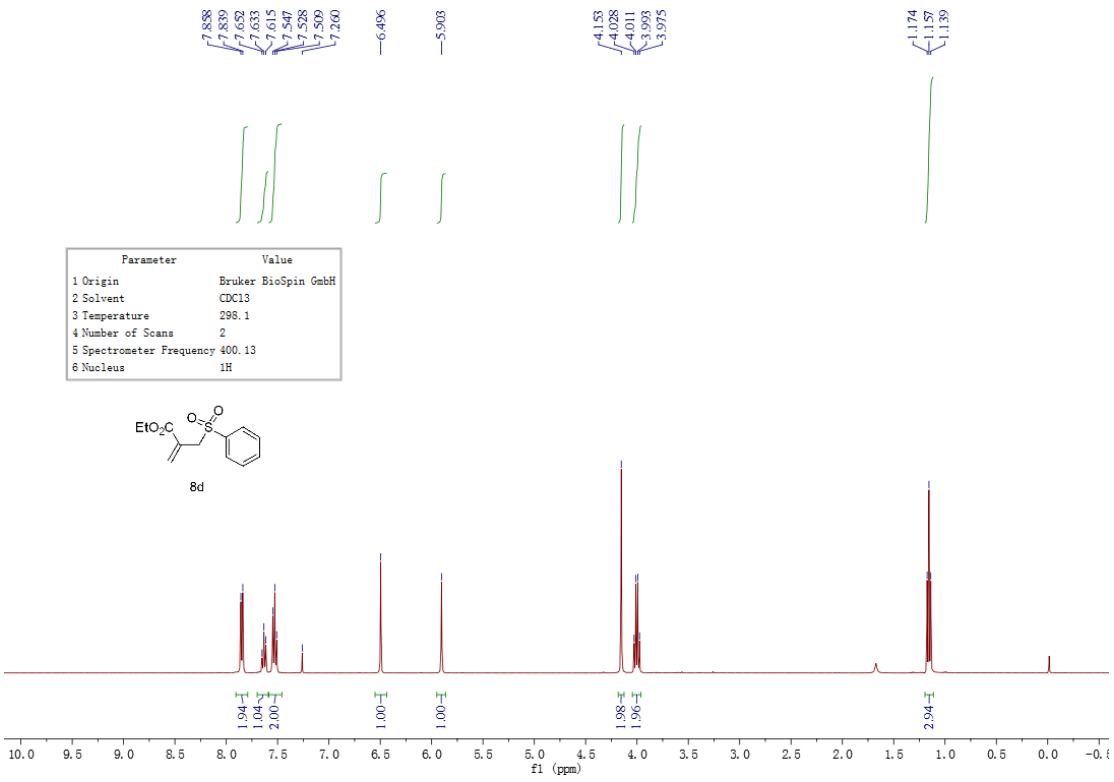
8b

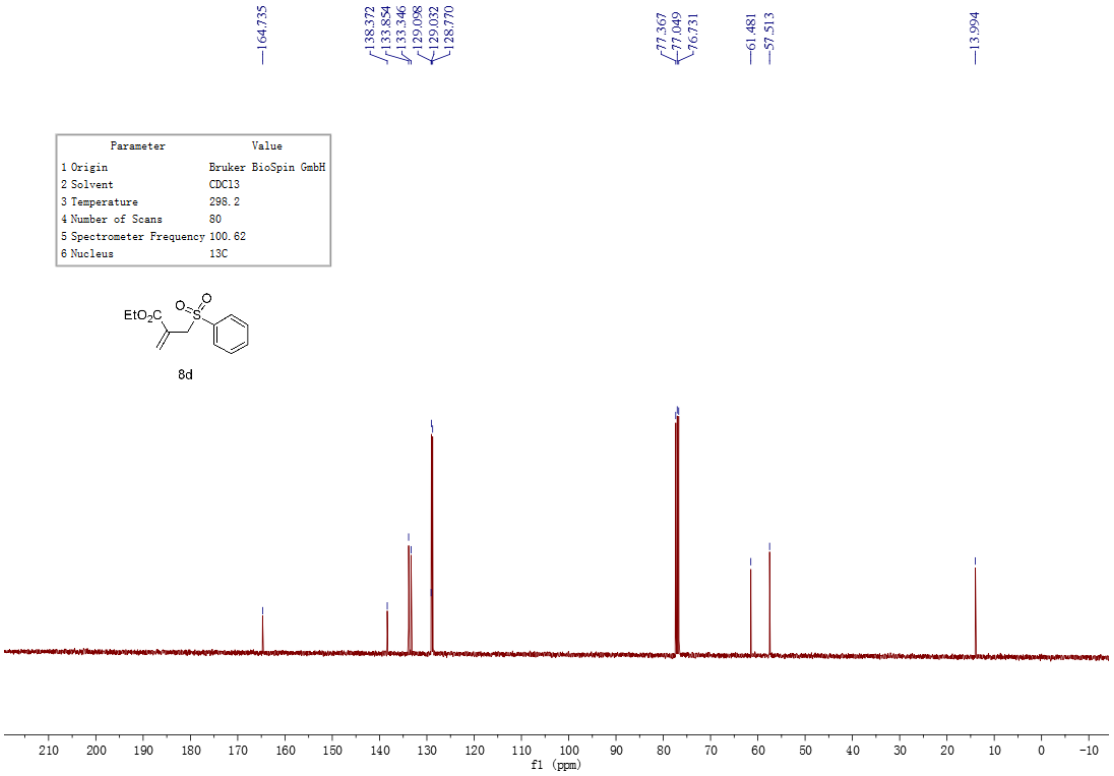


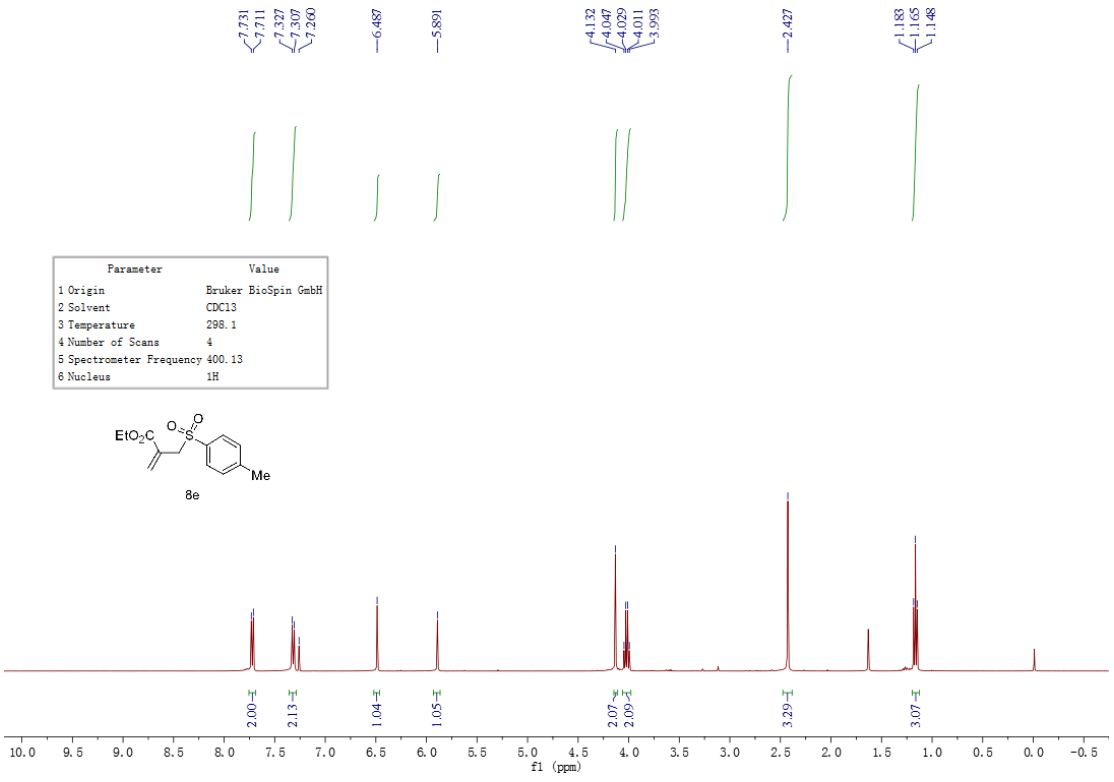
Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	298.2
4 Number of Scans	2
5 Spectrometer Frequency	400.15
6 Nucleus	1H

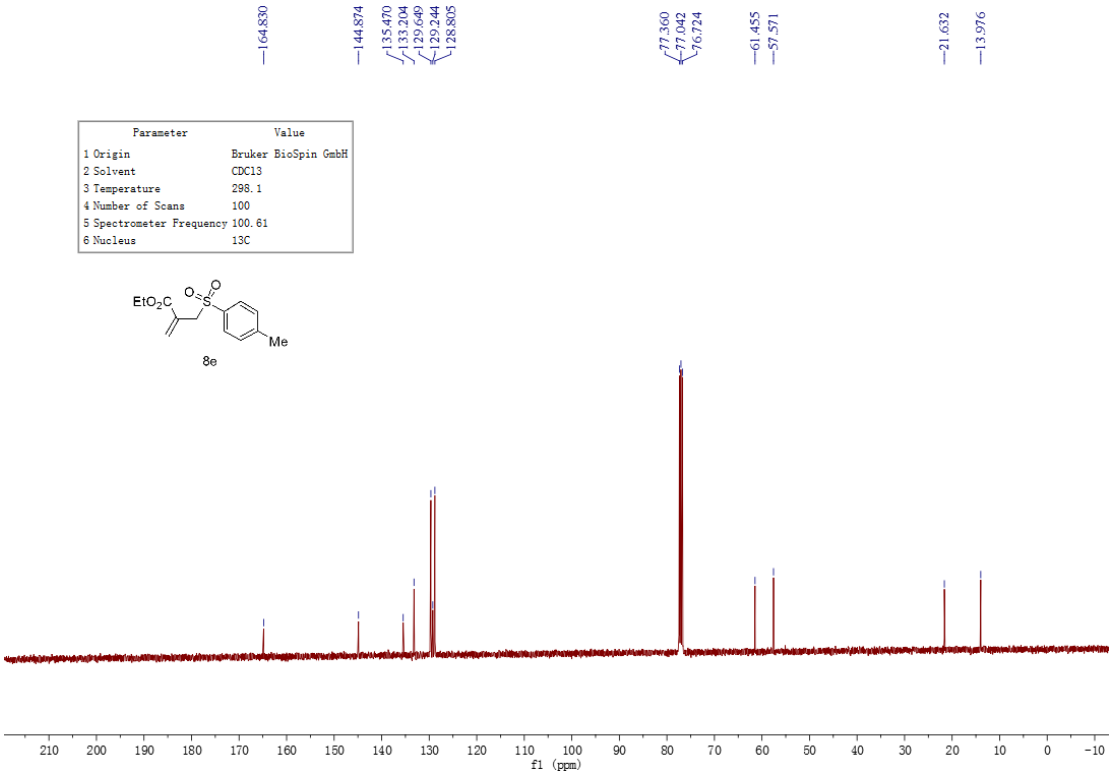
8c

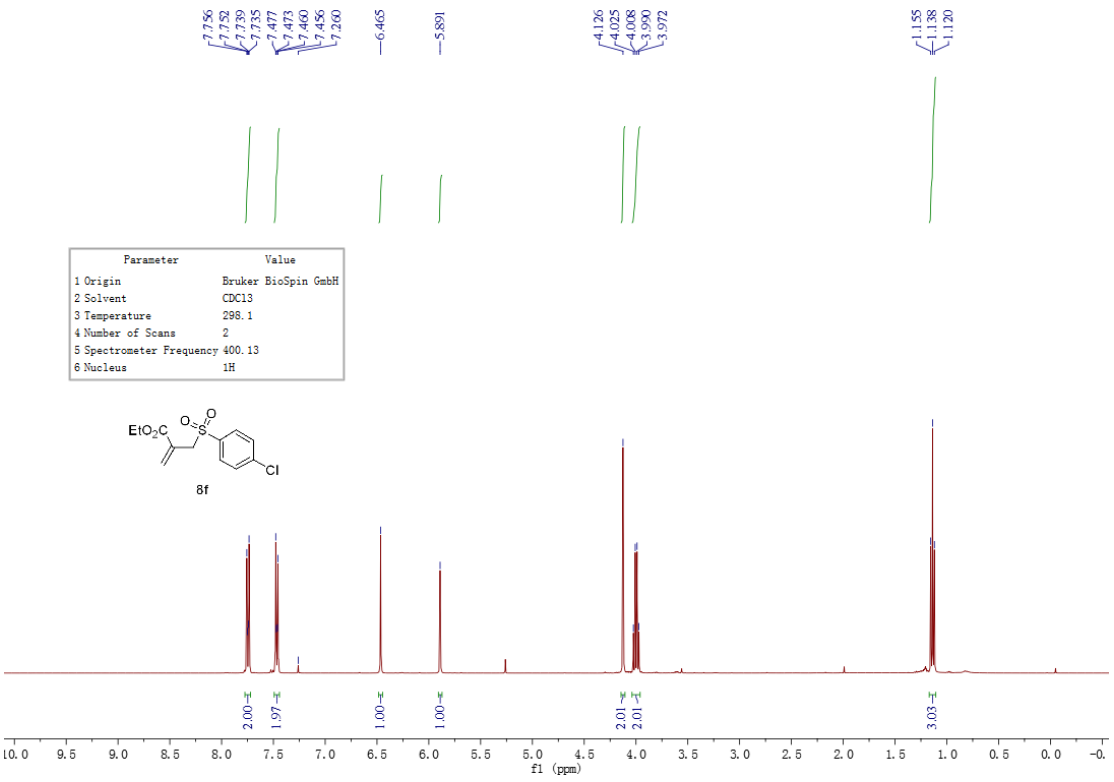

145.420
139.613
137.877
134.843
133.948
131.097
129.950
129.400
128.525
128.459
77.346
77.028
76.711
54.194
21.729
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.1
4 Number of Scans 80
5 Spectrometer Frequency 100.62
6 Nucleus 13C
Me
SO2Ph
8c
f1 (ppm)


7.858
7.839
7.652
7.633
7.615
7.547
7.528
7.509
7.260
6.496
5.903
4.153
4.028
4.011
3.993
3.975
1.174
1.157
1.139
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.1
4 Number of Scans 2
5 Spectrometer Frequency 400.13
6 Nucleus 1H
EtO2C
8d
1.94
1.04
2.00
1.00
1.00
1.98
1.96
2.94
f1 (ppm)


164.735
138.372
133.854
133.346
129.098
129.032
128.770
77.367
77.049
76.731
61.481
57.513
13.994
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.2
4 Number of Scans 80
5 Spectrometer Frequency 100.62
6 Nucleus 13C
EtO2C
O
S
O
8d
f1 (ppm)


7.731
7.711
7.327
7.307
7.260
6.487
5.891
4.132
4.047
4.029
4.011
3.993
2.427
1.183
1.165
1.148
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.1
4 Number of Scans 4
5 Spectrometer Frequency 400.13
6 Nucleus 1H
EtO2C
O
S
O
Me
8e
2.00
2.13
1.04
1.05
2.07
2.09
3.29
3.07
f1 (ppm)


164.830
144.874
135.470
133.204
129.649
129.244
128.805
77.360
77.042
76.724
61.455
57.571
21.632
13.976
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.1
4 Number of Scans 100
5 Spectrometer Frequency 100.61
6 Nucleus 13C
EtO2C
O
S
O
Me
8e
f1 (ppm)


7.756
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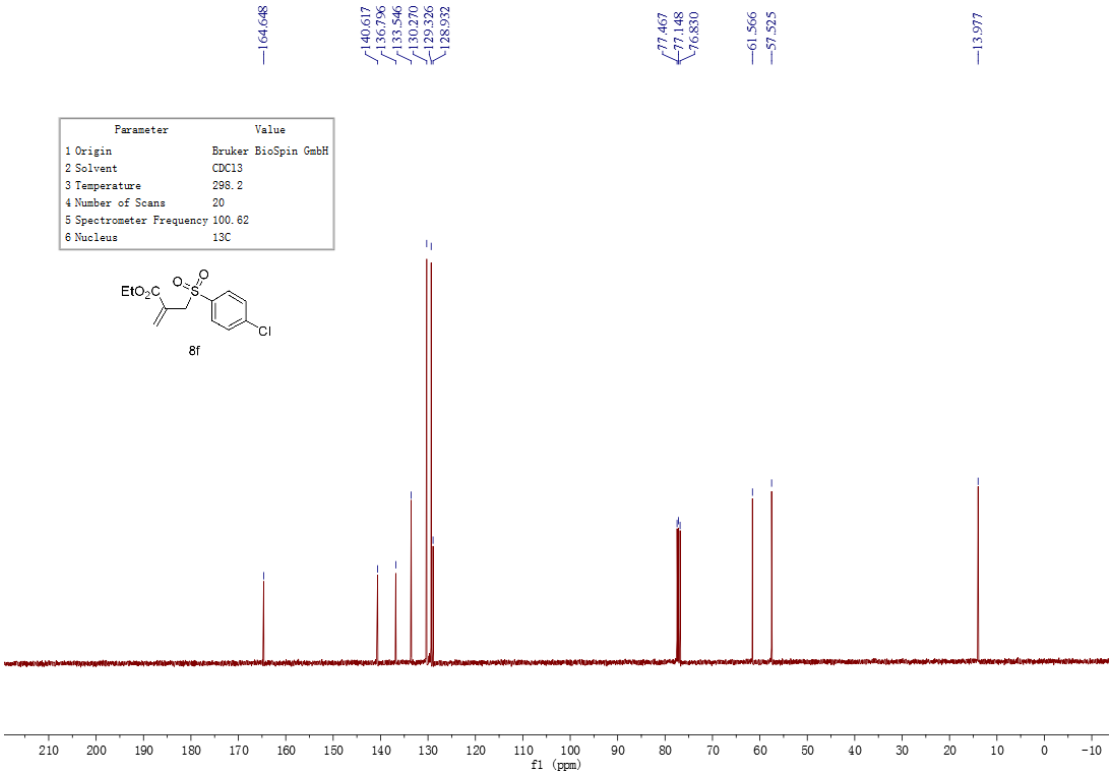
7.735
7.477
7.473
7.460
7.456
7.260
6.465
5.891
4.126
4.025
4.008
3.990
3.972
1.155
1.138
1.120
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.1
4 Number of Scans 2
5 Spectrometer Frequency 400.13
6 Nucleus 1H
EtO2C
O
S
O
Cl
8f
2.00
1.97
1.00
1.00
2.01
2.01
3.03
f1 (ppm)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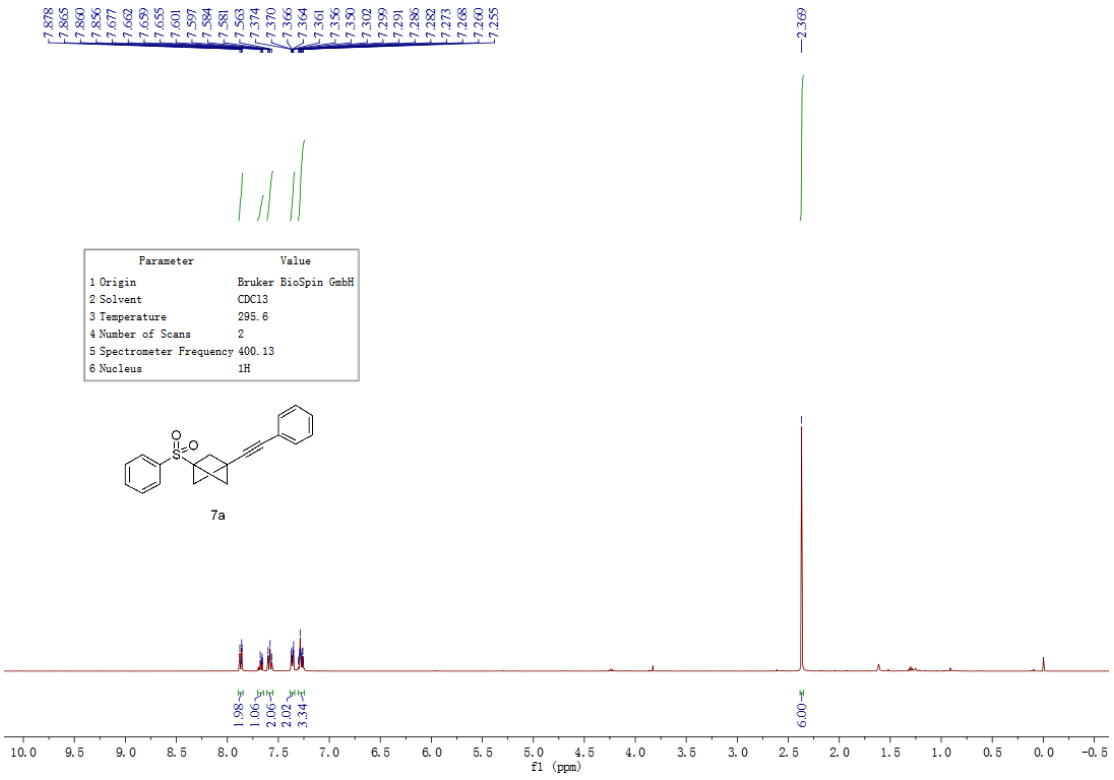
140.617
136.796
133.546
130.270
129.326
128.932
77.467
77.148
76.830
61.566
57.525
13.977
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.2
4 Number of Scans 20
5 Spectrometer Frequency 100.62
6 Nucleus 13C
EtO2C
O
S
O
Cl
8f
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)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7.662
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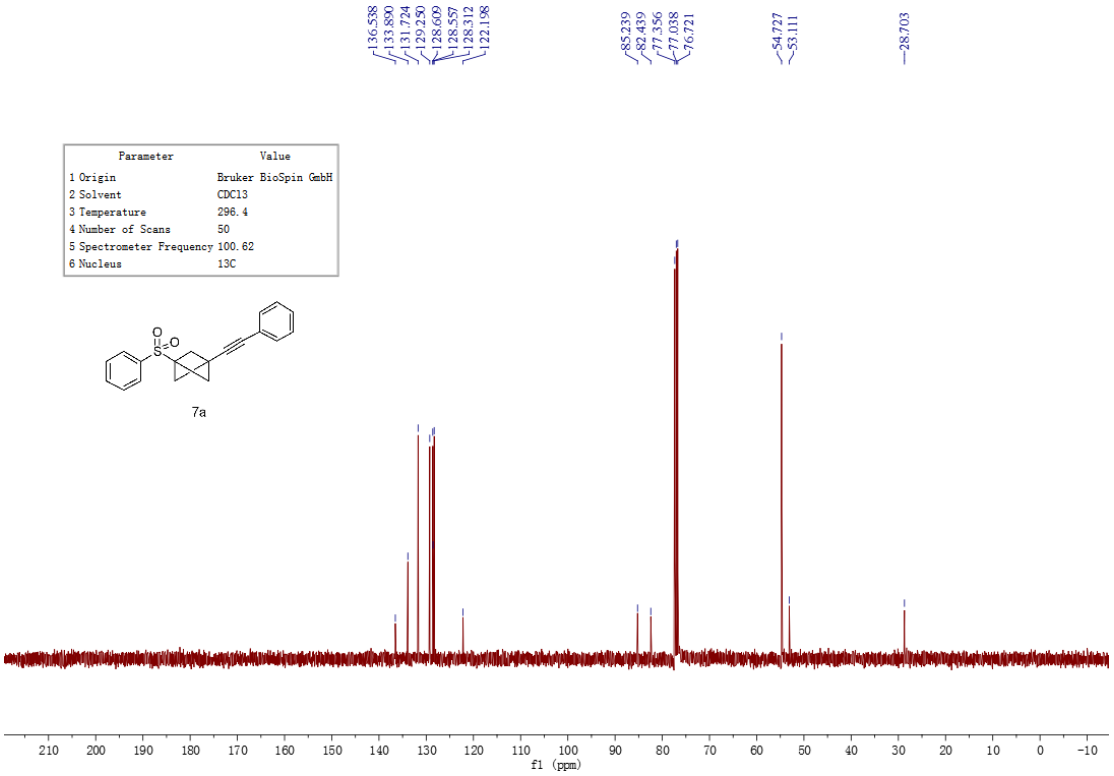
7.655
7.601
7.597
7.584
7.581
7.563
7.374
7.370
7.366
7.364
7.361
7.356
7.350
7.302
7.299
7.291
7.286
7.282
7.273
7.268
7.260
7.255
2.369
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 295.6
4 Number of Scans 2
5 Spectrometer Frequency 400.13
6 Nucleus 1H
O
S
O
7a
1.98
1.06
2.06
2.02
3.34
6.00
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)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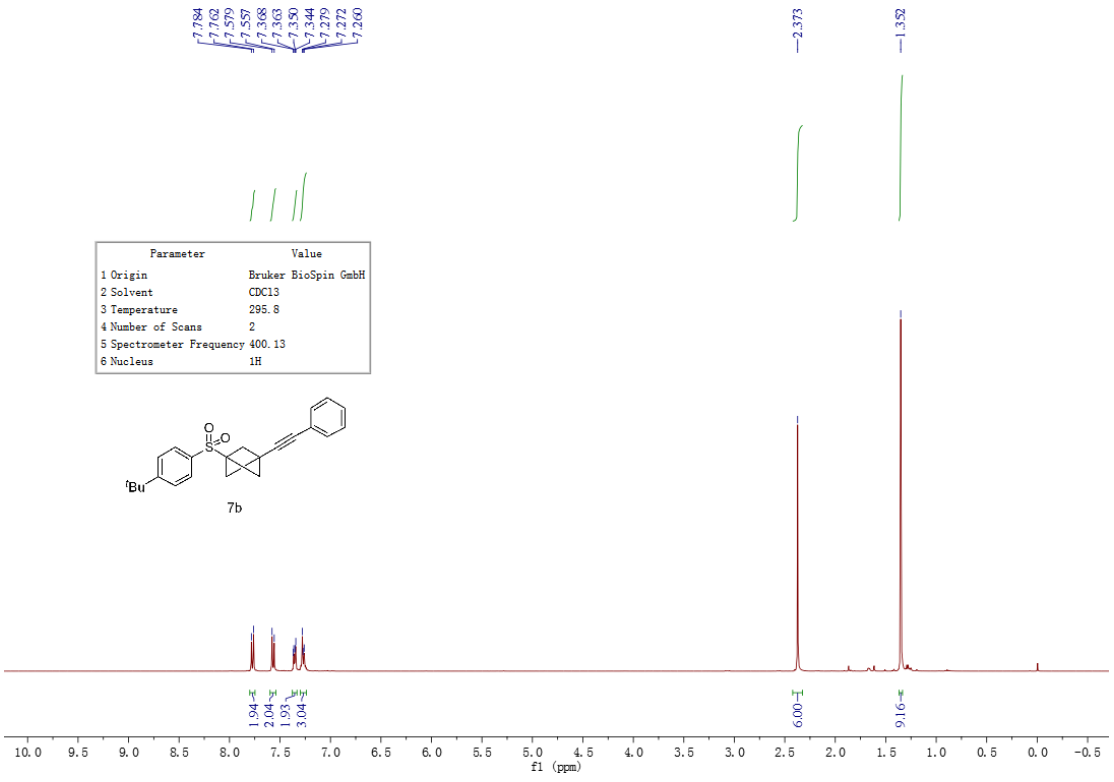
131.724
129.250
128.609
128.557
128.312
122.198
85.239
82.439
77.356
77.038
76.721
54.727
53.111
28.703
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 296.4
4 Number of Scans 50
5 Spectrometer Frequency 100.62
6 Nucleus 13C
O
S
O
7a
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)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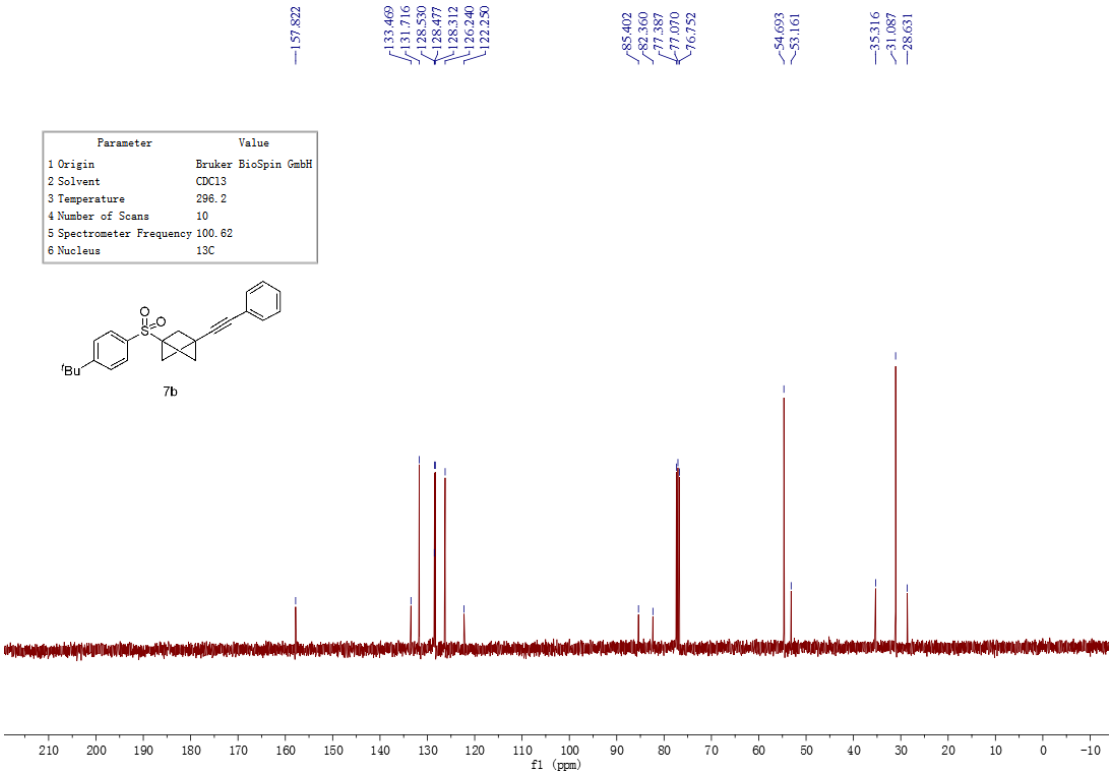
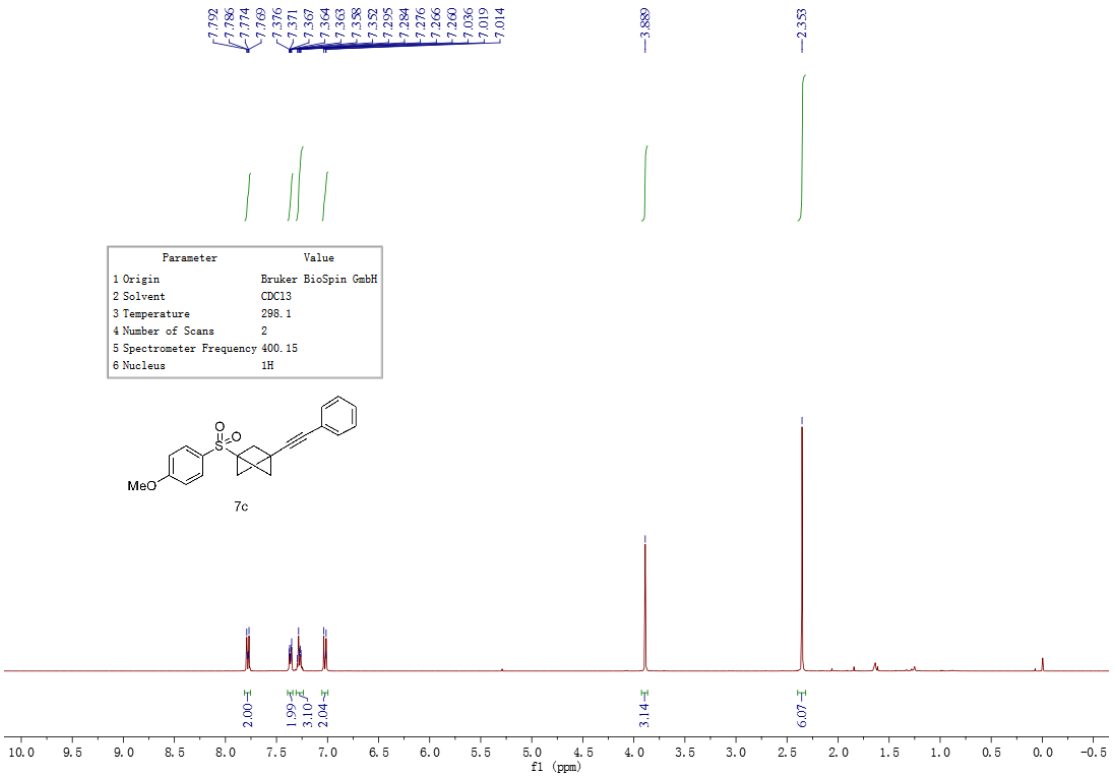
7.579
7.557
7.368
7.363
7.350
7.344
7.279
7.272
7.260
2.373
1.352
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 295.8
4 Number of Scans 2
5 Spectrometer Frequency 400.13
6 Nucleus 1H
O
S
O
tBu
7b
1.94
2.04
1.93
3.04
6.00
9.16
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)


