Supporting Information

Article Title: **A convenient synthetic route to sulfonimidamides from sulfonamides**

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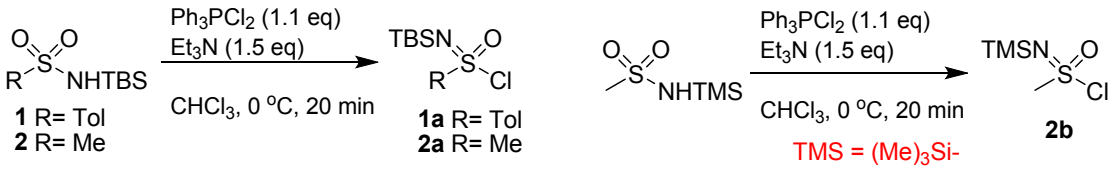
Contents

Screening of stability of 1a, 2a, and 2b



Scheme 1 Formation of sulfonimidoyl chlorides **1a**, **2a** and **2b**

N silyl sulfonimidoyl chlorides **1a**, **2a** and **2b** were formed in 20 min and under other conditions (Scheme 1). Then the reaction mixture was monitored with ^{1}H NMR using hexamethylbenzene as an internal standard, and yields were recorded over time (Figure 1).

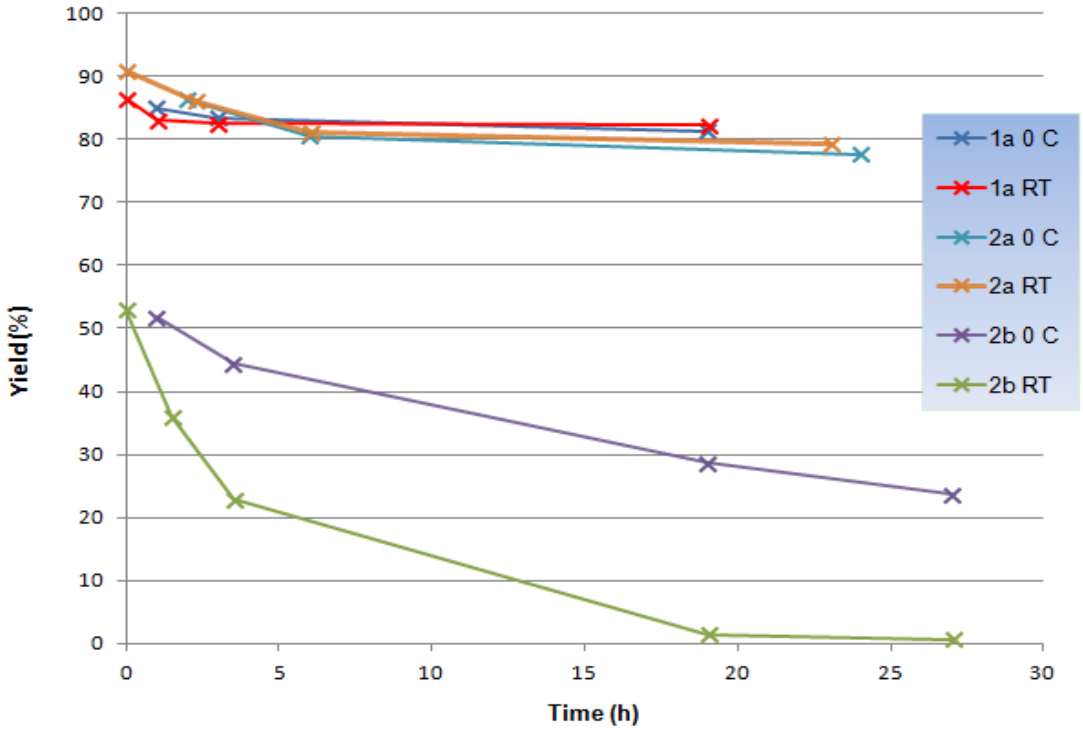


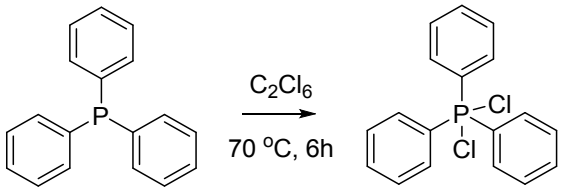
Figure 1 Yield of Sulfonimidoyl Chloride against Time

The stability of **1a** and **2a** was independent of temperature, only a modest reduction in yield was observed due to slow hydrolysis. The stability of **2b** was temperature dependent, it decomposed rapidly at room temperature, with only trace amounts of **2b** (<1%) present after 24 h. Therefore, TBS-protected sulfonamides were used for the synthesis of sulfonimidamides **4a-k** and **5a-f**.

Experimental section

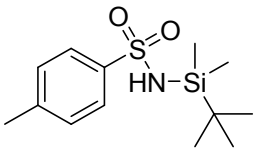
General. Unless otherwise noted all materials and reagents were obtained from commercial sources and used without further purification. All solvents used in moisture sensitive reactions were of commercial anhydrous grade. Melting points were measured on a Büchi 510 apparatus without correction. Nuclear magnetic resonance (NMR) spectra were recorded on Brucker 400 Ultrashield and 500 Ultrashield NMR spectrometers. Chemical shifts (δ) are reported in parts per million (ppm) and are referenced to the solvent, for ^{1}H NMR ($CDCl_3$ δ = 7.26, DMSO-d_6 δ = 2.50 ppm) and ^{13}C NMR ($CDCl_3$ δ = δ 77.0, DMSO-d_6 δ = 39.50). Multiplicities are reported using the following abbreviations: s = singlet, d = doublet, t = triplet, q = quartet, p = pentet, m = multiplet, br = broad resonance. Liquid chromatography mass spectrometry (LCMS) traces were recorded on a Waters Acquity UPLC instrument. High performance liquid chromatography (HPLC) was performed on a Kromasil C8 column (10 μm, 250x50 ID mm). Supercritical Fluid Chromatography (SFC) was performed on a Chiralpak IA column (5 μm, 250x20 ID mm). Automated flash chromatography was performed on Biotage and Grace Reveleris X2 machines. A Waters XBridge™ column with C18 packing material has been used for high resolution mass spectra (HRMS) experiments. HRMS results were recorded for all final compounds, on a Waters LCT spectrometer fitted with an electrospray (ESI) ion source. All final compounds were assessed as being >95% pure by NMR, and to be the correct mass by HRMS. Compound names were generated using 'structure to name' function in ChemDraw Ultra 11.0.

Preparation of Ph_3PCl_2[1]:



A solution of triphenylphosphine (1 equiv) and hexachloroethane (1 equiv) in dry $CHCl_3$ (3.0-–15.0 mL) under a N_2 atmosphere was heated to 70 °C with stirring for 6 h, a suspension formed upon heating. An extended reaction time was used to ensure complete conversion. The title compound was not isolated, the slurry containing the title compound was used directly for further transformations, a quantitative yield was assumed.

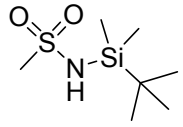
***N*-(*tert*-Butyldimethylsilyl)-4-methylbenzenesulfonamide (1):**



To a stirred suspension of 4-methylbenzenesulfonamide (29.3 g, 171 mmol) in dry THF (150 mL) was added triethylamine (52.4 mL, 375 mmol) under N_2 at 25 °C to give a clear solution. The mixture was cooled to 0 °C and a solution of *tert*-butyldimethylsilyl chloride (32.2 g, 214 mmol) in toluene (37 mL) was added cautiously over 30 min. The mixture warmed to 25 °C and stirred for 4 h, then warmed to 50 °C and stirred vigorously for 48 h (conversion was monitored by ^{1}H NMR, a longer reaction time was used to ensure complete conversion and simplify purification). The resulting suspension was cooled to 25 °C and the solid was removed by filtration and washed with Et_2O (25 x 4 mL). The filtrate and washings were combined and the solvent was removed under reduced pressure overnight to obtain a crude solid (47.7 g, 106%), which was mixed with Et_2O (100 mL) and THF (50 mL) and stirred at 25 °C for 30 min to give a suspension. The insoluble material was removed by filtration and the solvent was removed under reduced pressure to give a solid, which was held under reduced pressure for 2 days, affording the title compound; (43.7 g, 97% yield); mp: 113–115 °C; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.72–7.78 (m, 2H), 7.23–7.29 (m, 2H), 4.62 (s, 1H), 2.41 (s, 3H), 0.89

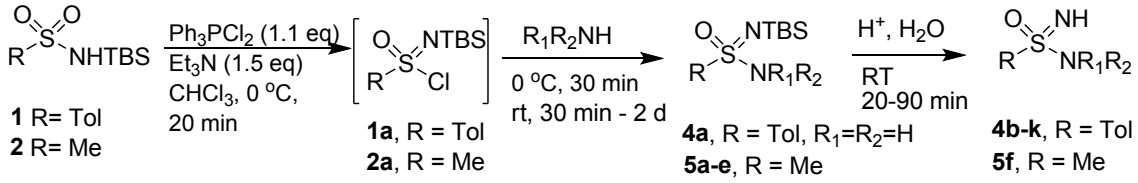
(s, 9H), 0.20 (s, 6H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 142.8, 141.2, 129.6, 126.3, 25.7, 21.7, 17.5, -4.3; HRMS (ESI+) calcd for $[M + H]^+$ $C_{13}H_{24}NO_2SSi^+$: 286.1297, found 286.1299.

***N*-(*tert*-Butyldimethylsilyl)methanesulfonamide (2):**



To a solution of methanesulfonamide (0.939 g, 9.87 mmol) dry THF (15 ml) was added triethylamine (2.75 ml, 19.74 mmol) with stirring at 25 °C. A solution of *tert*-butyldimethylsilyl chloride (1.73 g, 11.48 mmol) in dry toluene (5 mL) was added over 5 min, a suspension formed. The mixture was stirred for 72 h at 25 °C. The resulting suspension was filtered and the solid was washed with Et_2O (20 mL), a precipitate formed in the filtrate. Et_2O (10 mL) was added to the filtrate and the mixture was allowed to stand for 15 min then filtered to obtain a clear solution. The solvent was removed under reduced pressure and the resulting solid was held under vacuum for 24 h to give the title compound as a colourless solid; (1.928 g, 93% yield); mp: 102–103 °C; ^{1}H NMR (500 MHz, DMSO-d_6) δ 7.05 (s, 1H), 2.91 (s, 3H), 0.89 (s, 9H), 0.16 (s, 6H); ^{13}C NMR (126 MHz, DMSO-d_6) δ 44.0, 25.7, 17.2, -4.4; HRMS (ESI+) calcd for $[M + H]^+$ $C_7H_{20}NO_2SSi^+$: 210.0984, found 210.0994.

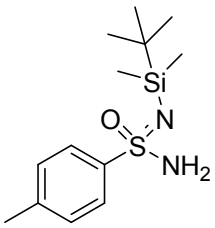
Typical procedure A: sulfonimidamides 4a-j from 1, and 5a-f from 2



To a stirred suspension of Ph_3PCl_2 (367 mg, 1.10 mmol) in dry $CHCl_3$ (3.0 mL) under a N_2 atmosphere, was added triethylamine (0.209 mL, 1.50 mmol). The mixture was stirred for 10 min at room temperature, a yellow suspension immediately formed. The reaction mixture was cooled to 0 °C and a solution of **1** (1.00 mmol) in dry $CHCl_3$ (0.7 mL) was added. The reaction mixture was stirred for 20 min at 0 °C, after 5 min a clear solution formed. No

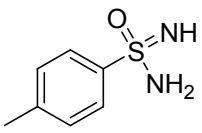
attempt was made to isolate the sulfonimidoyl chloride intermediate. To the reaction mixture was added a solution of amine (3.0 mmol) in dry $CHCl_3$ (2.0 mL) in one portion. The mixture was stirred at 0 °C for 30 min then warmed to room temperature (longer reaction times were used if required, conversion to sulfonimidamide was judged by LCMS). If a suspension formed, the solids were removed by filtration. The solvent was removed under reduced pressure to give a crude residue which was dissolved in acetonitrile (ca. 10 mL). The compound was deprotected under acidic conditions and the mixture was stirred at room temperature for 5 min to 1.5 h (conversion was judged by LCMS). The solvent was removed under reduced pressure to give an oil residue which was purified by HPLC or automated flash chromatography.

_N_'-(*tert*-Butyldimethylsilyl)-4-methylbenzenesulfonamide (4a):



Ammonia gas was introduced to the reaction mixture of *in-situ* formed **1a**. Flash chromatography using a gradient of EtOAc (12–100%) in heptane over 12 CV as mobile phase afforded a colourless solid; (0.583 g, 68% yield); mp: 109–111 °C; ^{1}H NMR (500 MHz, DMSO-d_6) δ 7.71–7.78 (m, 2H), 7.26–7.32 (m, 2H), 6.54 (s, 2H), 2.35 (s, 3H), 0.87 (s, 9H), 0.00 (s, 3H), -0.01 (s, 3H); ^{13}C NMR (126 MHz, DMSO-d_6) δ 145.7, 140.4, 128.7, 125.4, 26.0, 20.8, 17.8, -2.5, -2.5; HRMS (ESI+) calcd for $[M + H]^+$ $C_{13}H_{25}N_2OSSi^+$: 285.1457, found: 285.1454.

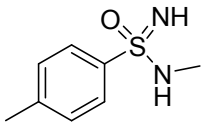
4-Methylbenzenesulfonimidamide (4b):



To a solution of *N*'-(*tert*-butyldimethylsilyl)-4-methylbenzenesulfonimidamide (171 mg, 0.60 mmol) (**4a**) in diethyl ether (1.8 mL) was added HCl in 1,4-dioxane (4 M, 0.300 mL, 1.20 mmol), a precipitate formed. The mixture was stirred at room temperature for 25 min. The ethereal suspension was extracted with water (5

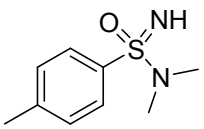
mL) then aqueous hydrochloric acid (1 M, 5 mL). The aqueous extracts were pooled and basified to pH 10 by addition of aqueous ammonium hydroxide (26% wt, 2.0 mL). The aqueous phase was extracted with EtOAc (3 x 15 mL). The organic extracts were combined, dried over anhydrous $CaCl_2$ and filtered. The solvent was removed under reduced pressure to give the title compound as a white crystalline solid; (79 mg, 77% yield); mp: 114–115 °C; ^{1}H NMR (500 MHz, DMSO-d_6) δ 7.79 (d, J = 8.2 Hz, 2H), 7.30 (d, J = 8.0 Hz, 2H), 5.94 (br s, 2H), 2.36 (s, 3H), (one very broad peak at 5.94 ppm and one proton not visible); ^{13}C NMR (126 MHz, DMSO-d_6) δ 143.9, 140.8, 128.8, 125.9, 20.8; HRMS (ESI+) calcd for $[M + H]^+$ $C_7H_{11}N_2OS^+$: 171.0592, found: 171.0605.

***N*,4-Dimethylbenzenesulfonimidamide (4c):**



A solution of $MeNH_2$ in EtOH (33% wt) (0.371 mL, 3.00 mmol) was added to the mixture of *in-situ* formed **1a**. Deprotection conditions: formic acid (0.575 ml, 15.0 mmol), water (0.450 mL, 25.0 mmol), 30 min. HPLC using a gradient of acetonitrile (5-90%) in H_2O/NH_3 (100: 0.2) as the mobile phase gave as a colourless solid; (95 mg, 52% yield); mp: 86–87 °C; ^{1}H NMR (500 MHz, DMSO-d_6) δ 7.69–7.77 (m, 2H), 7.3–7.38 (m, 2H), 6.60 (s, 1H), 4.01 (s, 1H), 2.37 (s, 3H), 2.33 (s, 3H); ^{13}C NMR (126 MHz, DMSO-d_6) δ 141.4, 138.5, 129.0, 126.9, 29.4, 20.8; HRMS (ESI+) calcd for $[M + H]^+$ $C_8H_{13}N_2OS^+$: 185.0748, found 185.0766.

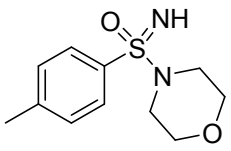
***N,N*,4-Trimethylbenzenesulfonimidamide (4d):**



A solution of $(Me)_2NH$ in THF (2M) (1.50 mL, 3.00 mmol) was added to the mixture of *in-situ* formed **1a**. Deprotection conditions: formic acid (1.00 mL, 26.5 mmol), water (1.00 ml, 55.5 mmol), 1 h. HPLC using a gradient of acetonitrile (5-90%) in H_2O/NH_3 (100: 0.2) as the mobile phase gave a colourless solid; (159 mg, 80% yield); mp: 84–85 °C; ^{1}H NMR (500 MHz, DMSO-d_6)

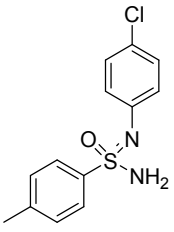
δ 7.69–7.73 (m, 2H), 7.43 (d, J = 7.9 Hz, 2H), 4.27 (s, 1H), 2.56 (s, 6H), 2.43 (s, 3H); ^{13}C NMR (126 MHz, DMSO-d_6) δ 142.1, 132.9, 129.2, 127.8, 38.5, 20.9; MS (ESI+) calcd for $[M + H]^+$ $C_9H_{15}N_2OS^+$: 199.0905, found 199.0919.

4-(4-Methylphenylsulfonimidoyl)morpholine[2] (4e):



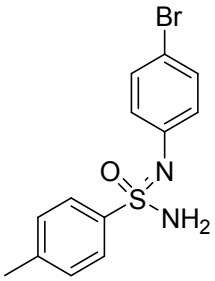
Morpholine (0.262 ml, 3.00 mmol) was added to the mixture of *in-situ* formed **1a**. Deprotection conditions: formic acid (1.00 mL, 26.5 mmol), water (1.00 ml, 55.5 mmol), 1 h. HPLC using a gradient of acetonitrile (0–50%) in H_2O/HCO_2H (100: 0.2) as the mobile phase afforded a colourless solid; (208 mg, 87% yield); mp: 106–108 °C; ^{1}H NMR (500 MHz, DMSO-d_6) δ 7.66–7.73 (m, 2H), 7.44 (d, *J* = 7.9 Hz, 2H), 4.44 (s, 1H), 3.62 (t, *J* = 4.7, 4.7 Hz, 4H), 2.75–2.87 (m, 4H), 2.43 (s, 3H); ^{13}C NMR (126 MHz, DMSO-d6) δ 142.5, 132.7, 129.2, 127.9, 65.6, 46.7, 20.9; HRMS (ESI+) calcd for $[M + H]^+$ $C_{11}H_{17}N_2O_2S^+$: 241.1010, found 241.1011.

***N*'-(4-Chlorophenyl)-4-methylbenzenesulfonimidamide (4f):**



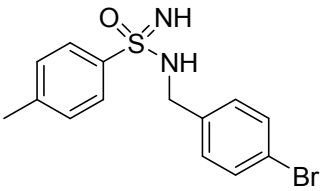
A solution of 4-chloroaniline (383 mg, 3.00 mmol) in dry $CHCl_3$ (2.0 mL) was added to the mixture of *in-situ* formed **1a**. Deprotection conditions: acetic acid (1.50 mL, 26.2 mmol), water (1.50 mL, 83.3 mmol), 1 h. HPLC using a gradient of acetonitrile (10–65%) in H_2O/HCO_2H (100: 0.2) as the mobile phase gave a colourless solid; (112 mg, 40% yield); mp: 128–130 °C; ^{1}H NMR (500 MHz, DMSO-d_6) δ 7.80 (d, *J* = 8.1 Hz, 2H), 7.35 (d, *J* = 8.1 Hz, 2H), 7.23 (s, 2H), 7.12–7.18 (m, 2H), 6.96 (d, *J* = 8.2 Hz, 2H), 2.36 (s, 3H); ^{13}C NMR (126 MHz, DMSO-d_6) δ 144.6, 141.9, 140.8, 129.3, 128.5, 126.5, 124.2, 20.9; HRMS (ESI+) calcd for $[M + H]^+$ $C_{13}H_{14}ClN_2OS^+$: 281.0515, found 281.0506.

N'-(4-Bromophenyl)-4-methylbenzenesulfonimidamide (4g):



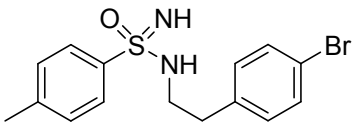
A solution of 4-bromoaniline (0.516 g, 3.00 mmol) in dry $CHCl_3$ (2.0 mL) was added to the mixture of *in-situ* formed **1a**. Deprotection conditions: HCl in dioxane (4 M) (2.00 mL, 8.00 mmol), 10 min. HPLC using a gradient of acetonitrile (0–65%) in H_2O/NH_3 (100: 0.2) as the mobile phase gave a colourless solid; (175 mg, 54% yield); mp: 133–135 °C; ^{1}H NMR (500 MHz, DMSO-d_6) δ 7.80 (d, *J* = 8.1 Hz, 2H), 7.35 (d, *J* = 8.1 Hz, 2H), 7.28 (d, *J* = 8.7 Hz, 2H), 7.25 (br s, 2H), 6.91 (d, *J* = 8.2 Hz, 2H), 2.36 (s, 3H);^{13}C NMR (126 MHz, DMSO-d_6) δ 145.0, 142.0, 140.8, 131.3, 129.3, 126.5, 124.7, 112.1, 20.9; MS (ESI+) calcd for $[M + H]^+$ $C_{13}H_{14}BrN_2OS^+$: 325.0010, found 324.9980.

***N*-(4-Bromobenzyl)-4-methylbenzenesulfonimidamide (4h):**



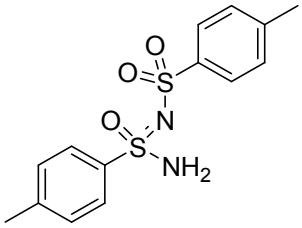
A solution of (4-bromophenyl)methanamine (558 mg, 3.00 mmol) in dry $CHCl_3$ (2.0 mL) was added to the mixture of *in-situ* formed **1a**. Deprotection conditions: formic acid (0.575 ml, 15.0 mmol), water (0.450 mL, 25.0 mmol), 30 min. SFC using 25% EtOH in CO_2 (120 bar) as the mobile phase gave a light pink solid; (113 mg, 33% yield); mp: 100–101 °C; ^{1}H NMR (500 MHz, DMSO-d_6) δ 7.74 (d, *J* = 8.2 Hz, 2H), 7.41–7.47 (m, 2H), 7.35 (br s, 1H)*, 7.31 (d, *J* = 8.0 Hz, 2H), 7.21 (d, *J* = 8.0 Hz, 2H), 4.14 (br s, 1H), 3.90 (s, 2H), 2.36 (s, 3H); ^{13}C NMR (126 MHz, DMSO-d_6) 141.4, 140.0, 138.4, 130.8, 129.7, 129.1, 126.7, 119.7, 46.1, 20.9; HRMS (ESI+) calcd for $[M + H]^+$ $C_{14}H_{16}BrN_2OS^+$: 339.0167, found 339.0181. (*Note: broad overlap with aromatic region).

***N*-(4-Bromophenethyl)-4-methylbenzenesulfonimidamide (4i):**



A solution of 2-(4-bromophenyl)ethanamine (0.465 mL, 3.00 mmol) in dry $CHCl_3$ (2.0 mL) was added to the mixture of *in-situ* formed **1a**. Deprotection conditions: formic acid (0.575 mL, 15.0 mmol), water (0.450 mL, 25.0 mmol), 30 min. SFC using 25% EtOH in CO_2 (120 bar) as the mobile phase gave a pink solid; (137 mg, 39% yield); mp: 92–95 °C; ^{1}H NMR (500 MHz, DMSO-d_6) δ 7.86 (d, *J* = 8.2 Hz, 2H), 7.54–7.59 (m, 2H), 7.45 (d, *J* = 8.0 Hz, 2H), 7.24 (d, *J* = 8.3 Hz, 2H), 7.03 (br s, 1H), 4.19 (br s, 1H), 3.03 (t, *J* = 6.8 Hz, 2H), 2.76 (t, *J* = 7.3 Hz, 2H), 2.50 (s, 3H); ^{13}C NMR (126 MHz, DMSO-d_6) δ 141.4, 139.7, 138.7, 131.0, 130.9, 129.0, 126.7, 119.1, 44.4, 20.8; HRMS (ESI+) calcd for $[M + H]^+$ $C_{15}H_{18}BrN_2OS^+$: 353.0323, found 353.0327.

***N*-(*p*-Toluenesulfonyl)-*p*-toluenesulfonimidamide (4j):**



A suspension of 4-methylbenzenesulfonamide (1.868 g, 10.91 mmol) in dry $CHCl_3$ (4 mL) was added to the mixture of *in-situ* formed **1a** (3.65 mmol). The mixture was stirred at room temperature for 48 h, a clear yellow solution formed. Deprotection conditions: formic acid (2.00 mL, 53.0 mmol), water (1.00 ml, 55.5 mmol), 1 h. HPLC using a gradient of acetonitrile (0–60%) in H_2O/HCO_2H (100: 0.2) as the mobile phase gave a colourless solid; (240 mg, 20% yield); mp: 150–152 °C (S-enantiomer was prepared by Liang using different chemistry approach;[3] mp: 152-152.5 °C); ^{1}H NMR (500 MHz, DMSO-d_6) δ 8.03 (s, 2H), 7.66 (d, *J* = 8.3 Hz, 2H), 7.54 (d, *J* = 8.2 Hz, 2H), 7.35 (d, *J* = 8.2 Hz, 2H), 7.25 (d, *J* = 8.1 Hz, 2H), 2.38 (s, 3H), 2.35 (s, 3H); HRMS (ESI+) calcd for $[M + H]^+$ $C_{14}H_{17}N_2O_3S_2^+$: 325.0681, found 325.0670.

Preparative separation of racemic material 4j:

Conditions: Chiralpak IC, 250 x 20 mm, 5 µm size, Heptane/EtOH/TEA 40/60/0.1 as mobile phase, 18 mL/min flow, rt, 254 nm, 10 min run.

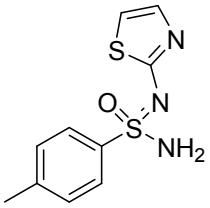
Enantiomer 1: **(-)-*N*-(*p*-Toluenesulfonyl)-*p*-toluenesulfonimidamide (*S*)-4j**

Retention time: 6.8 min, ee > 99.9%, $[\alpha]_D^{20}$ -105 (*c* 0.5, acetone) (Lit. $[\alpha]_D^{20}$ -110 (*c* 0.47, acetone).

Enantiomer 2: **(+)-*N*-(*p*-Toluenesulfonyl)-*p*-toluenesulfonimidamide (*R*)-4j**

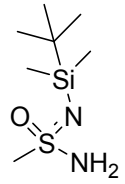
Retention time: 7.8 min, ee = 96.7%, $[\alpha]_D^{20}$ +102 (*c* 0.5, acetone) (not reported in lit.)

4-Methyl-N'-(thiazol-2-yl)benzenesulfonimidamide (4k):



A suspension of thiazol-2-amine (300 mg, 3.00 mmol) in dry THF (2.00 mL) was added to the mixture of *in-situ* formed **1a**. Deprotection conditions: formic acid (1.00 mL, 26.5 mmol), water (1.00 ml, 55.5 mmol), 90 min. HPLC using a gradient of acetonitrile (0–50%) in H_2O/HCO_2H (100: 0.2) as the mobile phase gave a faint yellow oil, which was solidified during storage at rt; (118 mg, 47% yield); mp: 115–116 °C; ^{1}H NMR (500 MHz, DMSO-d_6) δ 7.81 (d, *J* = 8.3 Hz, 2H), 7.71 (s, 2H), 7.38 (d, *J* = 8.0 Hz, 2H), 7.10 (d, *J* = 3.8 Hz, 1H), 6.86 (d, *J* = 3.8 Hz, 1H), 2.37 (s, 3H); ^{13}C NMR (126 MHz, DMSO-d_6) δ 165.7, 142.6, 139.5, 138.6, 129.4, 126.8, 111.8, 20.9; HRMS (ESI+) calcd for $[M + H]^+$ $C_{10}H_{12}N_3OS_2^+$: 254.0421, found 254.0433.

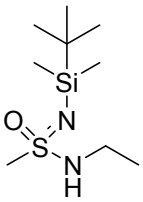
***N*'-(*tert*-Butyldimethylsilyl)methanesulfonimidamide (5a):**



Ammonia gas was introduced to the reaction mixture of *in-situ* formed **2a**. Flash chromatography using a gradient of EtOAc (12–77%) in heptane over 12 CV as mobile phase afforded a colourless solid; (0.665 g, 64% yield); mp: 108–109 °C; ^{1}H NMR (500 MHz, DMSO-d_6) δ 6.18 (s, 2H), 2.93 (s, 3H), 0.85 (s,

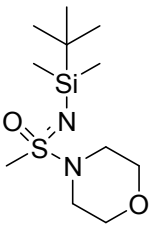
9H), 0.01 (s, 3H), 0.01 (s, 3H); ^{13}C NMR (126 MHz, DMSO-d_6) δ 48.3, 26.1, 17.7, -2.4; HRMS (ESI+): not available (weal UV).

_N_'-(_tert_-Butyldimethylsilyl)-_N_-ethylmethanesulfonimidamide (5b):



A solution of $EtNH_2$ in THF (2 M) (1.50 mL, 3.0 mmol) was added to the reaction mixture of *in-situ* formed **2a**. Automated flash chromatography on a Biotage KP-SIL 25g column using a gradient of EtOAc (20–80%) in heptane over 10 CV gave a colourless oil; (143 mg, 61% yield); ^{1}H NMR (500 MHz, DMSO-d_6) δ 6.21 (t, *J* = 5.9 Hz, 1H), 2.86–2.99 (m, 2H), 2.82 (s, 3H), 1.06 (t, *J* = 7.2 Hz, 3H), 0.85 (s, 9H), 0.01 (s, 3H), 0.01 (s, 3H); ^{13}C NMR (126 MHz, DMSO-d_6) δ 43.7, 38.0, 26.0, 17.7, 15.1, -2.4, -2.5; HRMS (ESI+) calcd for $[M + H]^+$ $C_9H_{25}N_2OSSi^+$: 237.1457, found 237.1447.

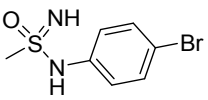
4-{_N_-[_tert_-Butyl(dimethyl)silyl]-_S_-methylsulfonimidoyl}morpholine[a] (5c):



Morpholine (0.261 mL, 3.00 mmol) was added to the reaction mixture of *in-situ* formed **2a**. Automated flash chromatography on a Biotage KP-SIL 25g column using a gradient of EtOAc (20–80%) in heptane over 10 CV gave a colourless oil; (185 mg, 66% yield); ^{1}H NMR (500 MHz, DMSO-d_6) δ 3.58–3.68 (m, 4H), 3.03 (t, *J* = 4.7 Hz, 4H), 2.76 (s, 3H), 0.85 (s, 9H), 0.03 (s, 3H), 0.02 (s, 3H); ^{13}C NMR (126 MHz, DMSO-d_6) δ 65.9, 46.3, 37.0, 25.9, 17.7, -2.6; HRMS (ESI+) calcd for $[M + H]^+$ $C_{11}H_{27}N_2O_2SSi^+$: 279.1563, found 279.1580.

([a] structure name was generated using ACD name because ChemDraw does not work for it.)

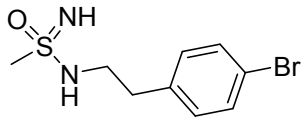
_N_'-(4-Bromophenyl)methanesulfonimidamide (5d):



A solution of 4-bromoaniline (516 mg, 3.00 mmol) in dry $CHCl_3$ (2.0 mL) was added to the reaction mixture of *in-situ* formed **2a**. Deprotection conditions: formic acid (1.00 mL, 26.5 mmol), water (1.00 ml, 55.5 mmol), 30 min. HPLC

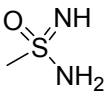
using a gradient of acetonitrile (5–95%) in H_2O/NH_3 (100: 0.2) as the mobile phase gave a colourless solid; (90 mg, 36% yield); mp: 135–137 °C; ^{1}H NMR (500 MHz, DMSO-d_6) δ 7.30 (d, *J* = 8.6 Hz, 2H), 6.92 (d, *J* = 8.2 Hz, 2H), 6.79 (s, 2H), 3.12 (s, 3H); ^{13}C NMR (126 MHz, DMSO-d_6) δ 145.3, 131.2, 124.5, 111.7, 45.6; HRMS (ESI+) calcd for $[M + H]^+$ $C_7H_{10}BrN_2OS^+$: 248.9697, found 248.9698.

***N*-(4-Bromophenethyl)methanesulfonimidamide (5e):**



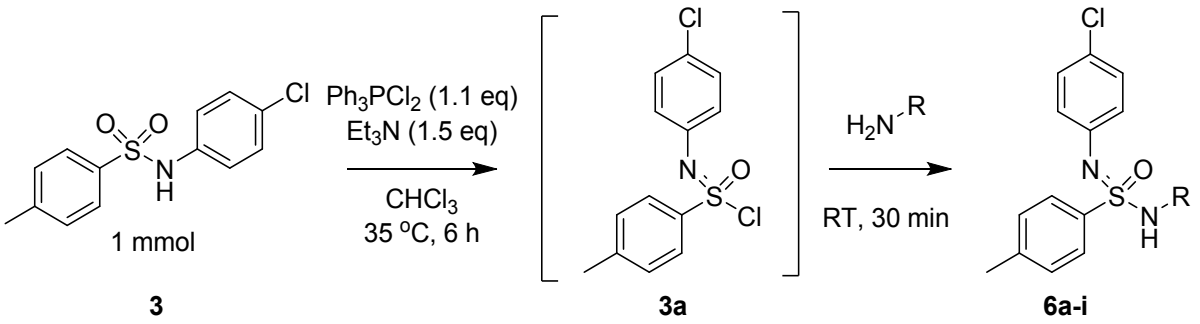
2-(4-Bromophenyl)ethanamine (0.465 ml, 3.00 mmol) was added to the reaction mixture of *in-situ* formed **2a**. Deprotection conditions: HCl in dioxane (4M) (1.00 mL, 4.00 mmol), 5 min. HPLC using a gradient of acetonitrile (0–60%) in H_2O/NH_3 (100: 0.2) as the mobile phase gave a colourless solid; (161 mg, 58% yield); mp: 86–87 °C; ^{1}H NMR (500 MHz, DMSO-d_6) δ 7.44–7.53 (m, 2H), 7.20 (d, *J* = 8.4 Hz, 2H), 6.42 (br s, 1H), 3.37 (br s, 1H), 3.12 (tq, *J* = 9.3, 5.3, 5.1 Hz, 2H), 2.78 (s, 3H), 2.72 (t, 2H); ^{13}C NMR (126 MHz, DMSO-d_6) δ 138.9, 131.1, 119.1, 44.5, 41.2, 35.3; (One broad ^{13}C peak (δ 131.1) accounts for an average of 2 aromatic carbon environments, confirmed by HSQC); HRMS (ESI+) calcd for $[M + H]^+$ $C_9H_{14}BrN_2OS^+$: 277.0010, found 277.0009.