157.822
133.469
131.716
128.530
128.477
128.312
126.240
122.250
85.402
82.360
77.387
77.070
76.752
54.693
53.161
35.316
31.087
28.631
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 296.2
4 Number of Scans 10
5 Spectrometer Frequency 100.62
6 Nucleus 13C
tBu
7b
f1 (ppm)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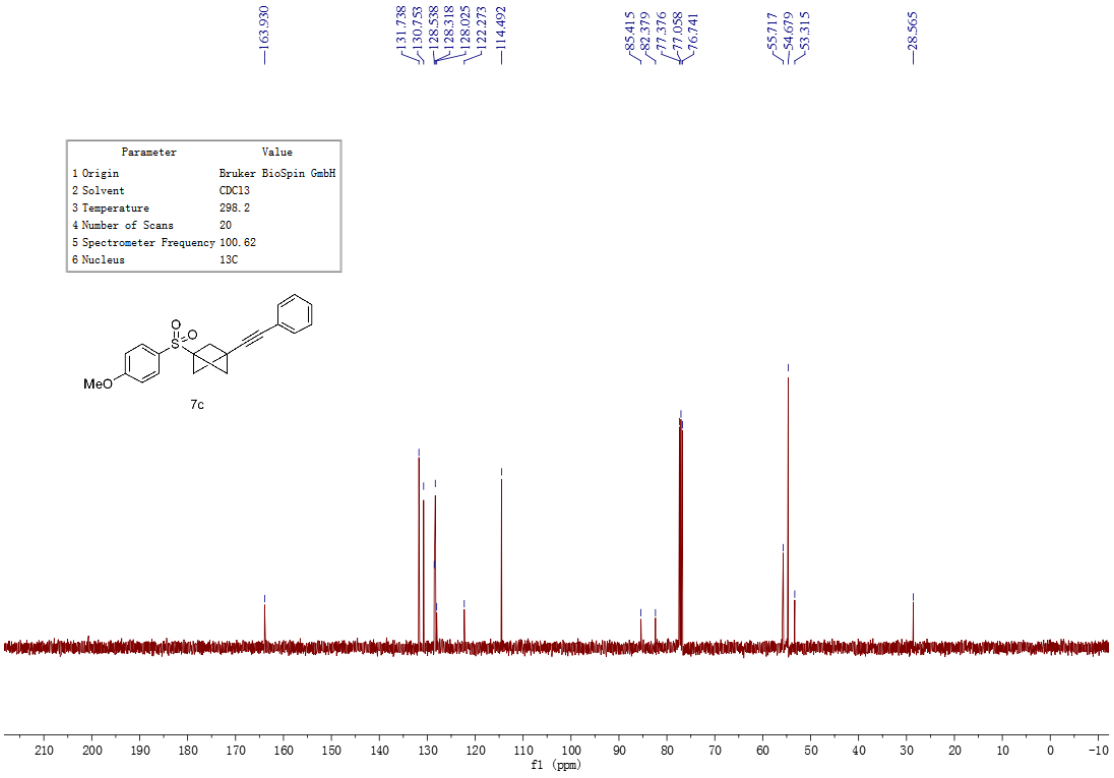
7.358
7.352
7.295
7.284
7.276
7.266
7.260
7.036
7.019
7.014
3.889
2.353
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.1
4 Number of Scans 2
5 Spectrometer Frequency 400.15
6 Nucleus 1H
MeO
7c
2.00
1.99
3.10
2.04
3.14
6.07
f1 (ppm)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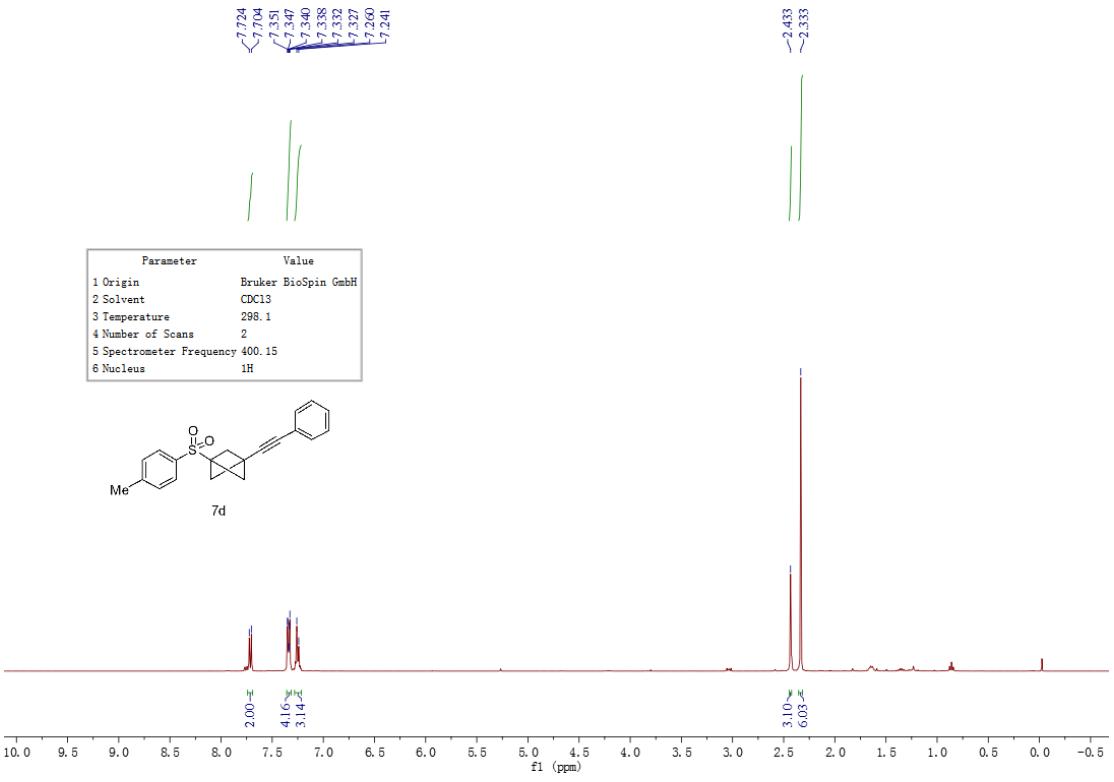
128.025
122.273
114.492
85.415
82.379
77.376
77.058
76.741
55.717
54.679
53.315
28.565
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.2
4 Number of Scans 20
5 Spectrometer Frequency 100.62
6 Nucleus 13C
MeO
7c
f1 (ppm)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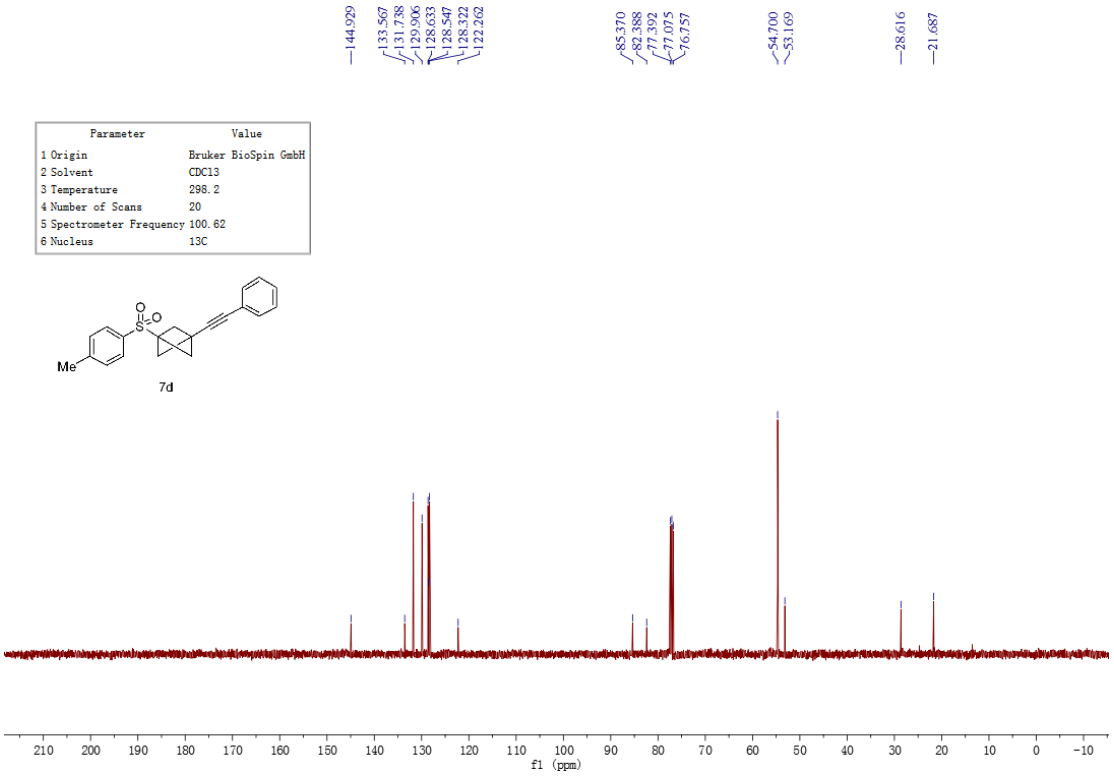
7.351
7.347
7.340
7.338
7.332
7.327
7.260
7.241
2.433
2.333
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.1
4 Number of Scans 2
5 Spectrometer Frequency 400.15
6 Nucleus 1H
Me
7d
2.00
4.16
3.14
3.10
6.03
f1 (ppm)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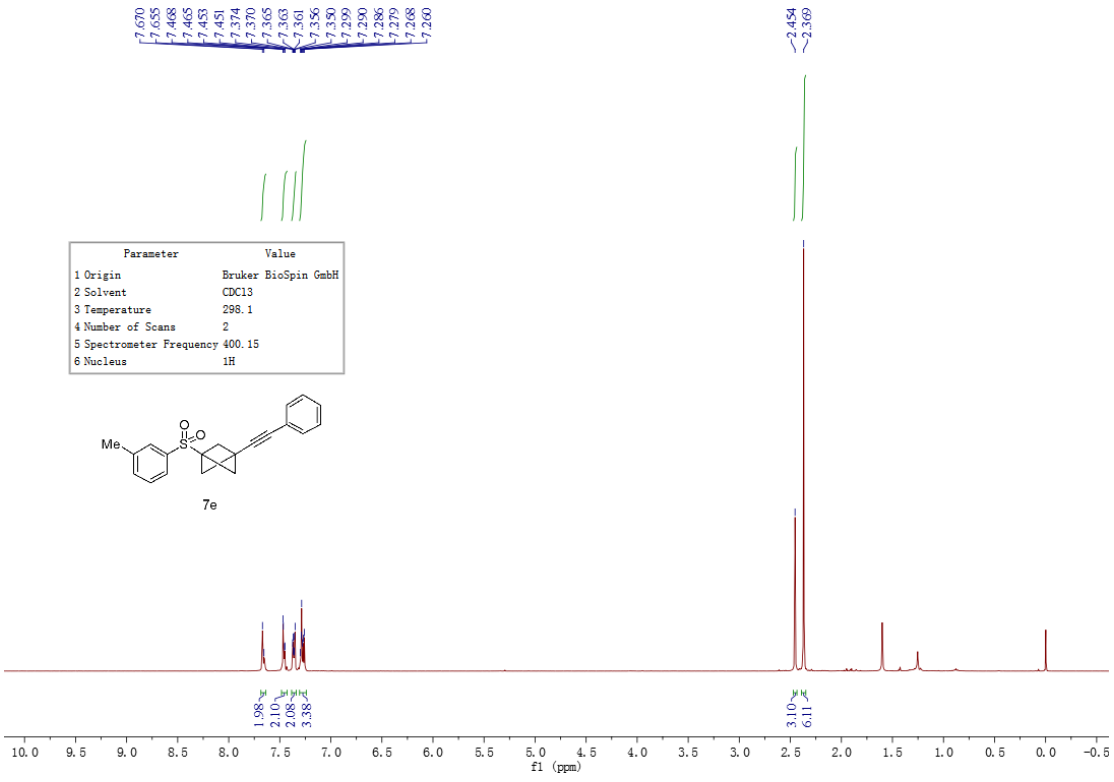
128.633
128.547
128.322
122.262
85.370
82.388
77.392
77.075
76.757
54.700
53.169
28.616
21.687
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.2
4 Number of Scans 20
5 Spectrometer Frequency 100.62
6 Nucleus 13C
Me
7d
f1 (ppm)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7.451
7.374
7.370
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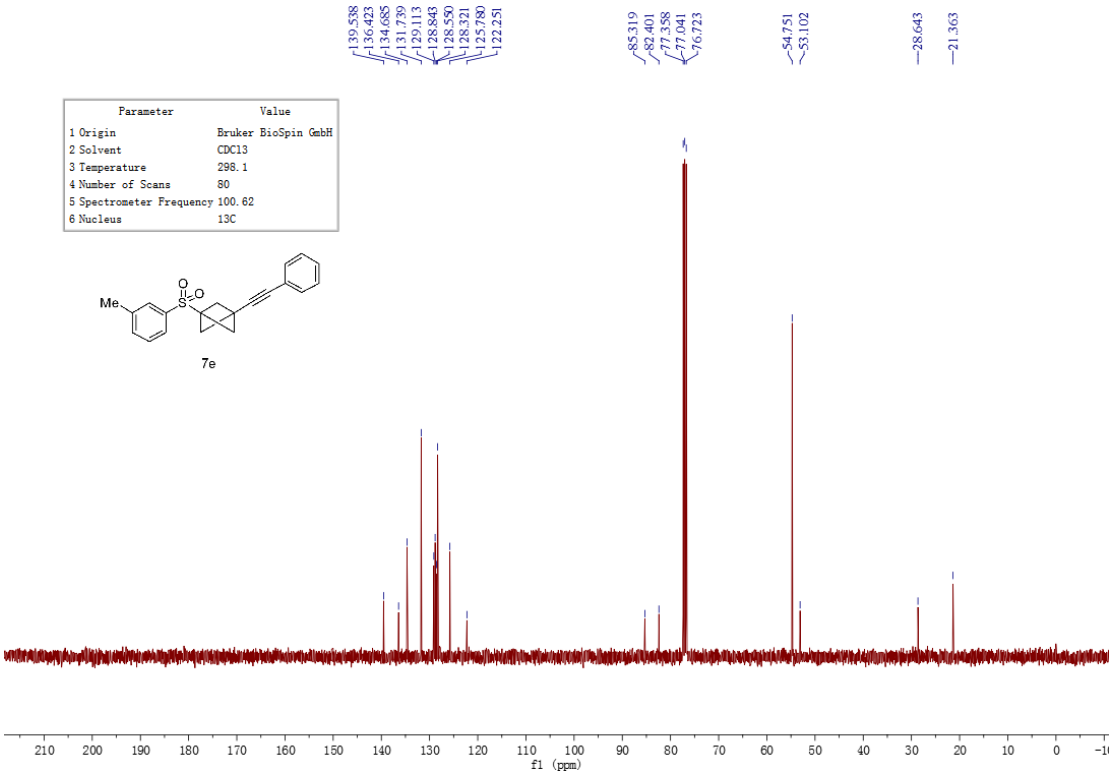
7.363
7.361
7.356
7.350
7.299
7.290
7.286
7.279
7.268
7.260
2.454
2.369
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.1
4 Number of Scans 2
5 Spectrometer Frequency 400.15
6 Nucleus 1H
Me
7e
1.98
2.10
2.08
3.38
3.10
6.11
f1 (ppm)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128.843
128.590
128.321
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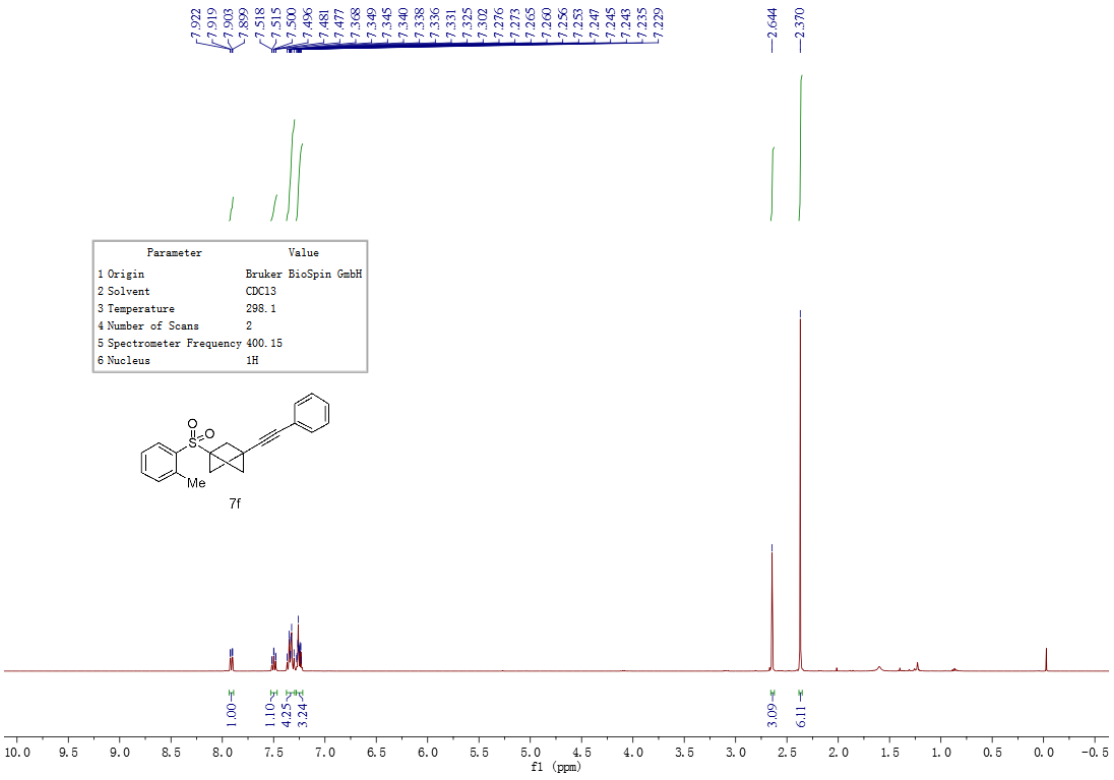
122.251
85.319
82.401
77.358
77.041
76.723
54.751
53.102
28.643
21.363
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.1
4 Number of Scans 80
5 Spectrometer Frequency 100.62
6 Nucleus 13C
Me
7e
f1 (ppm)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7.515
7.500
7.496
7.481
7.477
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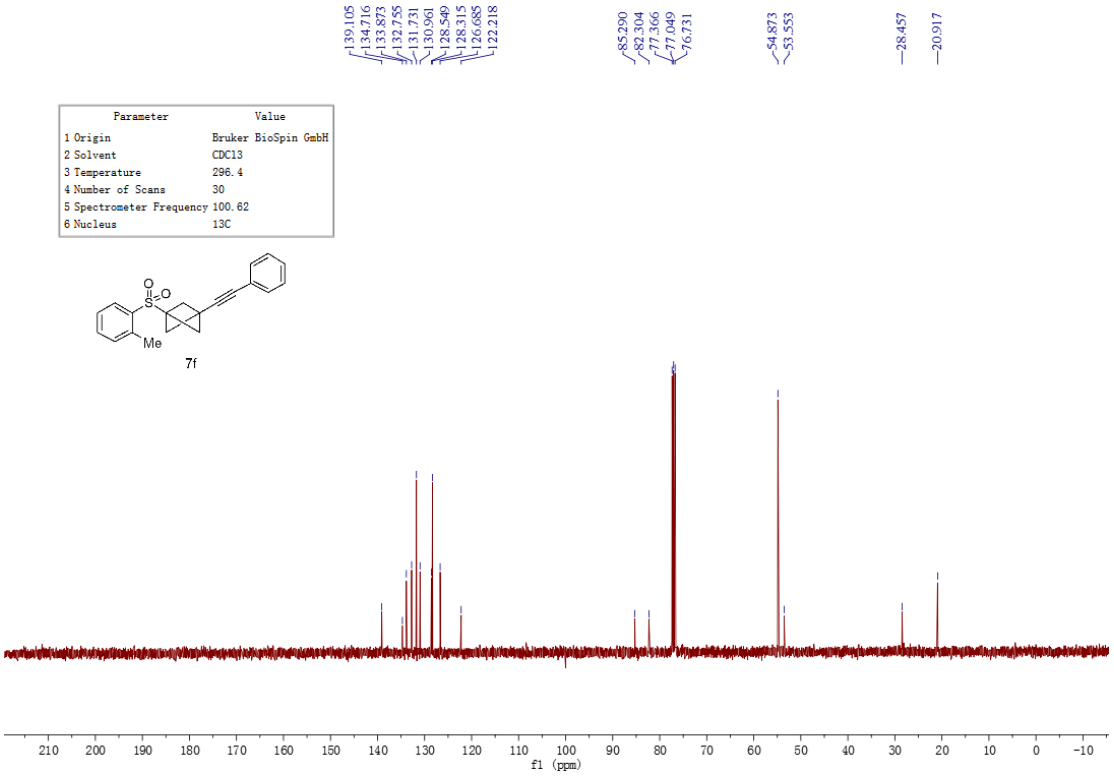
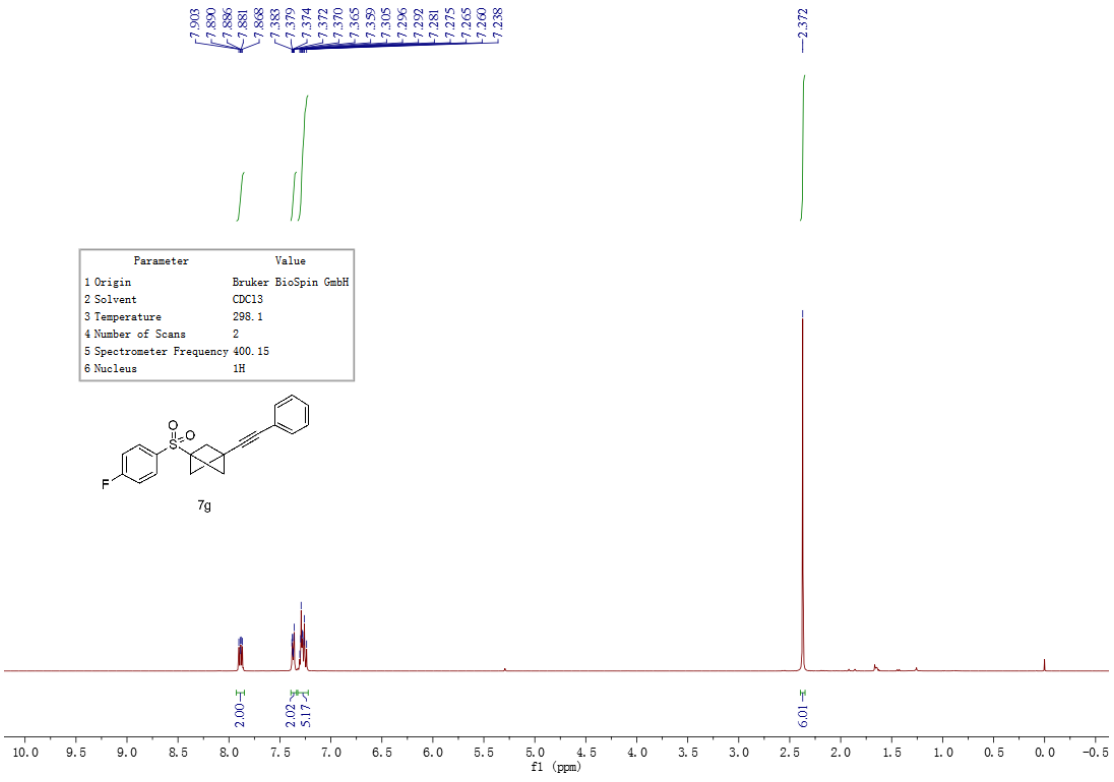
7.349
7.345
7.340
7.338
7.336
7.331
7.325
7.302
7.276
7.273
7.265
7.260
7.256
7.253
7.247
7.245
7.243
7.235
7.229
2.644
2.370
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.1
4 Number of Scans 2
5 Spectrometer Frequency 400.15
6 Nucleus 1H
Me
7f
1.00
1.10
4.25
3.24
3.09
6.11
f1 (ppm)


139.105
134.716
133.873
132.755
131.731
130.961
128.549
128.315
126.685
122.218
85.290
82.304
77.366
77.049
76.731
54.873
53.553
28.457
20.917
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 296.4
4 Number of Scans 30
5 Spectrometer Frequency 100.62
6 Nucleus 13C
O
S
O
Me
7f
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)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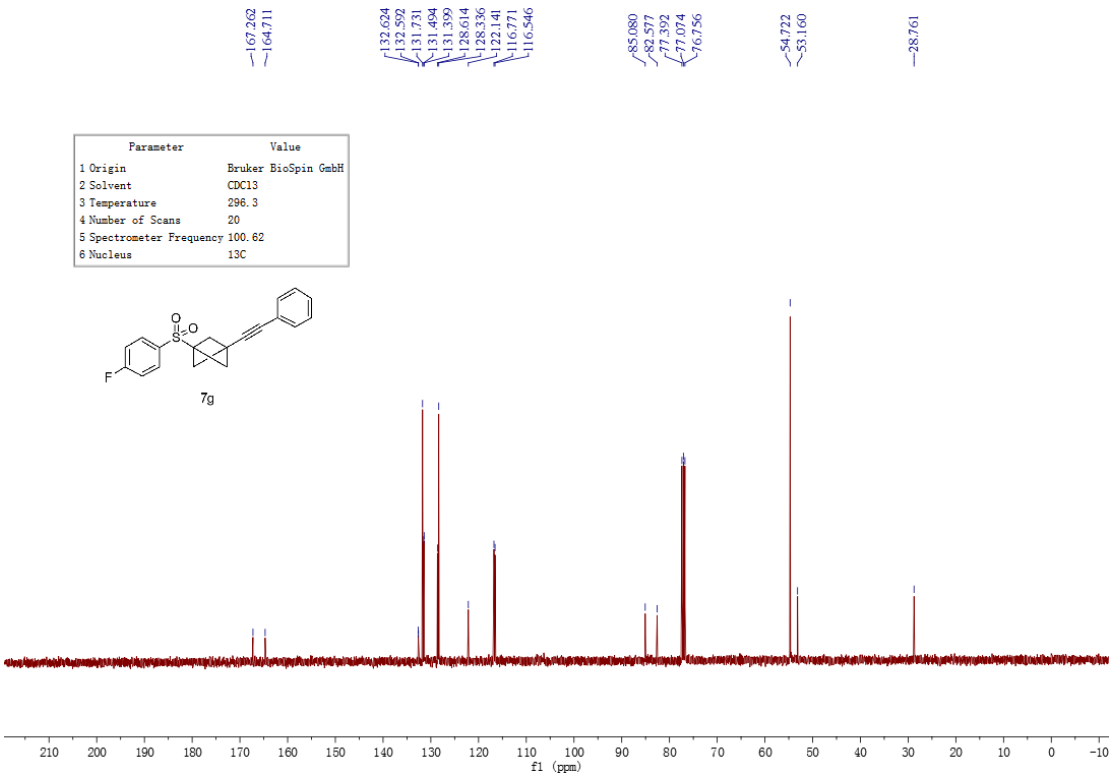
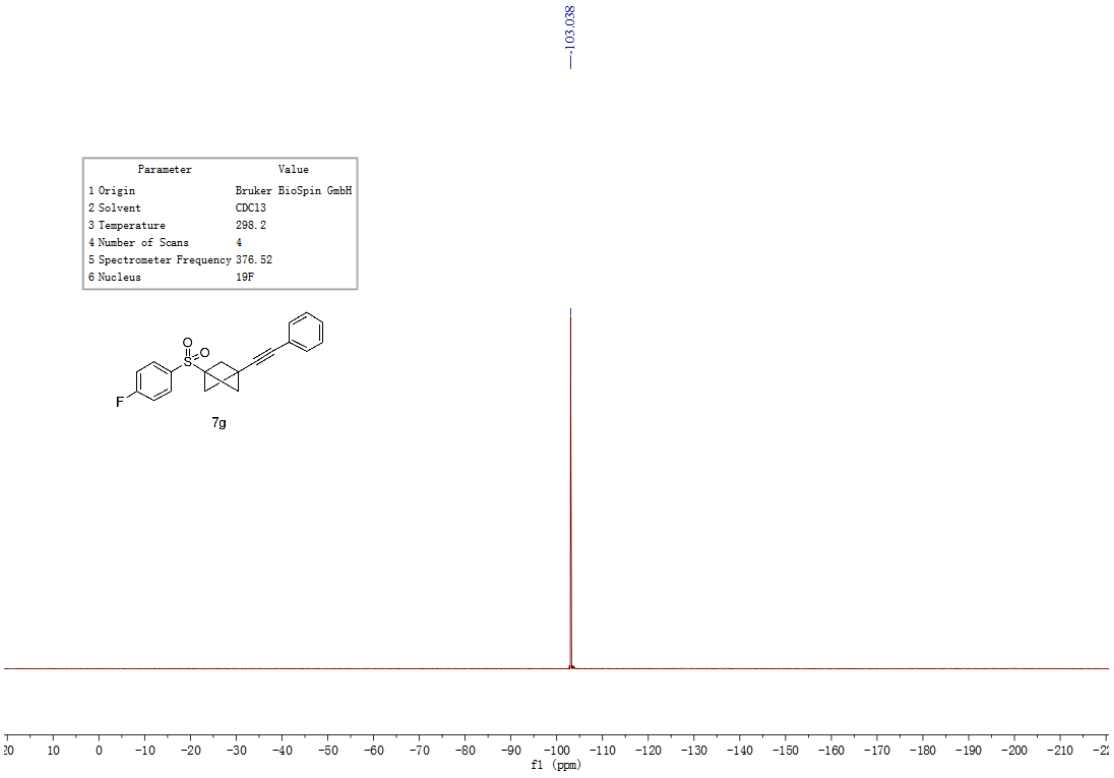
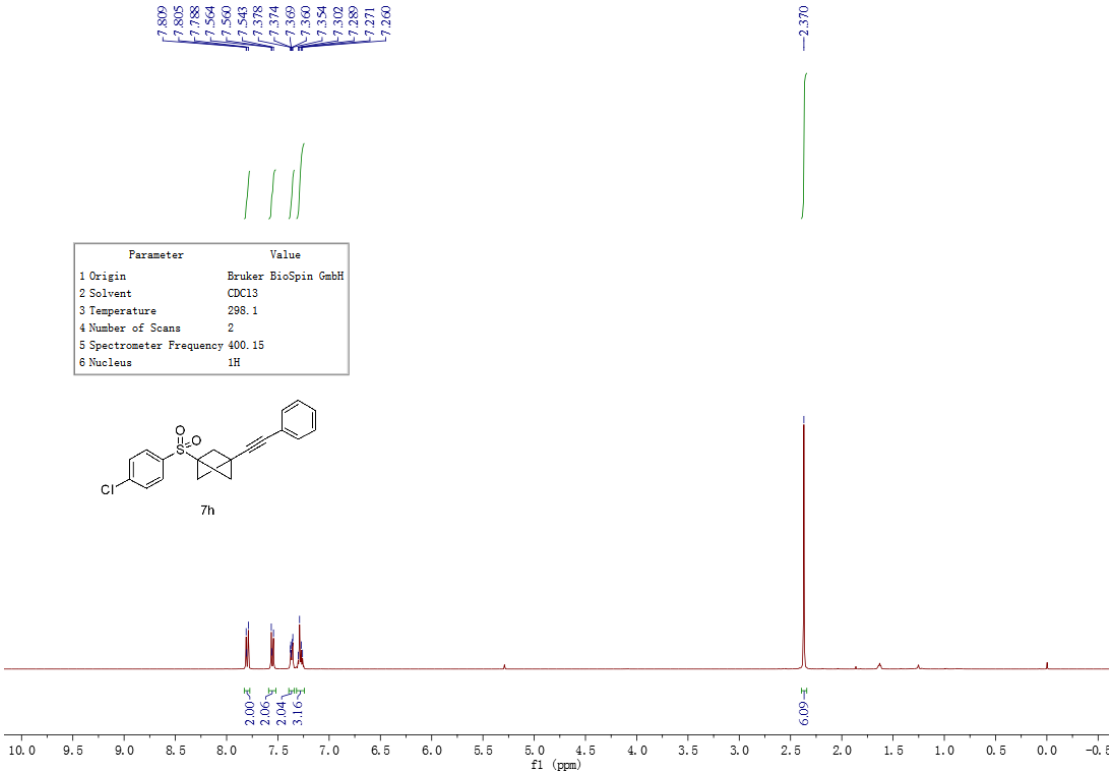
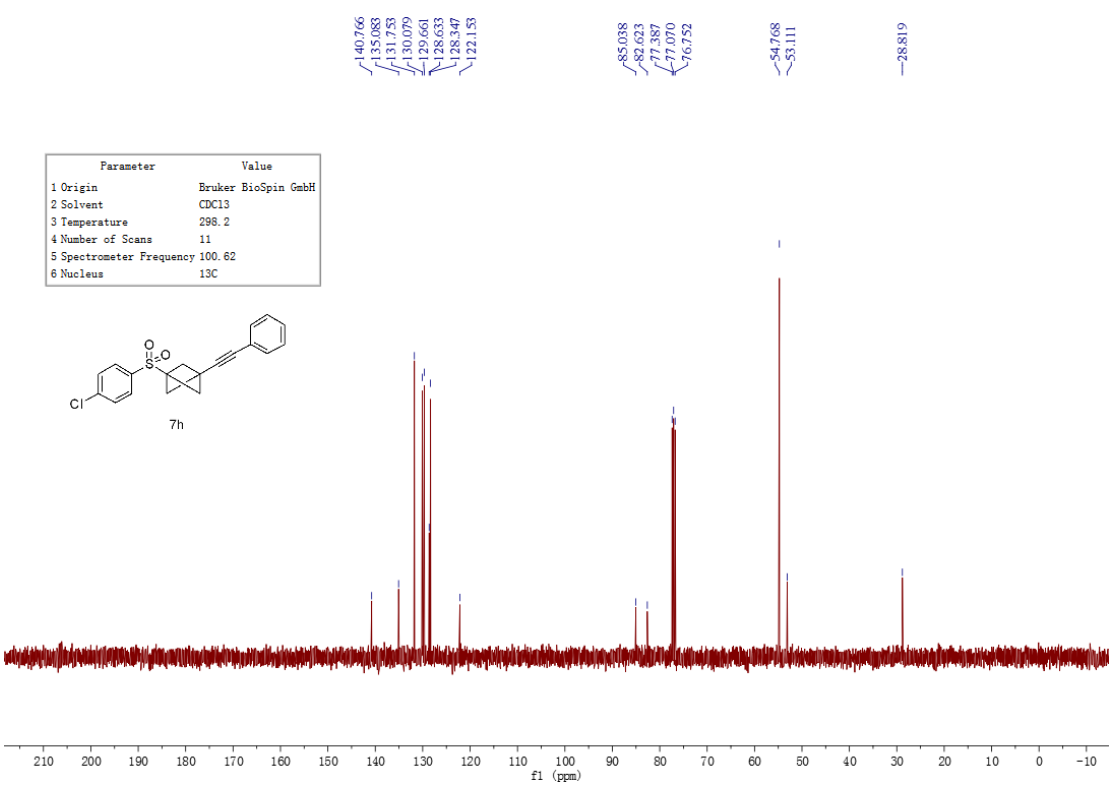
7.890
7.886
7.881
7.868
7.383
7.379
7.374
7.372
7.370
7.365
7.359
7.305
7.296
7.292
7.281
7.275
7.265
7.260
7.238
2.372
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.1
4 Number of Scans 2
5 Spectrometer Frequency 400.15
6 Nucleus 1H
O
S
O
F
7g
2.00
2.02
5.17
6.01
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)


167.262
164.711
132.624
132.592
131.731
131.494
131.399
128.614
128.336
122.141
116.771
116.546
85.080
82.577
77.392
77.074
76.756
54.722
53.160
28.761
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 296.3
4 Number of Scans 20
5 Spectrometer Frequency 100.62
6 Nucleus 13C
O
S
O
F
7g
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)


-103.038
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.2
4 Number of Scans 4
5 Spectrometer Frequency 376.52
6 Nucleus 19F
O
S
O
F
7g
20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210 -22
f1 (ppm)