Methanesulfonimidamide (5f):



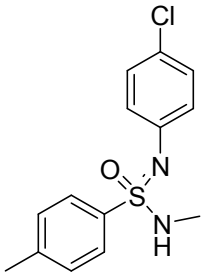
N'-(*tert*-butyldimethylsilyl)methanesulfonimidamide (**5a**) (75 mg, 0.36 mmol) was dissolved in FA (1.5 mL) and water (0.2 mL). The mixture was stirred at RT for 30 min. The solvents were removed under reduced pressure to give an oil residue, which was treated with i-PrOH and TBME to give the title product as a white crystalline solid; (30 mg, 89% yield); mp: 90–91 °C; ^{1}H NMR (400 MHz, DMSO-d_6) δ 6.22 (br s, 1H), 2.91 (s, 3H); (only one proton was integrated at 6.22 ppm); ^{13}C NMR (101 MHz, DMSO-d_6) δ 45.6; HRMS (ESI+) calcd for $[M + H]^+$ $CH_7N_2OS^+$: 95.0279, found 95.0268.

Typical procedure B: sulfonimidamides 6a-i from 3



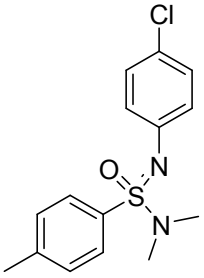
To a stirred suspension of Ph_3PCl_2 (367 mg, 1.10 mmol) in dry $CHCl_3$ (3.0 mL) under a N_2 atmosphere (prepared according to general procedure A), was added triethylamine (0.209 mL, 1.50 mmol). The mixture was stirred for 10 min at room temperature, a yellow suspension immediately formed. A solution of **3** (282 mg, 1.00 mmol) in dry $CHCl_3$ (0.7 mL) was added. The reaction mixture was stirred for 5 min at room temperature, a light brown solution formed. The reaction mixture was warmed to 35 °C and stirred for 6 hours, the solution darkened with time. No attempt was made to isolate **3a**. The reaction mixture was added slowly via syringe to a solution of amine (3 mmol) in dry $CHCl_3$ (2.0 mL). The mixture was stirred for 30 min at room temperature. If a suspension formed, the solids were removed by filtration. The solvent was removed under reduced pressure and the residue was purified by HPLC, SFC, or automated flash chromatography.

***N'*-(4-Chlorophenyl)-*N*,4-dimethylbenzenesulfonimidamide (6a):**



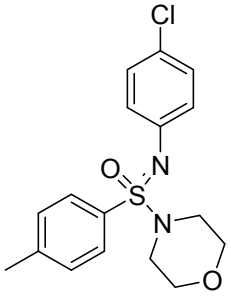
A solution of methylamine in EtOH (33% wt) (0.371 mL, 3.00 mmol) diluted with dry $CHCl_3$ (2.0 mL) was added to the reaction mixture of *in-situ* formed **3a**. Automated flash chromatography using heptane/isopropyl alcohol (87:13) as the mobile phase gave a colourless solid; (145 mg, 49% yield); mp: 156–157 °C; ^{1}H NMR (500 MHz, DMSO-d_6) δ 7.81 (d, *J* = 8.3 Hz, 2H), 7.40 (d, *J* = 8.0 Hz, 2H), 7.30 (m, 1H), 7.17–7.23 (m, 2H), 7.00–7.06 (m, 2H), 2.38 (s, 3H), 2.37 (d, *J* = 4.6 Hz, 3H); ^{13}C NMR (126 MHz, DMSO-d_6) δ 143.9, 142.6, 136.0, 129.6, 128.6, 127.3, 124.8, 124.5, 28.7, 21.0; HRMS (ESI+) calcd for $[M + H]^+$ $C_{14}H_{16}ClN_2OS^+$: 295.0672, found 295.0684.

N'-(4-chlorophenyl)-N,N,4-trimethylbenzenesulfonimidamide (6b):



A solution of $(Me)_2NH$ in THF (2 M) (1.5 mL, 3.00 mmol) was added to the reaction mixture of *in-situ* formed **3a**. HPLC using a gradient of 40-100% acetonitrile in H2O/ACN/NH_3 95/5/0.2 buffer gave as an off-white solid; (142 mg, 46% yield); mp: 87–89 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.85 (d, *J* = 8.0 Hz, 2H), 7.34 (d, *J* = 8.0 Hz, 2H), 7.14 – 7.21 (m, 4H), 2.67 (s, 6H), 2.44 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 143.4, 142.8, 132.1, 129.7, 129.1, 128.2, 126.9, 124.9, 38.7, 21.6; mp: 91–92 °C; HRMS (ESI+) calcd for $[M + H]^+$ $C_{15}H_{18}ClN_2OS^+$: 309.0828, found 309.0838.

4-[*N*-(4-Chlorophenyl)-*S*-(4-methylphenyl)sulfonimidoyl]morpholine[a] (6c):[2]

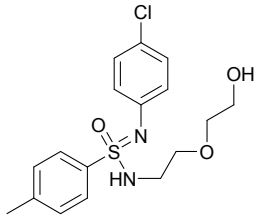


A solution of morpholine (0.261 mL, 3.00 mmol) in dry $CHCl_3$ (2.0 mL) was added to the reaction mixture of *in-situ* formed **3a**. HPLC using a

gradient of acetonitrile (5–90%) in water/ formic acid (100: 0.2) as the mobile phase gave as a colourless oil which partially solidified upon standing; (87 mg, 25% yield); ^{1}H NMR (500 MHz, DMSO-d_6) δ 7.79 (d, J = 8.3 Hz, 2H), 7.48 (d, *J* = 8.0 Hz, 2H), 7.24–7.3 (m, 2H), 7.1–7.16 (m, 2H), 3.46–3.6 (m, 4H), 2.81–2.93 (m, 4H), 2.42 (s, 3H); ^{13}C NMR (126 MHz, DMSO-d_6) δ 143.7, 142.6, 131.1, 129.8, 128.9, 127.9, 125.5, 124.8, 65.4, 46.4, 21.0; HRMS (ESI+) calcd for $[M + H]^+$ $C_{17}H_{20}ClN_2O_2S^+$: 351.0934, found 351.0957.

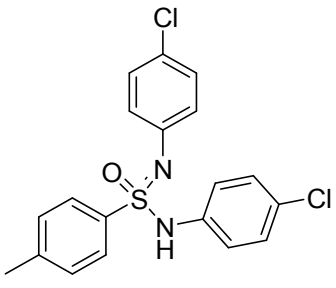
([a] structure name was generated using ACD name because ChemDraw does not work for it.)

***N*'-(4-chlorophenyl)-*N*-(2-(2-hydroxyethoxy)ethyl)-4-methylbenzenesulfonimidamide (6d):**



2-(2-aminoethoxy)ethanol (42.1 mg, 0.40 mmol) was added to the reaction mixture of *in-situ* formed **3a**. HPLC using a gradient of acetonitrile (5–90%) in H_2O/ NH_3 (100: 0.2) as the mobile phase gave as a yellow oil; (55.0 mg, 37% yield); ^{1}H NMR (400 MHz, DMSO-d6) δ 7.83 (d, *J* = 8.2 Hz, 2H), 7.49 (s, 1H), 7.39 (d, *J* = 8.2 Hz, 2H), 7.17 – 7.23 (m, 2H), 7.01 – 7.07 (m, 2H), 4.53 (t, *J* = 5.3, 5.3 Hz, 1H), 3.40 (q, *J* = 5.3, 5.3, 5.3 Hz, 2H), 3.22 – 3.33 (m, 4H), 2.89 (s, 2H), 2.38 (s, 3H); ^{13}C NMR (101 MHz, DMSO-d_6) δ 143.8, 142.6, 137.5, 129.53, 128.6, 127.1, 124.8, 124.6, 72.0, 68.7, 60.1, 42.4, 21.0; HRMS (ESI+) calcd for $[M + H]^+$ $C_{17}H_{22}ClN_2O_3S^+$: 369.1039, found 369.1035.

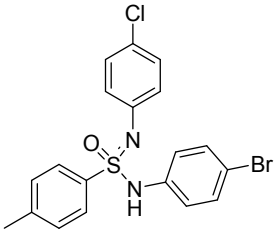
***N*,*N*′-Bis(4-chlorophenyl)-4-methylbenzenesulfonimidamide (6e):**



A solution of 4-chloroaniline (153 mg, 1.20 mmol) in dry $CHCl_3$ (2.0 mL) was added to the reaction mixture of *in-situ* formed **3a**. HPLC using a gradient of acetonitrile (5–90%) in H_2O/ NH_3 (100: 0.2) as the mobile phase gave a colourless solid; (75.0 mg,

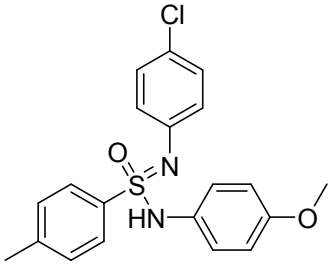
48% yield); mp: 146–147 °C; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.81 (d, *J* = 8.5, 2H), 7.21 (d, *J* = 8.1, 2H), 7.11–7.16 (m, 4H), 7.02–7.07 (m, 4H), 2.37 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 143.0, 139.0, 135.8, 129.6, 129.1, 128.7, 127.5, 123.6, 21.5; ^{1}H NMR (400 MHz, DMSO-d_6) δ 10.18 (s, 1H), 7.83 (d, *J* = 8.4 Hz, 2H), 7.37 (d, *J* = 8.4 Hz, 2H), 7.2 – 7.32 (m, 4H), 7.03 – 7.2 (m, 4H), 2.34 (s, 3H); ^{13}C NMR (101 MHz, DMSO-d_6) δ 143.4, 137.5, 136.2, 129.8, 129.0, 127.2, 124.6, 121.3, 21.0; HRMS (ESI+) calcd for $[M + H]^+$ $C_{19}H_{17}Cl_2N_2OS^+$:391.0439, found 391.0449. (Note: In $CDCl_3$ the N–H resonance was not observed, possibly because it is readily exchangeable).

_N_-(4-Bromophenyl)-_N'_-(4-chlorophenyl)-4-methylbenzenesulfonimidamide (6f):



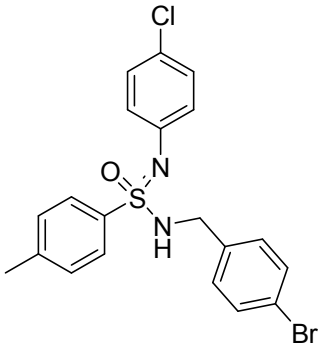
A solution of 4-bromoaniline (516 mg, 3.00 mmol) in dry $CHCl_3$ (2.0 mL) was added to the reaction mixture of *in-situ* formed **3a**. SFC using 25% EtOH in CO_2 (120 bar) as the mobile phase gave a light brown solid; (239 mg, 55% yield); mp: 146–148 °C (decomposed); ^{1}H NMR (500 MHz, DMSO-d_6) δ 10.19 (s, 1H), 7.83 (d, *J* = 8.4 Hz, 2H), 7.34–7.4 (m, 4H), 7.25 (d, *J* = 8.2 Hz, 2H), 7.10 (br s, 4H), 2.34 (s, 3H); ^{13}C NMR (126 MHz, DMSO-d_6) δ 143.3, 137.8, 137.4, 136.1, 131.8, 129.7, 128.9, 127.1, 125.0, 124.5, 121.4, 121.3, 20.9; HRMS (ESI+) calcd for $[M + H]^+$ $C_{19}H_{17}BrClN_2OS^+$ 434.9933, found 434.9928.

N'-(4-chlorophenyl)-N-(4-methoxyphenyl)-4-methylbenzenesulfonimidamide (6g):



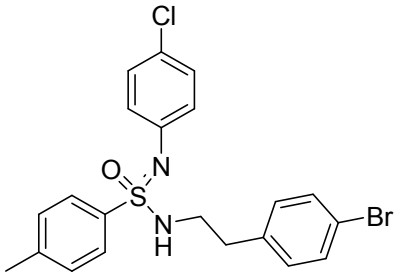
A solution of 4-methoxyaniline (49.3 mg, 0.40 mmol) in dry $CHCl_3$ (2.0 mL) was added to the reaction mixture of *in-situ* formed **3a**. HPLC using a gradient of acetonitrile (5–90%) in H_2O/ NH_3 (100: 0.2) as the mobile phase gave an off-white solid; (26.4 mg, 17% yield); mp: 160–161 °C; ^{1}H NMR (400 MHz, DMSO-d6) δ 9.73 (s, 1H), 7.77 (d, *J* = 8.1 Hz, 2H), 7.34 (d, *J* = 8.1 Hz, 2H), 7.25 (d, *J* = 8.6 Hz, 2H), 7.13 (d, *J* = 8.6 Hz, 2H), 6.95 (s, 2H), 6.76 (d, *J* = 8.6 Hz, 2H), 3.65 (s, 3H), 2.34 (s, 3H); ^{13}C NMR (101 MHz, DMSO-d6) δ 142.9, 136.4, 129.5, 128.8, 127.1, 123.5, 114.2, 55.1, 20.9; HRMS (ESI+) calcd for $[M + H]^+$ $C_{20}H_{20}ClIN_2O_2S^+$ 387.0934, found 387.0941.

_N_-(4-Bromobenzyl)-N'-(4-chlorophenyl)-4-methylbenzenesulfonimidamide (6h):



A solution of (4-bromophenyl)methanamine (558 mg, 3.00 mmol) in dry $CHCl_3$ (2.0 mL) was added to the reaction mixture of *in-situ* formed **3a**. HPLC using Heptane/EtOH/TEA (50:50:0.1) as the mobile phase gave a light pink solid; (182 mg, 41% yield); mp: 116–117 °C; ^{1}H NMR (500 MHz, DMSO-d_6) δ 7.97 (t, *J* = 6.0 Hz, 1H), 7.77–7.82 (m, 2H), 7.32–7.42 (m, 4H), 7.17–7.22 (m, 2H), 7.01–7.1 (m, 4H), 3.93 (d, *J* = 6.0 Hz, 2H), 2.38 (s, 3H); ^{13}C NMR (126 MHz, DMSO-d_6) δ 143.7, 142.6, 137.4, 137.1, 130.9, 129.8, 129.5, 128.6, 127.1, 124.9, 124.7, 120.1, 45.6, 20.9; HRMS (ESI+) calcd for $[M + H]^+$ $C_{20}H_{19}BrClN_2OS^+$: 449.0090, found 449.0077.

_N_-(4-Bromophenethyl)-_N′_-(4-chlorophenyl)-4-methylbenzenesulfonimidamide (6i):

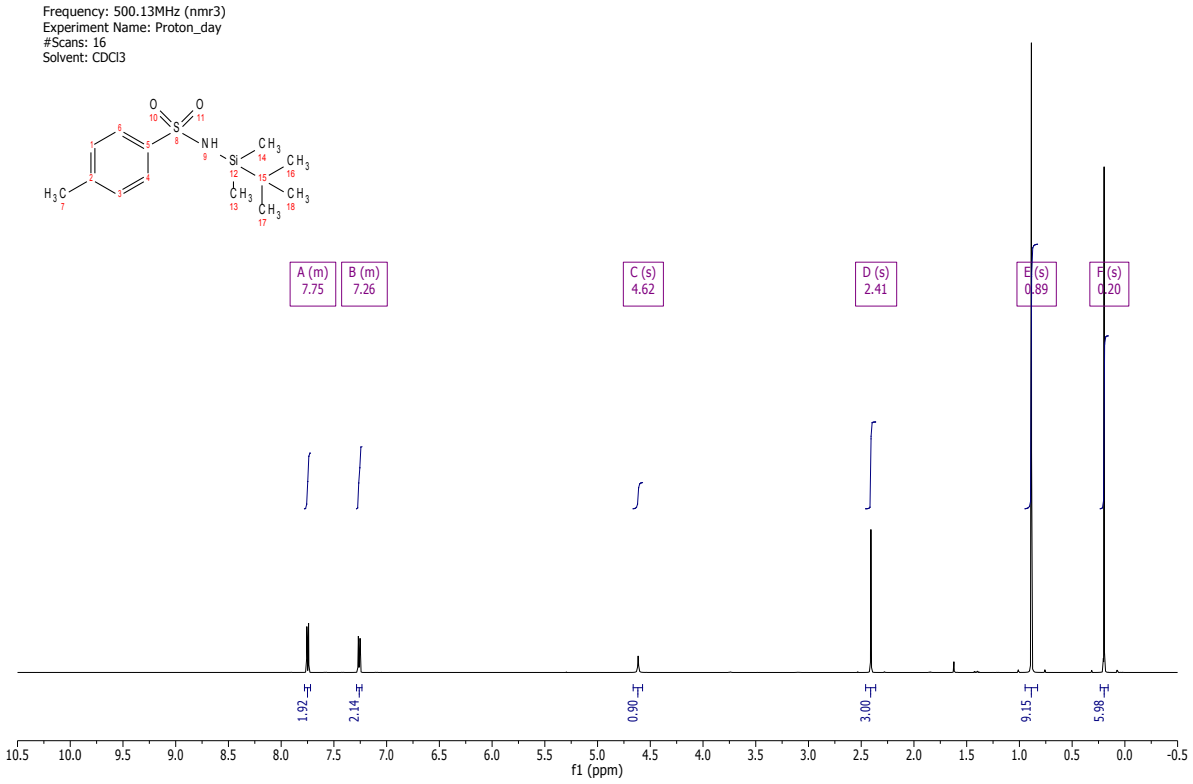


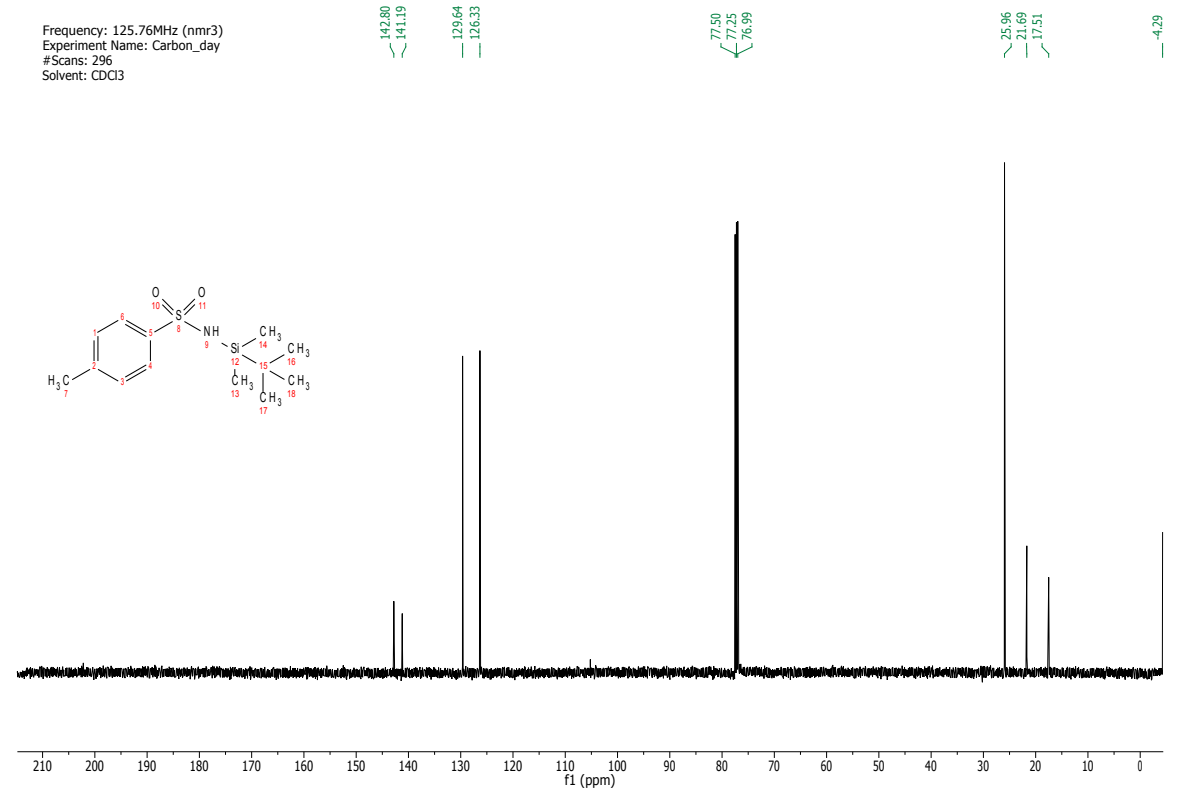
A solution of 2-(4-bromophenyl)ethanamine (600 mg, 3.00 mmol) in dry $CHCl_3$ (2.0 mL) was added to the reaction mixture of *in-situ* formed **3a**. HPLC using 15% EtOH/TEA

(100: 0.5) in CO_2 (120 bar) as the mobile phase. The title compound was obtained as a colourless solid; (157 mg, 34% yield); mp: 107–108 °C; ^{1}H NMR (500 MHz, DMSO-d_6) δ 7.75–7.8 (m, 2H), 7.49 (s, 1H), 7.34–7.41 (m, 4H), 7.12–7.18 (m, 2H), 7.01 (d, J = 8.3 Hz, 2H), 6.91–6.98 (m, 2H), 2.94 (d, J = 9.2 Hz, 2H), 2.57 (t, J = 7.0 Hz, 2H), 2.38 (s, 3H); ^{13}C NMR (126 MHz, DMSO-d_6) δ 143.8, 142.5, 138.2, 137.2, 131.0, 130.9, 129.5, 128.5, 127.0, 124.7, 124.5, 119.2, 43.8, 34.2, 21.0; HRMS (ESI+) calcd for $[M + H]^+$ $C_{21}H_{21}BrClN_2OS^+$: 463.0246, found 463.0269.

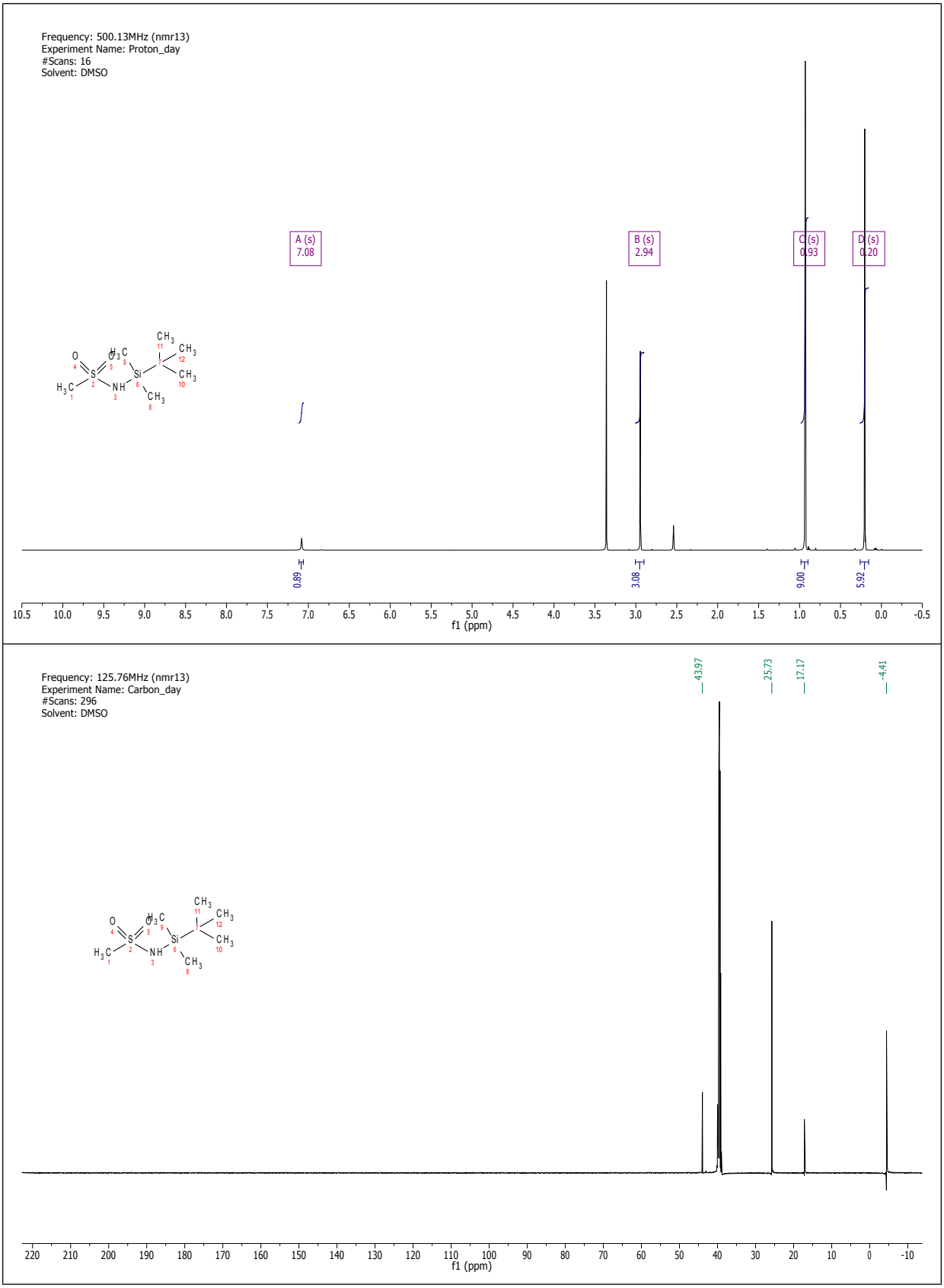
^{1}H NMR and ^{13}C NMR:

Compound 1

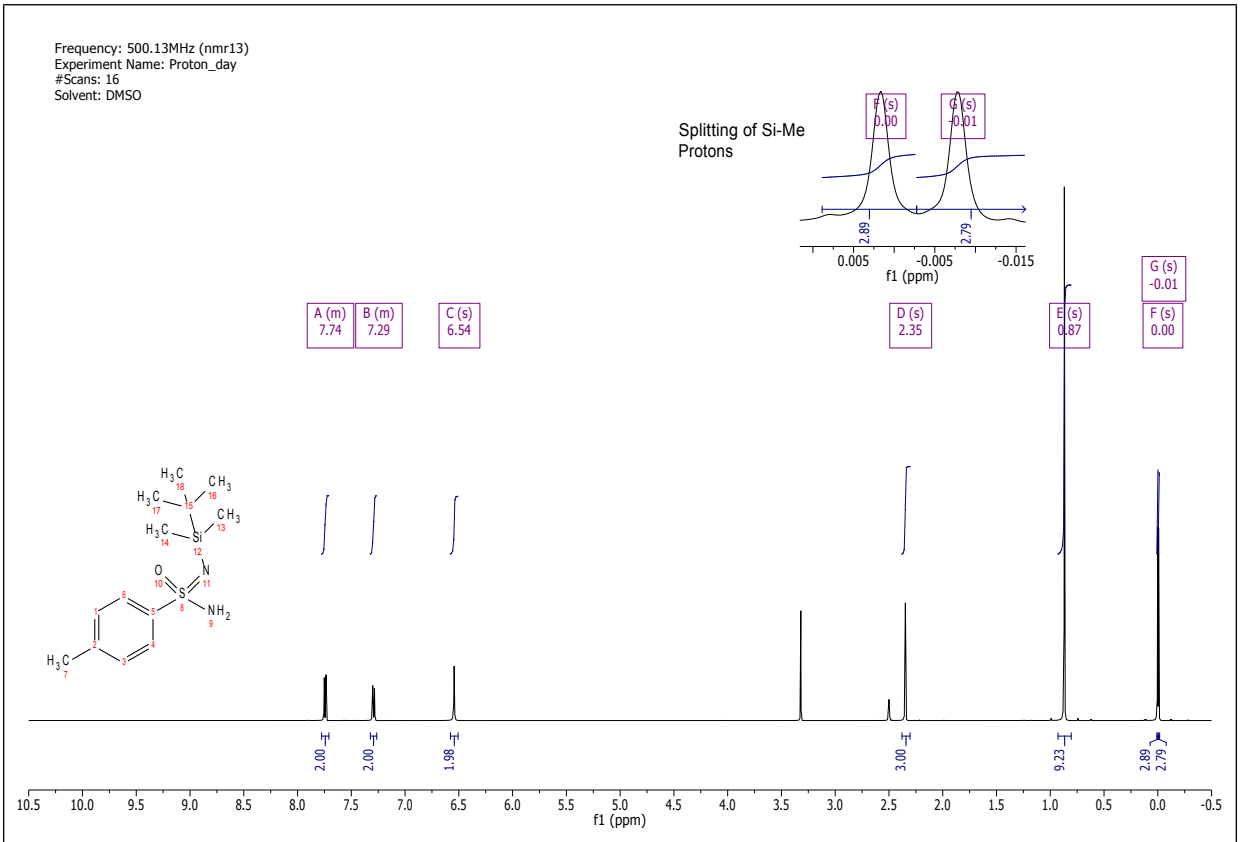


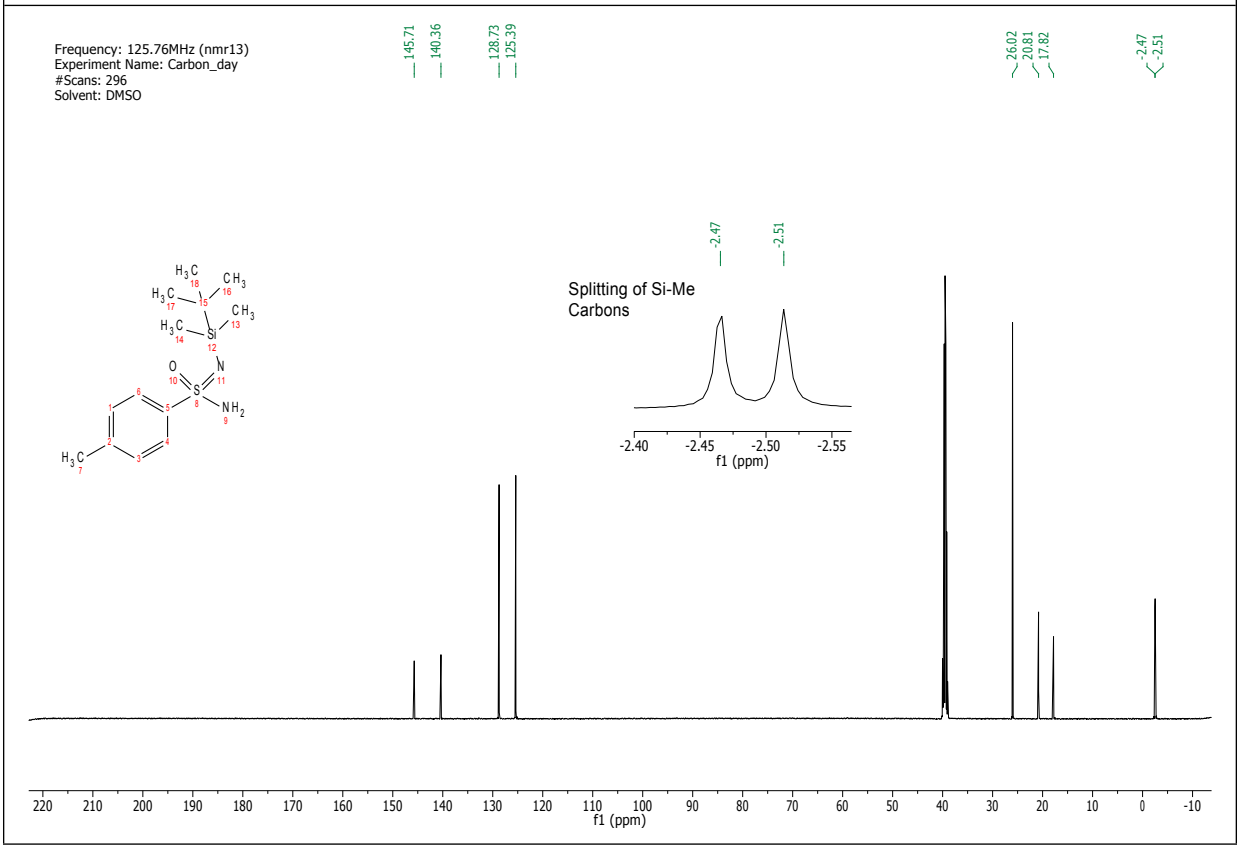


Compound 2

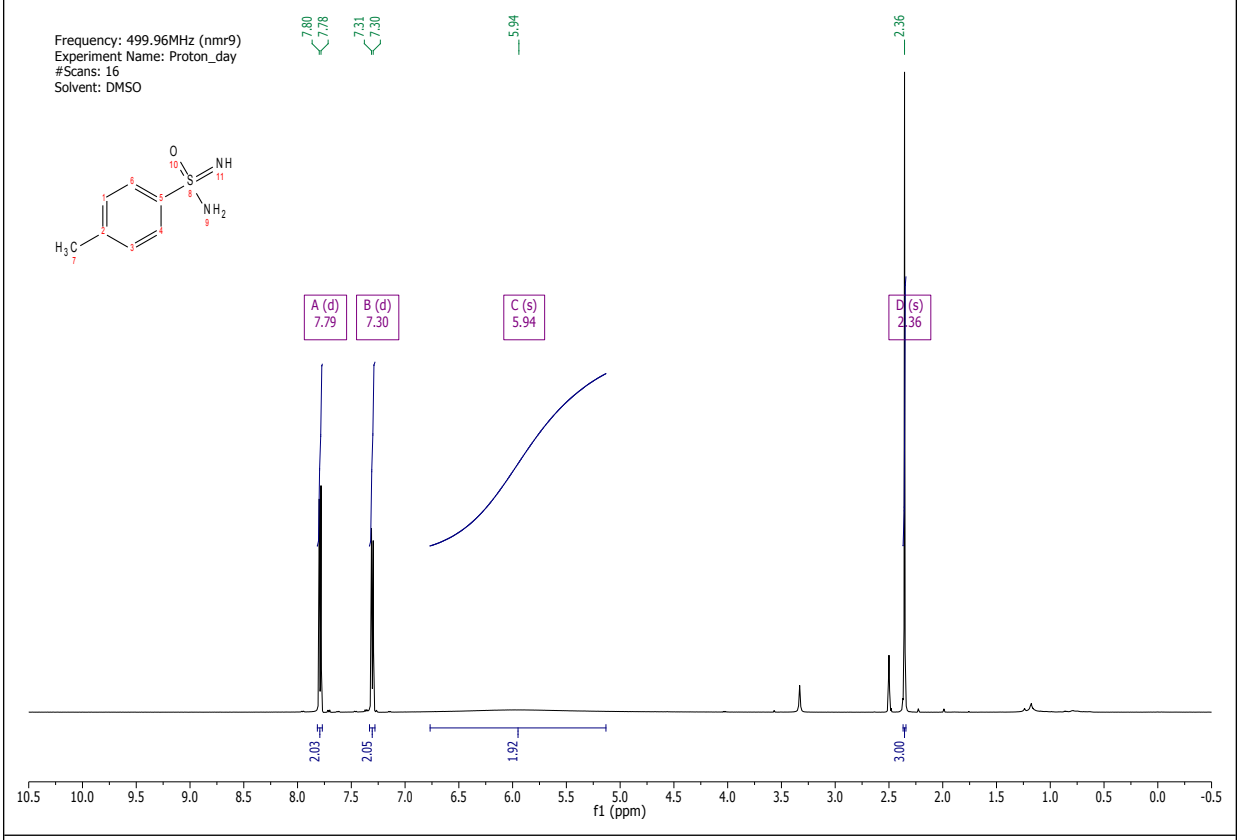

Frequency: 500.13MHz (nmr13)
Experiment Name: Proton_day
#Scans: 16
Solvent: DMSO
A (s)
7.08
B (s)
2.94
C (s)
0.93
D (s)
0.20
0.89
3.08
9.00
5.92
f1 (ppm)
Frequency: 125.76MHz (nmr13)
Experiment Name: Carbon_day
#Scans: 296
Solvent: DMSO
43.97
25.73
17.17
-4.41
f1 (ppm)