7.809
7.805
7.788
7.564
7.560
7.543
7.378
7.374
7.369
7.360
7.354
7.302
7.289
7.271
7.260
2.370
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.1
4 Number of Scans 2
5 Spectrometer Frequency 400.15
6 Nucleus 1H
Cl
7h
2.00
2.06
2.04
3.16
6.09
f1 (ppm)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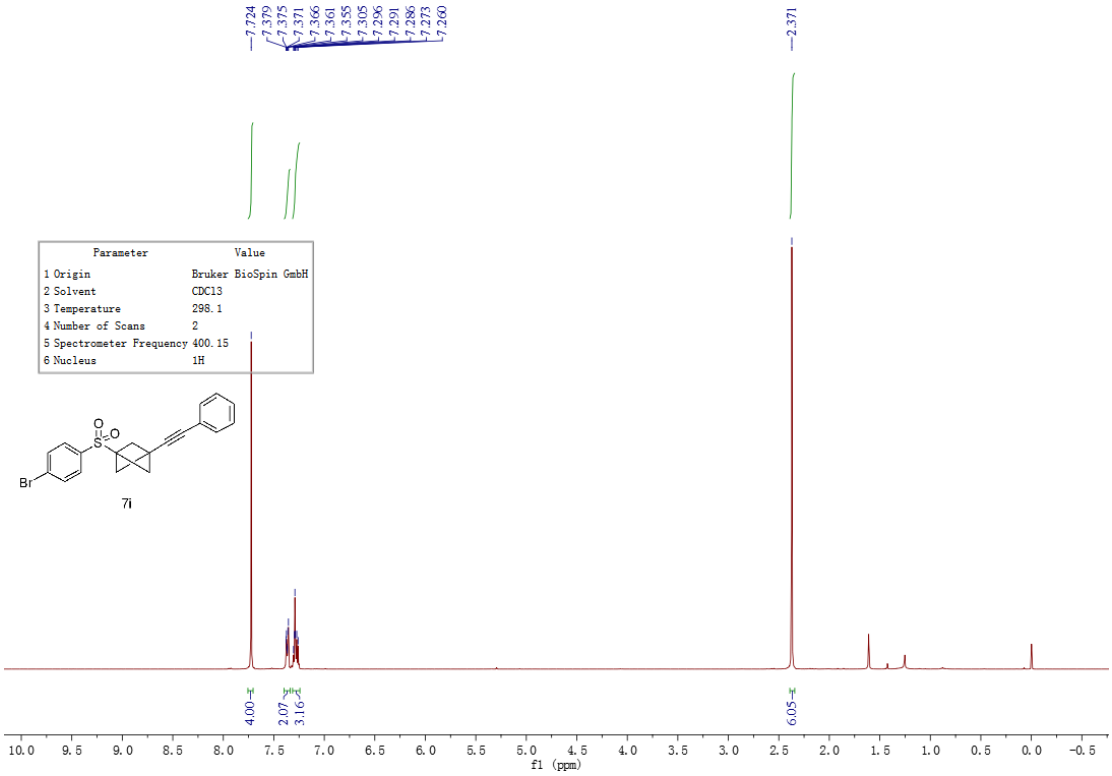
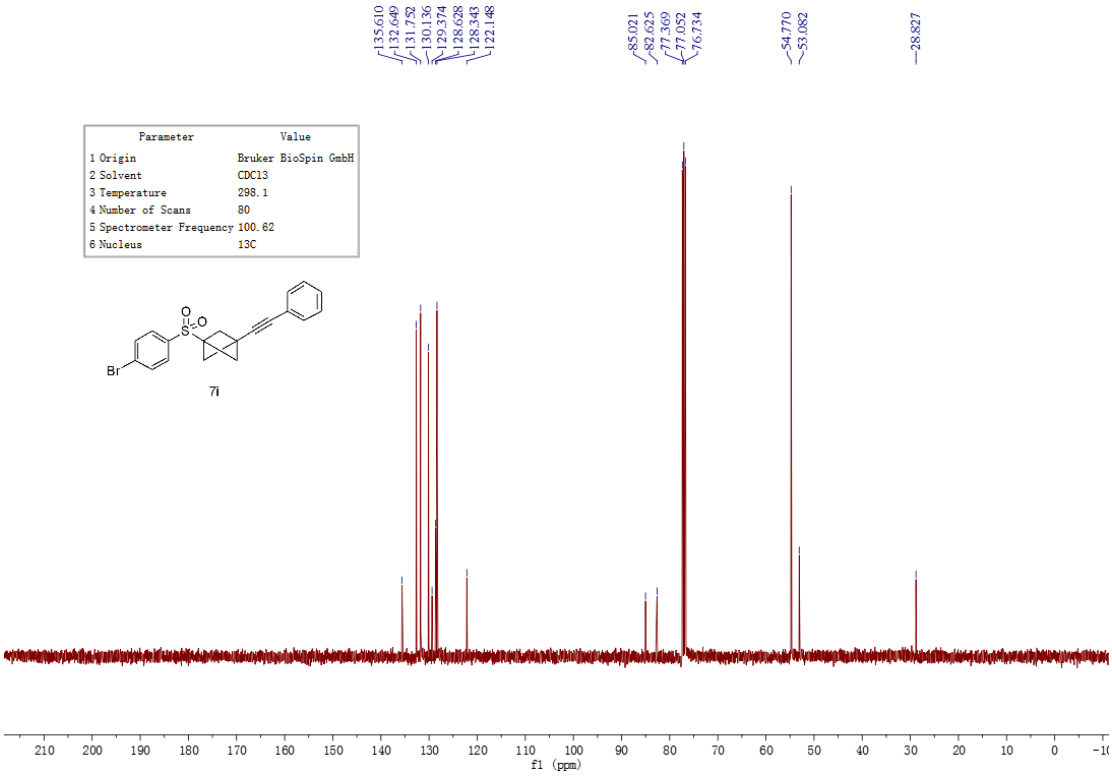
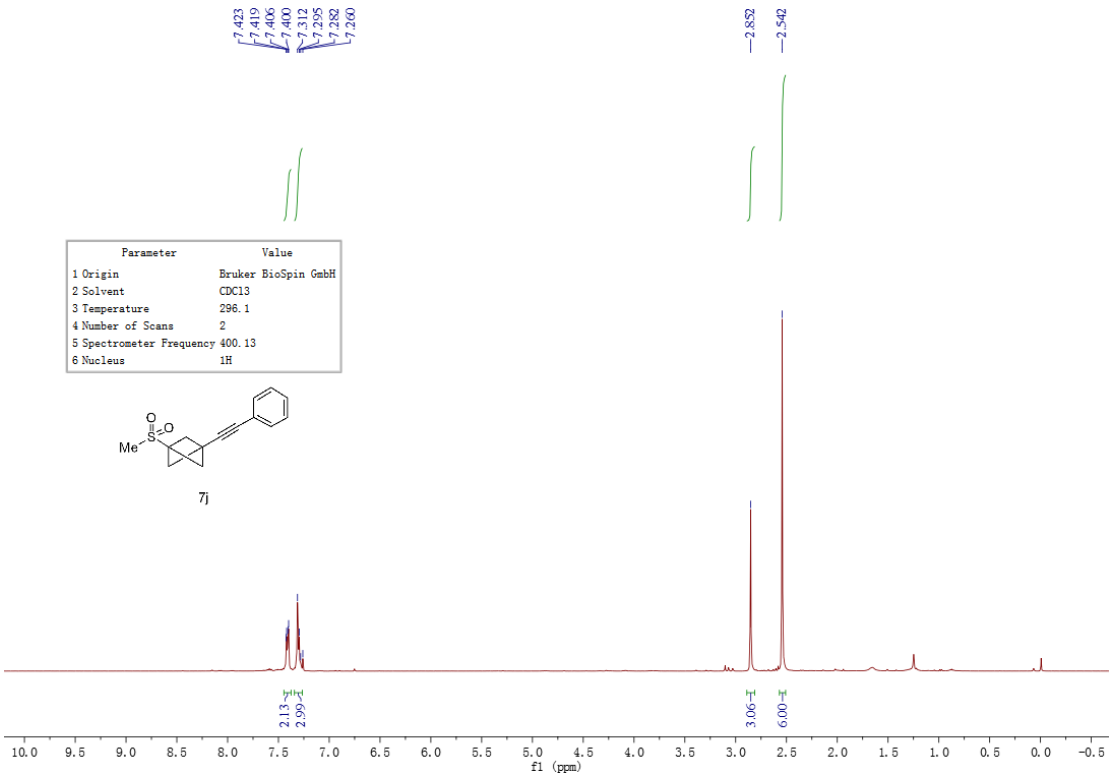
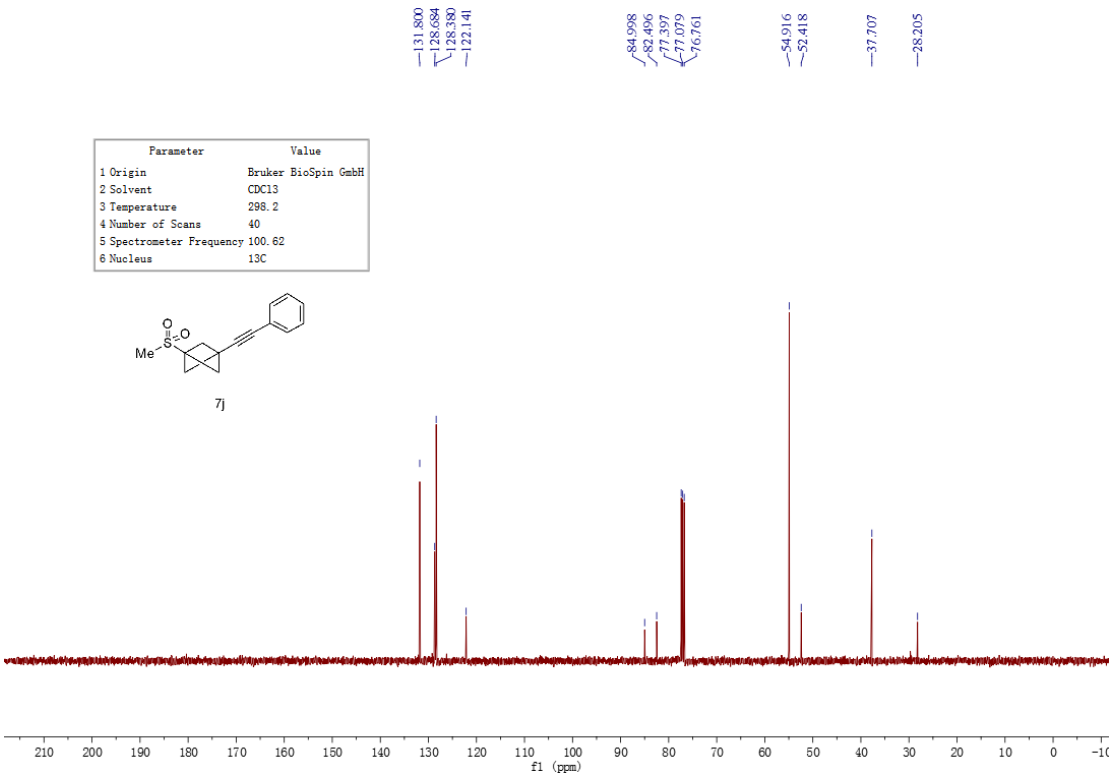
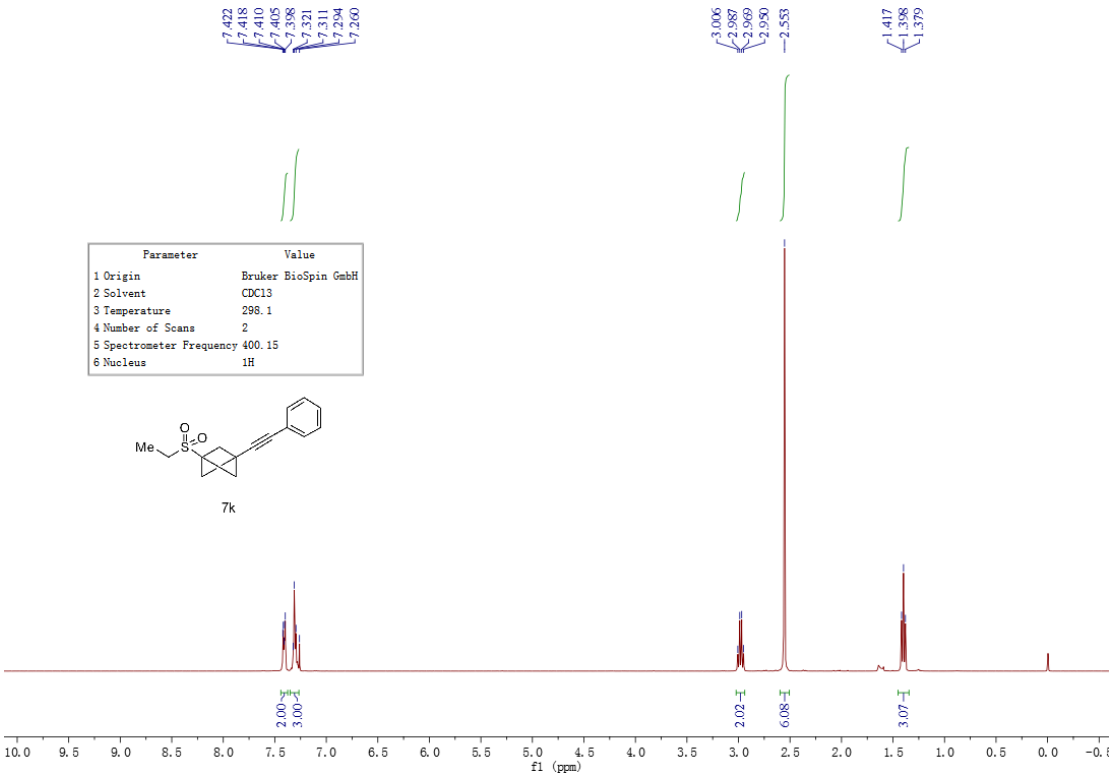
135.083
131.753
130.079
129.661
128.633
128.347
122.153
85.038
82.623
77.387
77.070
76.752
54.768
53.111
28.819
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.2
4 Number of Scans 11
5 Spectrometer Frequency 100.62
6 Nucleus 13C
Cl
7h
f1 (ppm)


7.724
7.379
7.375
7.371
7.366
7.361
7.355
7.305
7.296
7.291
7.286
7.273
7.260
2.371
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.1
4 Number of Scans 2
5 Spectrometer Frequency 400.15
6 Nucleus 1H
Br
7i
4.00
2.07
3.16
6.05
f1 (ppm)


135.610
132.649
131.752
130.136
129.374
128.628
128.343
122.148
85.021
82.625
77.369
77.052
76.734
54.770
53.082
28.827
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.1
4 Number of Scans 80
5 Spectrometer Frequency 100.62
6 Nucleus 13C
Br
7i
f1 (ppm)


7.423
7.419
7.406
7.400
7.312
7.295
7.282
7.260
2.852
2.542
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 296.1
4 Number of Scans 2
5 Spectrometer Frequency 400.13
6 Nucleus 1H
Me
7j
2.13
2.99
3.06
6.00
f1 (ppm)


131.800
128.684
128.380
122.141
84.998
82.496
77.397
77.079
76.761
54.916
52.418
37.707
28.205
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.2
4 Number of Scans 40
5 Spectrometer Frequency 100.62
6 Nucleus 13C
Me
7j
f1 (ppm)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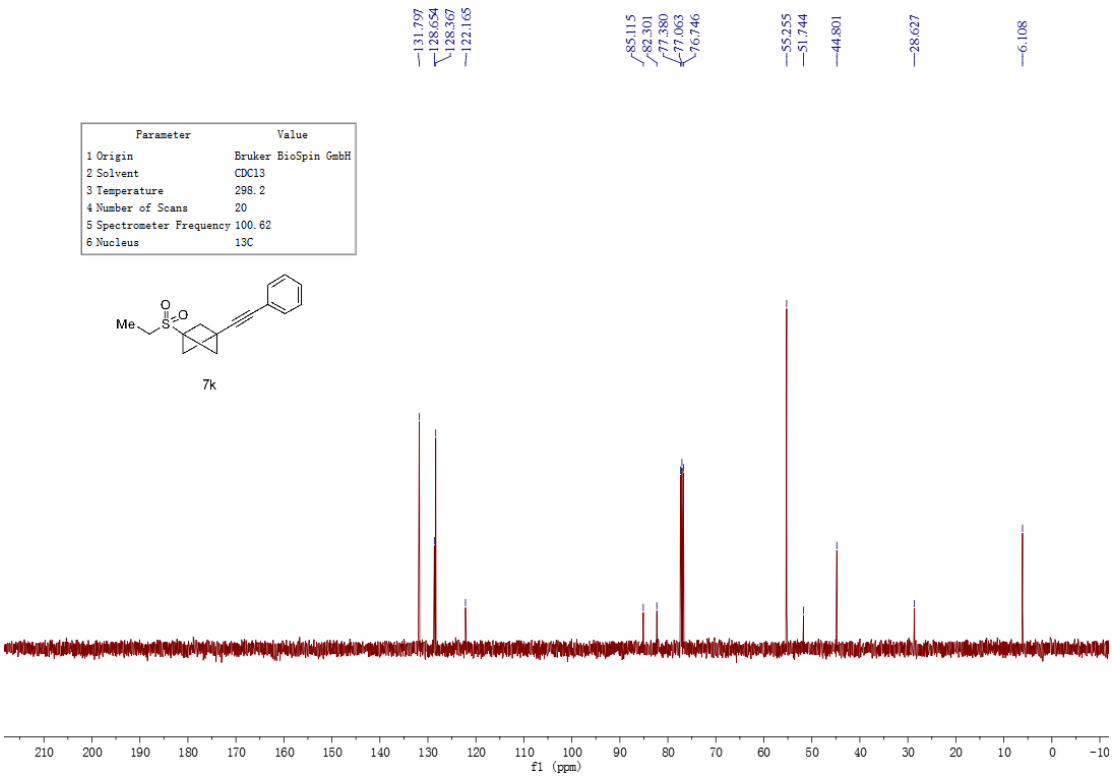
7.418
7.410
7.405
7.398
7.321
7.311
7.294
7.260
3.006
2.987
2.969
2.950
2.553
1.417
1.398
1.379
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.1
4 Number of Scans 2
5 Spectrometer Frequency 400.15
6 Nucleus 1H
Me
7k
2.00
3.00
2.02
6.08
3.07
f1 (ppm)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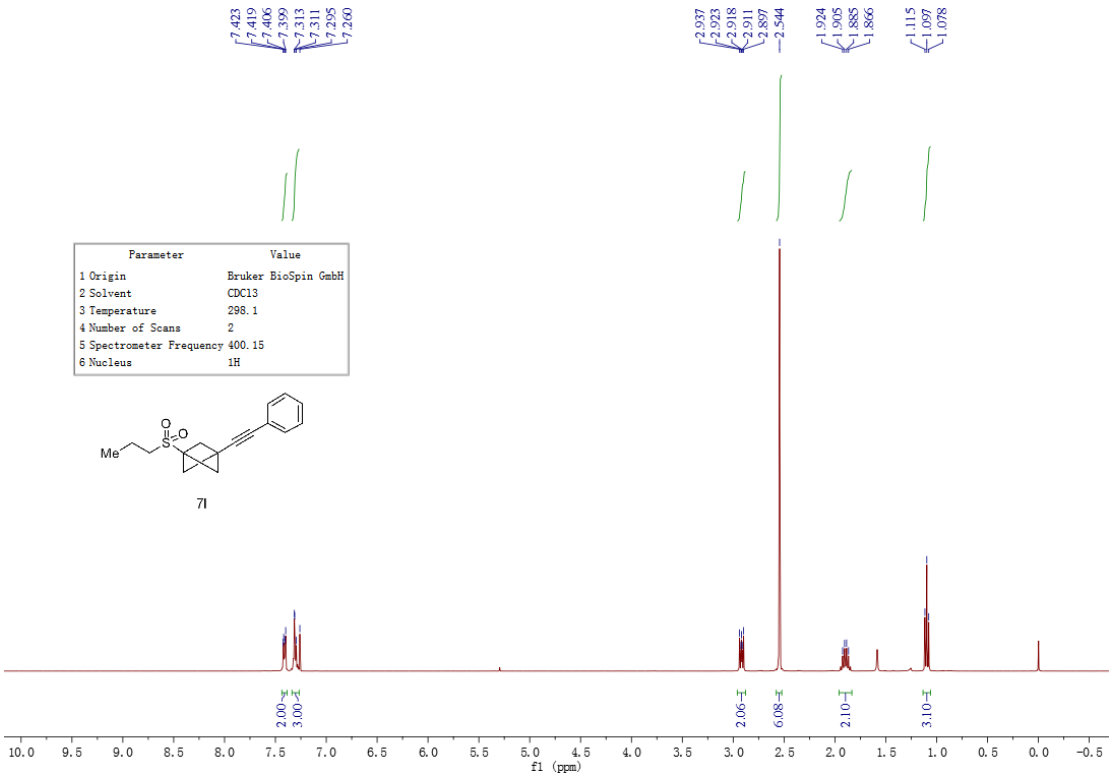
128.367
122.165
85.115
82.301
77.380
77.063
76.746
55.255
51.744
44.801
28.627
6.108
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.2
4 Number of Scans 20
5 Spectrometer Frequency 100.62
6 Nucleus 13C
Me
7k
f1 (ppm)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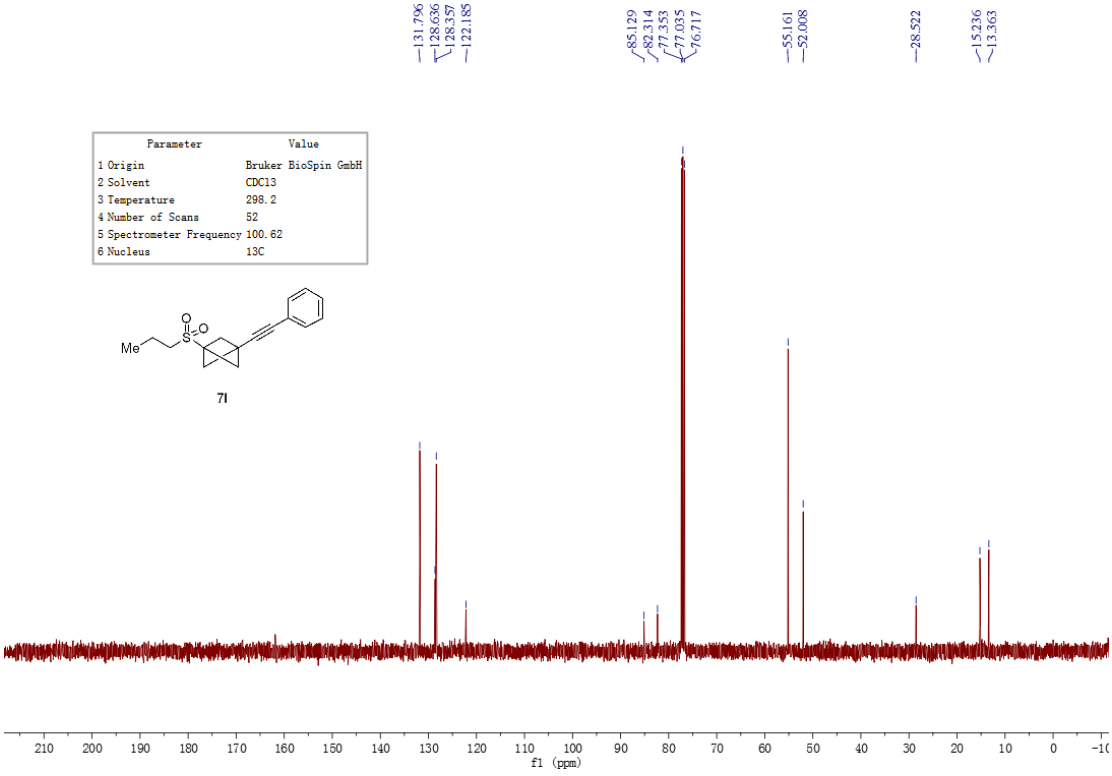
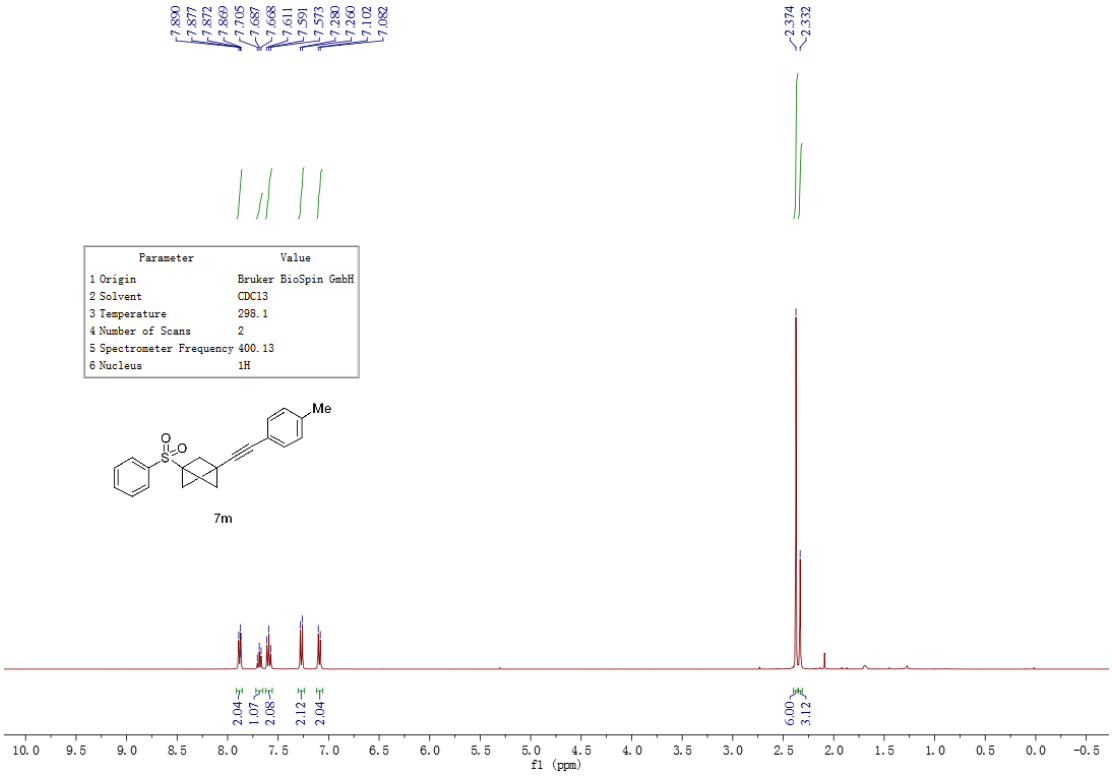
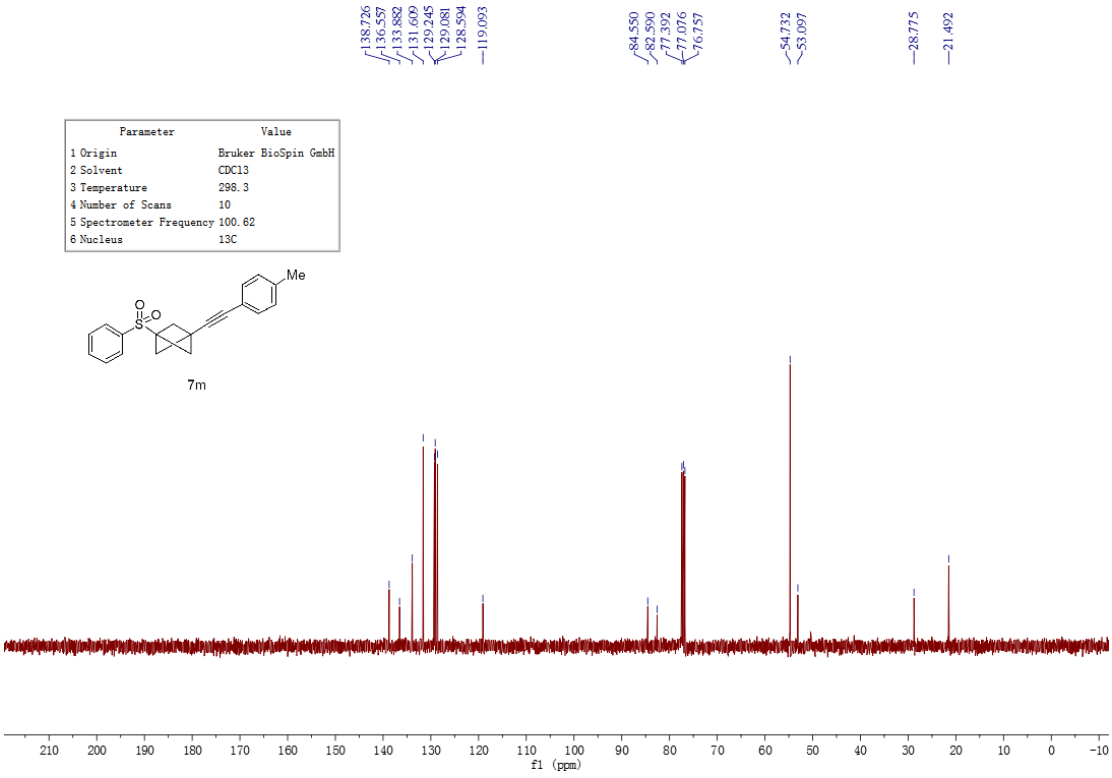
7.419
7.406
7.399
7.313
7.311
7.295
7.260
2.937
2.923
2.918
2.911
2.897
2.544
1.924
1.905
1.885
1.866
1.115
1.097
1.078
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.1
4 Number of Scans 2
5 Spectrometer Frequency 400.15
6 Nucleus 1H
Me
7l
2.00
3.00
2.06
6.08
2.10
3.10
f1 (ppm)


131.796
128.636
128.357
122.185
85.129
82.314
77.353
77.035
76.717
55.161
52.008
28.522
15.236
13.363
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.2
4 Number of Scans 52
5 Spectrometer Frequency 100.62
6 Nucleus 13C
Me
7l
f1 (ppm)


7.890
7.877
7.872
7.869
7.705
7.687
7.668
7.611
7.591
7.573
7.280
7.260
7.102
7.082
2.374
2.332
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.1
4 Number of Scans 2
5 Spectrometer Frequency 400.13
6 Nucleus 1H
Me
7m
2.04
1.07
2.08
2.12
2.04
6.00
3.12
f1 (ppm)


138.726
136.557
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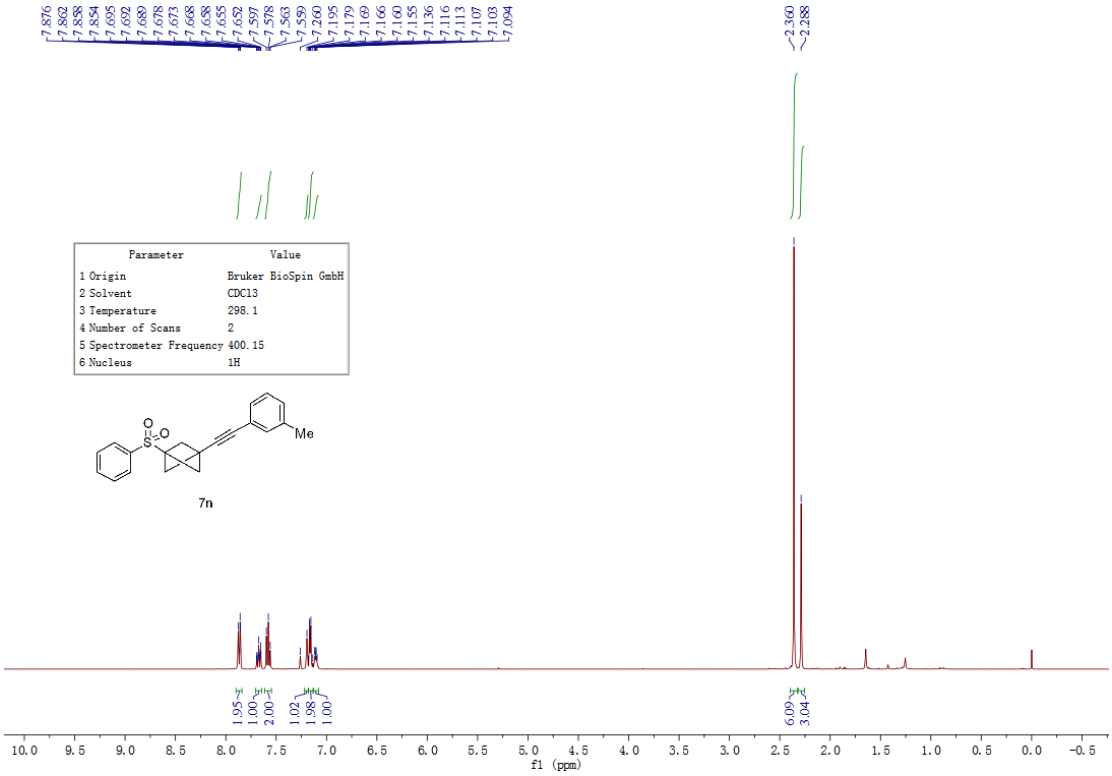
131.609
129.245
129.081
128.594
119.093
84.550
82.590
77.392
77.076
76.757
54.732
53.097
28.775
21.492
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.3
4 Number of Scans 10
5 Spectrometer Frequency 100.62
6 Nucleus 13C
Me
7m
f1 (ppm)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7.862
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7.854
7.695
7.692
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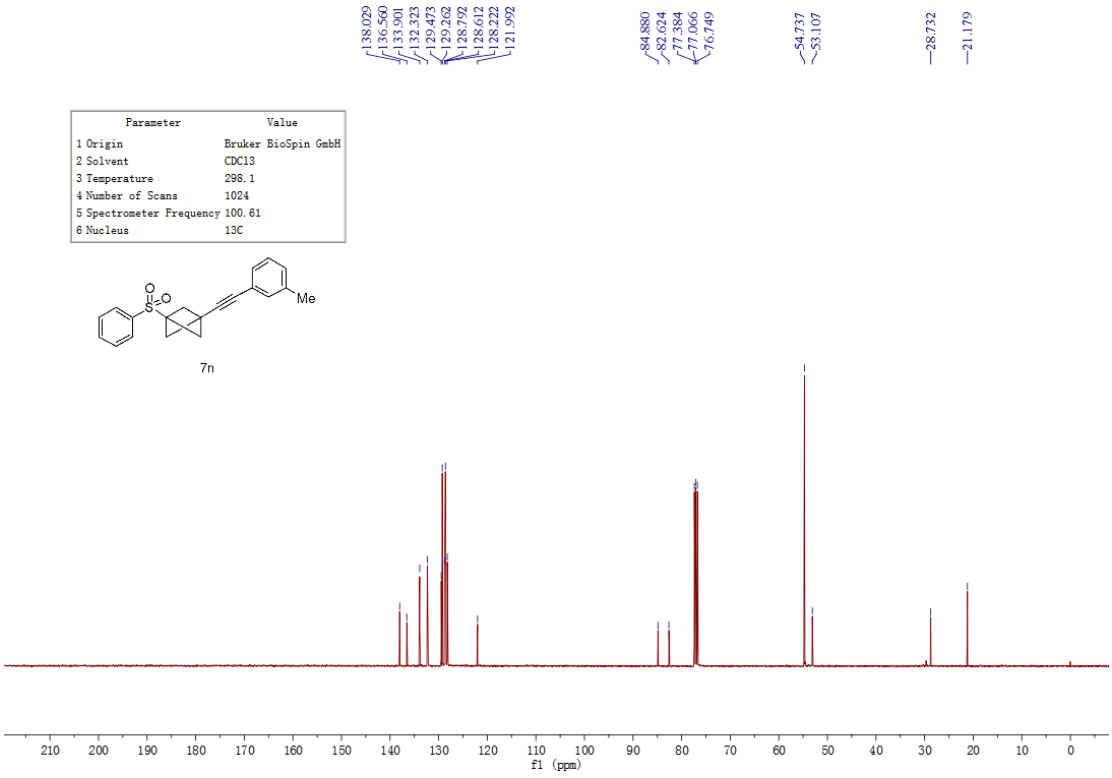
7.678
7.673
7.668
7.658
7.655
7.652
7.597
7.578
7.563
7.559
7.260
7.195
7.179
7.169
7.166
7.160
7.155
7.136
7.116
7.113
7.107
7.103
7.094
2.360
2.288
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.1
4 Number of Scans 2
5 Spectrometer Frequency 400.15
6 Nucleus 1H
O
S
O
Me
7n
1.95
1.00
2.00
1.02
1.98
1.00
6.09
3.04
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)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136.560
133.901
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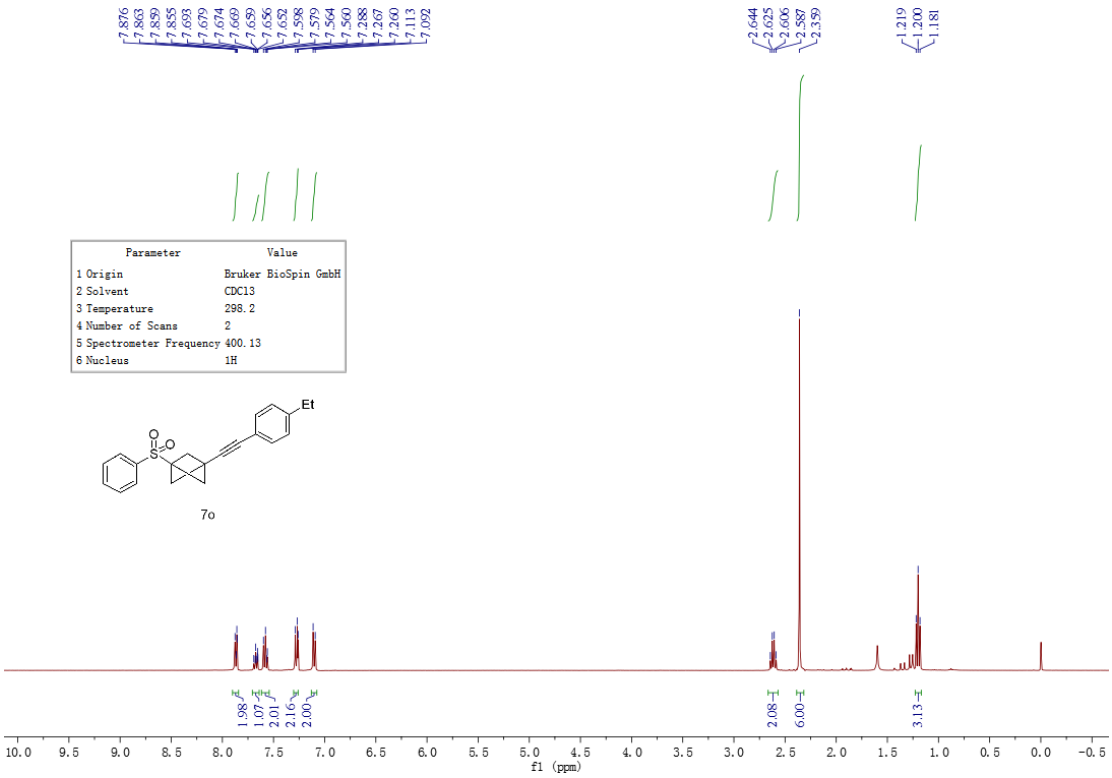
129.262
128.792
128.612
128.222
121.992
84.880
82.624
77.384
77.066
76.749
54.737
53.107
28.732
21.179
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.1
4 Number of Scans 1024
5 Spectrometer Frequency 100.61
6 Nucleus 13C
O
S
O
Me
7n
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)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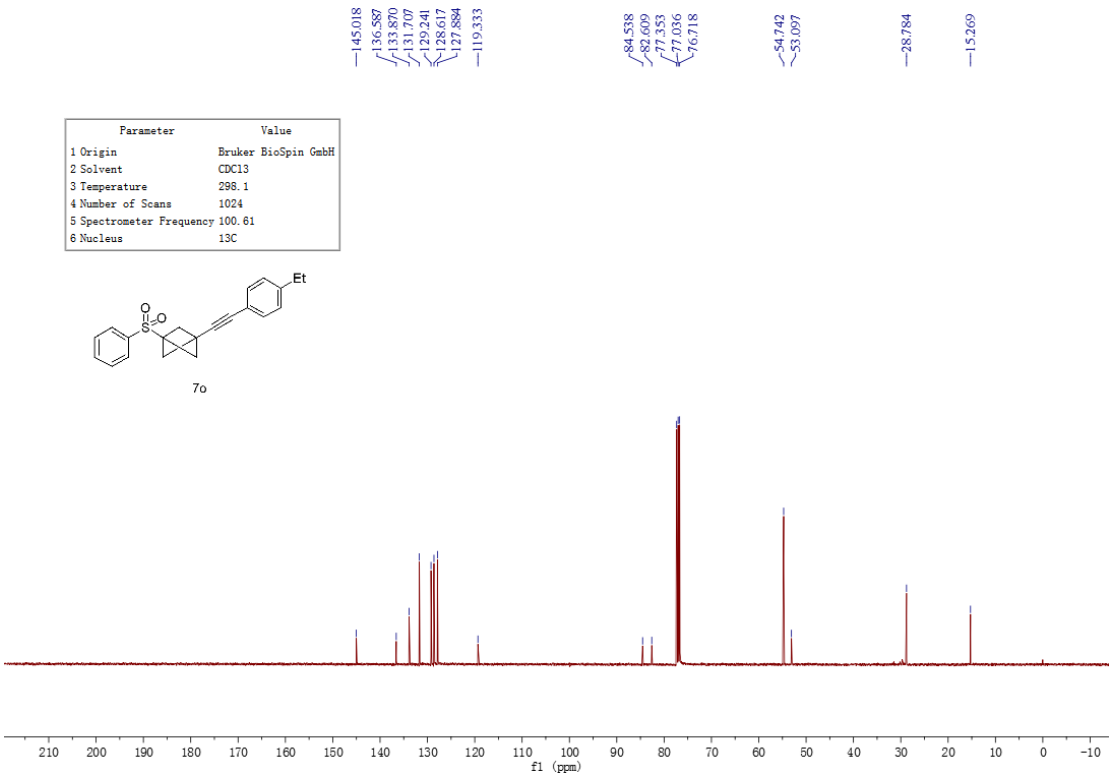
7.855
7.693
7.679
7.674
7.669
7.659
7.656
7.652
7.598
7.579
7.564
7.560
7.288
7.267
7.260
7.113
7.092
2.644
2.625
2.606
2.587
2.359
1.219
1.200
1.181
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.2
4 Number of Scans 2
5 Spectrometer Frequency 400.13
6 Nucleus 1H
Et
O
S
O
1.98
1.07
2.01
2.16
2.00
2.08
6.00
3.13
f1 (ppm)