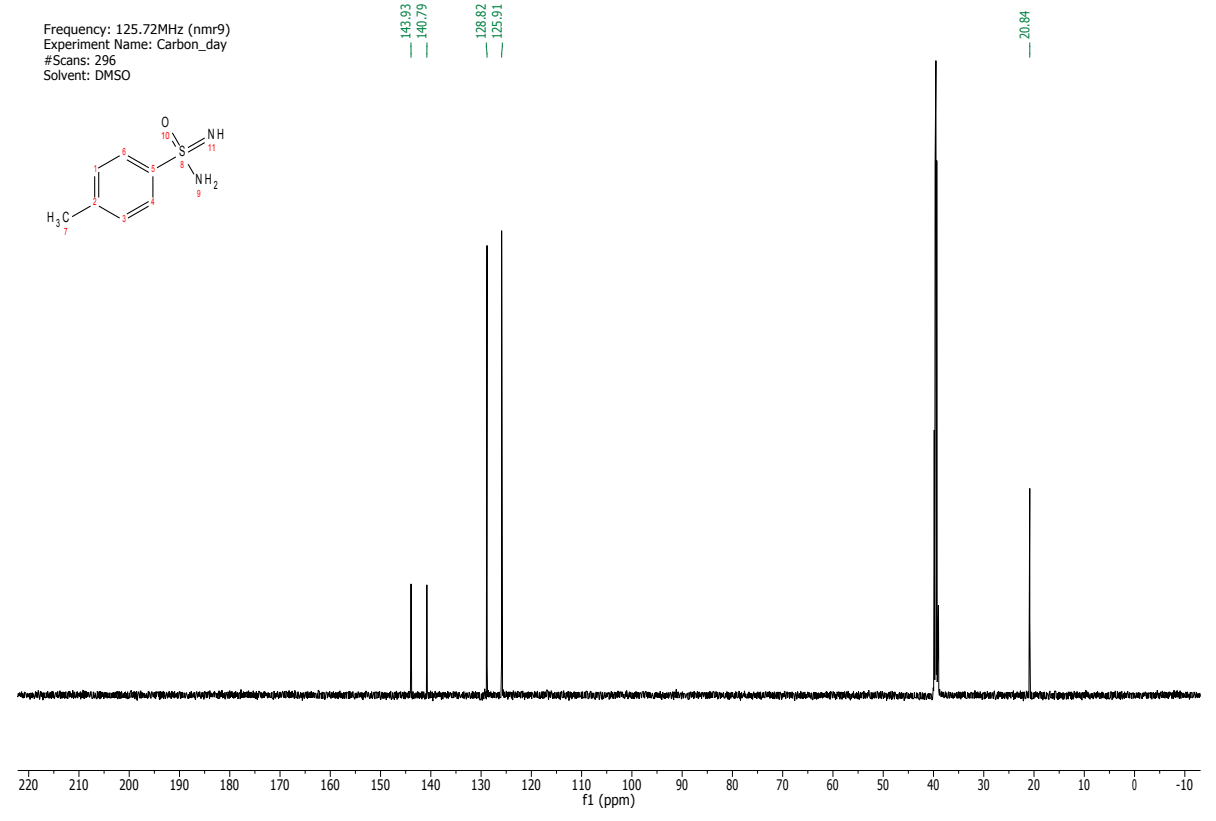
Compound 4a


Frequency: 500.13MHz (nmr13)
Experiment Name: Proton_day
#Scans: 16
Solvent: DMSO
Splitting of Si-Me Protons
F (s) 0.00
G (s) -0.01
2.89
2.79
0.005
-0.005
-0.015
f1 (ppm)
A (m) 7.74
B (m) 7.29
C (s) 6.54
D (s) 2.35
E (s) 0.87
G (s) -0.01
F (s) 0.00
2.00
2.00
1.98
3.00
9.23
2.89
2.79
10.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)

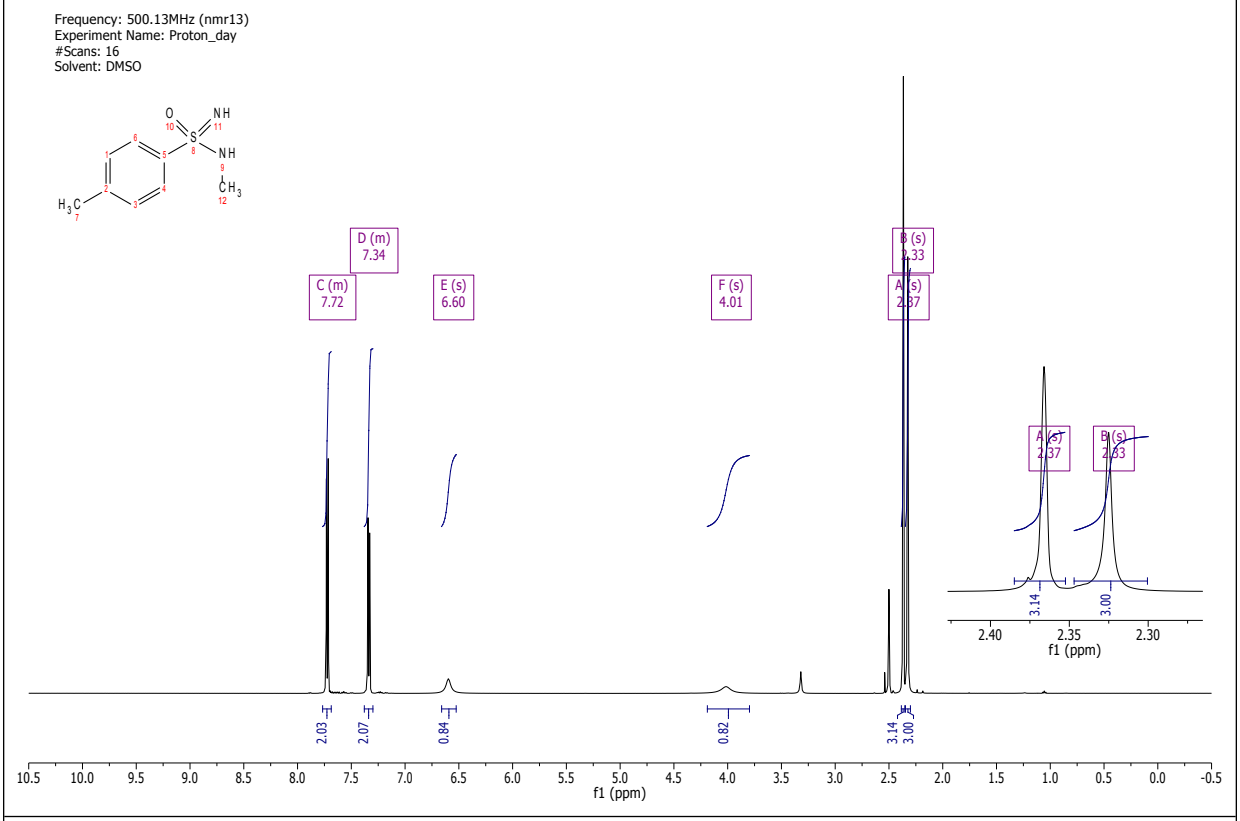

Frequency: 125.76MHz (nmr13)
Experiment Name: Carbon_day
#Scans: 296
Solvent: DMSO
145.71
140.36
128.73
125.39
26.02
20.81
17.82
-2.47
-2.51
Splitting of Si-Me Carbons
-2.40 -2.45 -2.50 -2.55
f1 (ppm)
220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

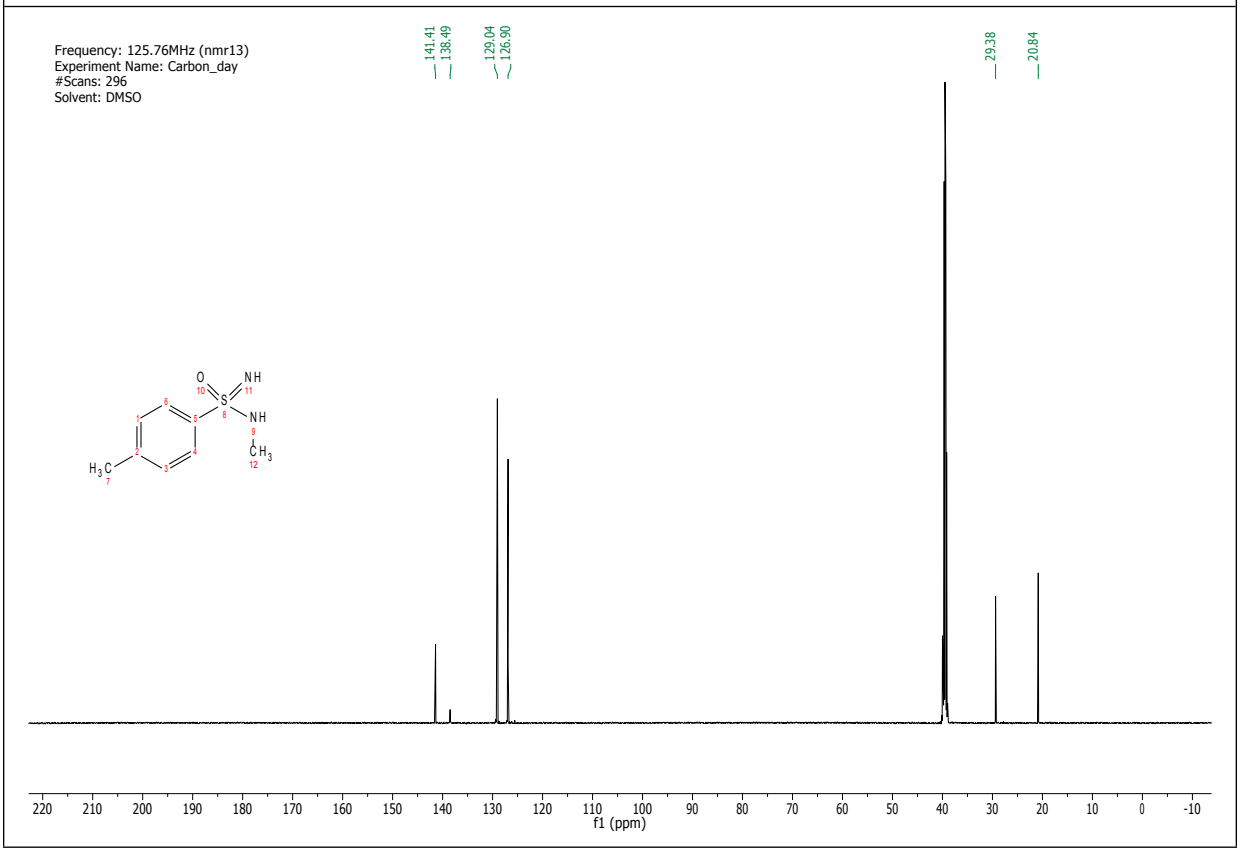
Compound 4b


Frequency: 499.96MHz (nmr9)
Experiment Name: Proton_day
#Scans: 16
Solvent: DMSO
7.80
7.78
7.31
7.30
5.94
2.36
A (d) 7.79
B (d) 7.30
C (s) 5.94
D (s) 2.36
2.03
2.05
1.92
3.00
f1 (ppm)

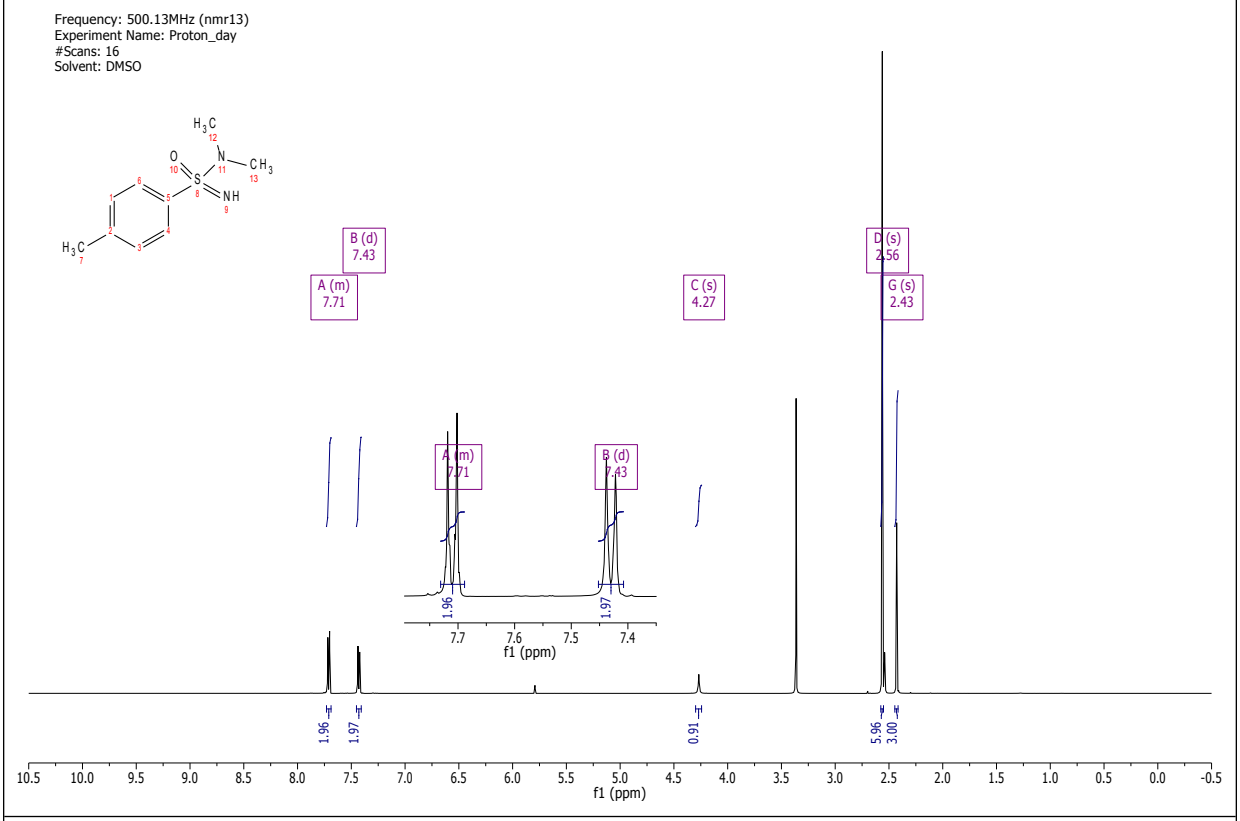

Frequency: 125.72MHz (nmr9)
Experiment Name: Carbon_day
#Scans: 296
Solvent: DMSO
143.93
140.79
128.82
125.91
20.84
f1 (ppm)