7o


145.018
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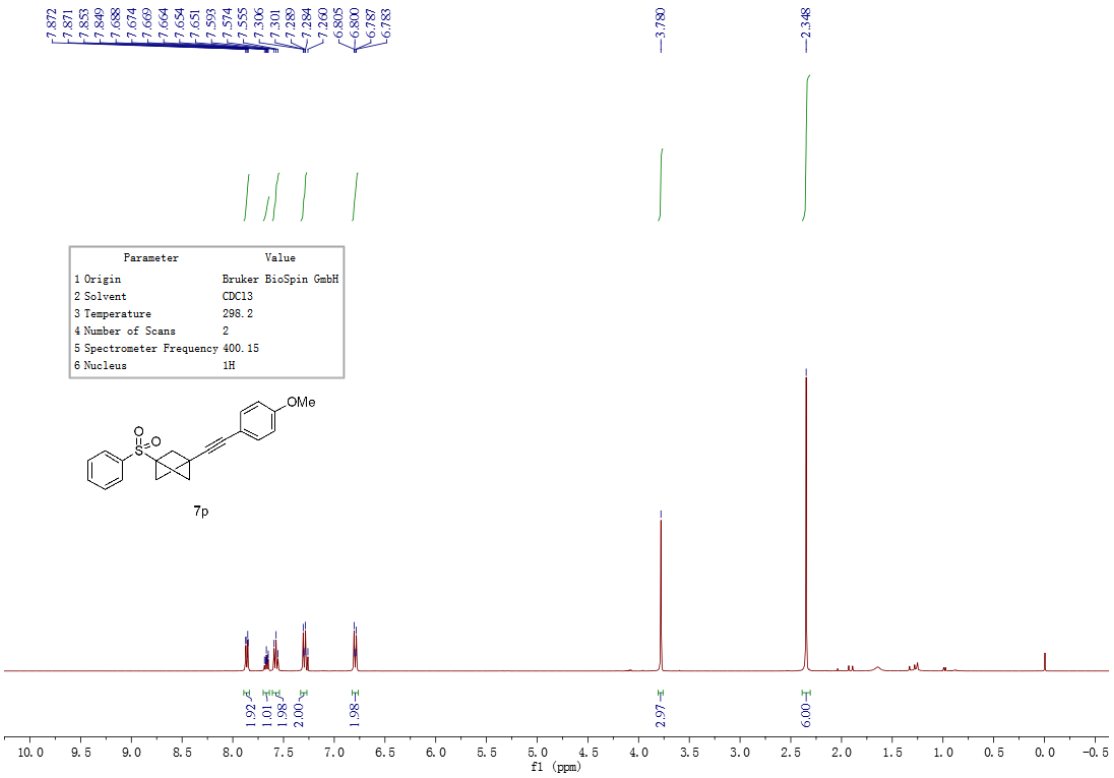
133.870
131.707
129.241
128.617
127.884
119.333
84.538
82.609
77.353
77.036
76.718
54.742
53.097
28.784
15.269
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.1
4 Number of Scans 1024
5 Spectrometer Frequency 100.61
6 Nucleus 13C
Et
O
S
O
f1 (ppm)

7o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7.688
7.674
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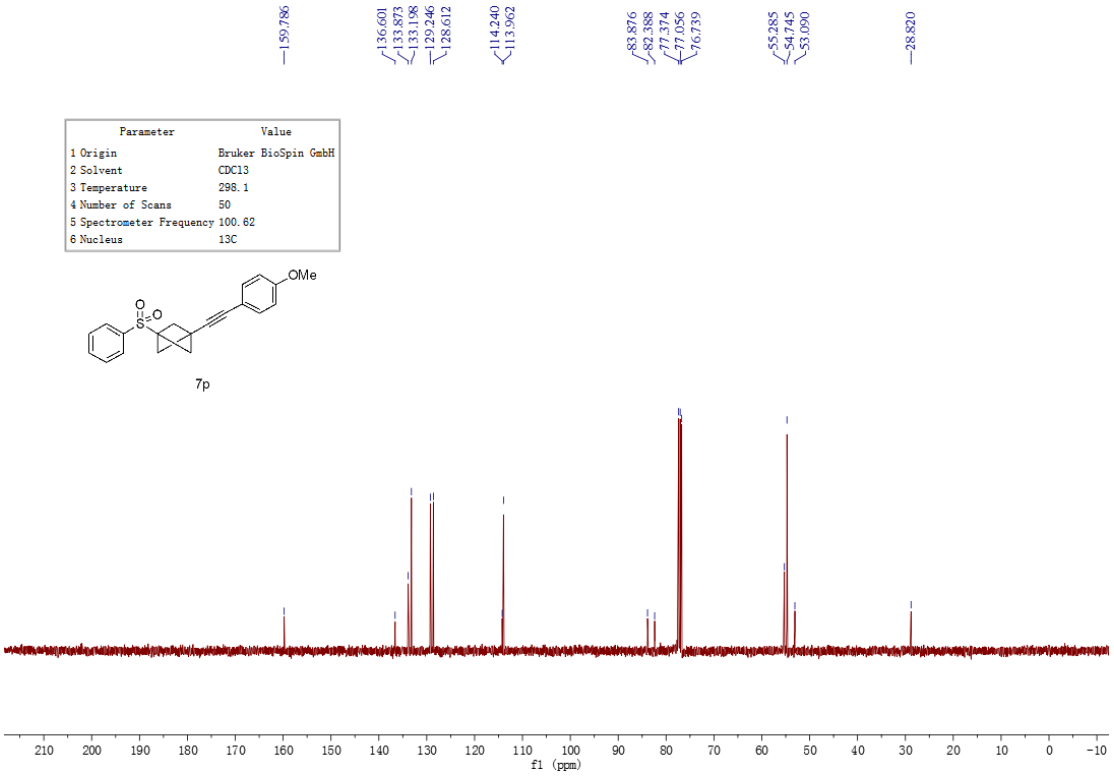
7.664
7.654
7.651
7.593
7.574
7.555
7.306
7.301
7.289
7.284
7.260
6.805
6.800
6.787
6.783
3.780
2.348
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.2
4 Number of Scans 2
5 Spectrometer Frequency 400.15
6 Nucleus 1H
OMe
7p
1.92
1.01
1.98
2.00
1.98
2.97
6.00
f1 (ppm)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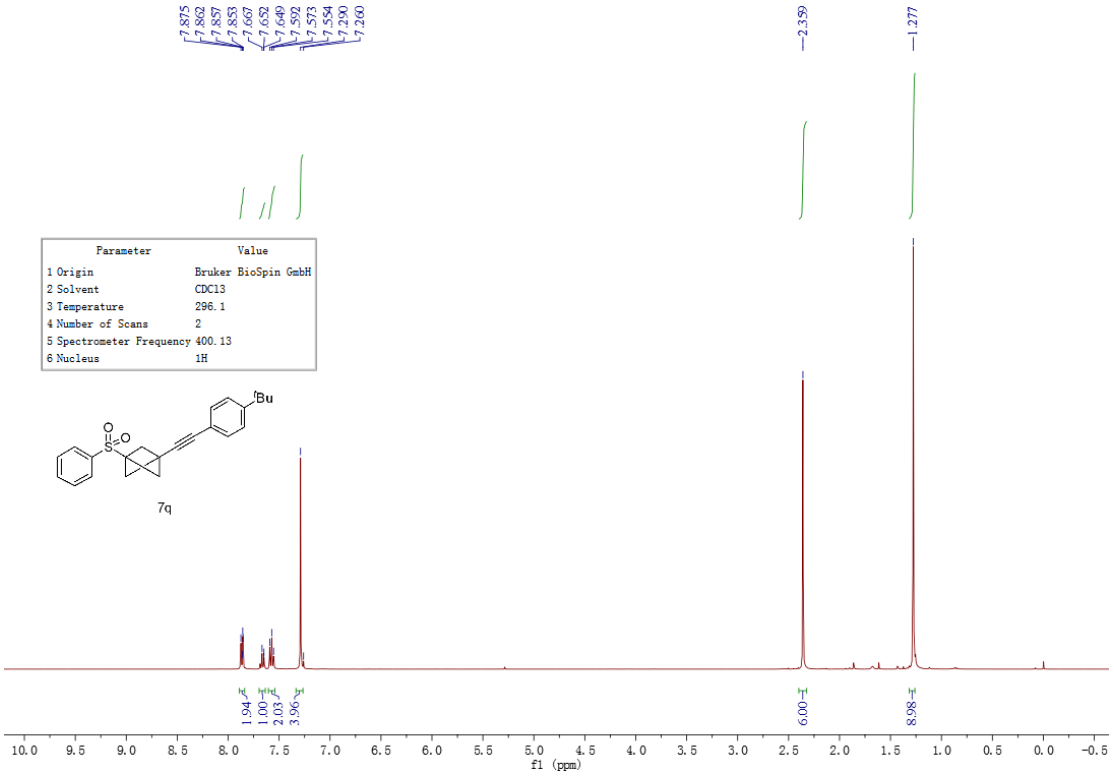
128.612
114.240
113.962
83.876
82.388
77.374
77.056
76.739
55.285
54.745
53.090
28.820
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.1
4 Number of Scans 50
5 Spectrometer Frequency 100.62
6 Nucleus 13C
OMe
7p
f1 (ppm)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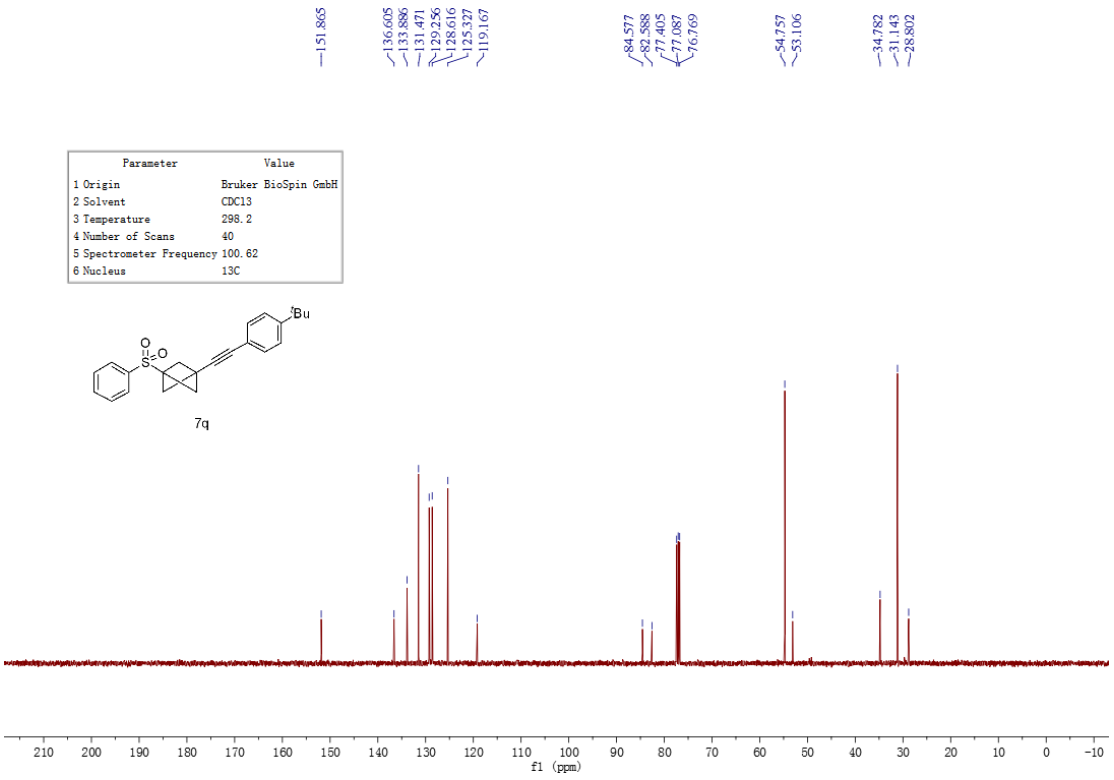
7.857
7.853
7.667
7.652
7.649
7.592
7.573
7.554
7.290
7.260
2.359
1.277
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 296.1
4 Number of Scans 2
5 Spectrometer Frequency 400.13
6 Nucleus 1H
tBu
7q
1.94
1.00
2.03
3.96
6.00
8.98
f1 (ppm)


151.865
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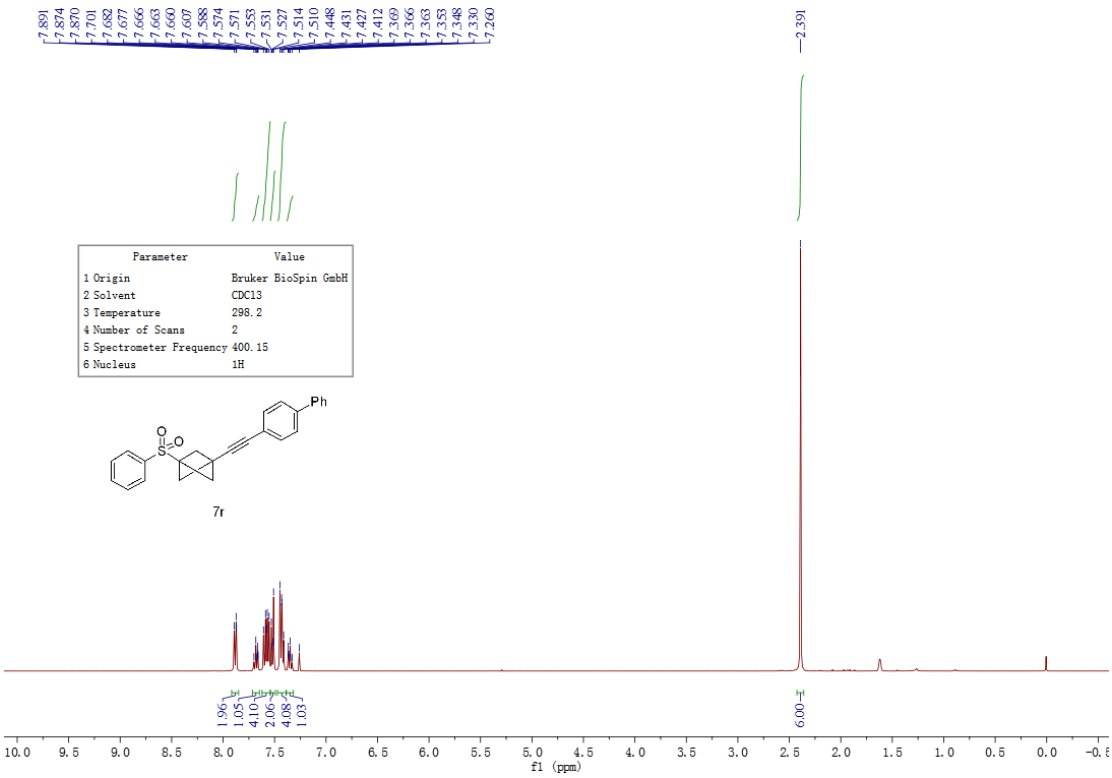
133.886
131.471
129.256
128.616
125.327
119.167
84.577
82.588
77.405
77.087
76.769
54.757
53.106
34.782
31.143
28.802
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.2
4 Number of Scans 40
5 Spectrometer Frequency 100.62
6 Nucleus 13C
tBu
7q
f1 (ppm)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7.607
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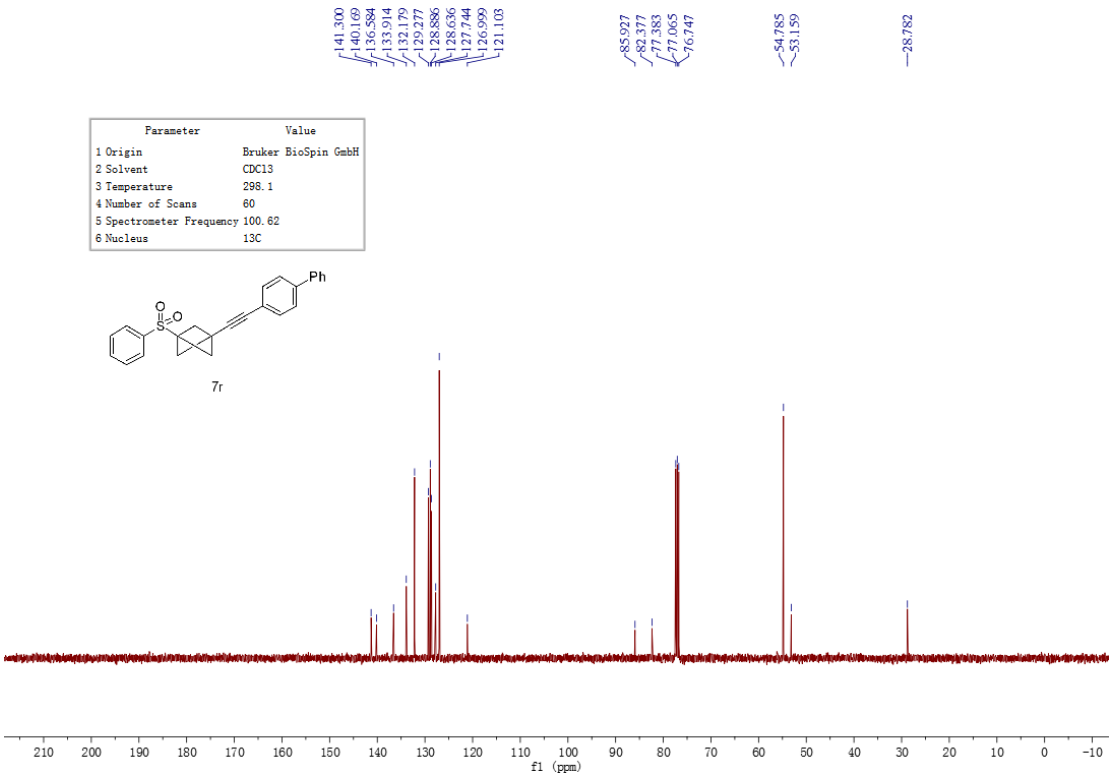
7.574
7.571
7.553
7.531
7.527
7.514
7.510
7.448
7.431
7.427
7.412
7.369
7.366
7.363
7.353
7.348
7.330
7.260
2.391
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.2
4 Number of Scans 2
5 Spectrometer Frequency 400.15
6 Nucleus 1H
Ph
O
S
O
7r
1.96
1.05
4.10
2.06
4.08
1.03
6.00
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)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140.169
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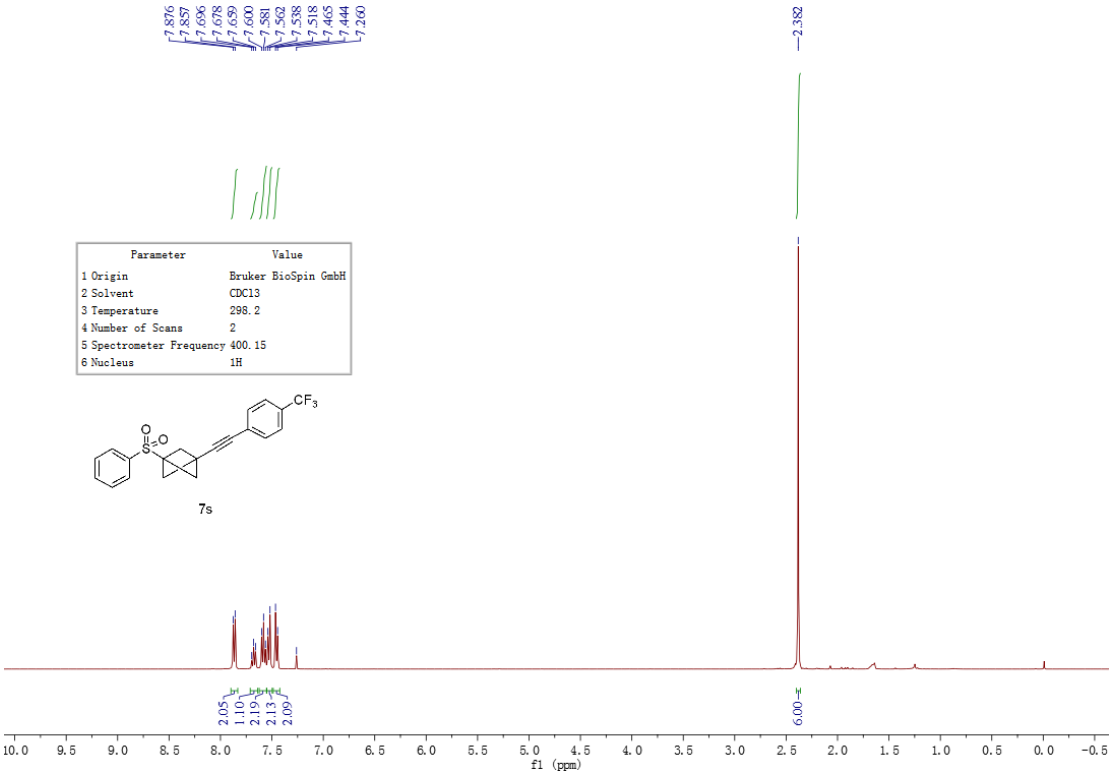
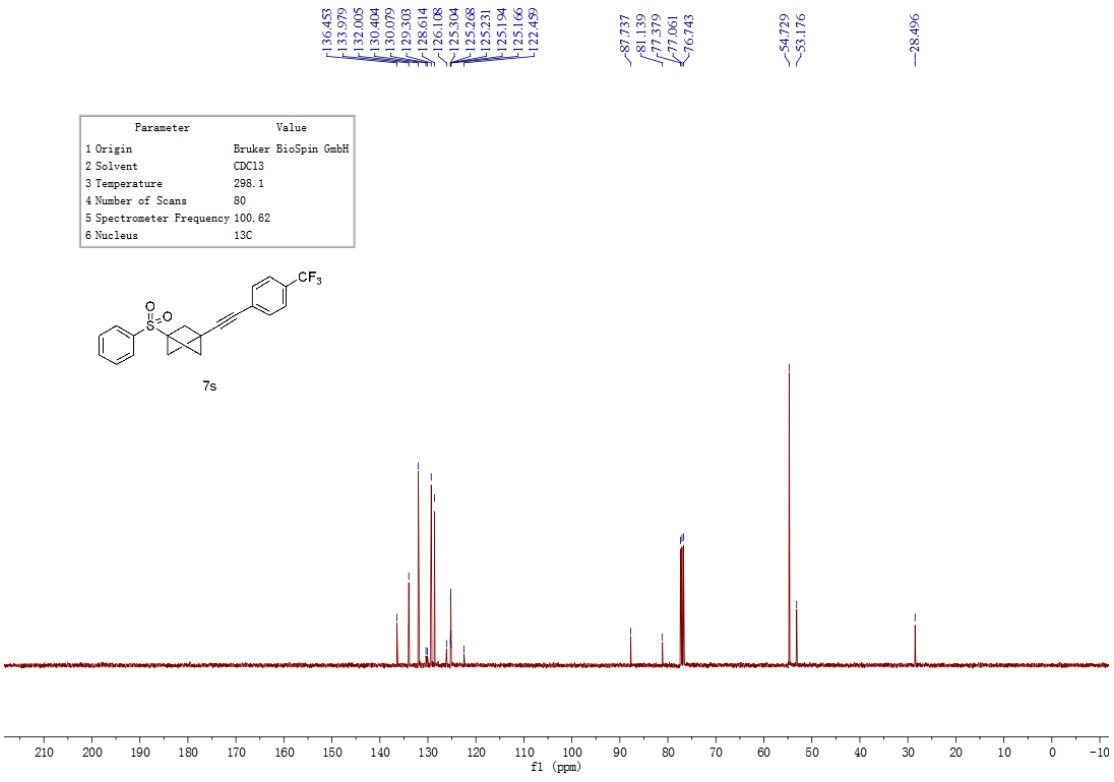
133.914
132.179
129.277
128.886
128.636
127.744
126.999
121.103
85.927
82.377
77.383
77.065
76.747
54.785
53.159
28.782
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.1
4 Number of Scans 60
5 Spectrometer Frequency 100.62
6 Nucleus 13C
Ph
O
S
O
7r
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)


7.876
7.857
7.696
7.678
7.659
7.600
7.581
7.562
7.538
7.518
7.465
7.444
7.260
2.382
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.2
4 Number of Scans 2
5 Spectrometer Frequency 400.15
6 Nucleus 1H
CF3
O
S
O
7s
2.05
1.10
2.19
2.13
2.09
6.00
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)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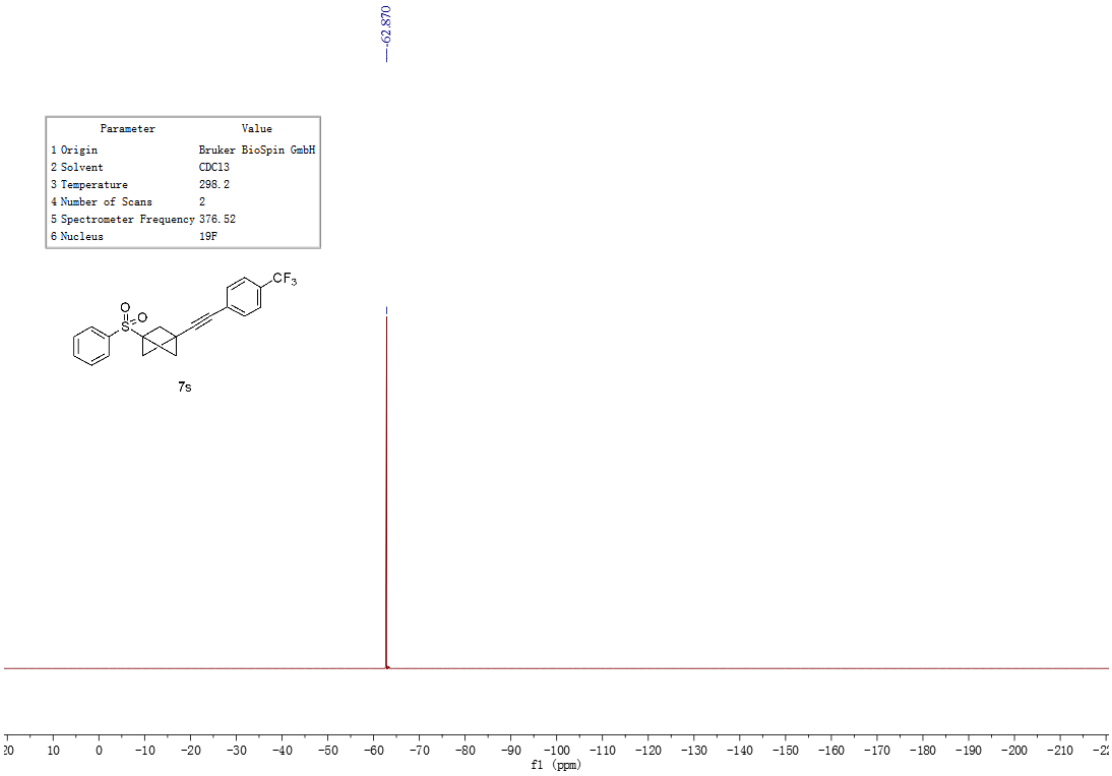
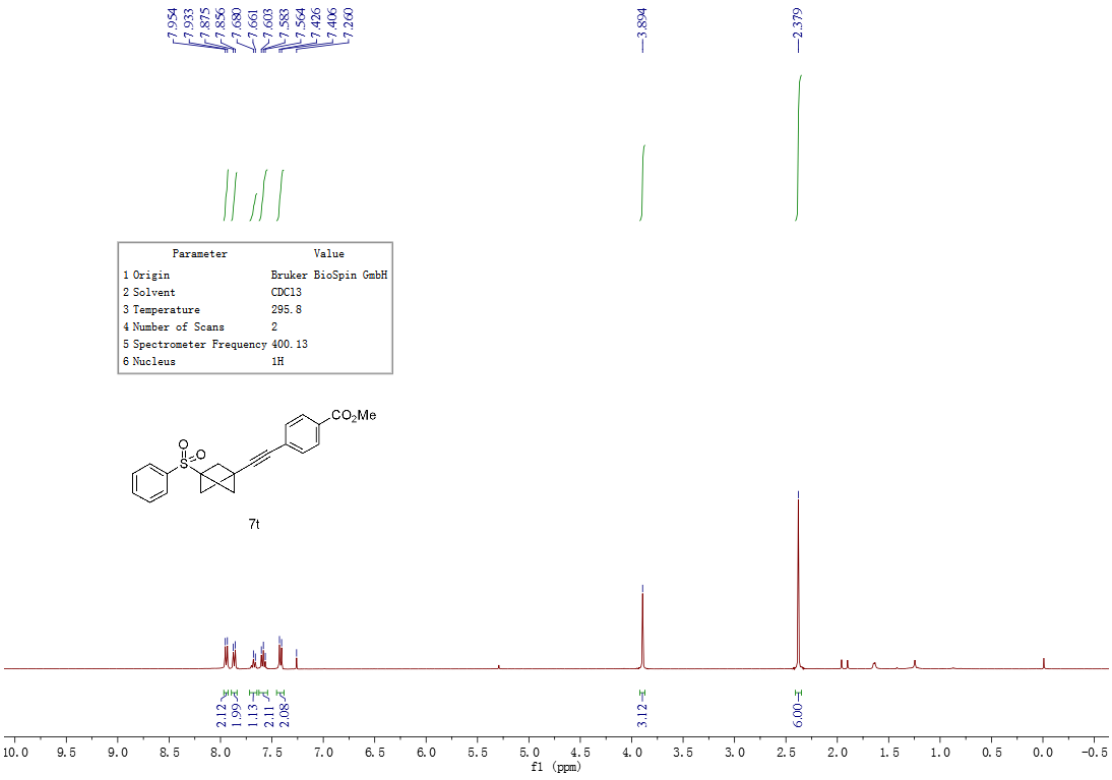
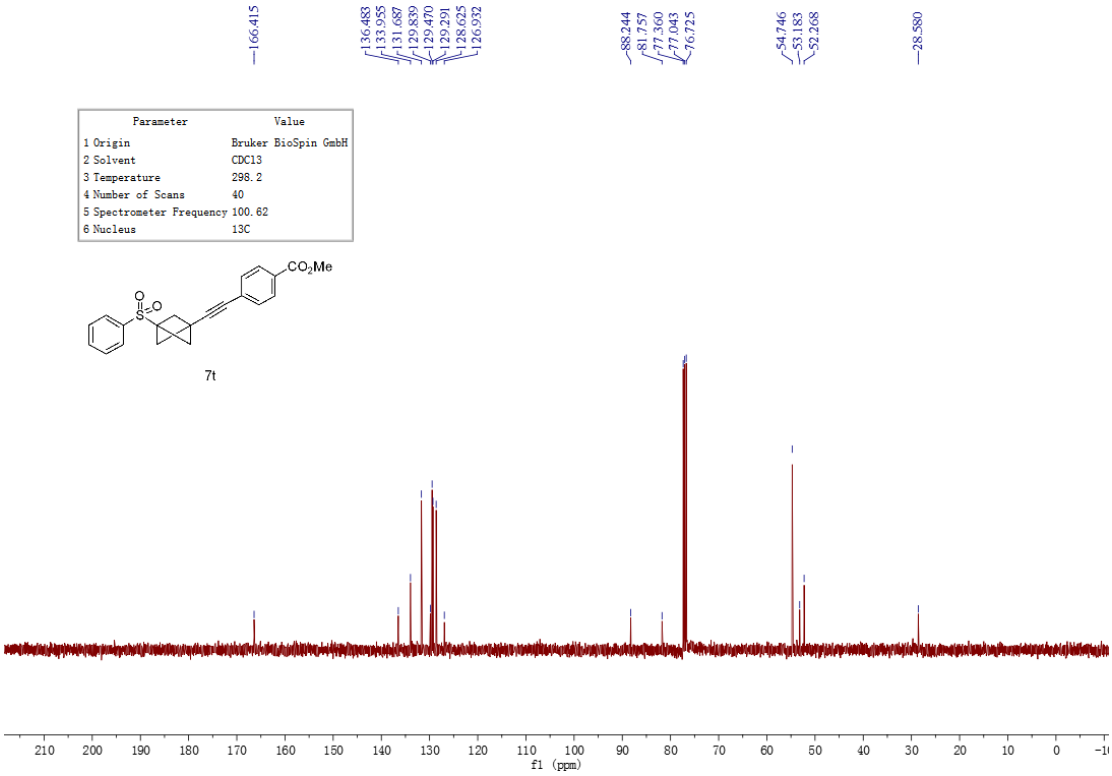
132.005
130.404
130.079
129.303
128.614
126.108
125.304
125.268
125.231
125.194
125.166
122.489
87.737
81.139
77.379
77.061
76.743
54.729
53.176
28.496
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.1
4 Number of Scans 80
5 Spectrometer Frequency 100.62
6 Nucleus 13C
CF3
O
S
O
7s
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)