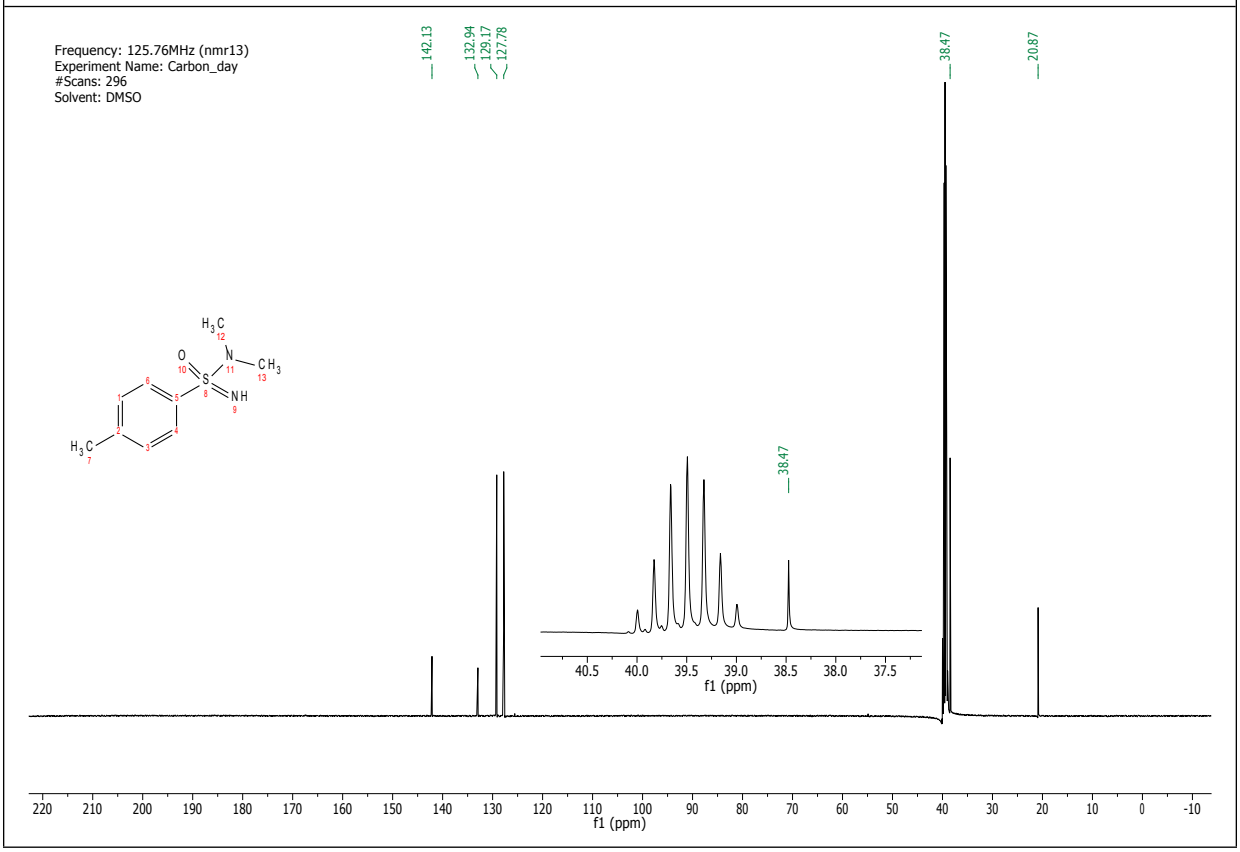
Compound 4c


Frequency: 500.13MHz (nmr13)
Experiment Name: Proton_day
#Scans: 16
Solvent: DMSO
C (m) 7.72
D (m) 7.34
E (s) 6.60
F (s) 4.01
A (s) 2.37
B (s) 2.33
2.03
2.07
0.84
0.82
3.14
3.00
f1 (ppm)

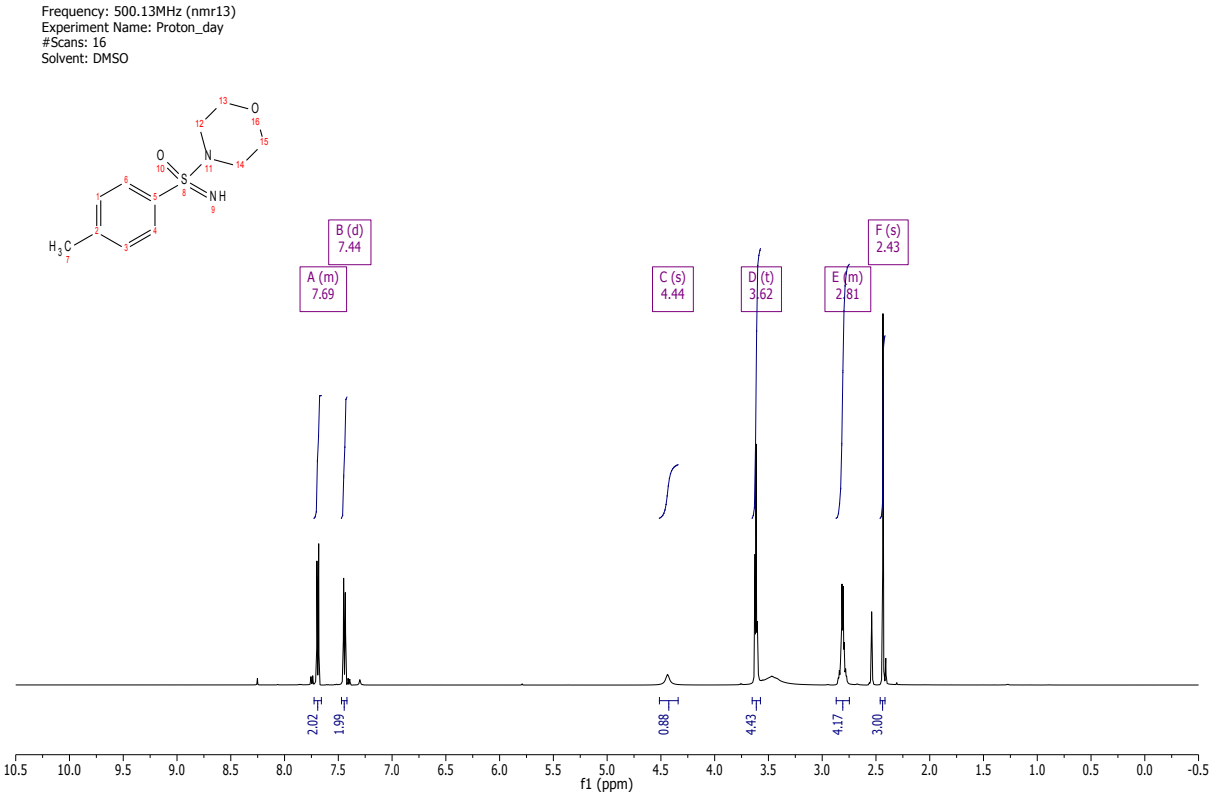

Frequency: 125.76MHz (nmr13)
Experiment Name: Carbon_day
#Scans: 296
Solvent: DMSO
141.41
138.49
129.04
126.90
29.38
20.84
f1 (ppm)

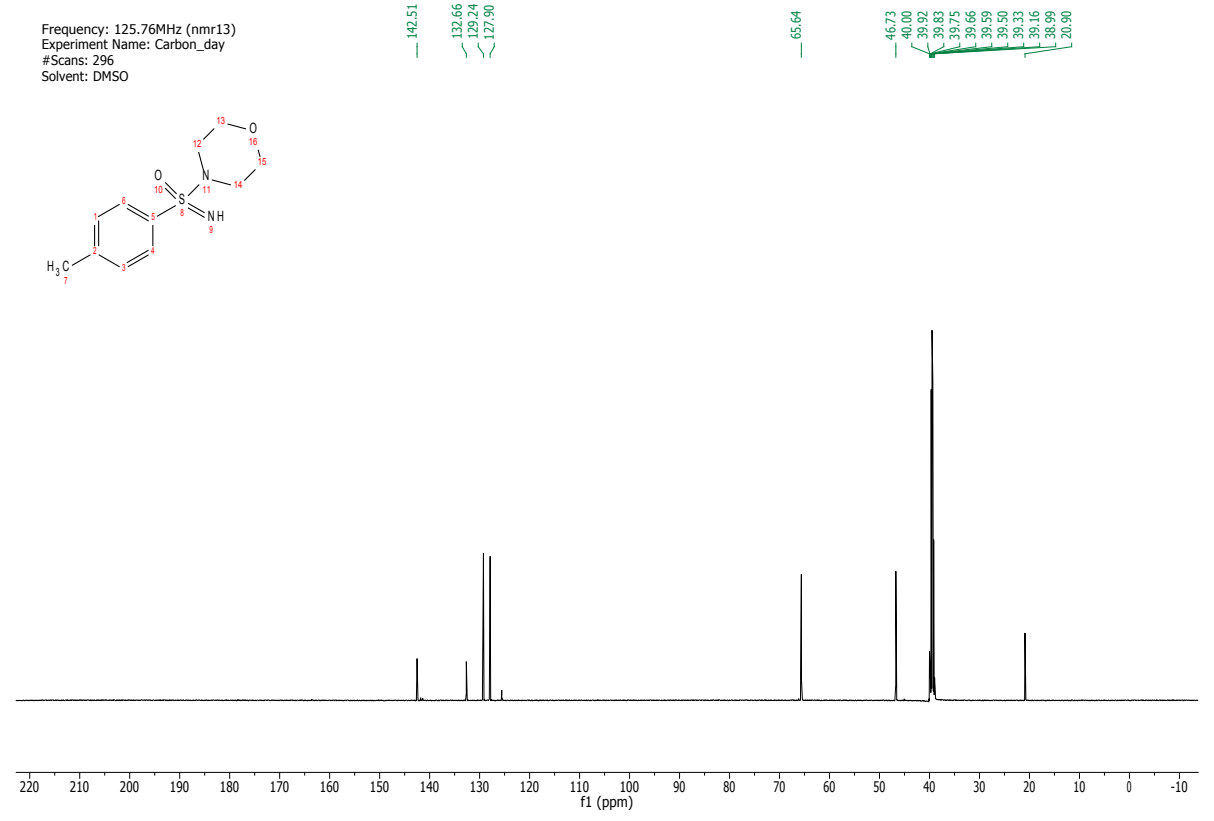
Compound 4d


Frequency: 500.13MHz (nmr13)
Experiment Name: Proton_day
#Scans: 16
Solvent: DMSO
B (d) 7.43
A (m) 7.71
C (s) 4.27
D (s) 2.56
G (s) 2.43
1.96
1.97
0.91
5.96
3.00
f1 (ppm)

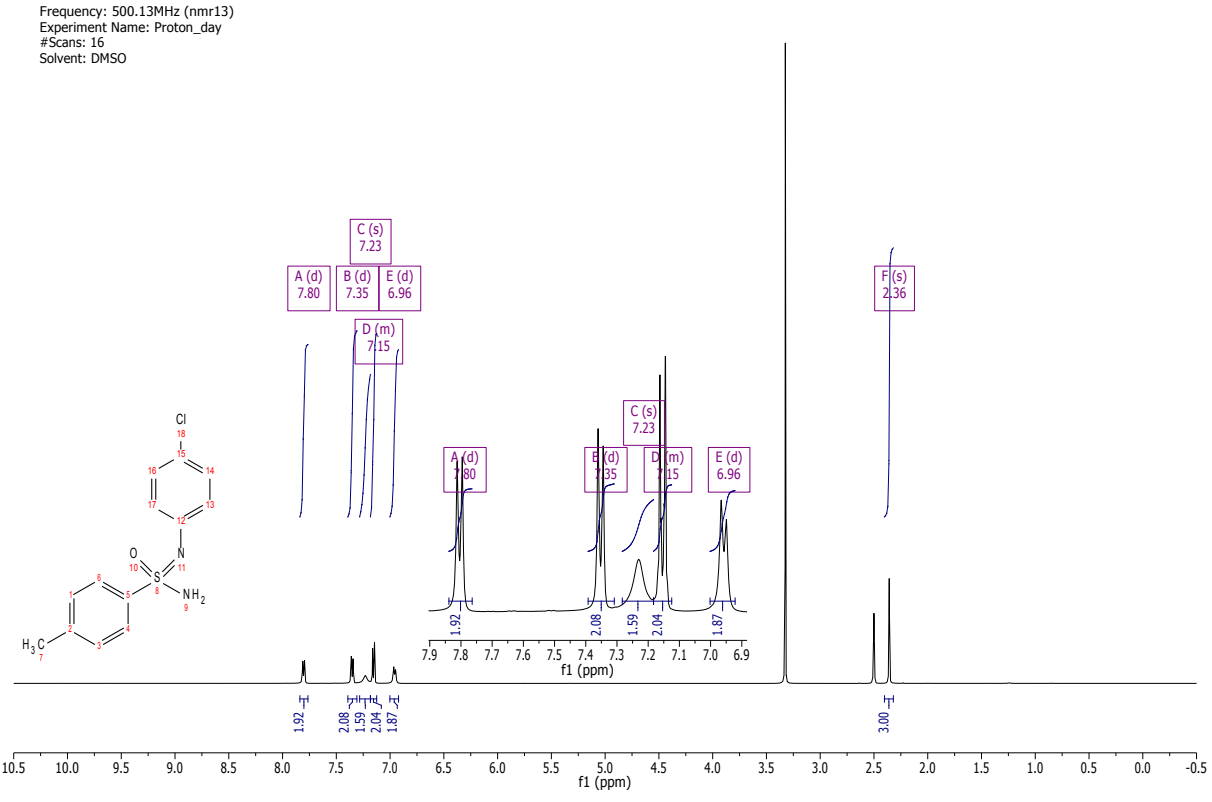

Frequency: 125.76MHz (nmr13)
Experiment Name: Carbon_day
#Scans: 296
Solvent: DMSO
142.13
132.94
129.17
127.78
38.47
20.87
f1 (ppm)

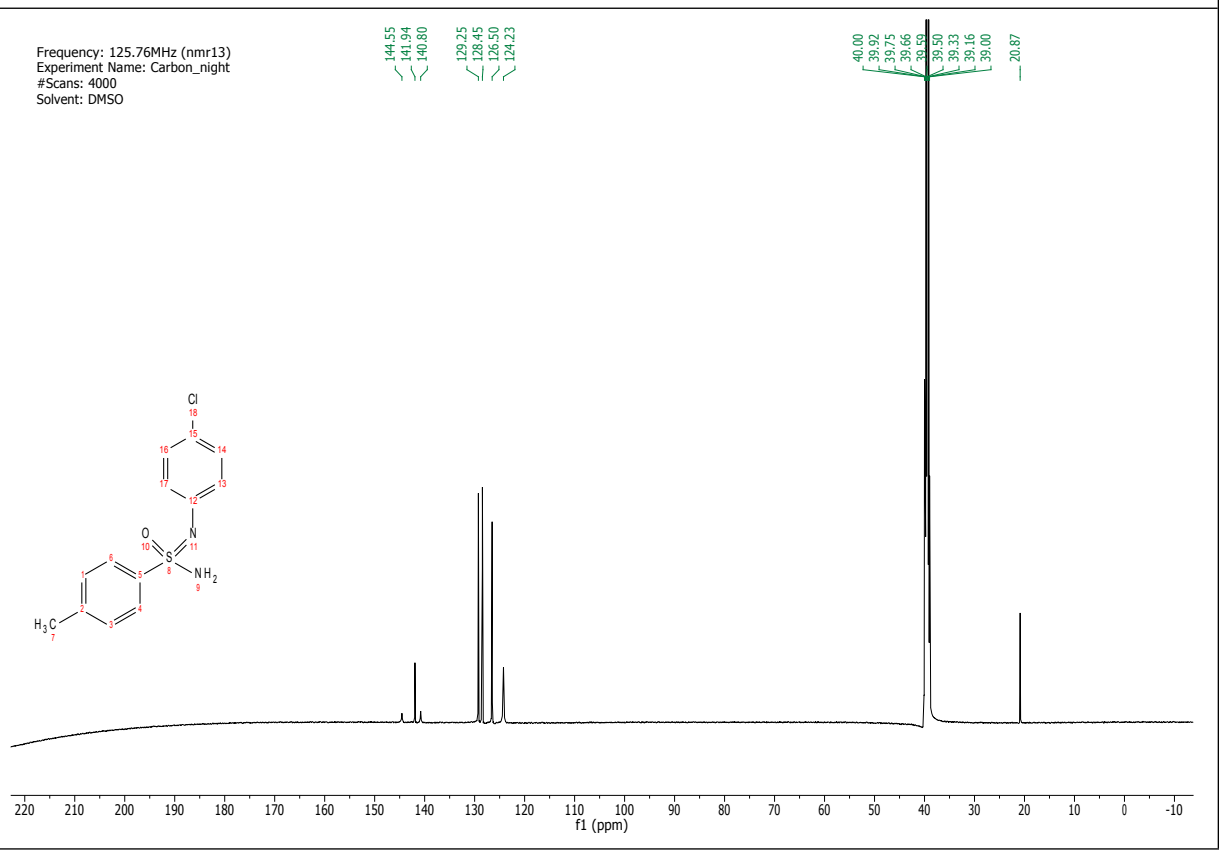
Compound 4e


Frequency: 500.13MHz (nmr13)
Experiment Name: Proton_day
#Scans: 16
Solvent: DMSO
A (m) 7.69
B (d) 7.44
C (s) 4.44
D (t) 3.62
E (m) 2.81
F (s) 2.43
2.02
1.99
0.88
4.43
4.17
3.00
f1 (ppm)