-62.870
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.2
4 Number of Scans 2
5 Spectrometer Frequency 376.52
6 Nucleus 19F
CF3
O
S
O
7s
f1 (ppm)


7.954
7.933
7.875
7.856
7.680
7.661
7.603
7.583
7.564
7.426
7.406
7.260
3.894
2.379
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 295.8
4 Number of Scans 2
5 Spectrometer Frequency 400.13
6 Nucleus 1H
CO2Me
O
S
O
7t
2.12
1.99
1.13
2.11
2.08
3.12
6.00
f1 (ppm)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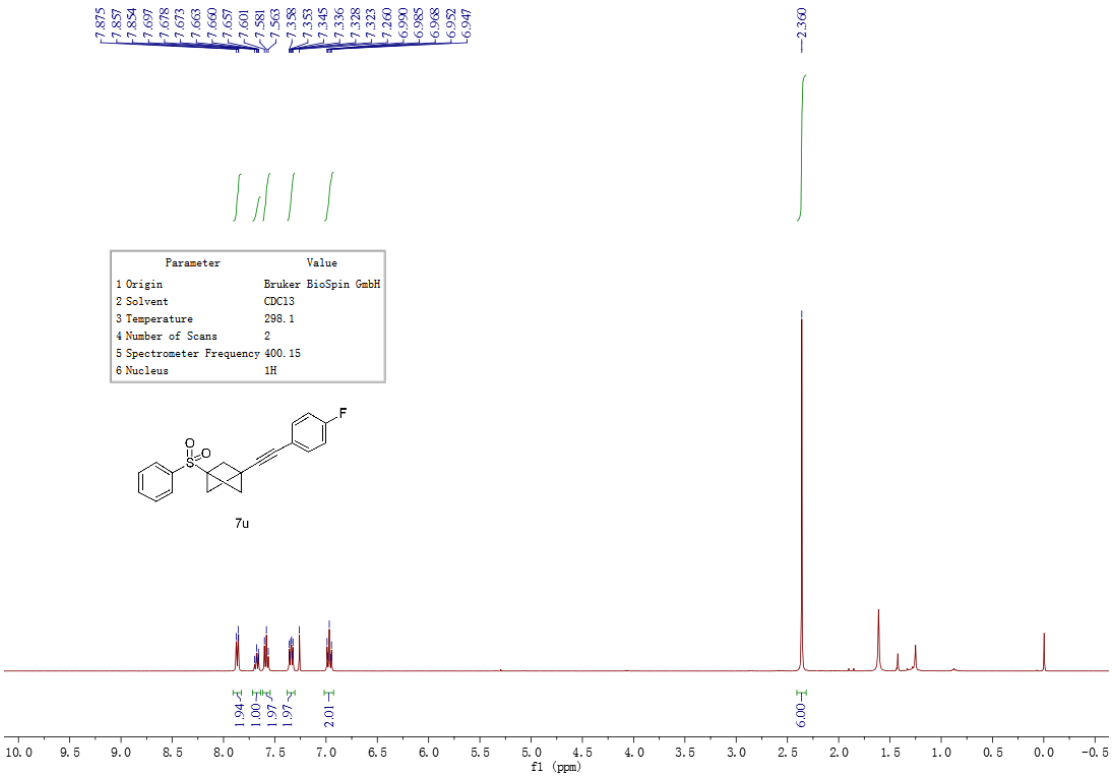
129.291
128.625
126.932
88.244
81.757
77.360
77.043
76.725
54.746
53.183
52.268
28.580
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.2
4 Number of Scans 40
5 Spectrometer Frequency 100.62
6 Nucleus 13C
CO2Me
7t
f1 (ppm)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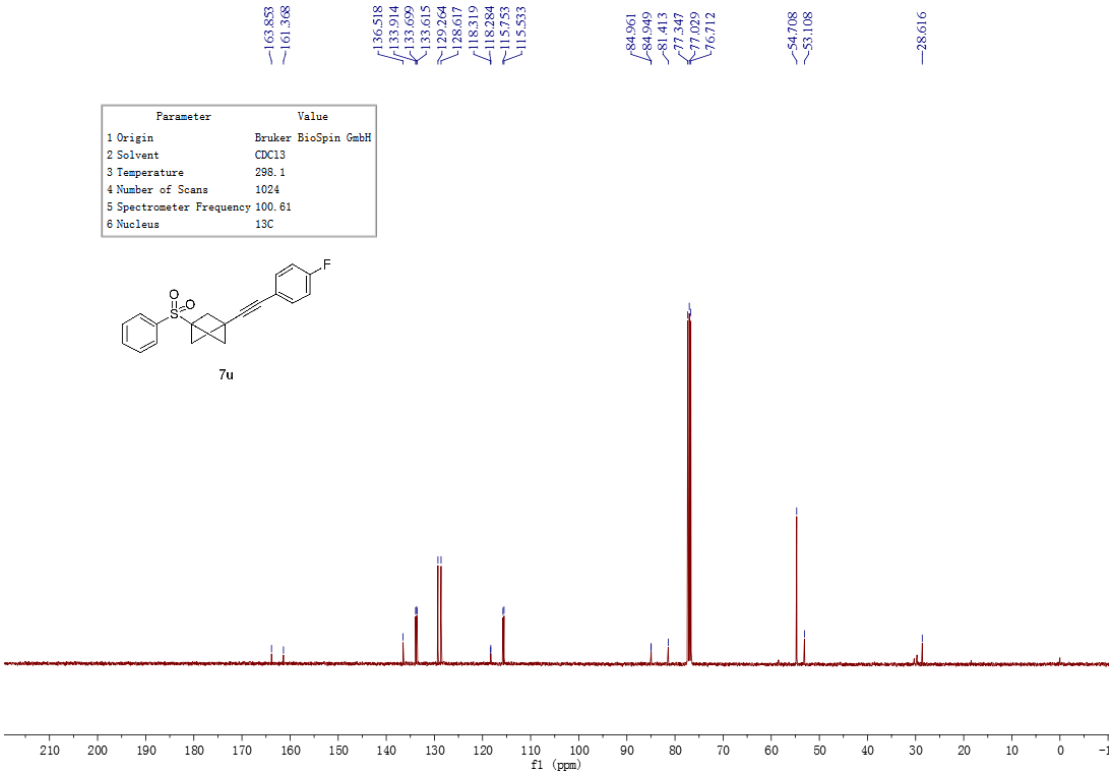
7.601
7.581
7.563
7.358
7.353
7.345
7.336
7.328
7.323
7.260
6.990
6.985
6.968
6.952
6.947
2.360
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.1
4 Number of Scans 2
5 Spectrometer Frequency 400.15
6 Nucleus 1H
F
7u
1.94
1.00
1.97
1.97
2.01
6.00
f1 (ppm)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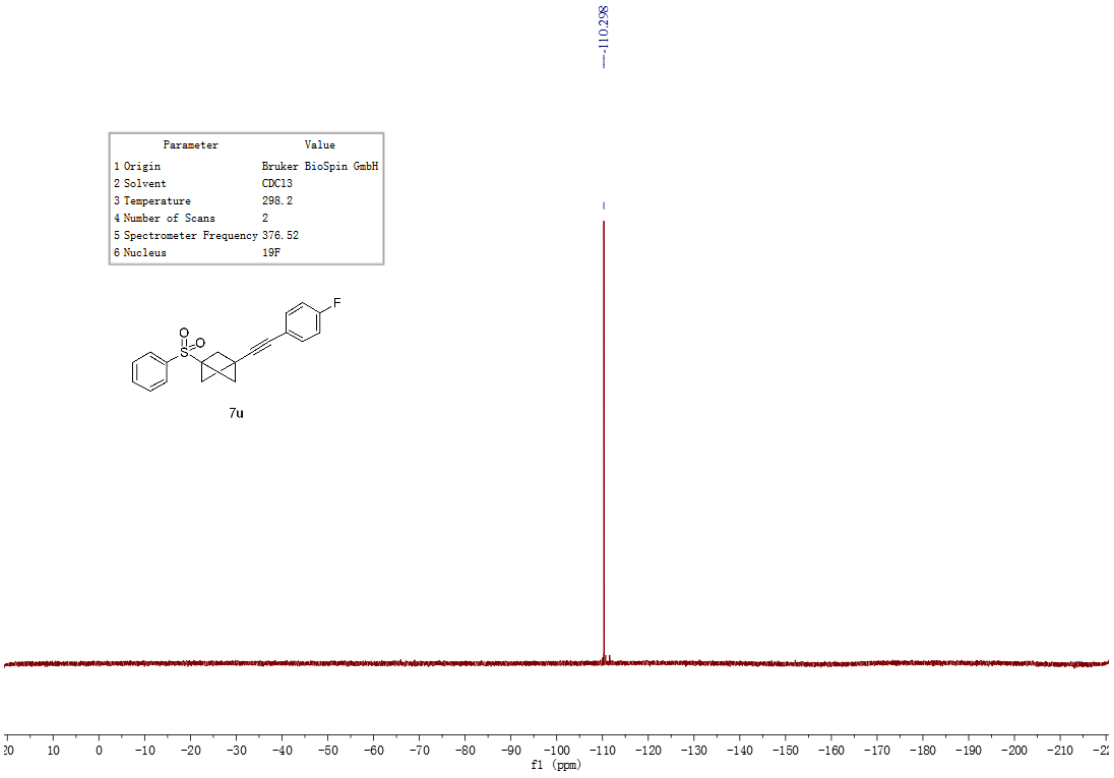
133.699
133.615
129.264
128.617
118.319
118.284
115.753
115.533
84.961
84.949
81.413
77.347
77.029
76.712
54.708
53.108
28.616
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.1
4 Number of Scans 1024
5 Spectrometer Frequency 100.61
6 Nucleus 13C
F
O
S
O
7u
f1 (ppm)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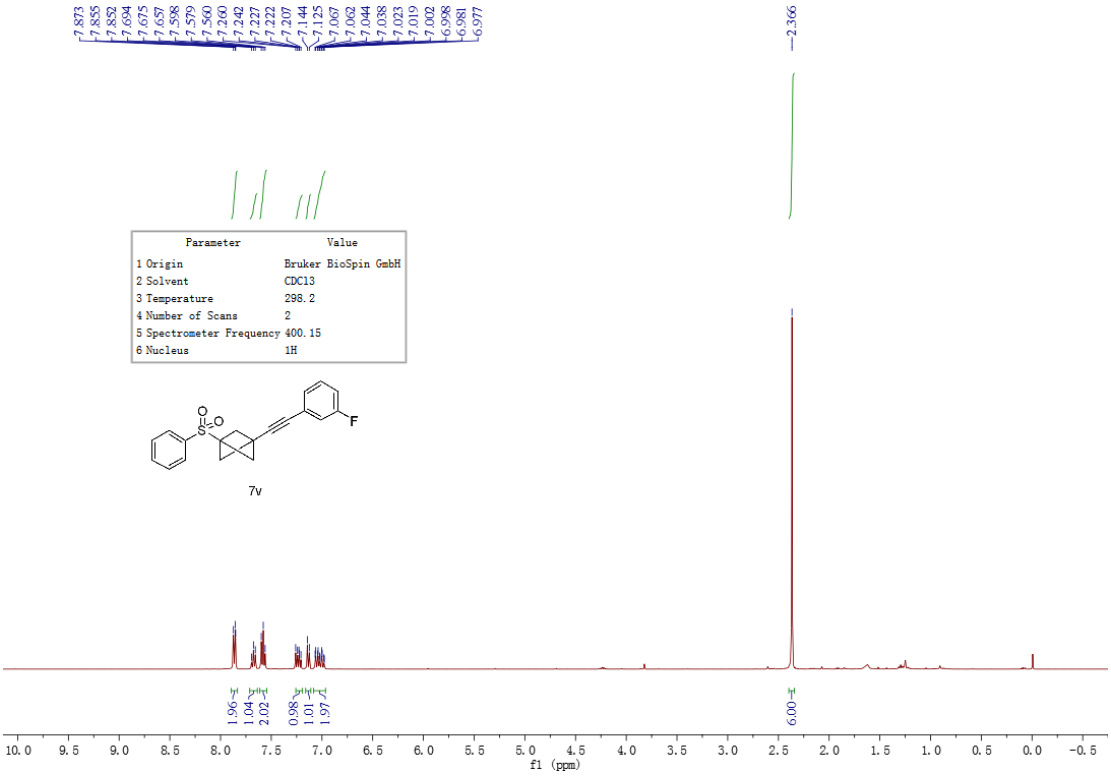
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.2
4 Number of Scans 2
5 Spectrometer Frequency 376.52
6 Nucleus 19F
F
O
S
O
7u
f1 (ppm)


7.873
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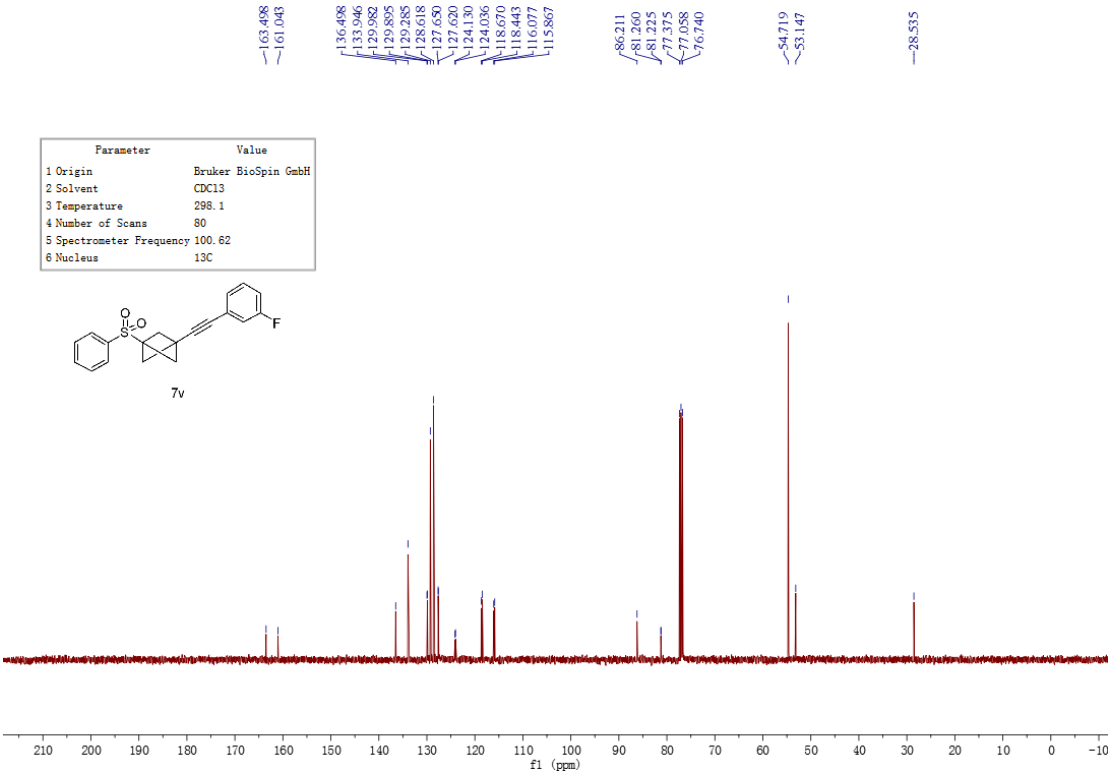
7.852
7.694
7.675
7.657
7.598
7.579
7.560
7.260
7.242
7.227
7.222
7.207
7.144
7.125
7.067
7.062
7.044
7.038
7.023
7.019
7.002
6.998
6.981
6.977
2.366
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.2
4 Number of Scans 2
5 Spectrometer Frequency 400.15
6 Nucleus 1H
O
S
O
F
7v
1.96
1.04
2.02
0.98
1.01
1.97
6.00
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)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161.043
136.498
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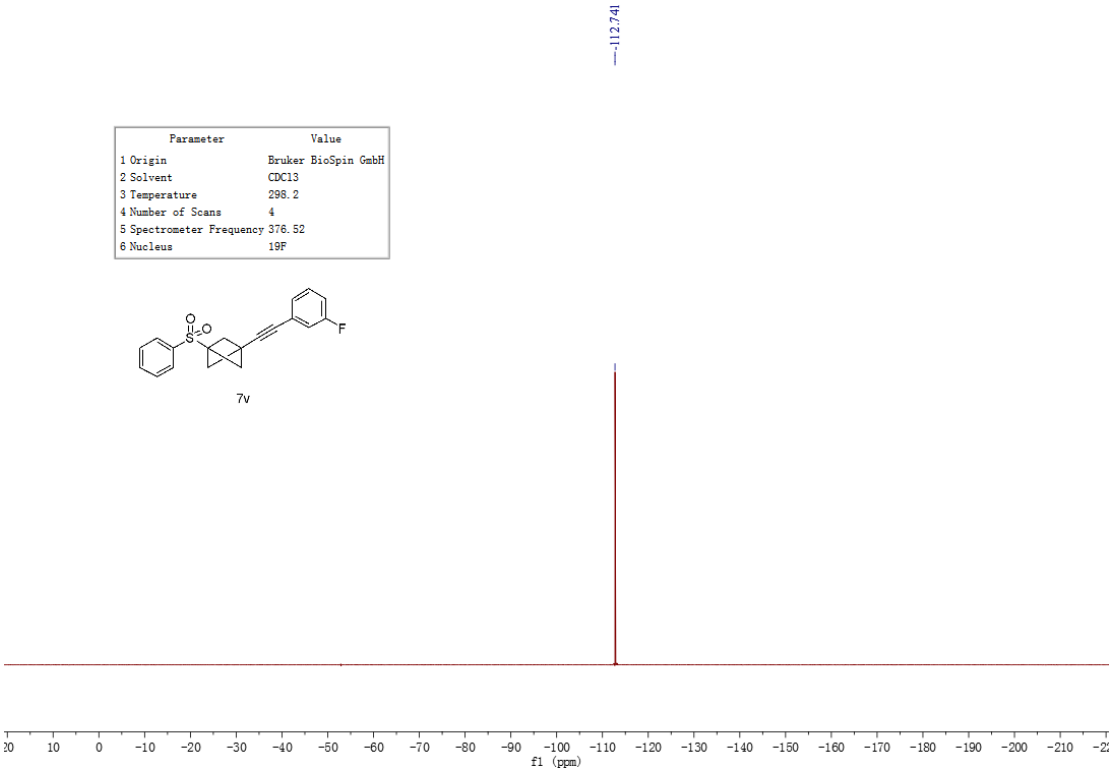
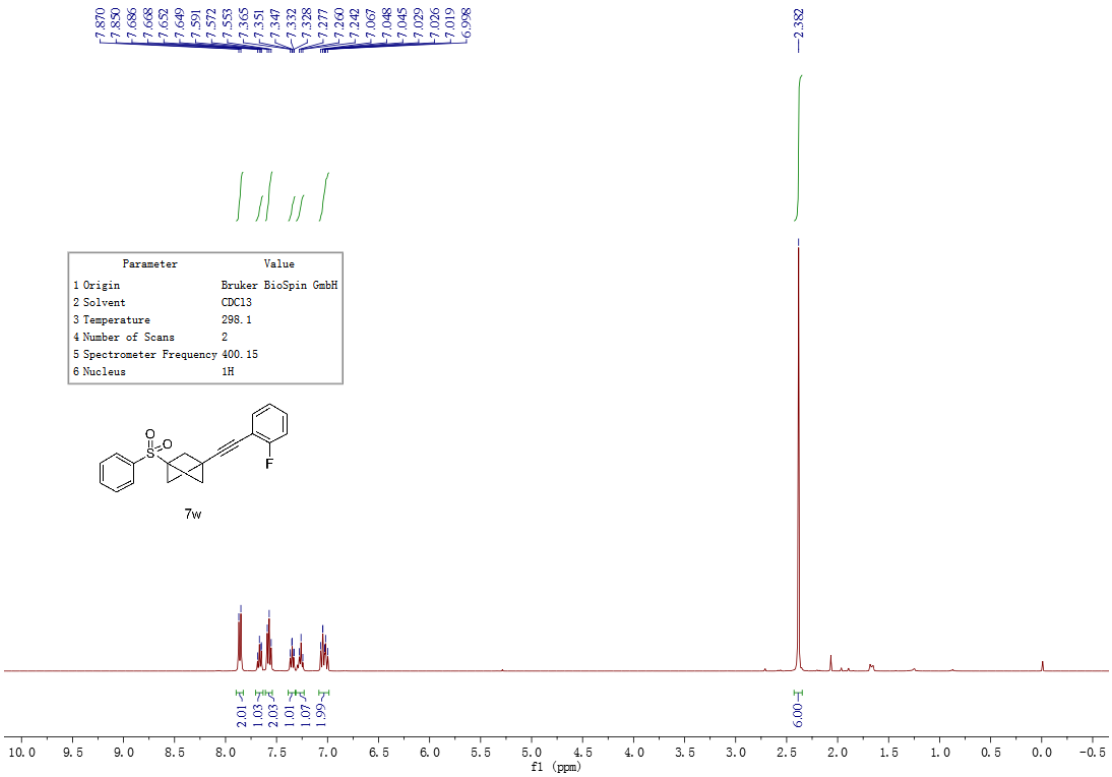
129.982
129.895
129.285
128.618
127.650
127.620
124.130
124.036
118.670
118.443
116.077
115.867
86.211
81.260
81.225
77.375
77.058
76.740
54.719
53.147
28.535
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.1
4 Number of Scans 80
5 Spectrometer Frequency 100.62
6 Nucleus 13C
O
S
O
F
7v
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)


-112.741
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.2
4 Number of Scans 4
5 Spectrometer Frequency 376.52
6 Nucleus 19F
O
S
O
F
7v
f1 (ppm)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7.649
7.591
7.572
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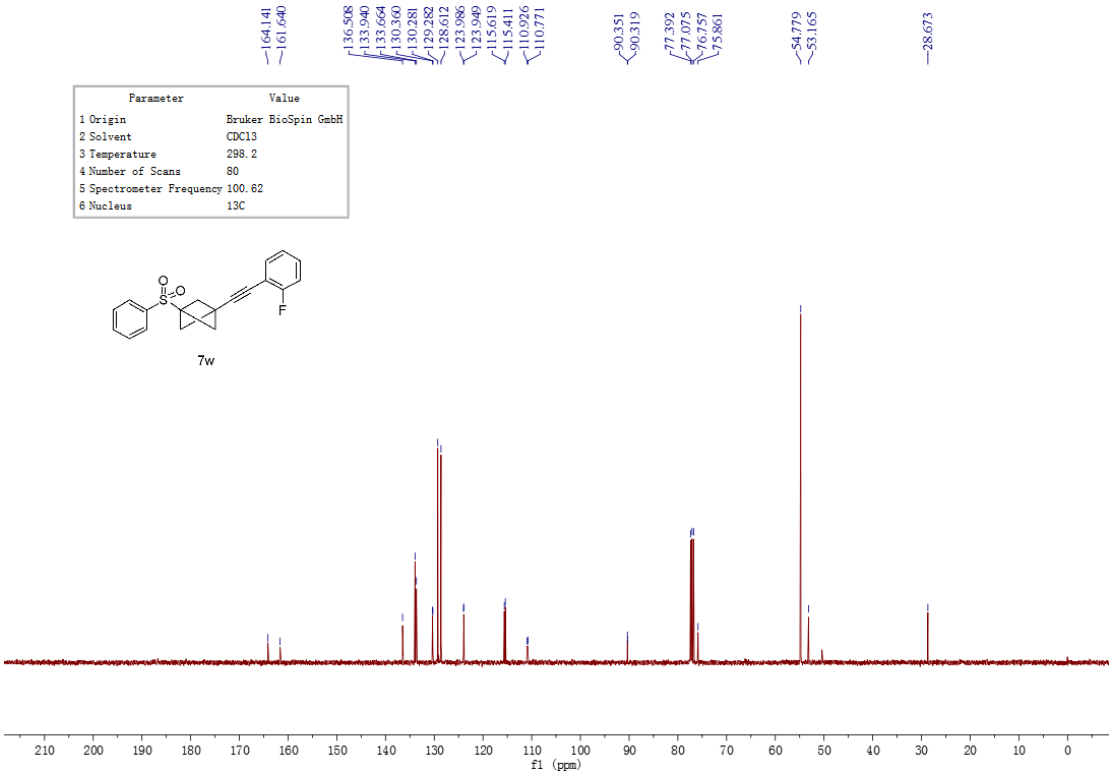
7.365
7.351
7.347
7.332
7.328
7.277
7.260
7.242
7.067
7.048
7.045
7.029
7.026
7.019
6.998
2.382
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.1
4 Number of Scans 2
5 Spectrometer Frequency 400.15
6 Nucleus 1H
O
S
O
F
7w
2.01
1.03
2.03
1.01
1.07
1.99
6.00
f1 (ppm)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129.282
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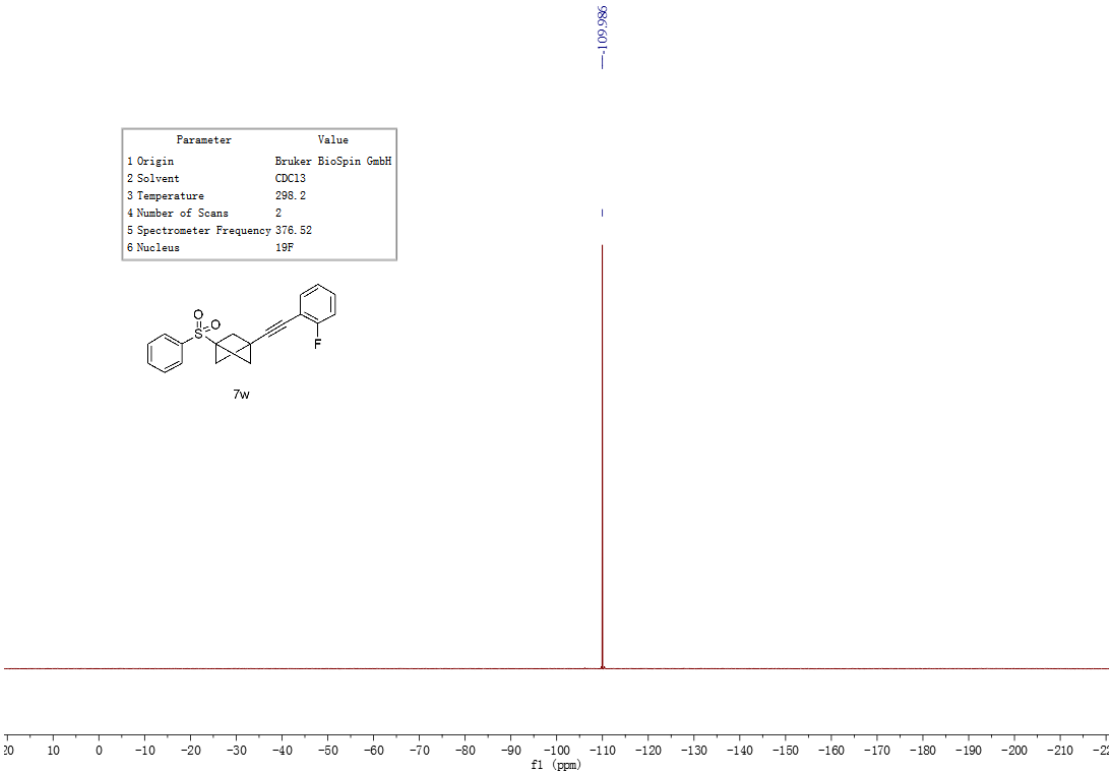
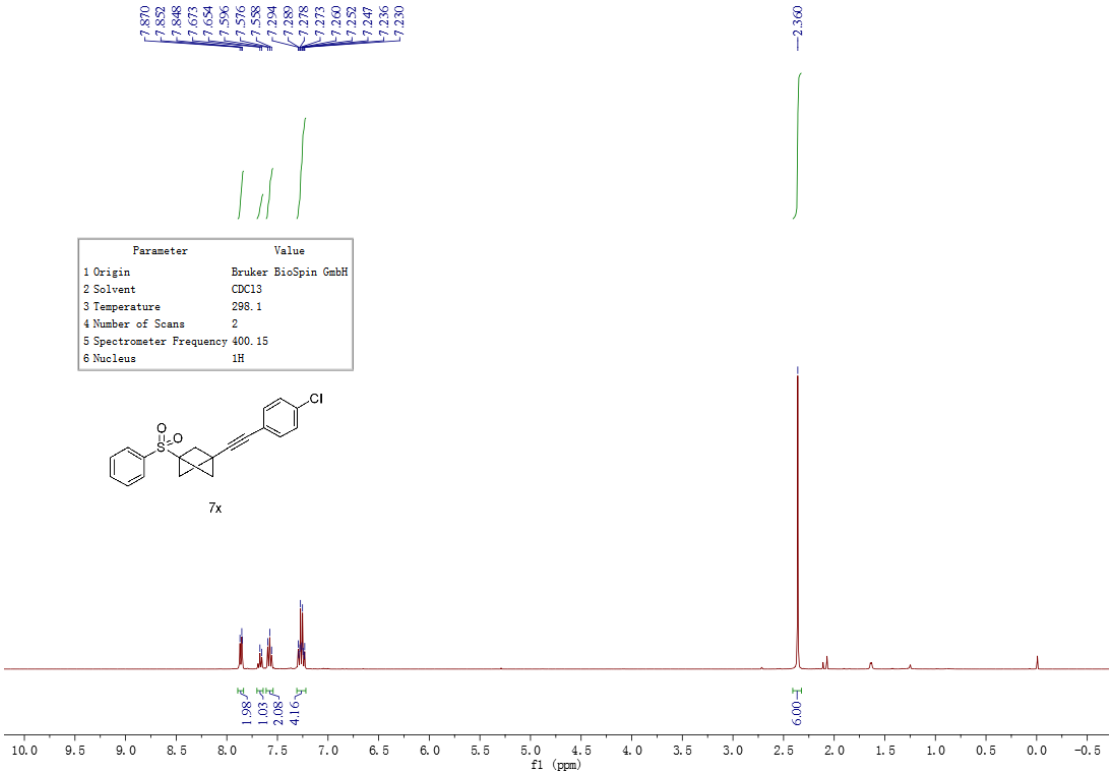
123.949
115.619
115.411
110.926
110.771
90.351
90.319
77.392
77.075
76.757
75.861
54.779
53.165
28.673
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.2
4 Number of Scans 80
5 Spectrometer Frequency 100.62
6 Nucleus 13C
O
S
O
F
7w
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)


109.986
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.2
4 Number of Scans 2
5 Spectrometer Frequency 376.52
6 Nucleus 19F
O
S
O
F
7w
20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210
f1 (ppm)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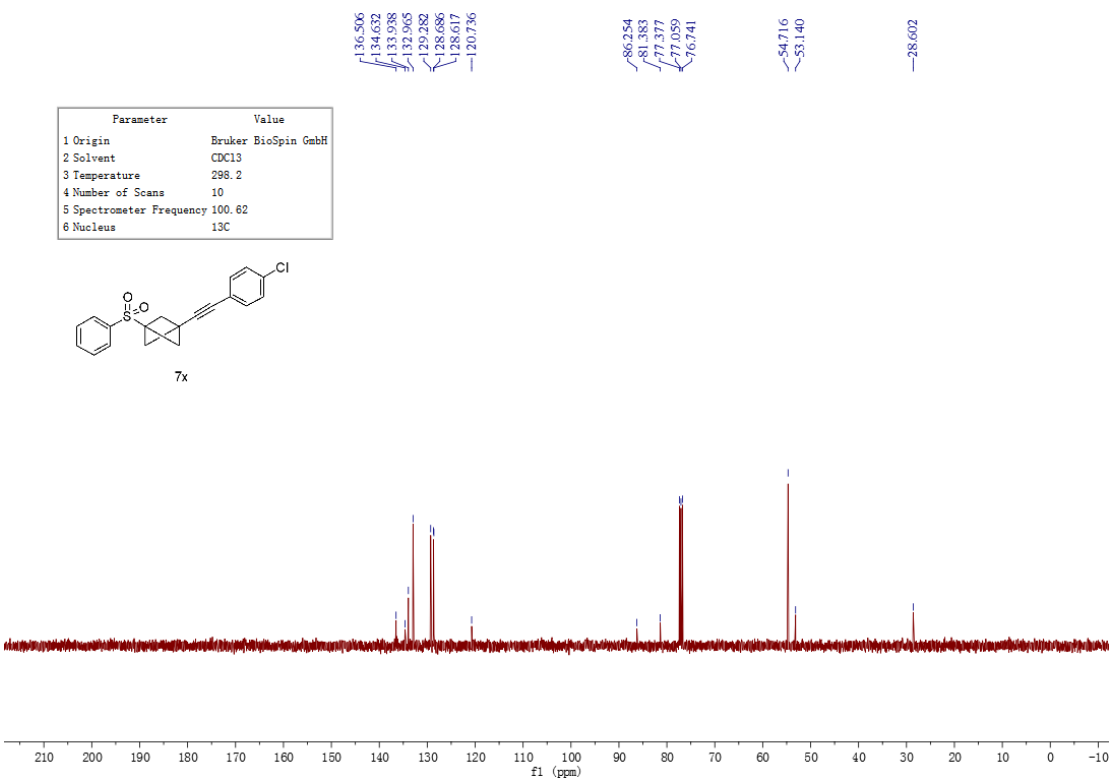
7.654
7.596
7.576
7.538
7.294
7.289
7.278
7.273
7.260
7.252
7.247
7.236
7.230
2.360
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.1
4 Number of Scans 2
5 Spectrometer Frequency 400.15
6 Nucleus 1H
Cl
7x
1.98
1.03
2.08
4.16
6.00
f1 (ppm)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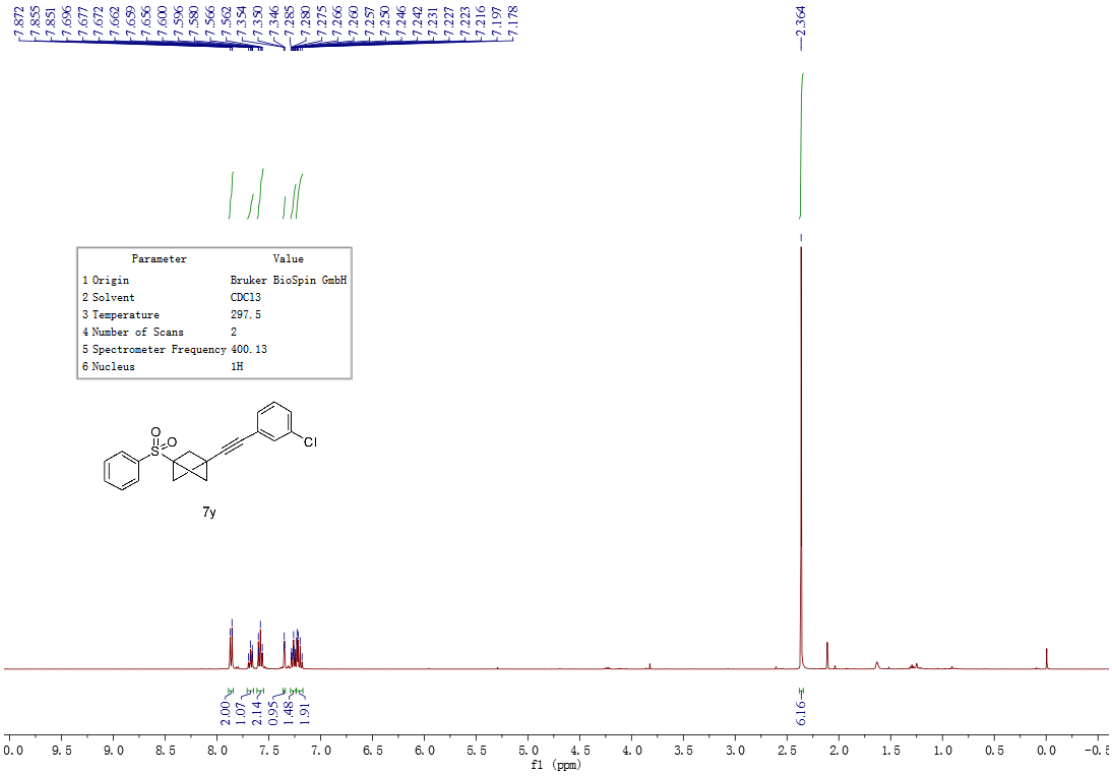
128.686
128.617
120.736
86.254
81.383
77.377
77.059
76.741
54.716
53.140
28.602
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.2
4 Number of Scans 10
5 Spectrometer Frequency 100.62
6 Nucleus 13C
Cl
7x
f1 (ppm)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7.596
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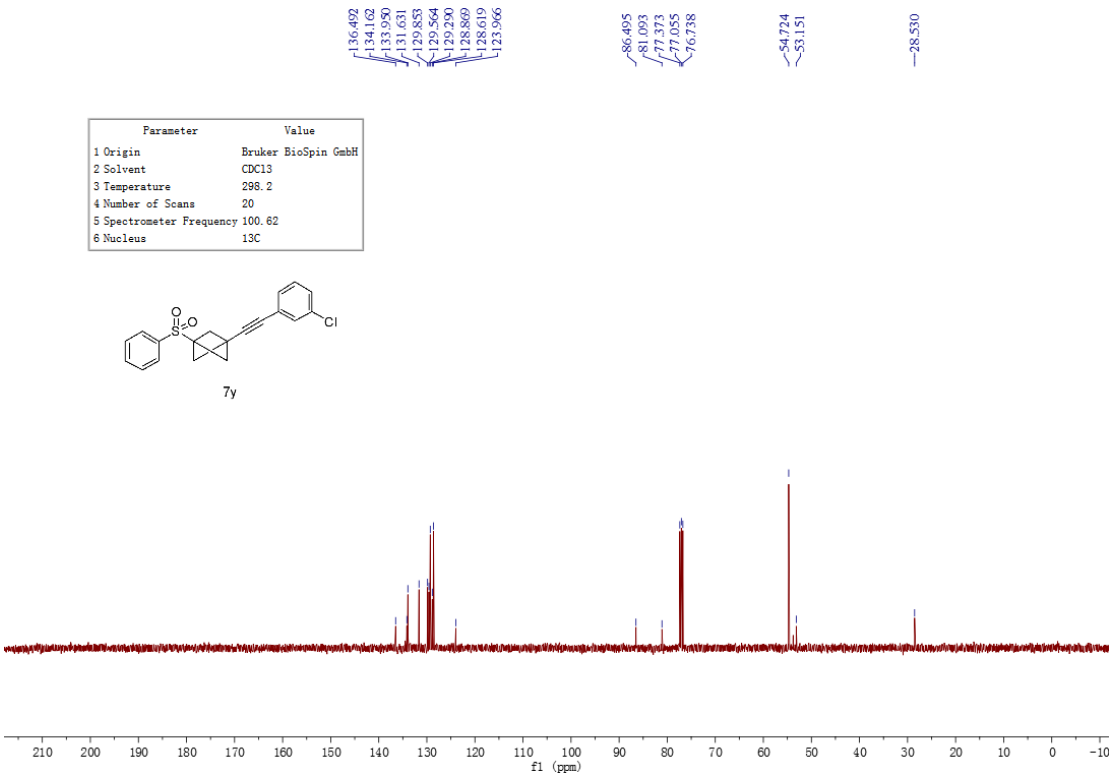
7.566
7.562
7.354
7.350
7.346
7.285
7.280
7.275
7.266
7.260
7.257
7.250
7.246
7.242
7.231
7.227
7.223
7.216
7.197
7.178
2.364
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 297.5
4 Number of Scans 2
5 Spectrometer Frequency 400.13
6 Nucleus 1H
Cl
7y
2.00
1.07
2.14
0.95
1.48
1.91
6.16
f1 (ppm)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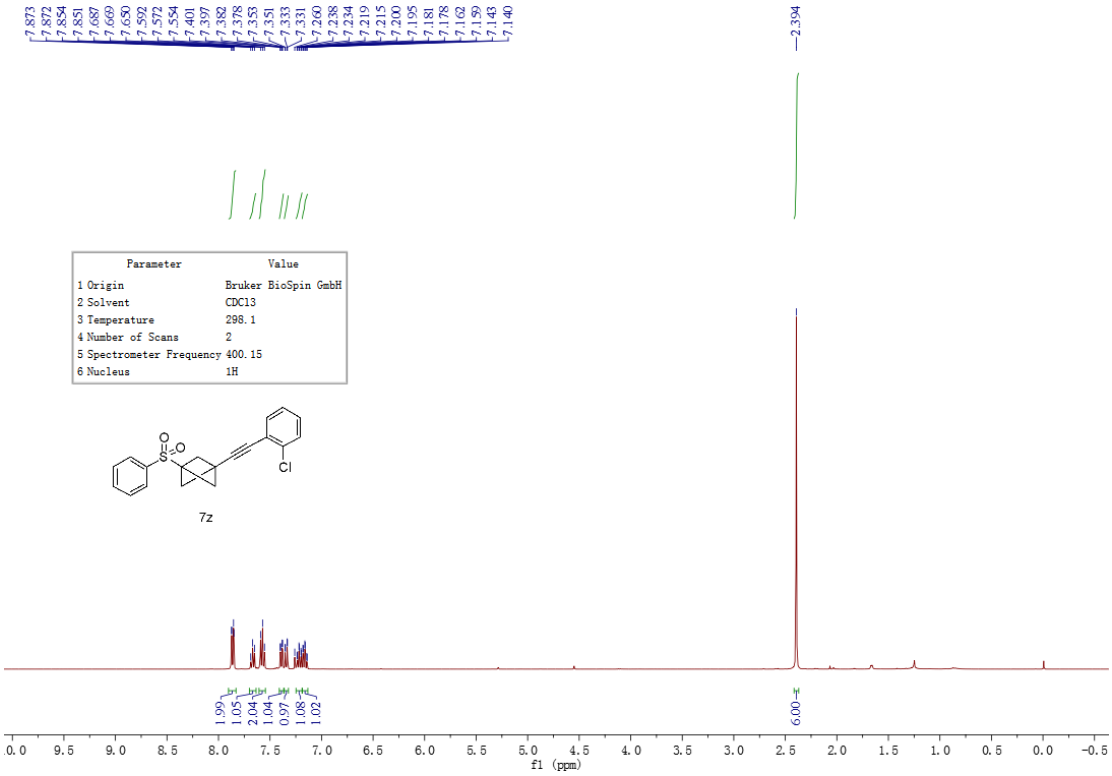
128.869
128.619
123.966
86.495
81.093
77.373
77.055
76.738
54.724
53.151
28.530
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.2
4 Number of Scans 20
5 Spectrometer Frequency 100.62
6 Nucleus 13C
Cl
7y
f1 (ppm)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7.592
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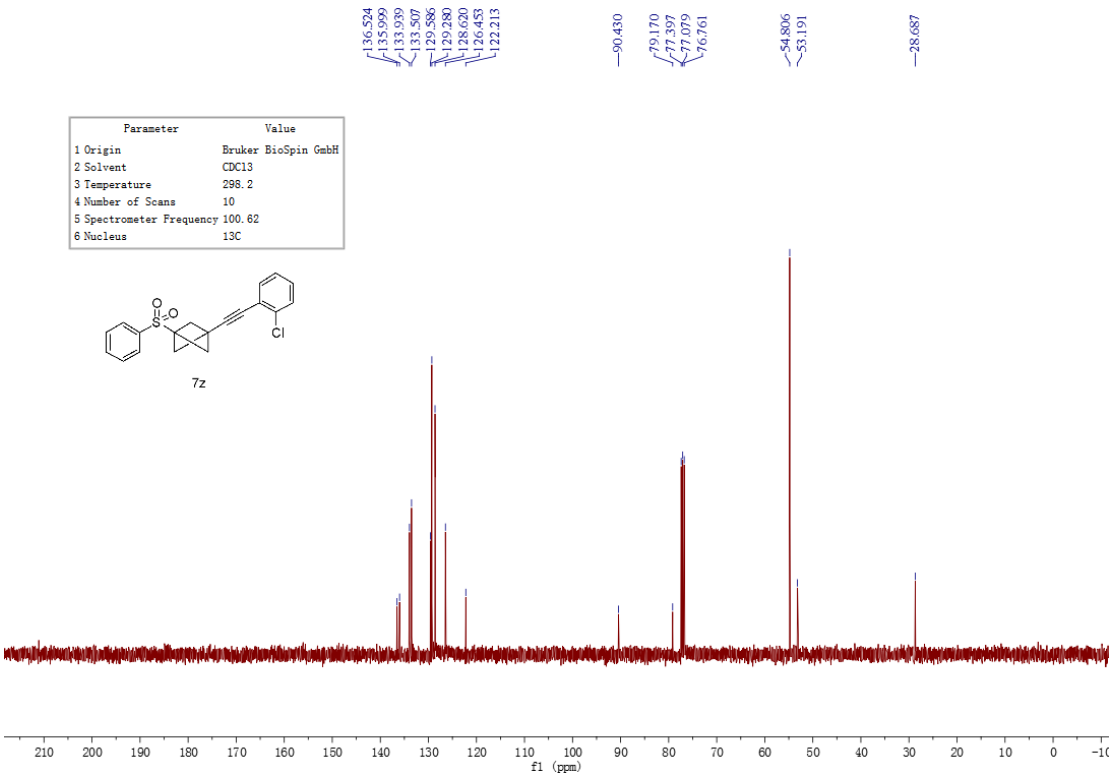
7.397
7.382
7.378
7.353
7.351
7.333
7.331
7.260
7.238
7.234
7.219
7.215
7.200
7.195
7.181
7.178
7.162
7.159
7.143
7.140
2.394
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.1
4 Number of Scans 2
5 Spectrometer Frequency 400.15
6 Nucleus 1H
O
S
O
Cl
7z
1.99
1.05
2.04
1.04
0.97
1.08
1.02
6.00
f1 (ppm)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126.453
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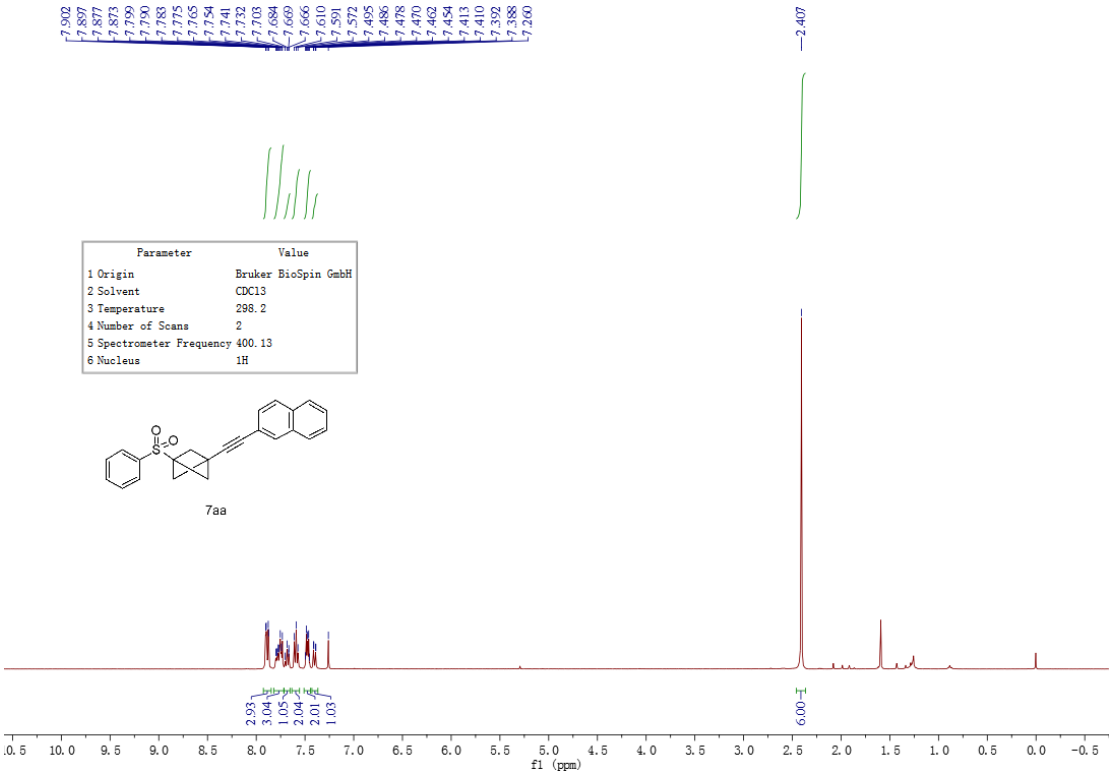
90.430
79.170
77.397
77.079
76.761
54.806
53.191
28.687
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.2
4 Number of Scans 10
5 Spectrometer Frequency 100.62
6 Nucleus 13C
O
S
O
Cl
7z
f1 (ppm)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7.684
7.669
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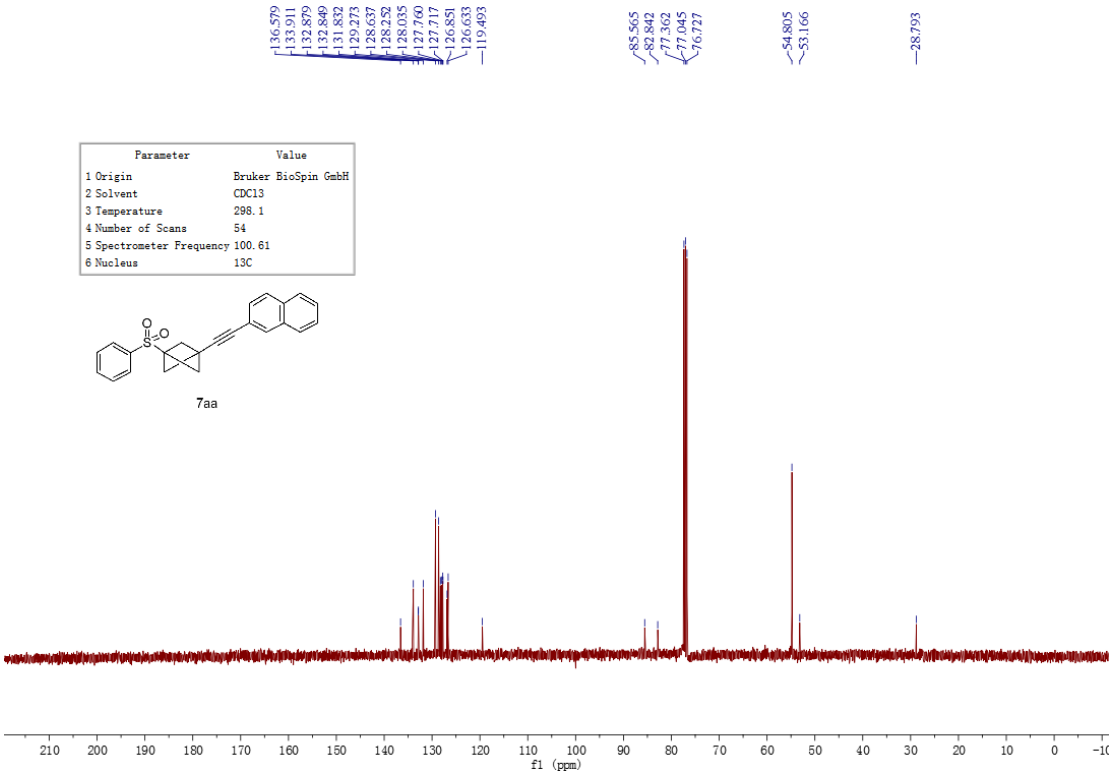
7.610
7.591
7.572
7.495
7.486
7.478
7.470
7.462
7.454
7.413
7.410
7.392
7.388
7.260
2.407
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.2
4 Number of Scans 2
5 Spectrometer Frequency 400.13
6 Nucleus 1H
7aa
2.93
3.04
1.05
2.04
2.01
1.03
6.00
f1 (ppm)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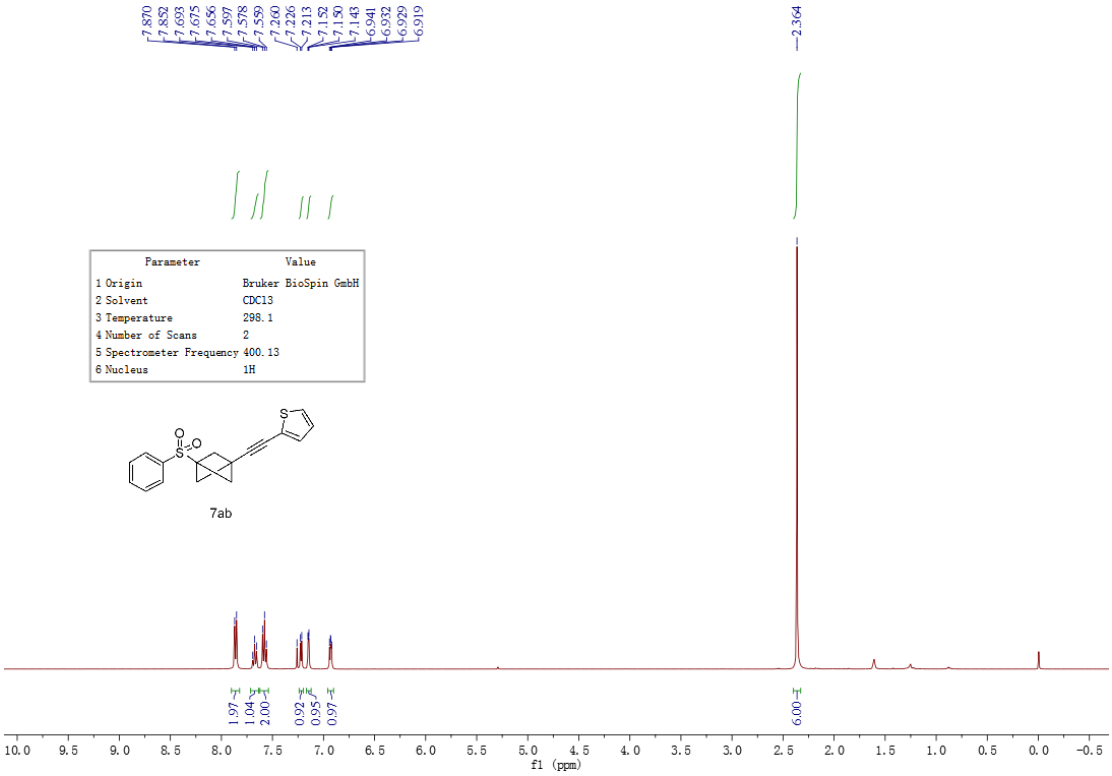
126.633
119.493
85.565
82.842
77.362
77.045
76.727
54.805
53.166
28.793
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.1
4 Number of Scans 54
5 Spectrometer Frequency 100.61
6 Nucleus 13C
7aa
f1 (ppm)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7.213
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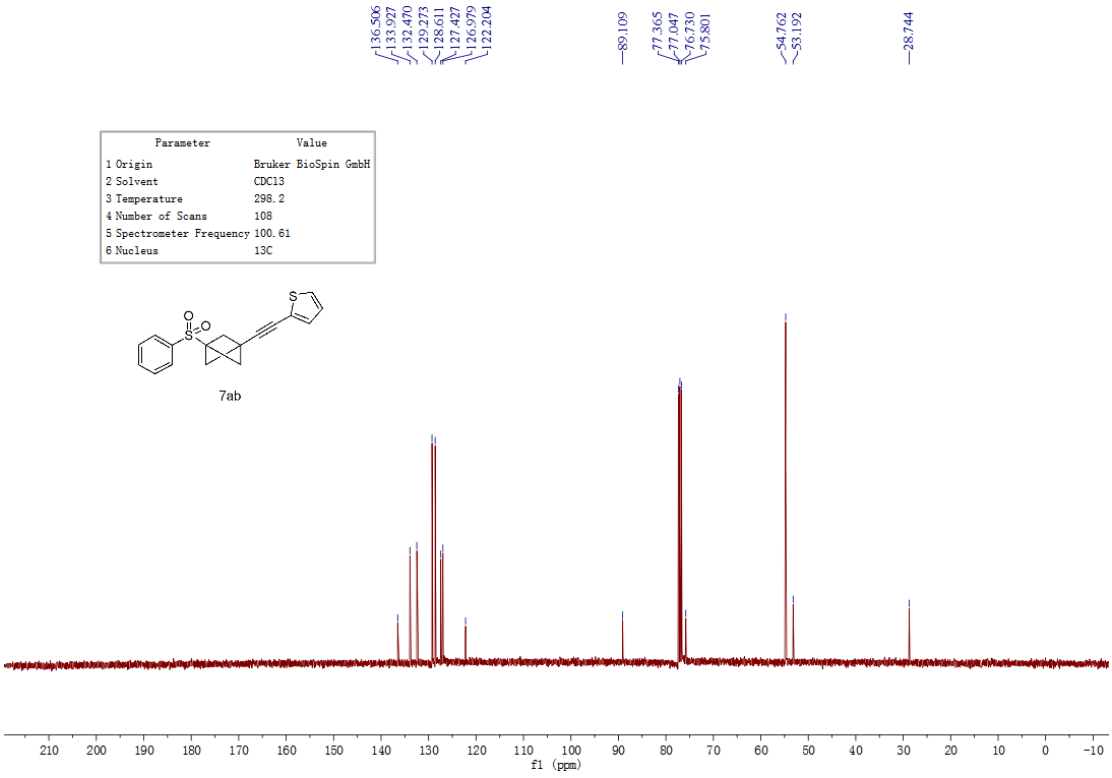
7.130
7.143
6.941
6.932
6.929
6.919
2.364
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.1
4 Number of Scans 2
5 Spectrometer Frequency 400.13
6 Nucleus 1H
7ab
1.97
1.04
2.00
0.92
0.95
0.97
6.00
f1 (ppm)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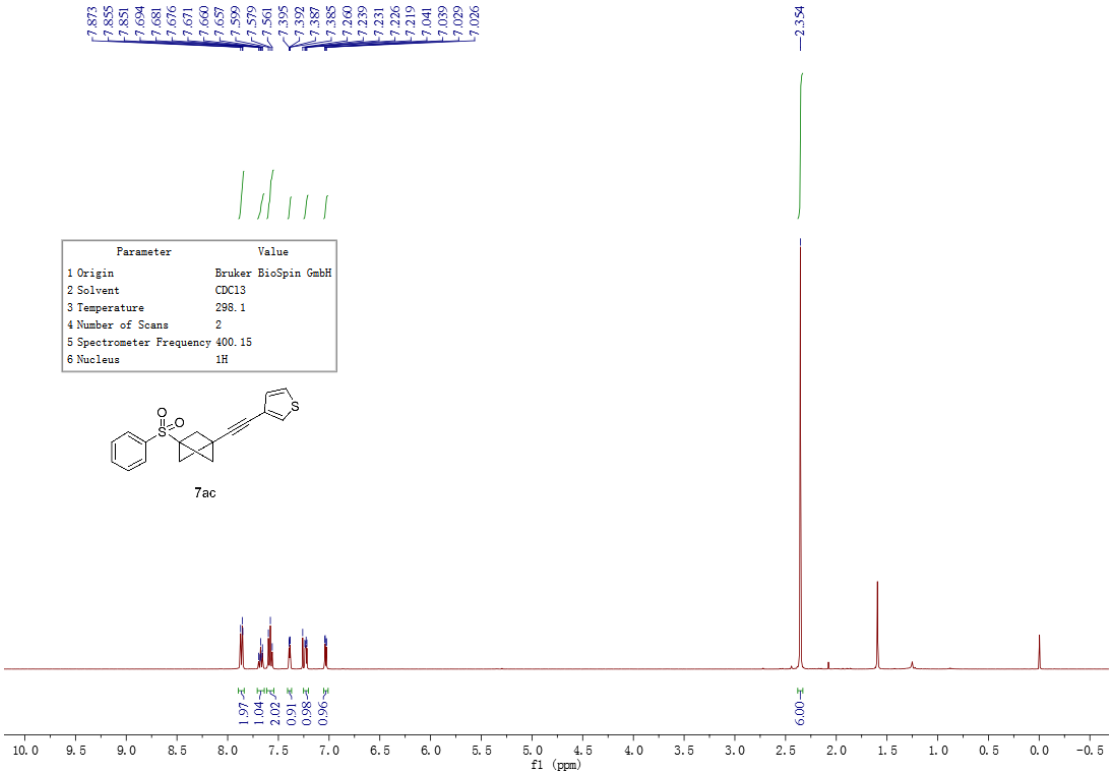
127.427
126.979
122.204
89.109
77.365
77.047
76.730
75.801
54.762
53.192
28.744
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.2
4 Number of Scans 108
5 Spectrometer Frequency 100.61
6 Nucleus 13C
7ab
f1 (ppm)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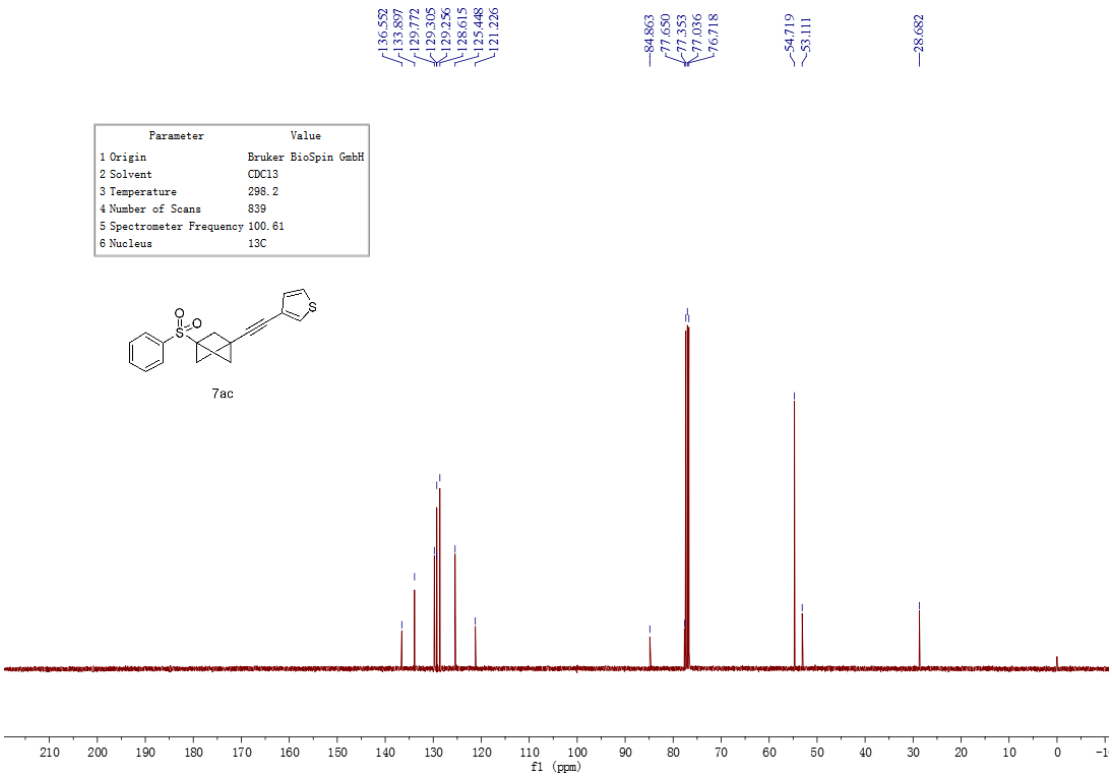
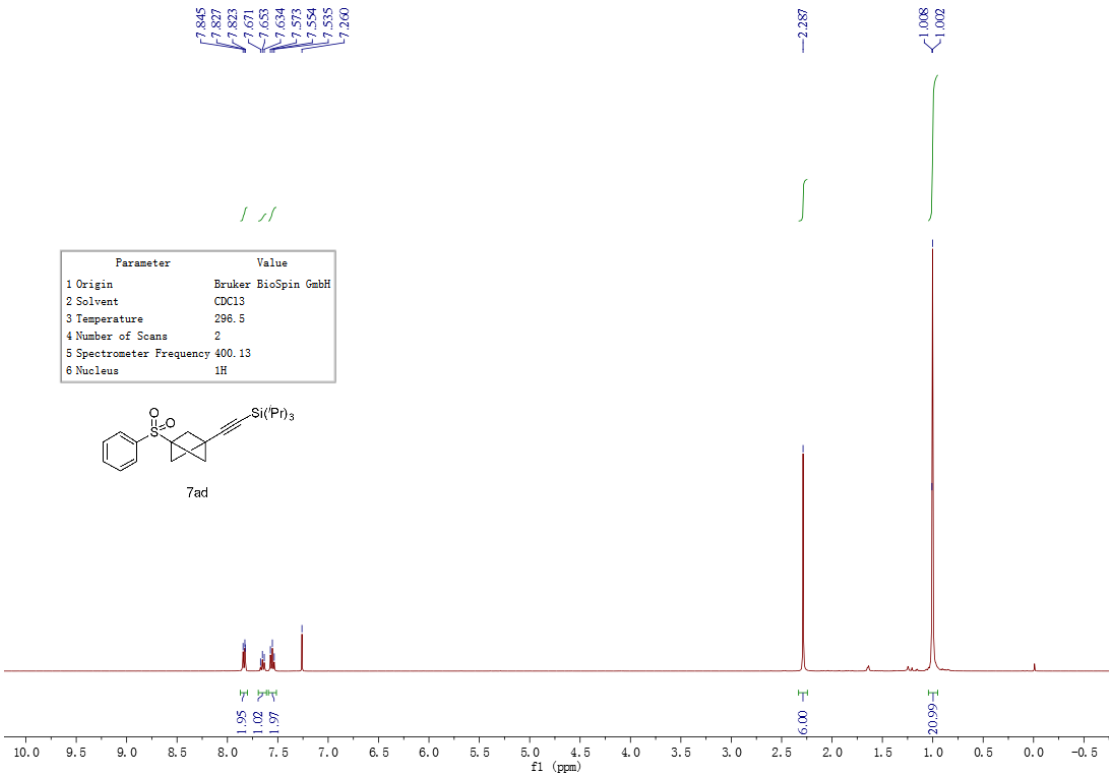
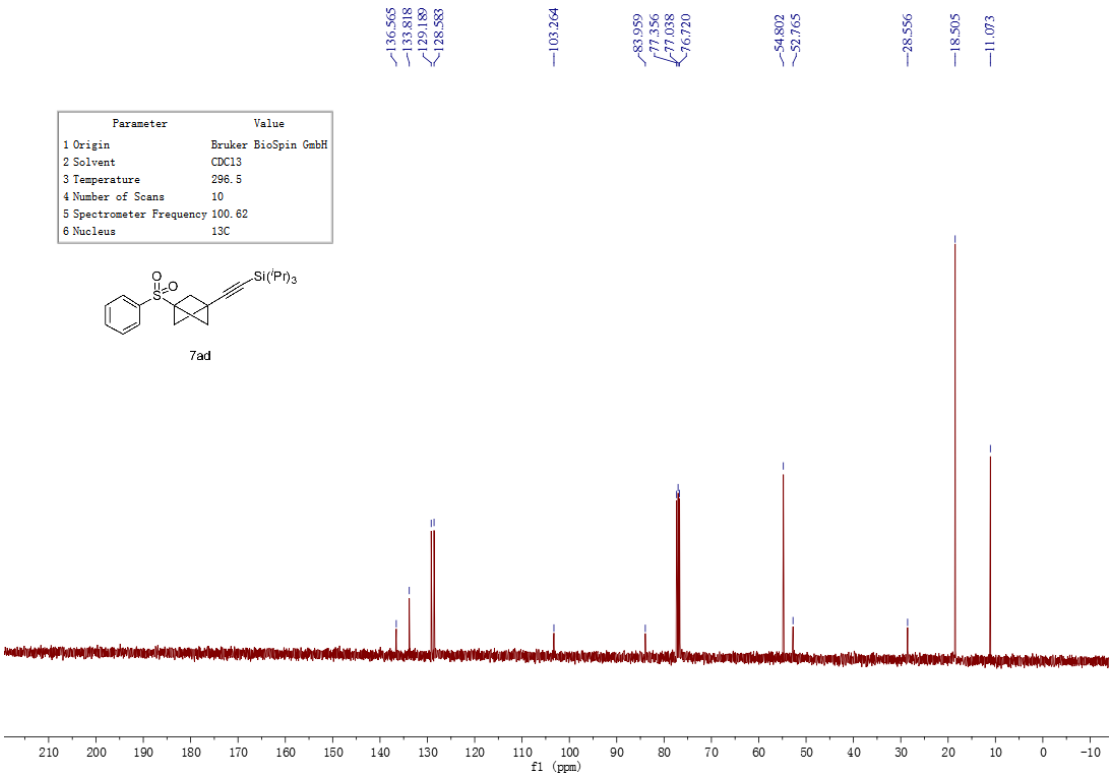
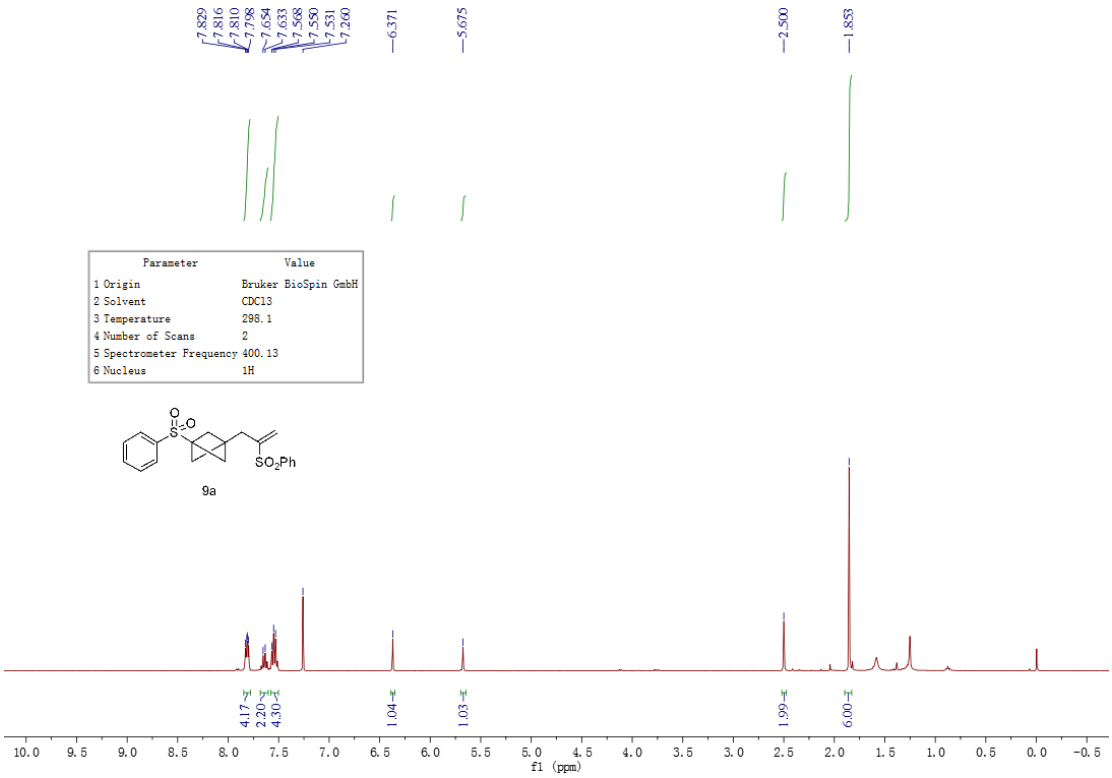
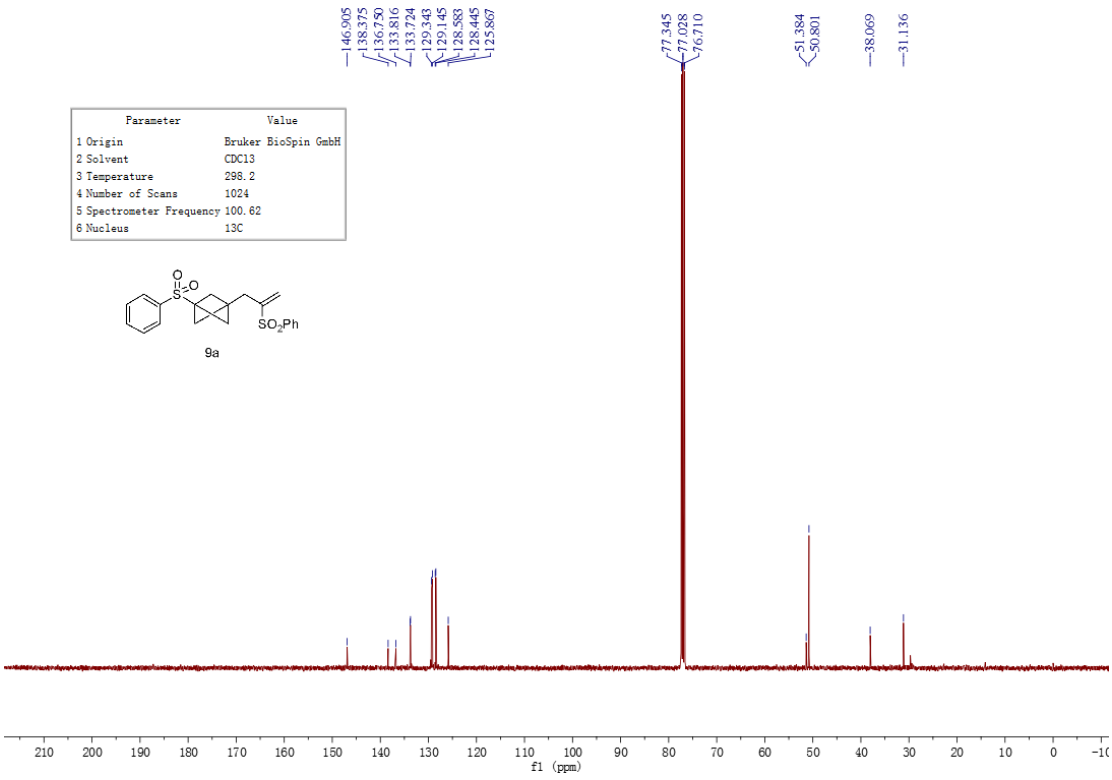
7.392
7.387
7.385
7.260
7.239
7.231
7.226
7.219
7.041
7.039
7.029
7.026
2.354
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.1
4 Number of Scans 2
5 Spectrometer Frequency 400.15
6 Nucleus 1H
7ac
1.97
1.04
2.02
0.91
0.98
0.96
6.00
f1 (ppm)