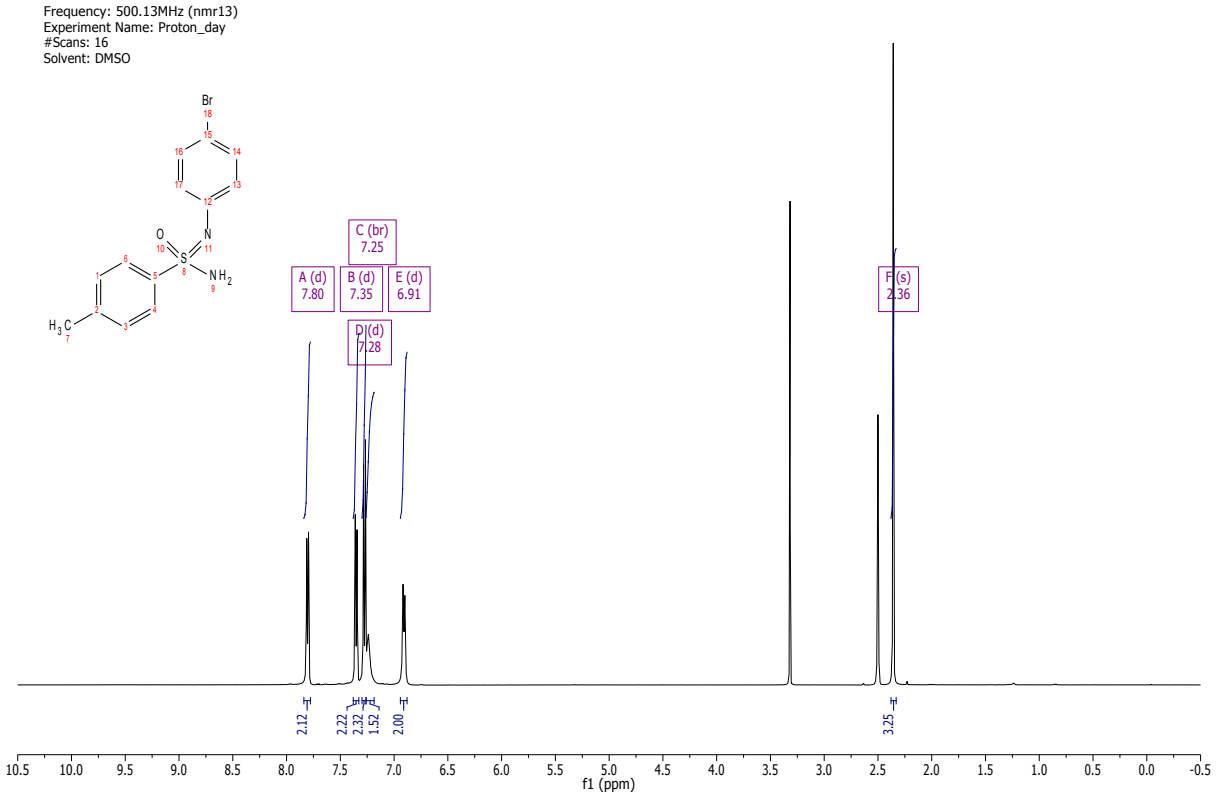

Frequency: 125.76MHz (nmr13)
Experiment Name: Carbon_day
#Scans: 296
Solvent: DMSO
142.51
132.66
129.24
127.90
65.64
46.73
40.00
39.92
39.83
39.75
39.66
39.59
39.50
39.33
39.16
38.99
20.90
f1 (ppm)

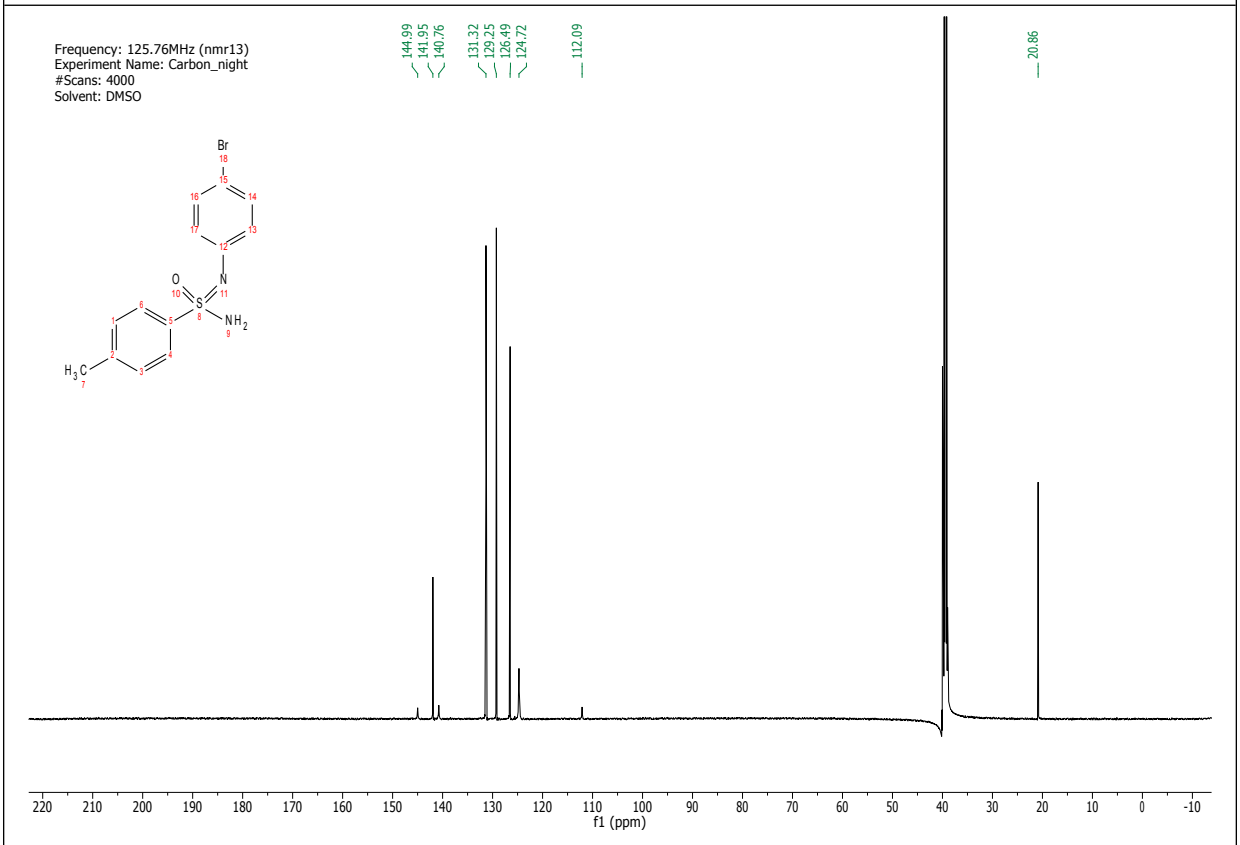
Compound 4f


Frequency: 500.13MHz (nmr13)
Experiment Name: Proton_day
#Scans: 16
Solvent: DMSO
A (d) 7.80
B (d) 7.35
C (s) 7.23
D (m) 7.15
E (d) 6.96
F (s) 2.36
1.92
2.08
1.59
2.04
1.87
3.00
f1 (ppm)

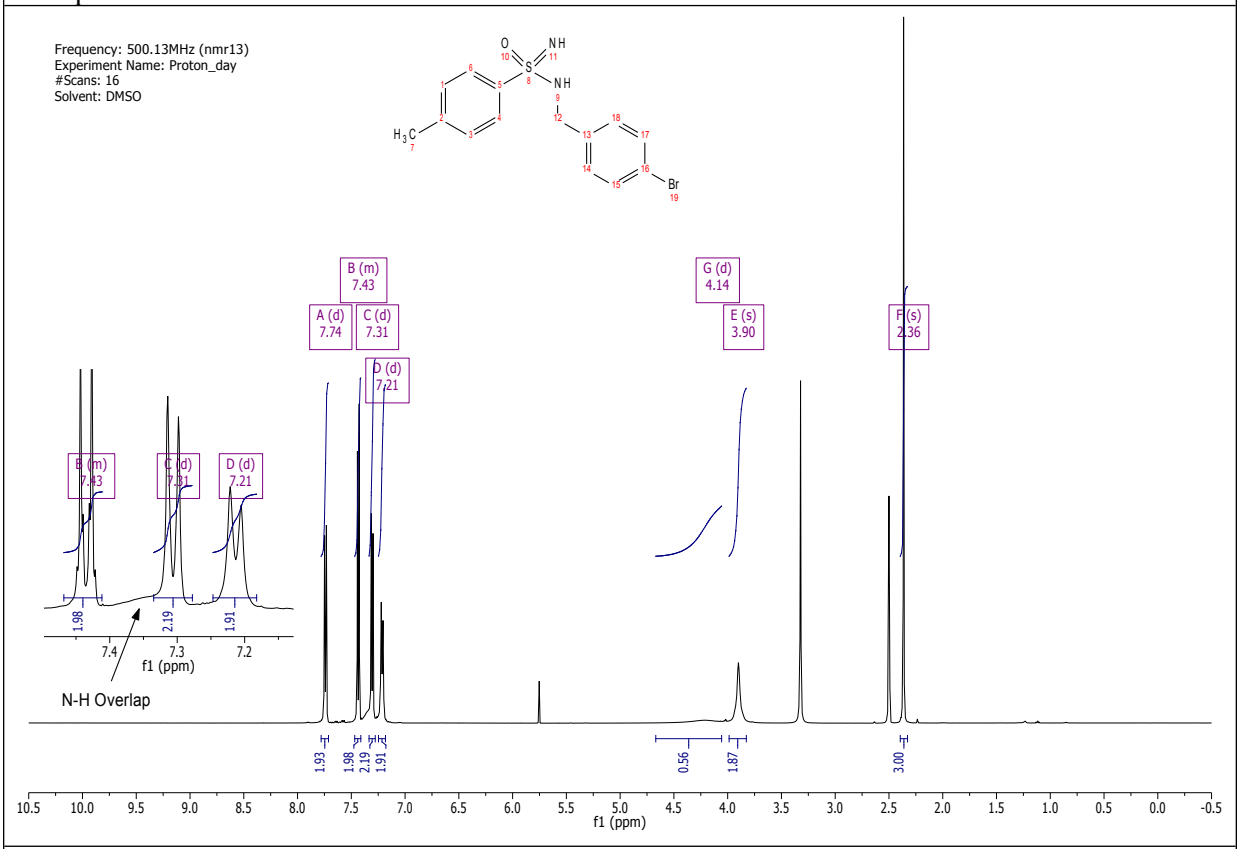

Frequency: 125.76MHz (nmr13)
Experiment Name: Carbon_night
#Scans: 4000
Solvent: DMSO
144.55
141.94
140.80
129.25
128.45
126.50
124.23
40.00
39.92
39.75
39.66
39.50
39.33
39.16
39.00
20.87
f1 (ppm)

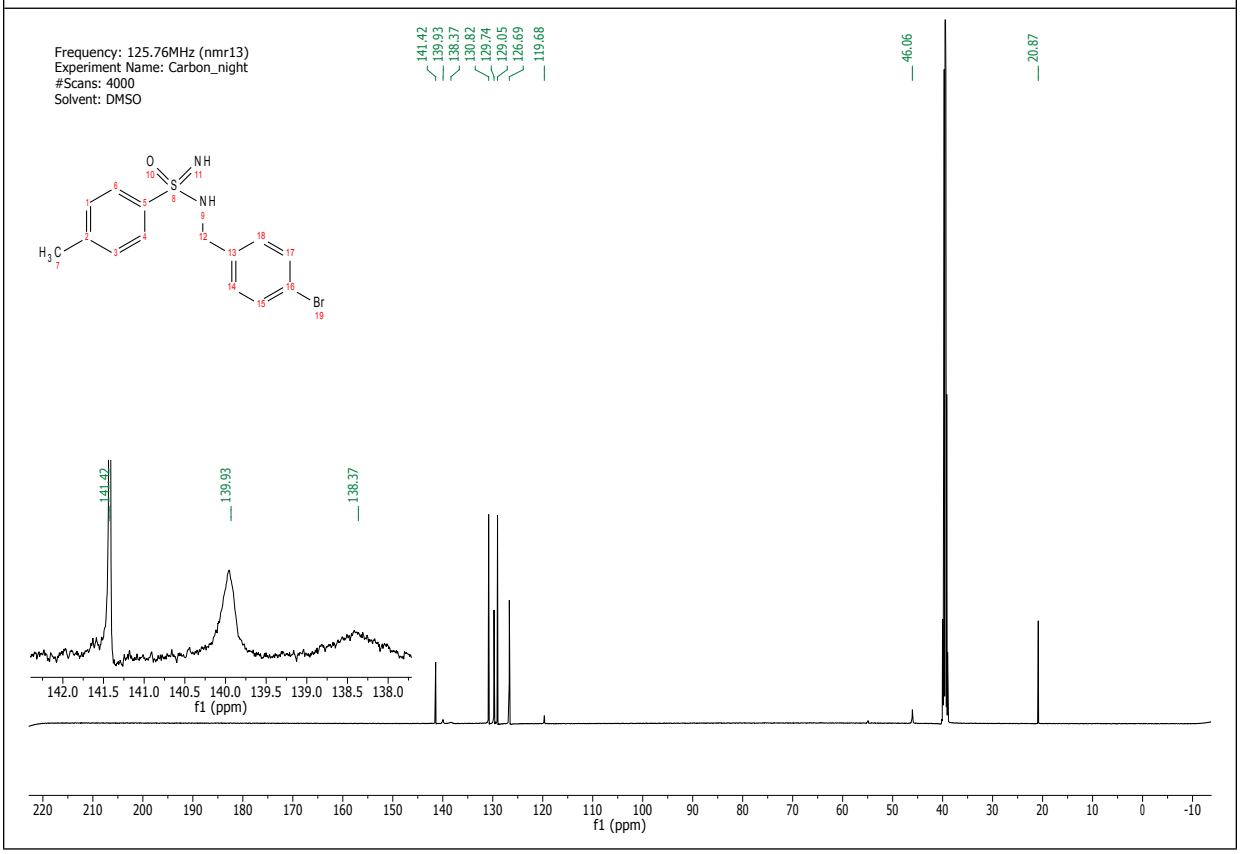
Compound 4g


Frequency: 500.13MHz (nmr13)
Experiment Name: Proton_day
#Scans: 16
Solvent: DMSO
A (d) 7.80
B (d) 7.35
C (br) 7.25
D (d) 7.28
E (d) 6.91
F (s) 2.36
2.12
2.22
2.32
1.52
2.00
3.25
f1 (ppm)

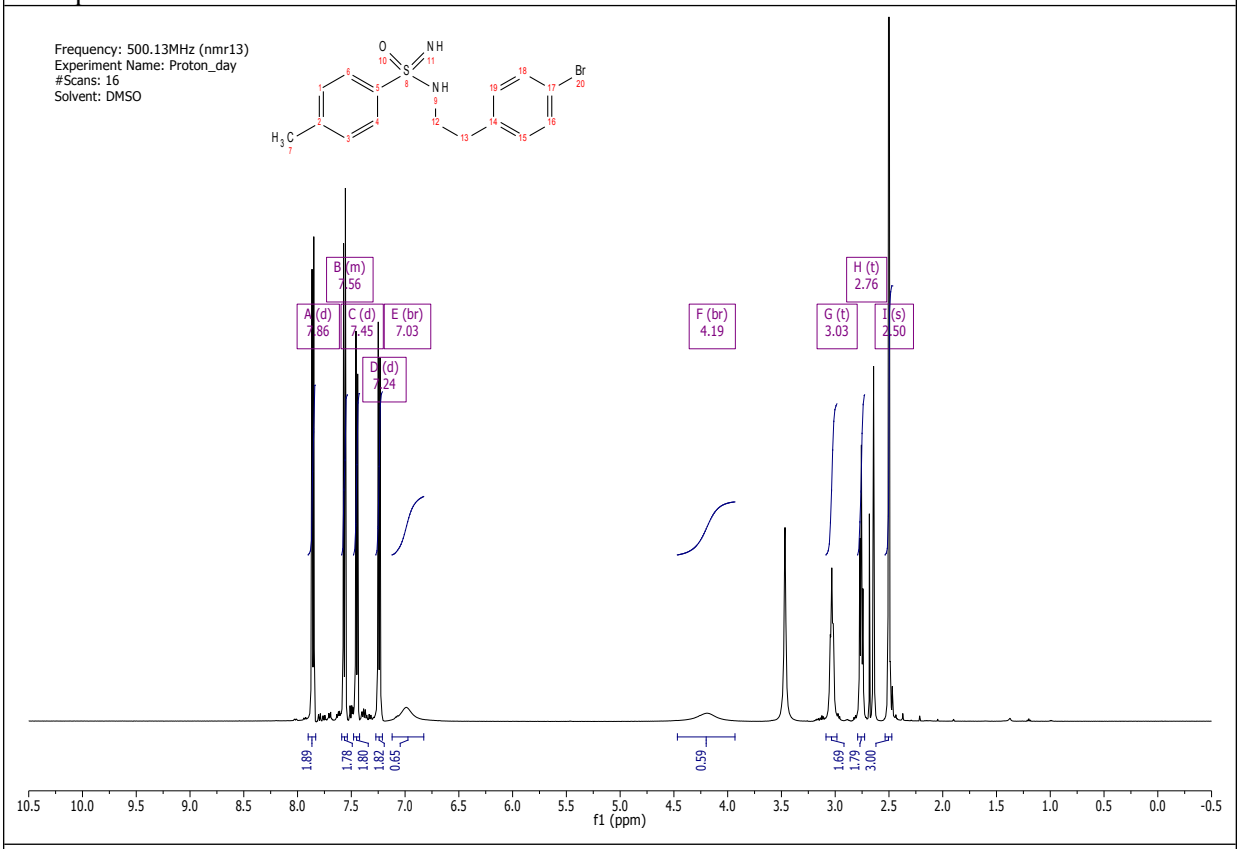

Frequency: 125.76MHz (nmr13)
Experiment Name: Carbon_night
#Scans: 4000
Solvent: DMSO
144.99
141.95
140.76
131.32
129.25
126.49
124.72
112.09
20.86
f1 (ppm)