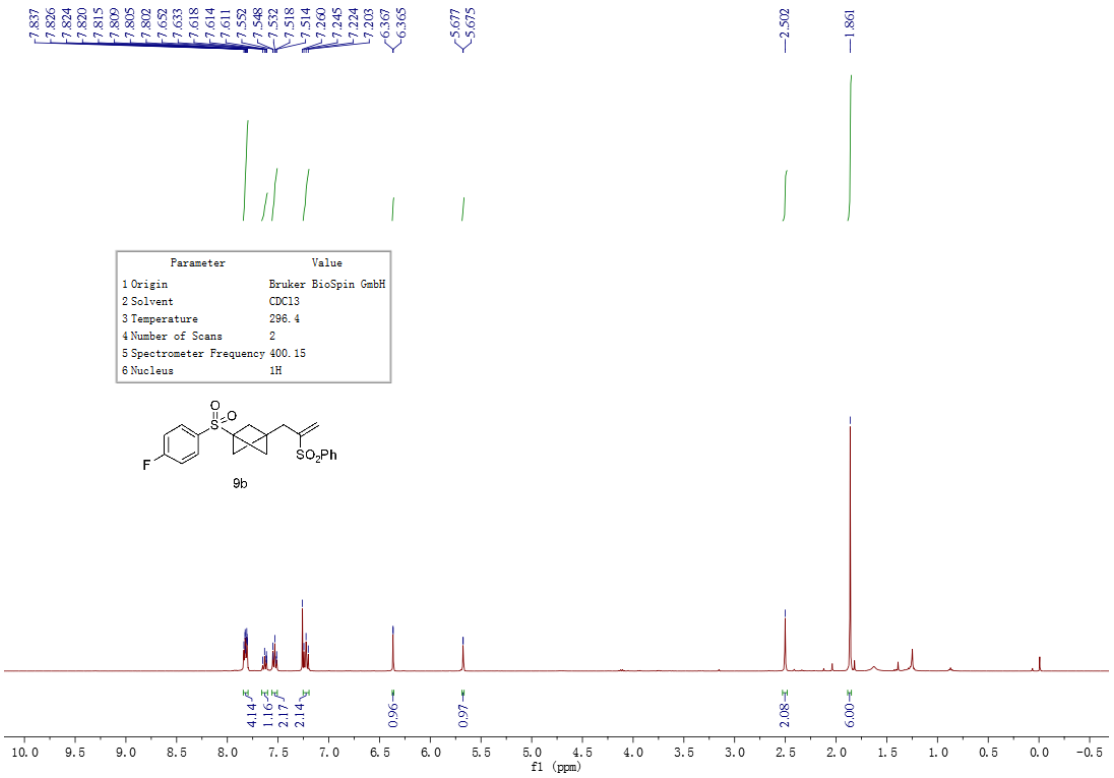

136.552
133.897
129.772
129.305
129.256
128.615
125.448
121.226
84.863
77.650
77.353
77.036
76.718
54.719
53.111
28.682
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.2
4 Number of Scans 839
5 Spectrometer Frequency 100.61
6 Nucleus 13C
7ac
f1 (ppm)

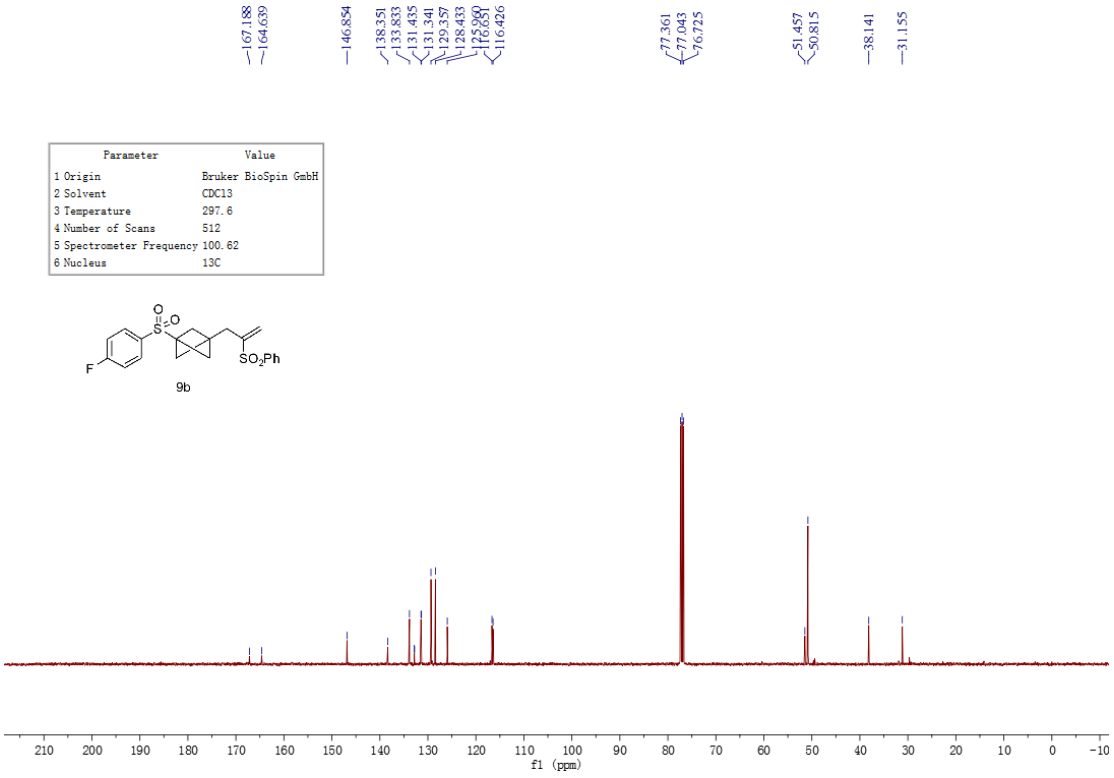

7.845
7.827
7.823
7.671
7.653
7.634
7.573
7.554
7.535
7.260
2.287
1.008
1.002
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 296.5
4 Number of Scans 2
5 Spectrometer Frequency 400.13
6 Nucleus 1H
Si(iPr)3
7ad
1.95
1.02
1.97
6.00
20.99
f1 (ppm)

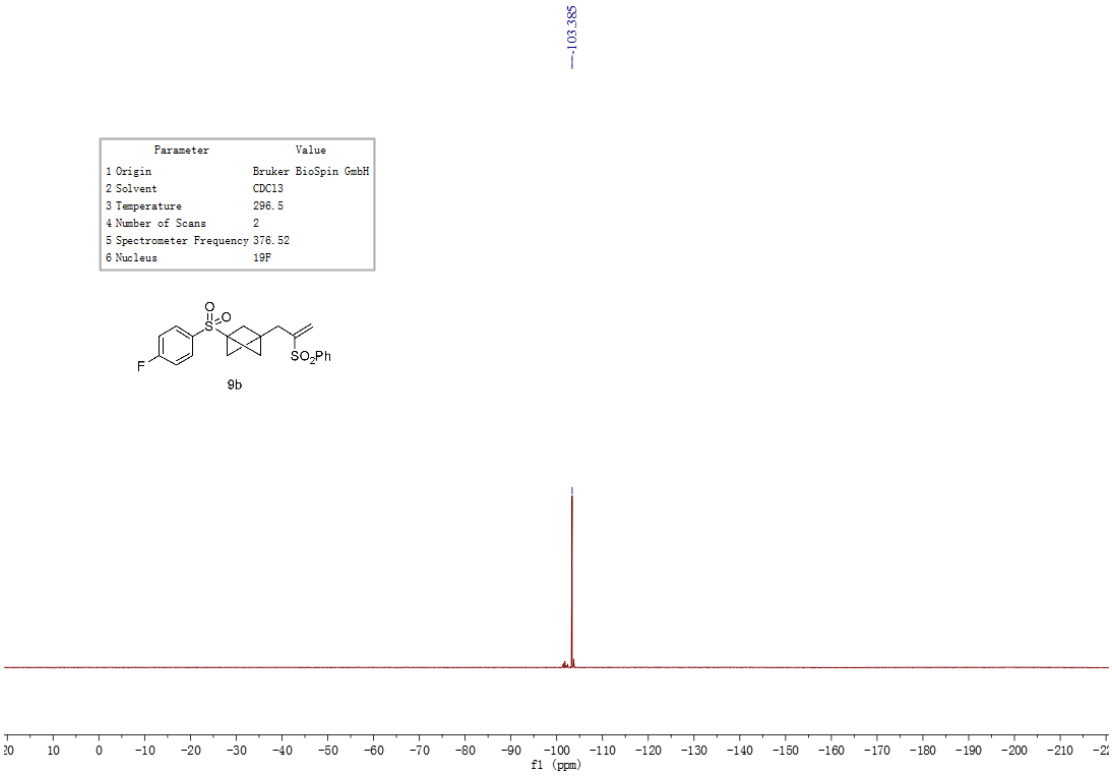

136.565
133.818
129.189
128.583
103.264
83.959
77.356
77.038
76.720
54.802
52.765
28.556
18.505
11.073
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 296.5
4 Number of Scans 10
5 Spectrometer Frequency 100.62
6 Nucleus 13C
Si(iPr)3
7ad
f1 (ppm)

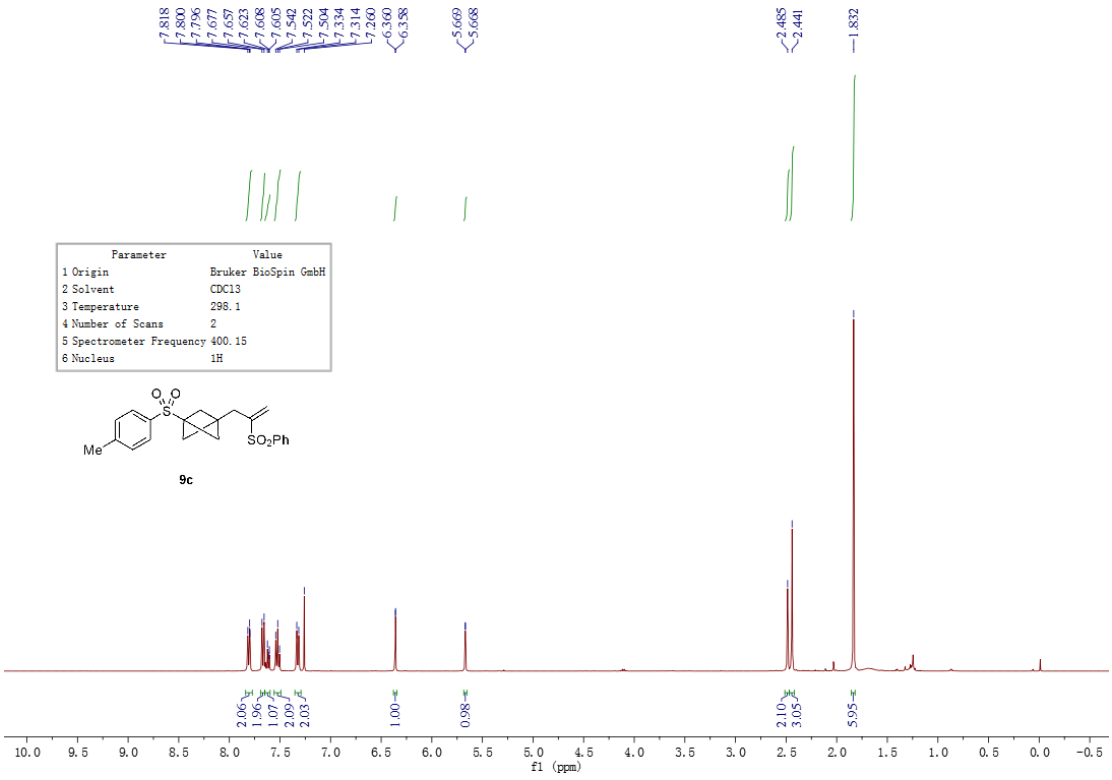

7.829
7.816
7.810
7.798
7.654
7.633
7.568
7.550
7.531
7.260
6.371
5.675
2.500
1.853
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.1
4 Number of Scans 2
5 Spectrometer Frequency 400.13
6 Nucleus 1H
SO2Ph
9a
4.17
2.20
4.30
1.04
1.03
1.99
6.00
f1 (ppm)

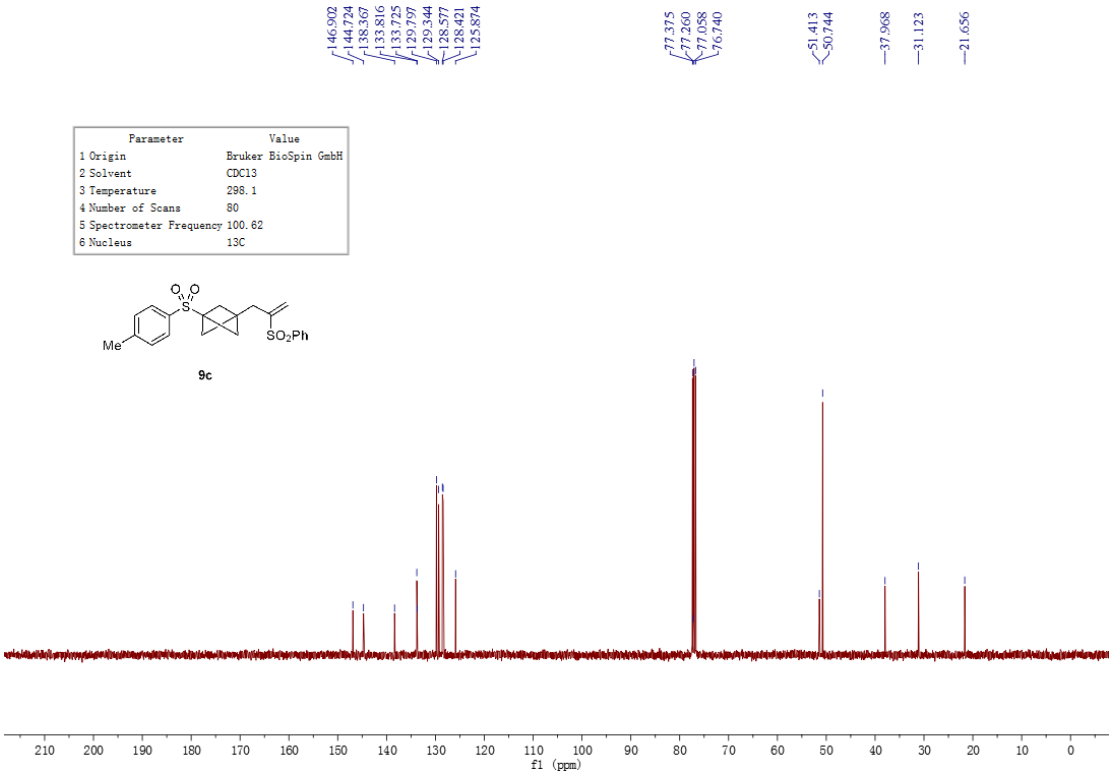

146.905
138.375
136.750
133.816
133.724
129.343
129.145
128.583
128.445
125.867
77.345
77.028
76.710
51.384
50.801
38.069
31.136
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.2
4 Number of Scans 1024
5 Spectrometer Frequency 100.62
6 Nucleus 13C
SO2Ph
9a
f1 (ppm)

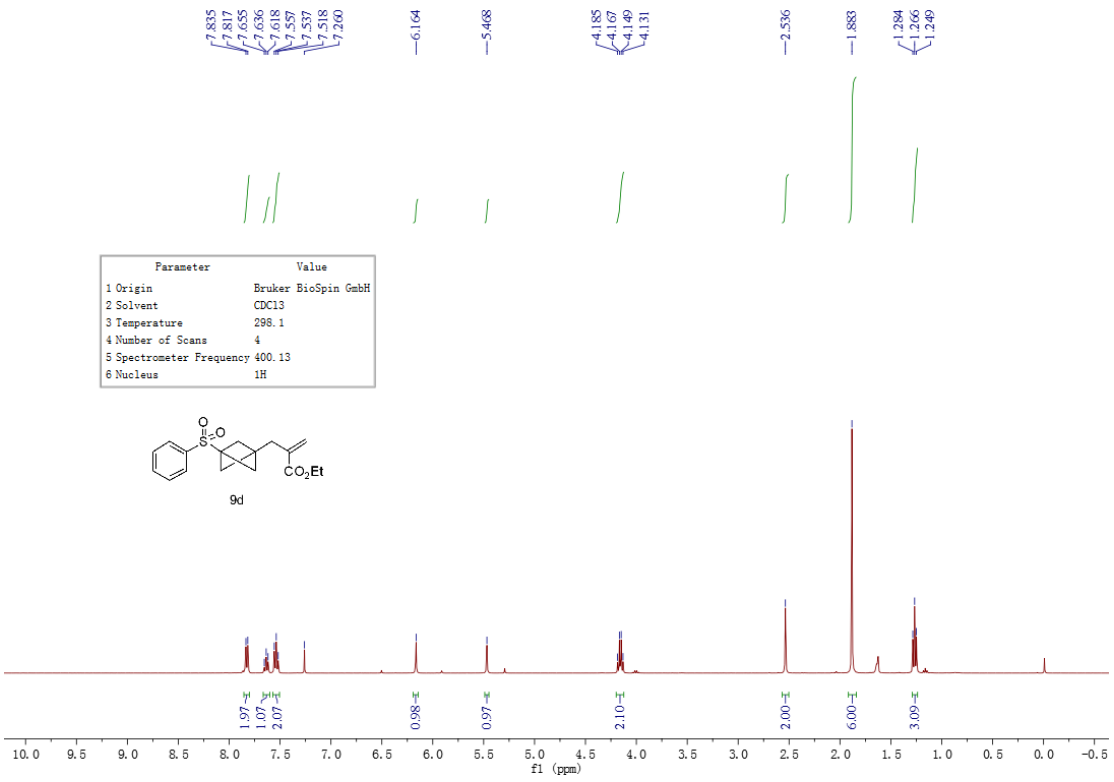

7.837
7.826
7.824
7.820
7.815
7.809
7.805
7.802
7.652
7.633
7.618
7.614
7.611
7.552
7.548
7.532
7.518
7.514
7.260
7.245
7.224
7.203
6.367
6.365
5.677
5.675
2.502
1.861
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 296.4
4 Number of Scans 2
5 Spectrometer Frequency 400.15
6 Nucleus 1H
F
SO2Ph
9b
4.14
1.16
2.17
2.14
0.96
0.97
2.08
6.00
f1 (ppm)

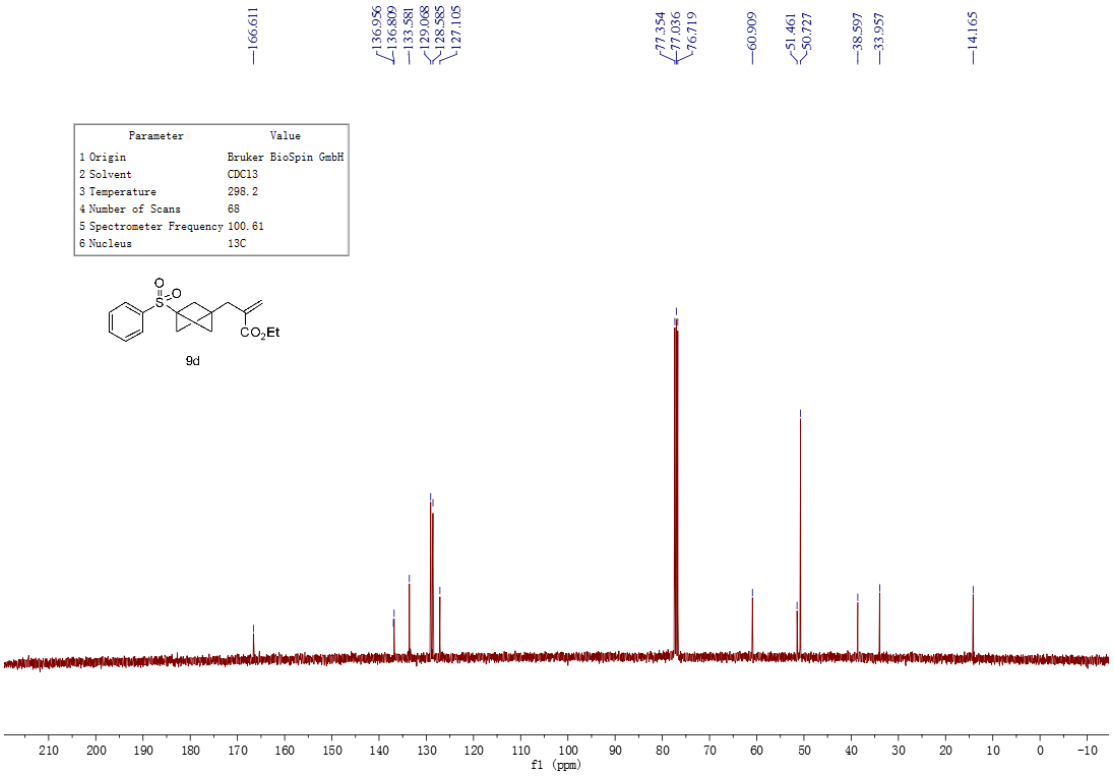

167.188
164.639
146.854
138.351
133.833
131.435
131.341
129.357
128.433
125.960
116.651
116.426
77.361
77.043
76.725
51.457
50.815
38.141
31.155
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 297.6
4 Number of Scans 512
5 Spectrometer Frequency 100.62
6 Nucleus 13C
F
SO2Ph
9b
f1 (ppm)

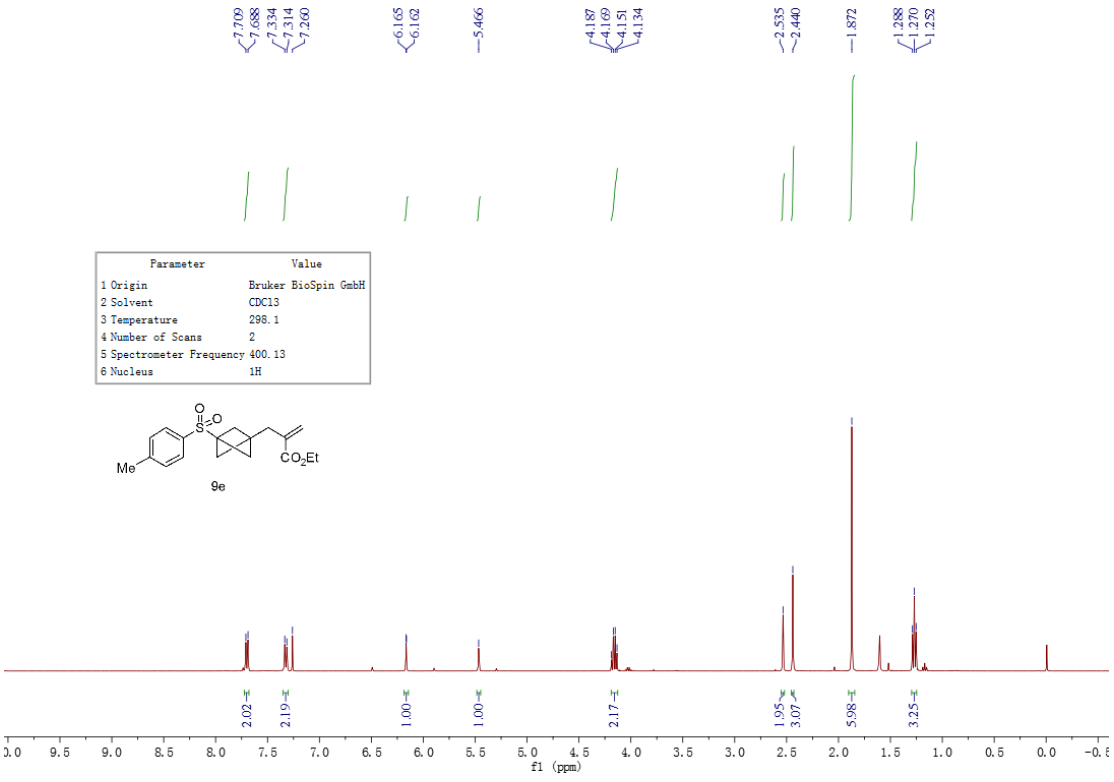

-103.385
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 296.5
4 Number of Scans 2
5 Spectrometer Frequency 376.52
6 Nucleus 19F
F
SO2Ph
9b
f1 (ppm)

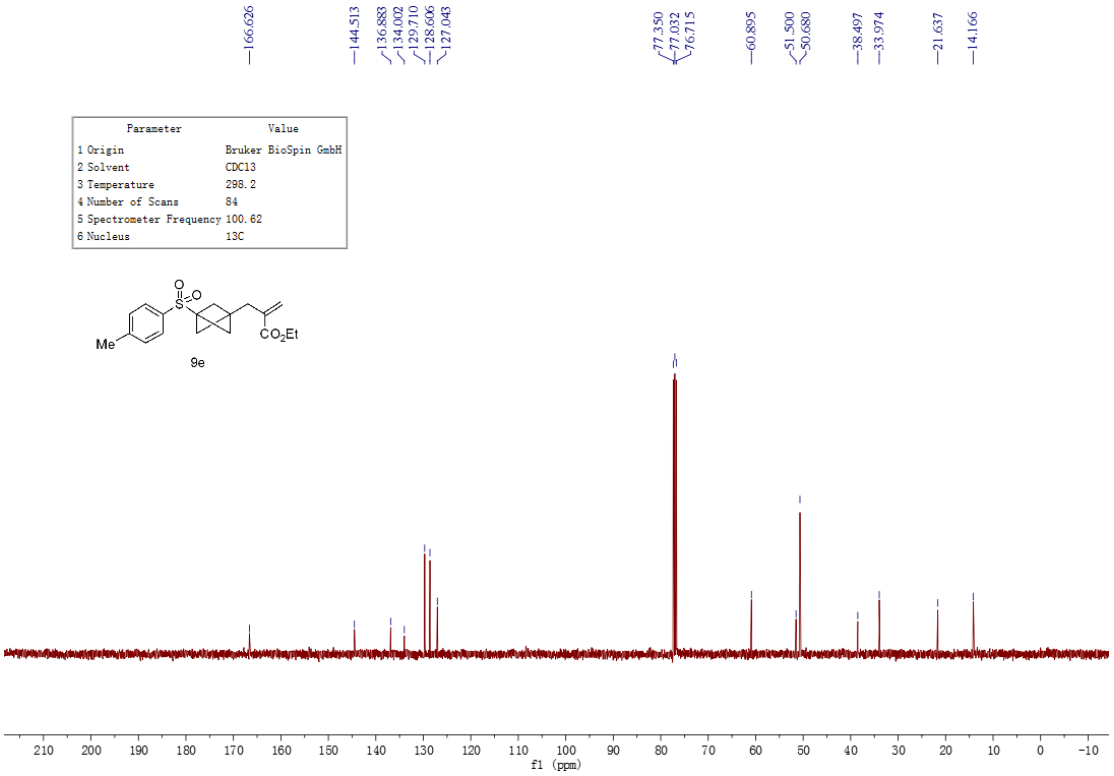

7.818
7.800
7.796
7.677
7.657
7.623
7.608
7.605
7.542
7.522
7.504
7.334
7.314
7.260
6.360
6.338
5.669
5.668
2.485
2.441
1.832
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.1
4 Number of Scans 2
5 Spectrometer Frequency 400.15
6 Nucleus 1H
Me
SO2Ph
9c
2.06
1.96
1.07
2.09
2.03
1.00
0.98
2.10
3.05
5.95
f1 (ppm)

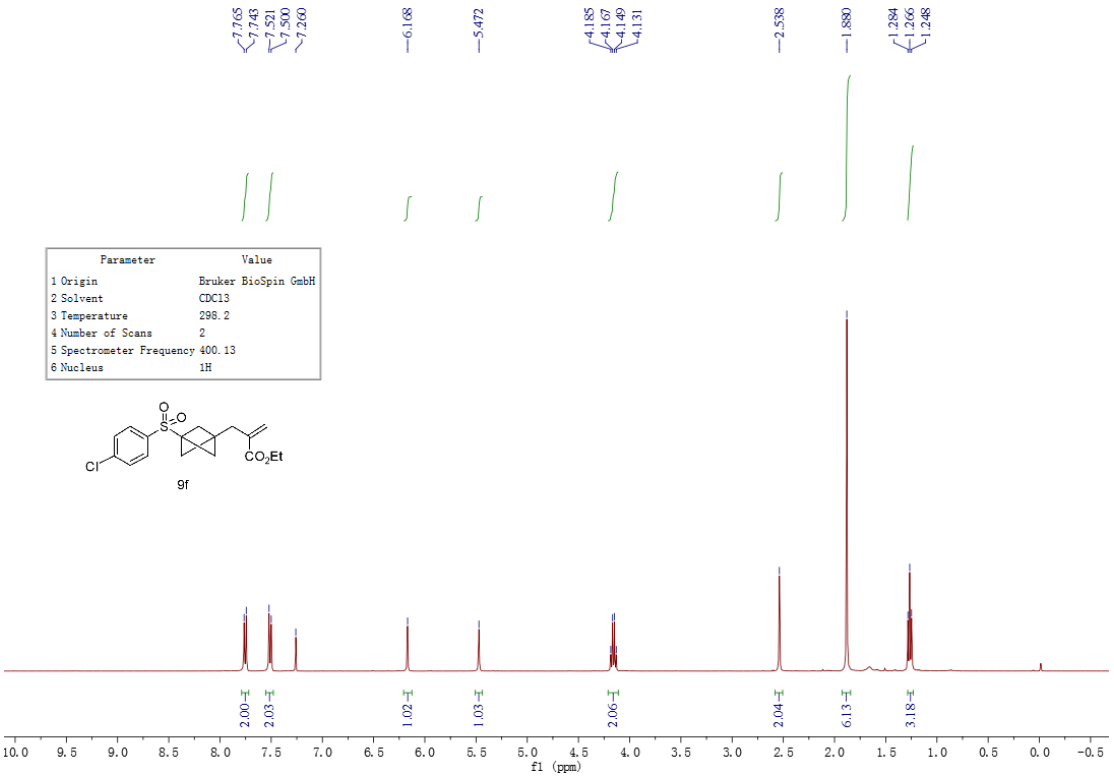

146.902
144.724
138.367
133.816
133.725
129.797
129.344
128.577
128.421
125.874
77.375
77.260
77.058
76.740
51.413
50.744
37.968
31.123
21.656
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.1
4 Number of Scans 80
5 Spectrometer Frequency 100.62
6 Nucleus 13C
Me
SO2Ph
9c
f1 (ppm)

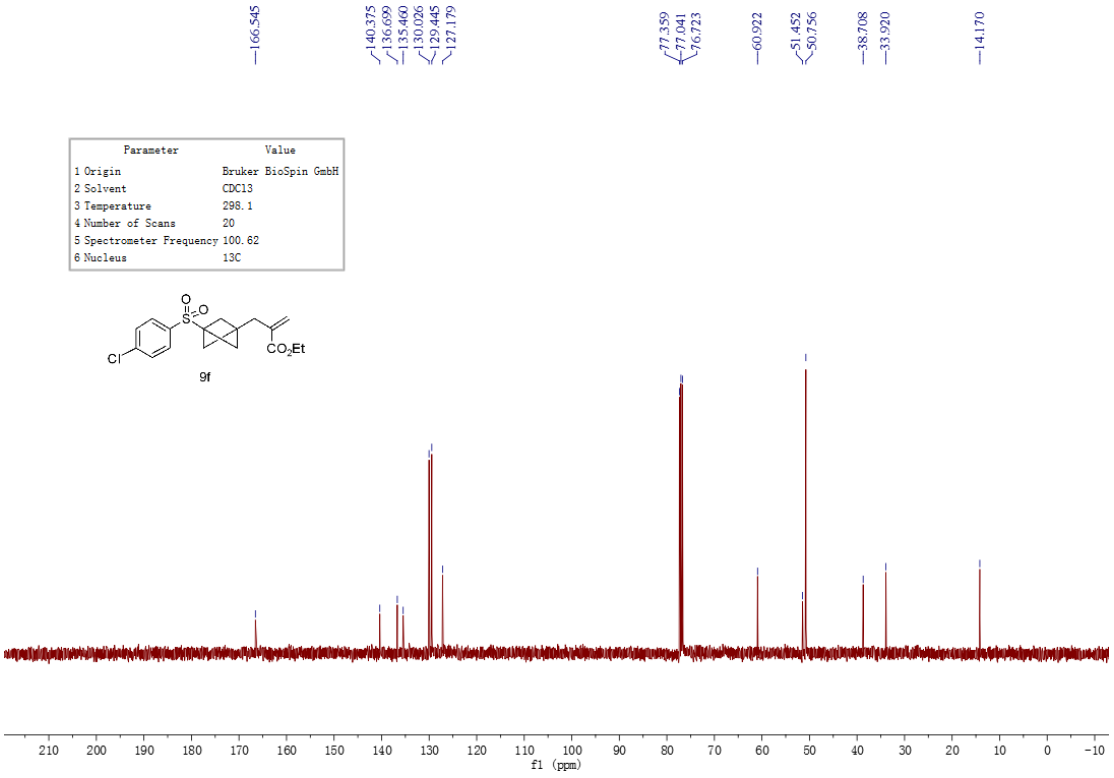

7.835
7.817
7.655
7.636
7.618
7.557
7.537
7.518
7.260
6.164
5.468
4.185
4.167
4.149
4.131
2.536
1.883
1.284
1.266
1.249
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.1
4 Number of Scans 4
5 Spectrometer Frequency 400.13
6 Nucleus 1H
CO2Et
9d
1.97
1.07
2.07
0.98
0.97
2.10
2.00
6.00
3.09
f1 (ppm)

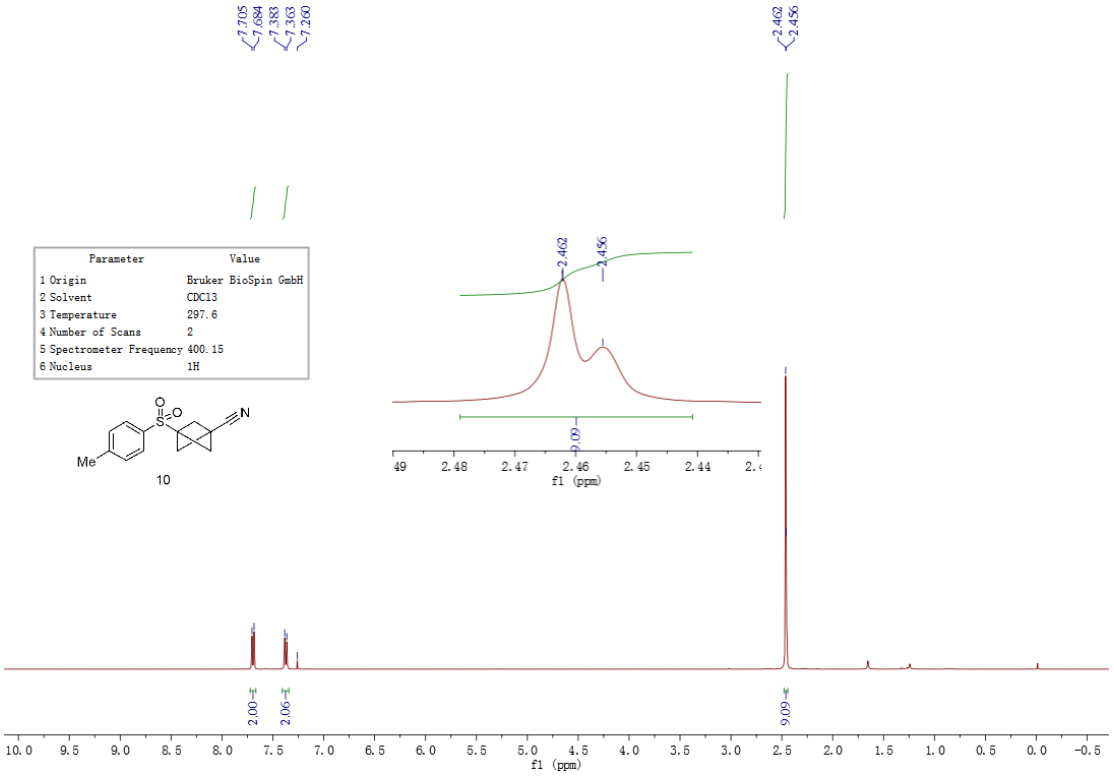

166.611
136.956
136.809
133.581
129.068
128.585
127.105
77.354
77.036
76.719
60.909
51.461
50.727
38.597
33.957
14.165
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.2
4 Number of Scans 68
5 Spectrometer Frequency 100.61
6 Nucleus 13C
O
S
O
CO2Et
9d
f1 (ppm)

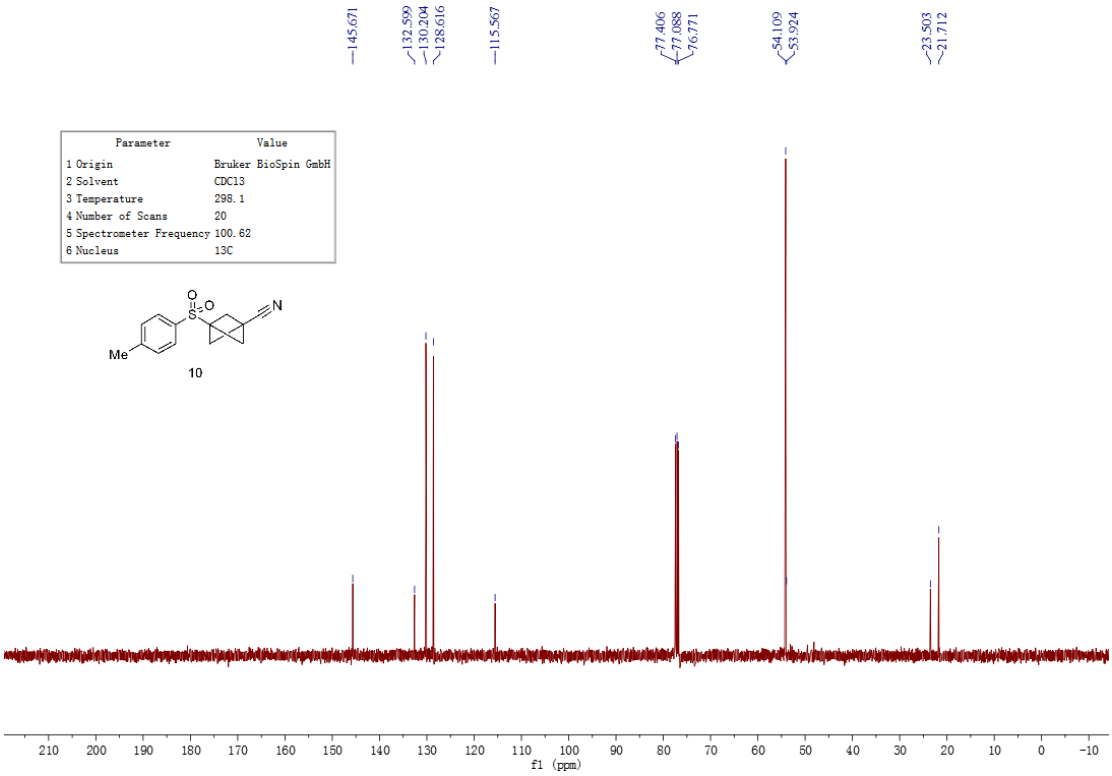

7.709
7.688
7.334
7.314
7.260
6.165
6.162
5.466
4.187
4.169
4.151
4.134
2.535
2.440
1.872
1.288
1.270
1.252
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.1
4 Number of Scans 2
5 Spectrometer Frequency 400.13
6 Nucleus 1H
O
S
O
CO2Et
Me
9e
2.02
2.19
1.00
1.00
2.17
1.95
3.07
5.98
3.25
f1 (ppm)

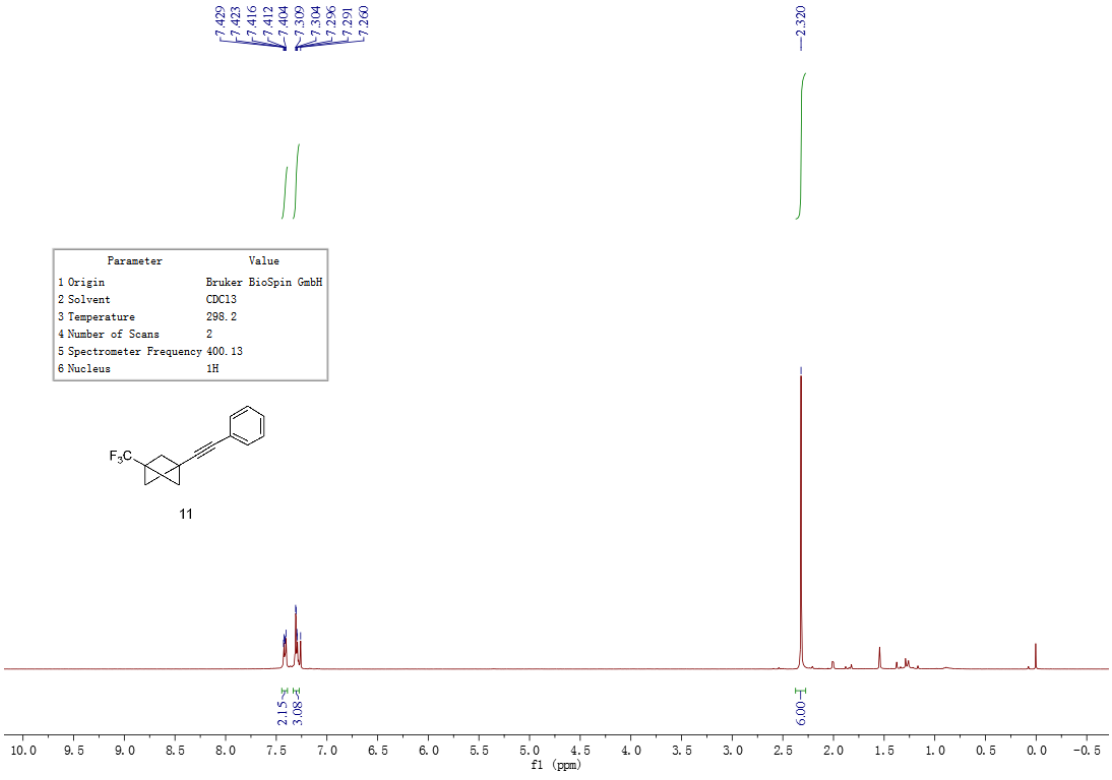

166.626
144.513
136.883
134.002
129.710
128.606
127.043
77.350
77.032
76.715
60.895
51.500
50.680
38.497
33.974
21.637
14.166
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.2
4 Number of Scans 84
5 Spectrometer Frequency 100.62
6 Nucleus 13C
Me
CO2Et
9e
f1 (ppm)

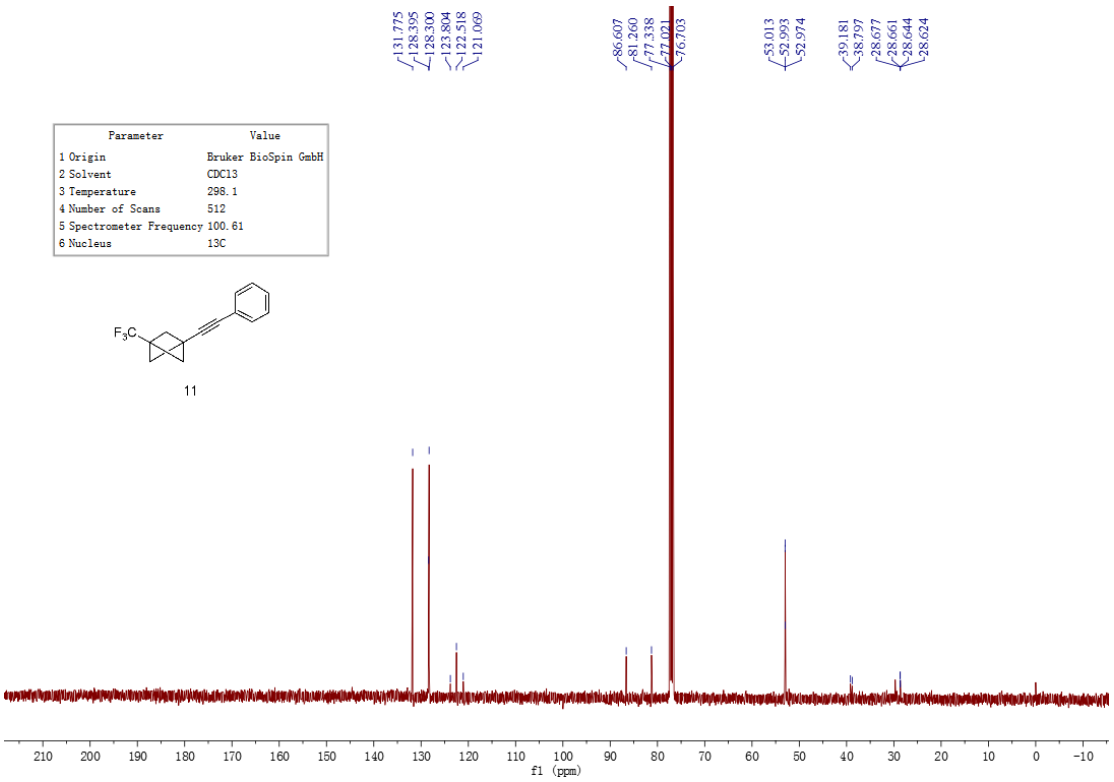

7.765
7.743
7.521
7.500
7.260
6.168
5.472
4.185
4.167
4.149
4.131
2.538
1.880
1.284
1.266
1.248
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.2
4 Number of Scans 2
5 Spectrometer Frequency 400.13
6 Nucleus 1H
Cl
CO2Et
9f
2.00
2.03
1.02
1.03
2.06
2.04
6.13
3.18
f1 (ppm)

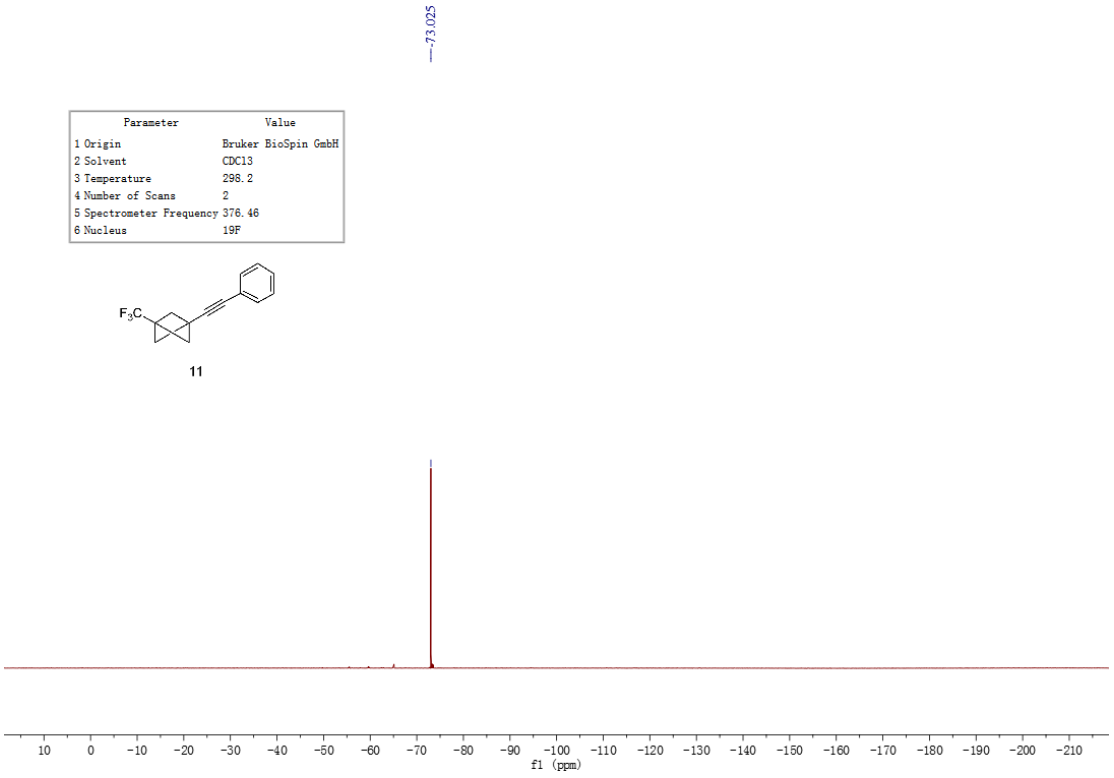

166.545
140.375
136.699
135.460
130.026
129.445
127.179
77.359
77.041
76.723
60.922
51.452
50.756
38.708
33.920
14.170
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.1
4 Number of Scans 20
5 Spectrometer Frequency 100.62
6 Nucleus 13C
O
S
O
Cl
CO2Et
9f
f1 (ppm)

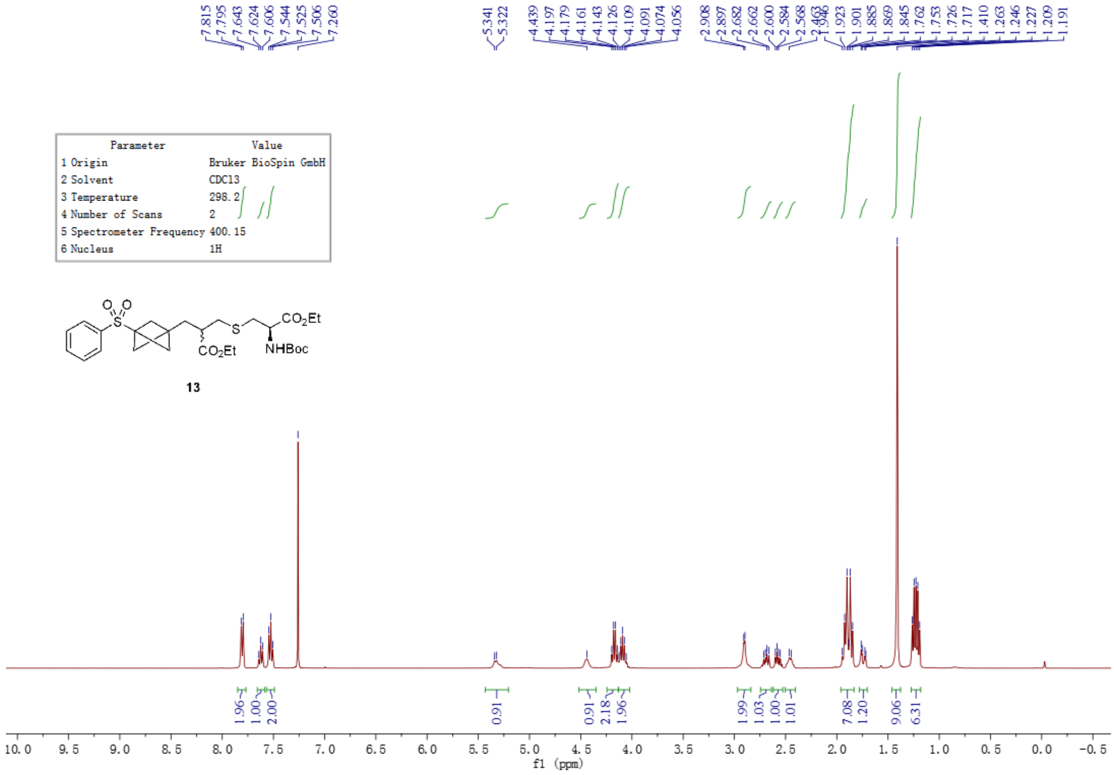

7.705
7.684
7.383
7.363
7.260
2.462
2.456
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 297.6
4 Number of Scans 2
5 Spectrometer Frequency 400.15
6 Nucleus 1H
O
S
O
N
Me
10
2.00
2.06
9.09
f1 (ppm)


145.671
132.599
130.204
128.616
115.567
77.406
77.088
76.771
54.109
53.924
23.503
21.712
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.1
4 Number of Scans 20
5 Spectrometer Frequency 100.62
6 Nucleus 13C
O
S
O
N
Me
10
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)


7.429
7.423
7.416
7.412
7.404
7.309
7.304
7.296
7.291
7.260
2.320
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.2
4 Number of Scans 2
5 Spectrometer Frequency 400.13
6 Nucleus 1H
F3C
11
2.15
3.08
6.00
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)

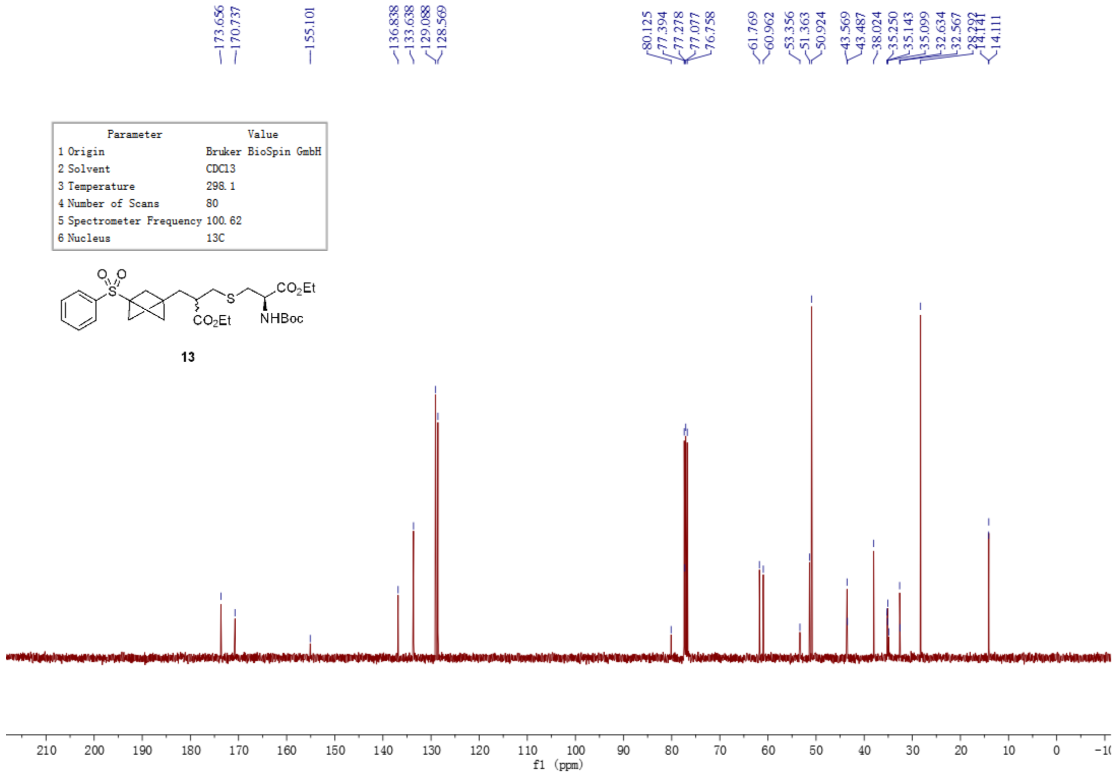

131.775
128.395
128.300
123.804
122.518
121.069
86.607
81.260
77.338
77.021
76.703
53.013
52.993
52.974
39.181
38.797
28.677
28.661
28.644
28.624
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.1
4 Number of Scans 512
5 Spectrometer Frequency 100.61
6 Nucleus 13C
F3C
11
f1 (ppm)


-73.025
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.2
4 Number of Scans 2
5 Spectrometer Frequency 376.46
6 Nucleus 19F
F3C
11
f1 (ppm)



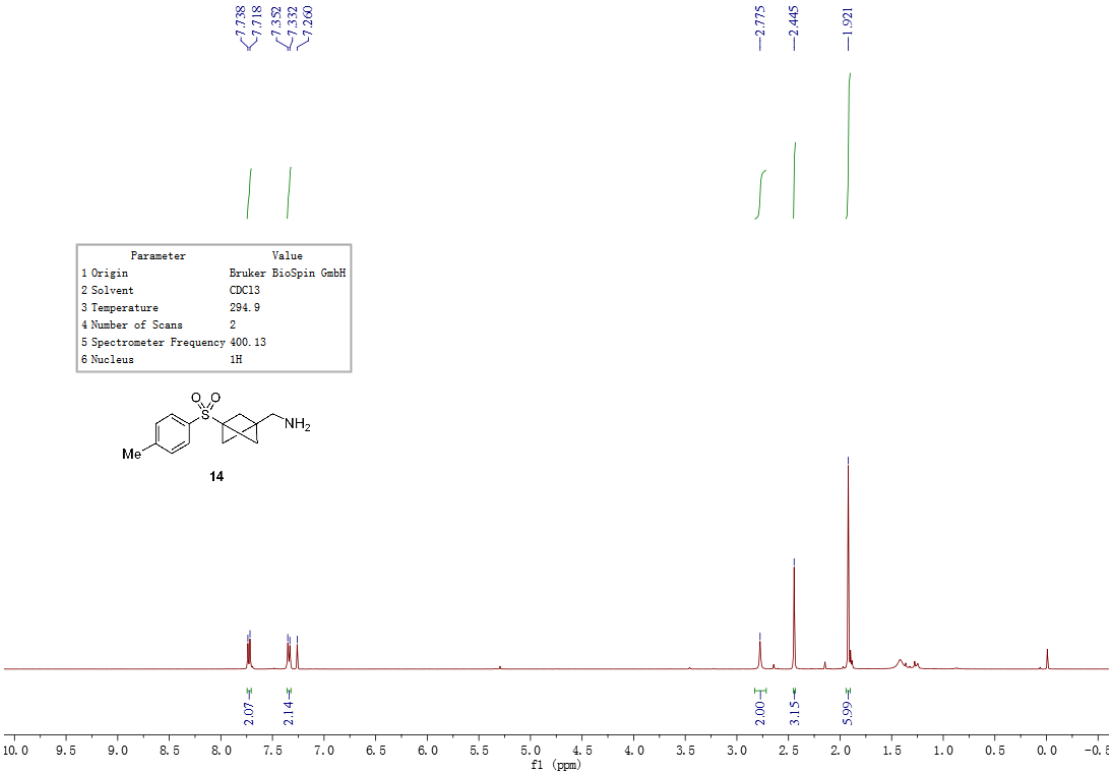
Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	298.2
4 Number of Scans	2
5 Spectrometer Frequency	400.15
6 Nucleus	1H

13

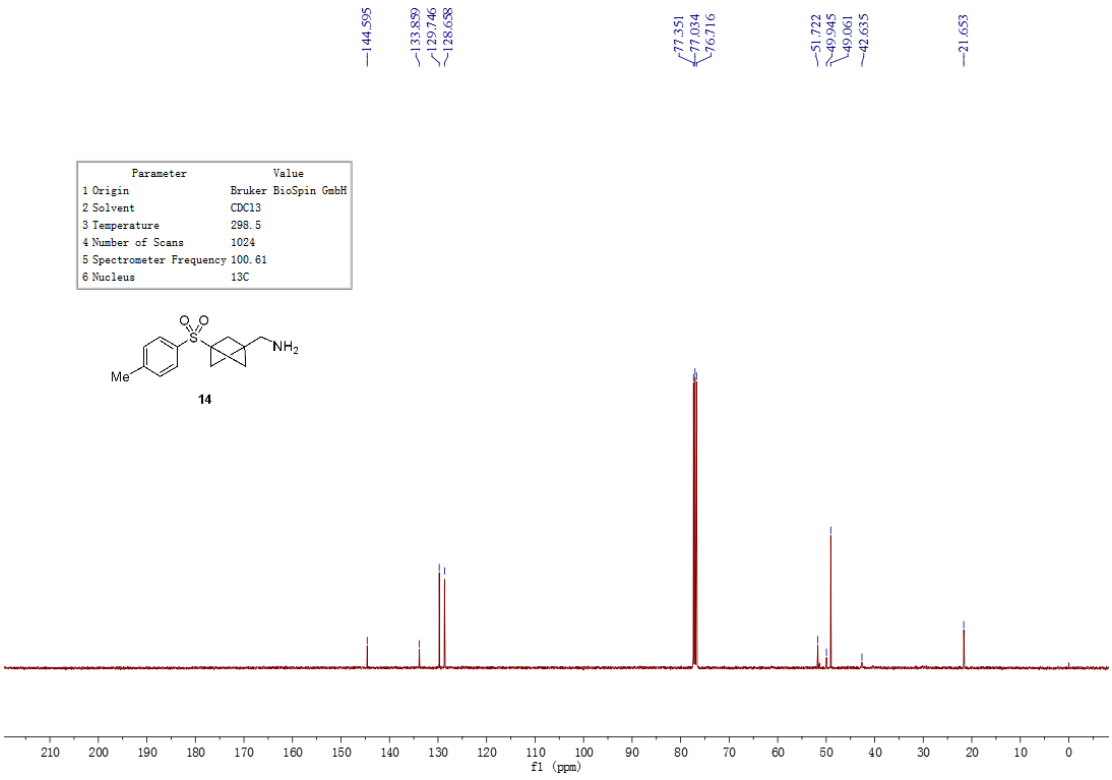


Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	298.1
4 Number of Scans	80
5 Spectrometer Frequency	100.62
6 Nucleus	13C

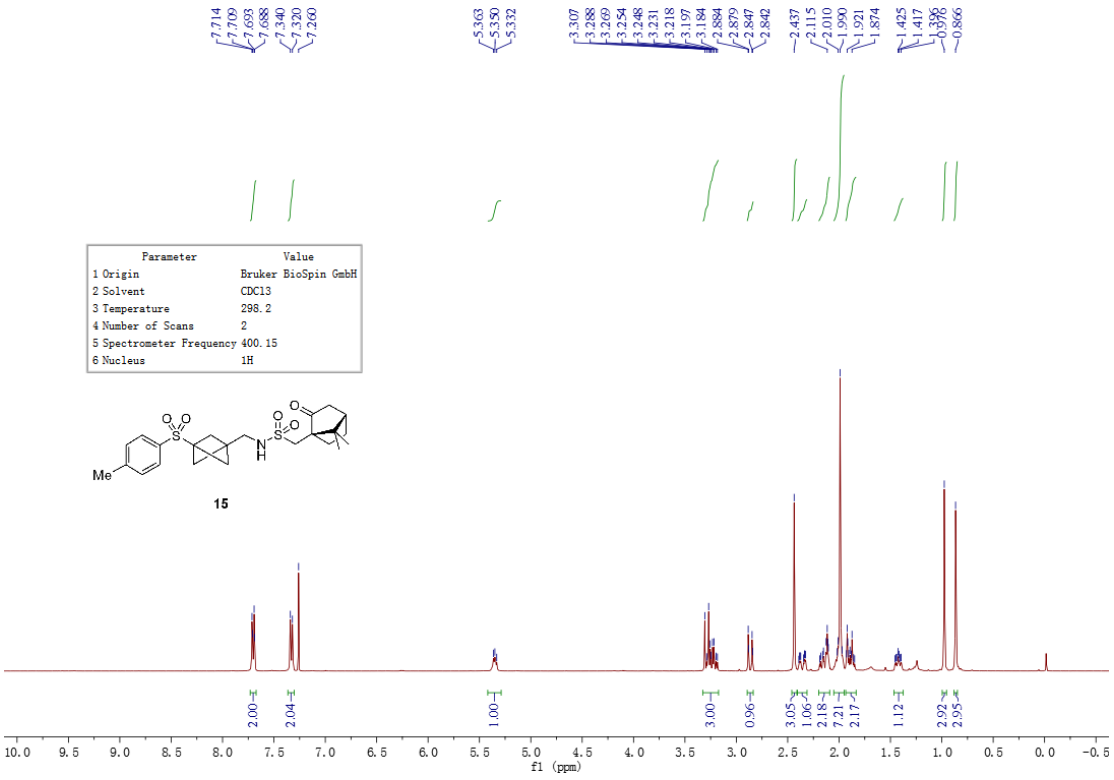
13

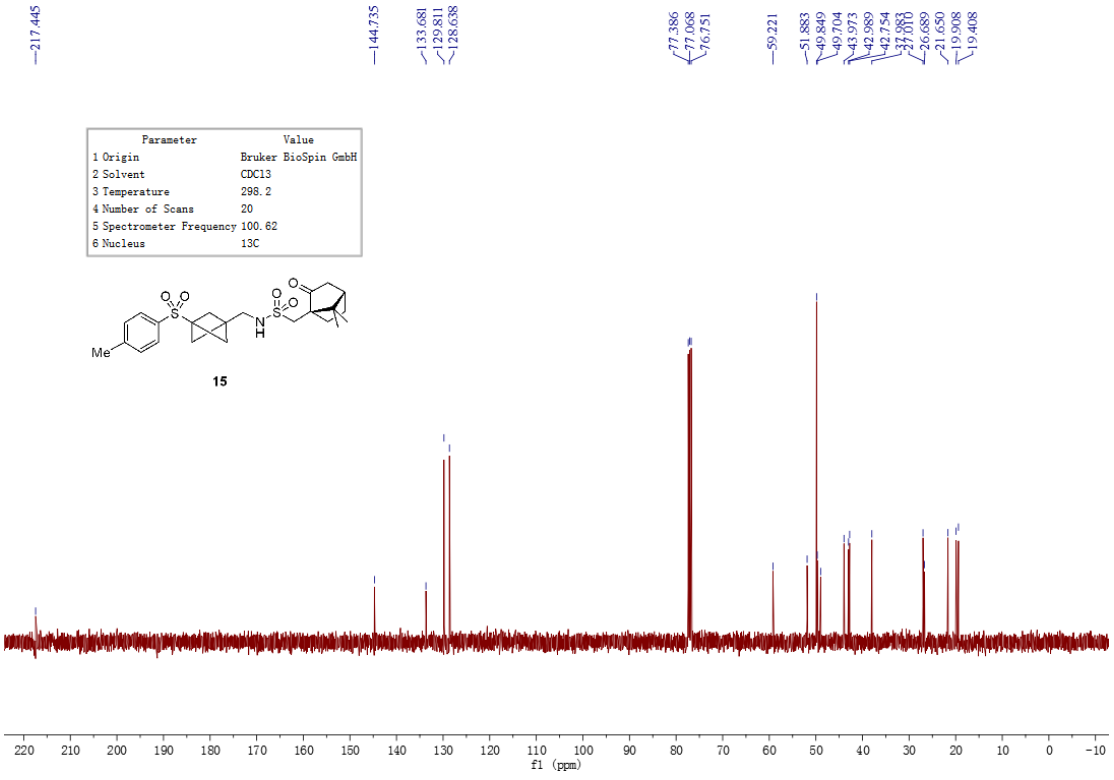

7.738
7.718
7.352
7.332
7.260
2.775
2.445
1.921
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 294.9
4 Number of Scans 2
5 Spectrometer Frequency 400.13
6 Nucleus 1H
O
O
S
NH2
Me
2.07
2.14
2.00
3.15
5.99
f1 (ppm)

14


144.595
133.859
129.746
128.658
77.351
77.034
76.716
51.722
49.945
49.061
42.635
21.653
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.5
4 Number of Scans 1024
5 Spectrometer Frequency 100.61
6 Nucleus 13C
O
O
S
NH2
Me
f1 (ppm)

14


7.714
7.709
7.693
7.688
7.340
7.320
7.260
5.363
5.350
5.332
3.307
3.288
3.269
3.254
3.248
3.231
3.218
3.197
3.184
2.884
2.879
2.847
2.842
2.437
2.115
2.010
1.990
1.921
1.874
1.425
1.417
0.978
0.866
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.2
4 Number of Scans 2
5 Spectrometer Frequency 400.15
6 Nucleus 1H
Me
15
2.00
2.04
1.00
3.00
0.96
3.05
1.06
2.18
7.21
2.17
1.12
2.92
2.95
f1 (ppm)


217.445
144.735
133.681
129.811
128.638
77.386
77.068
76.751
59.221
51.883
49.849
49.704
43.973
42.989
42.754
37.893
37.600
26.689
21.650
19.908
19.408
Parameter Value
1 Origin Bruker BioSpin GmbH
2 Solvent CDCl3
3 Temperature 298.2
4 Number of Scans 20
5 Spectrometer Frequency 100.62
6 Nucleus 13C
Me
15
f1 (ppm)