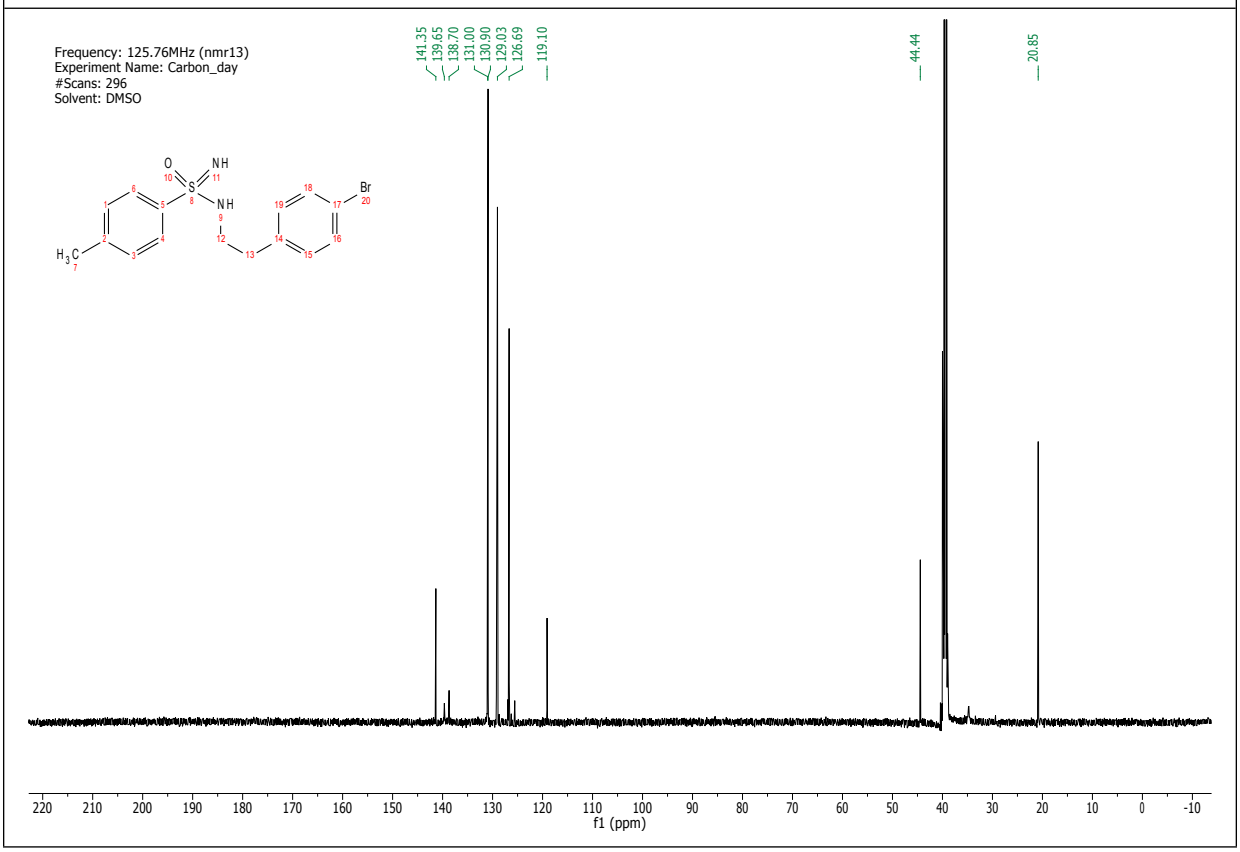
Compound 4h


Frequency: 500.13MHz (nmr13)
Experiment Name: Proton_day
#Scans: 16
Solvent: DMSO
B (m) 7.43
A (d) 7.74
C (d) 7.31
D (d) 7.21
G (d) 4.14
E (s) 3.90
F (s) 2.36
N-H Overlap
f1 (ppm)

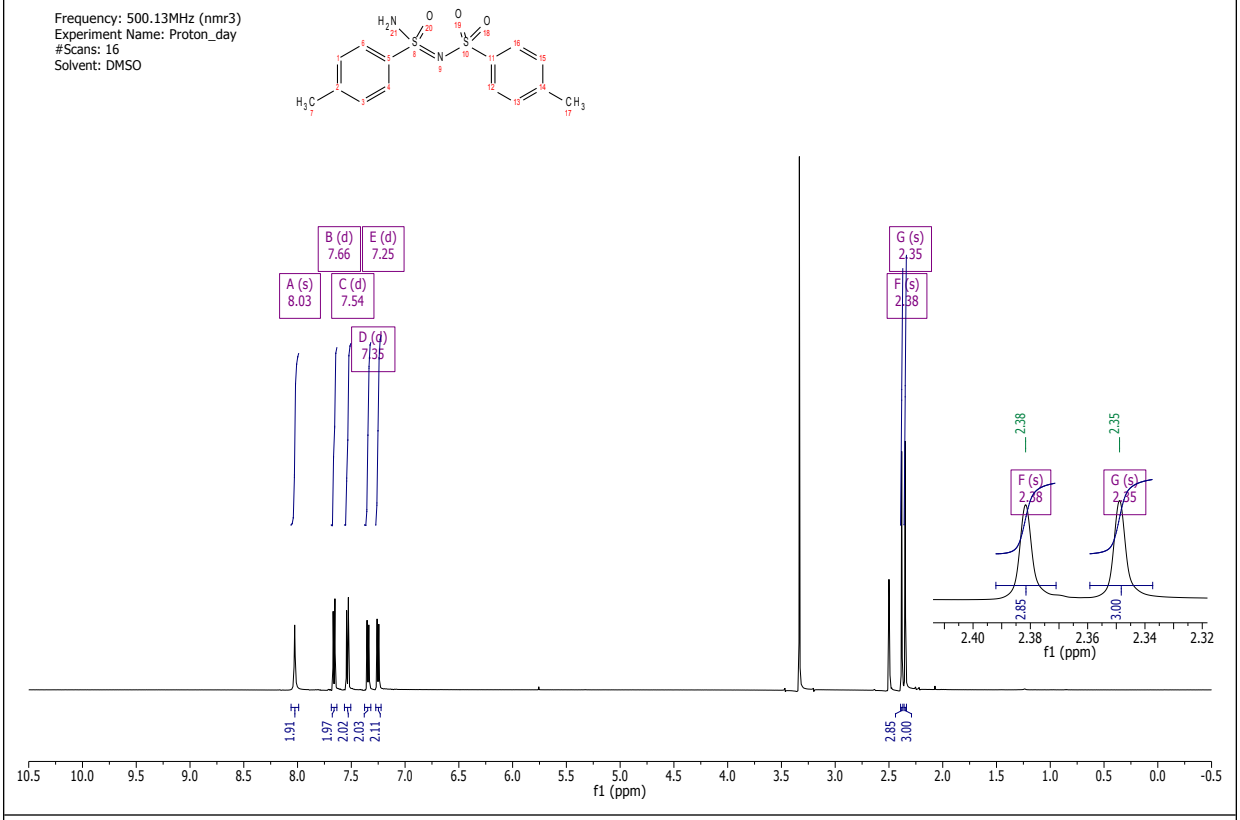

Frequency: 125.76MHz (nmr13)
Experiment Name: Carbon_night
#Scans: 4000
Solvent: DMSO
141.42
139.93
138.37
130.82
129.74
129.05
126.69
119.68
46.06
20.87
f1 (ppm)

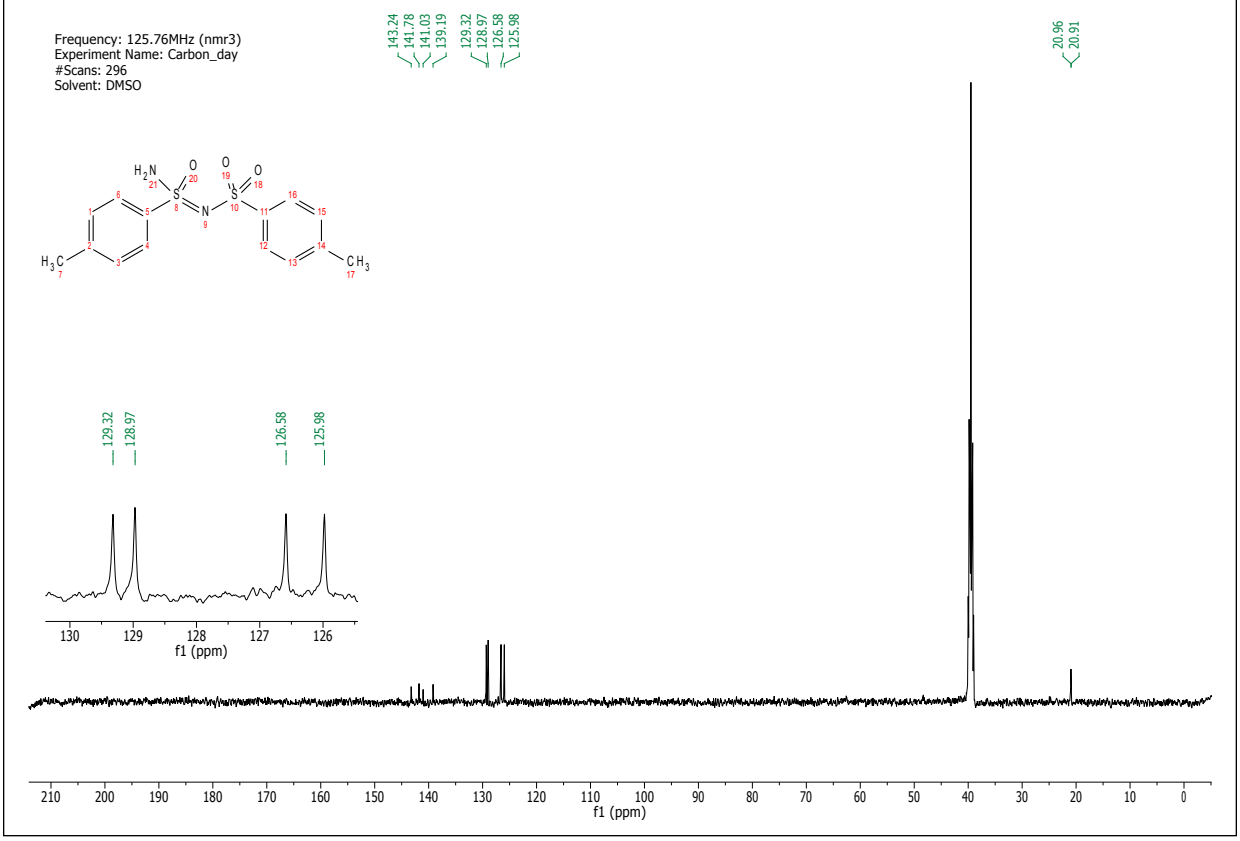
Compound 4i


Frequency: 500.13MHz (nmr13)
Experiment Name: Proton_day
#Scans: 16
Solvent: DMSO
A (d) 7.86
B (m) 7.56
C (d) 7.45
D (d) 7.24
E (br) 7.03
F (br) 4.19
G (t) 3.03
H (t) 2.76
I (s) 2.50
1.89
1.78
1.80
1.82
0.65
0.59
1.69
1.79
3.00
f1 (ppm)

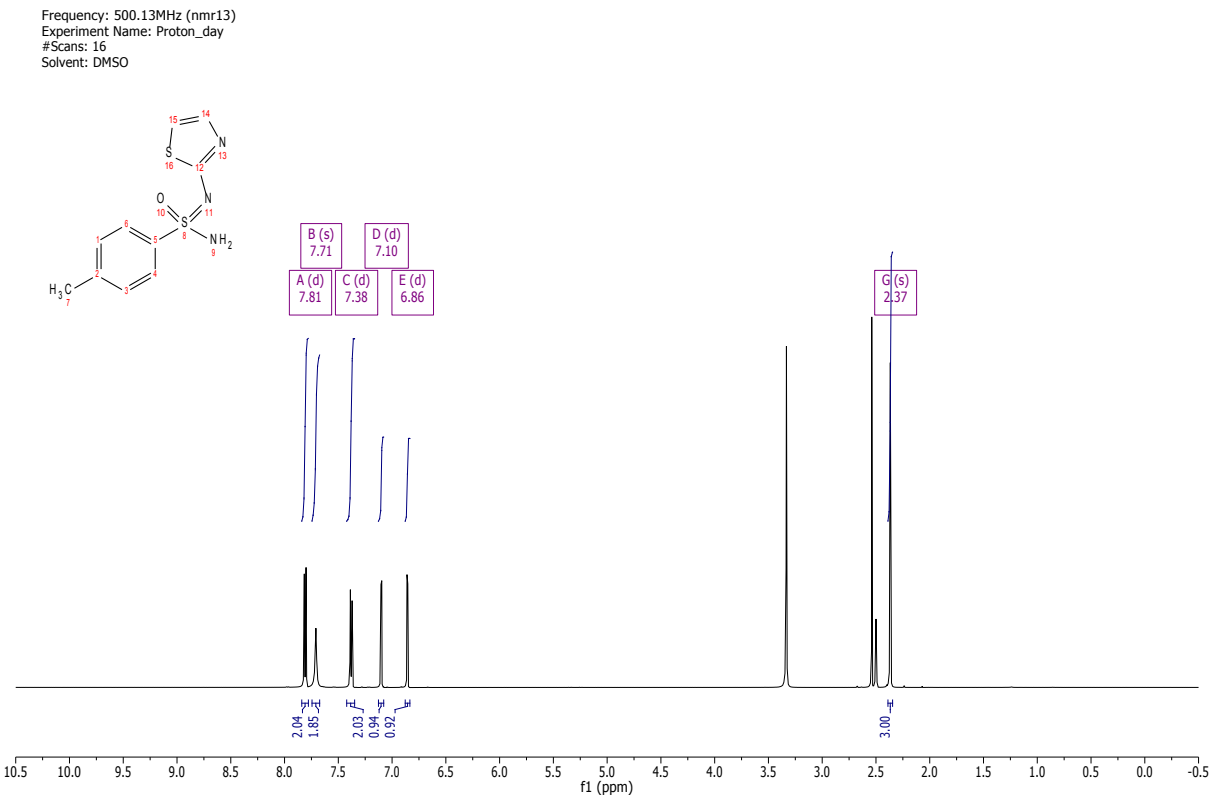

Frequency: 125.76MHz (nmr13)
Experiment Name: Carbon_day
#Scans: 296
Solvent: DMSO
141.35
139.65
138.70
131.00
130.90
129.03
126.69
119.10
44.44
20.85
f1 (ppm)

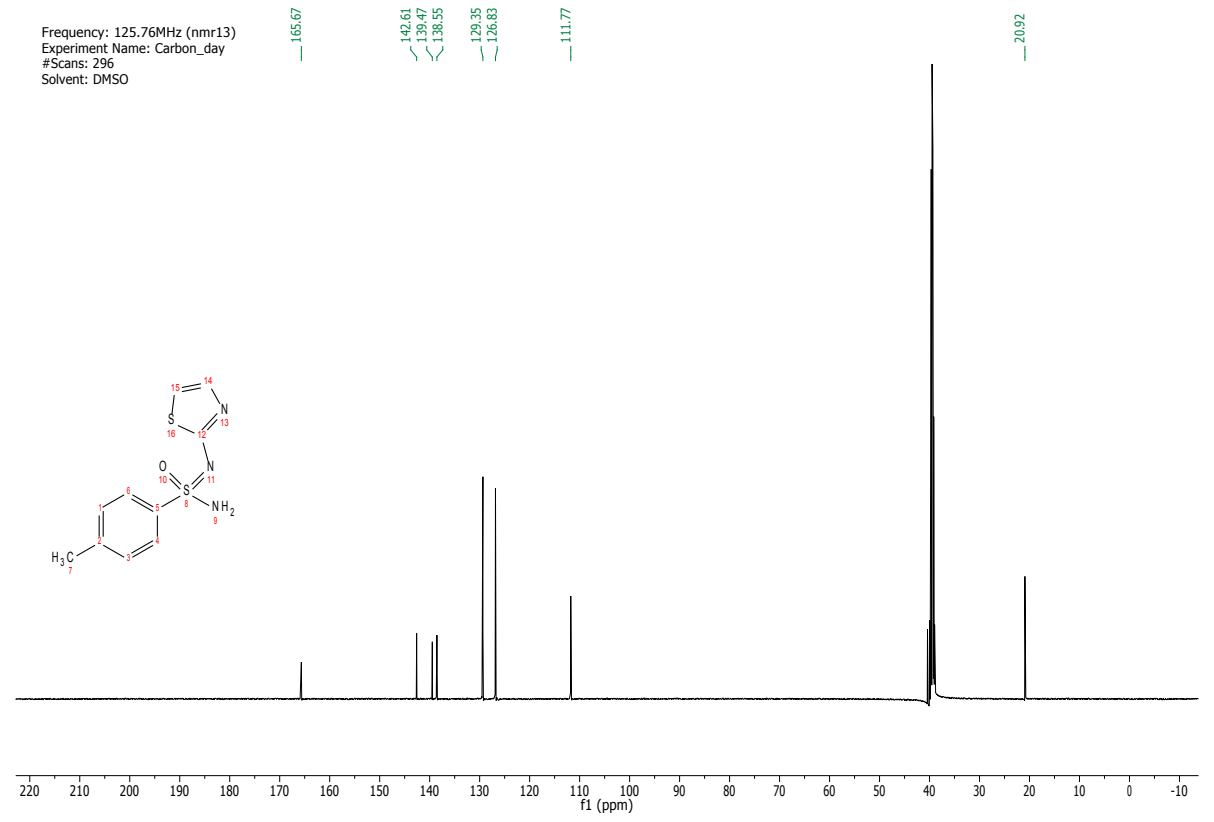
Compound 4j


Frequency: 500.13MHz (nmr3)
Experiment Name: Proton_day
#Scans: 16
Solvent: DMSO
B (d) 7.66
E (d) 7.25
A (s) 8.03
C (d) 7.54
D (d) 7.35
G (s) 2.35
F (s) 2.38
1.91
1.97
2.02
2.03
2.11
2.85
3.00
f1 (ppm)

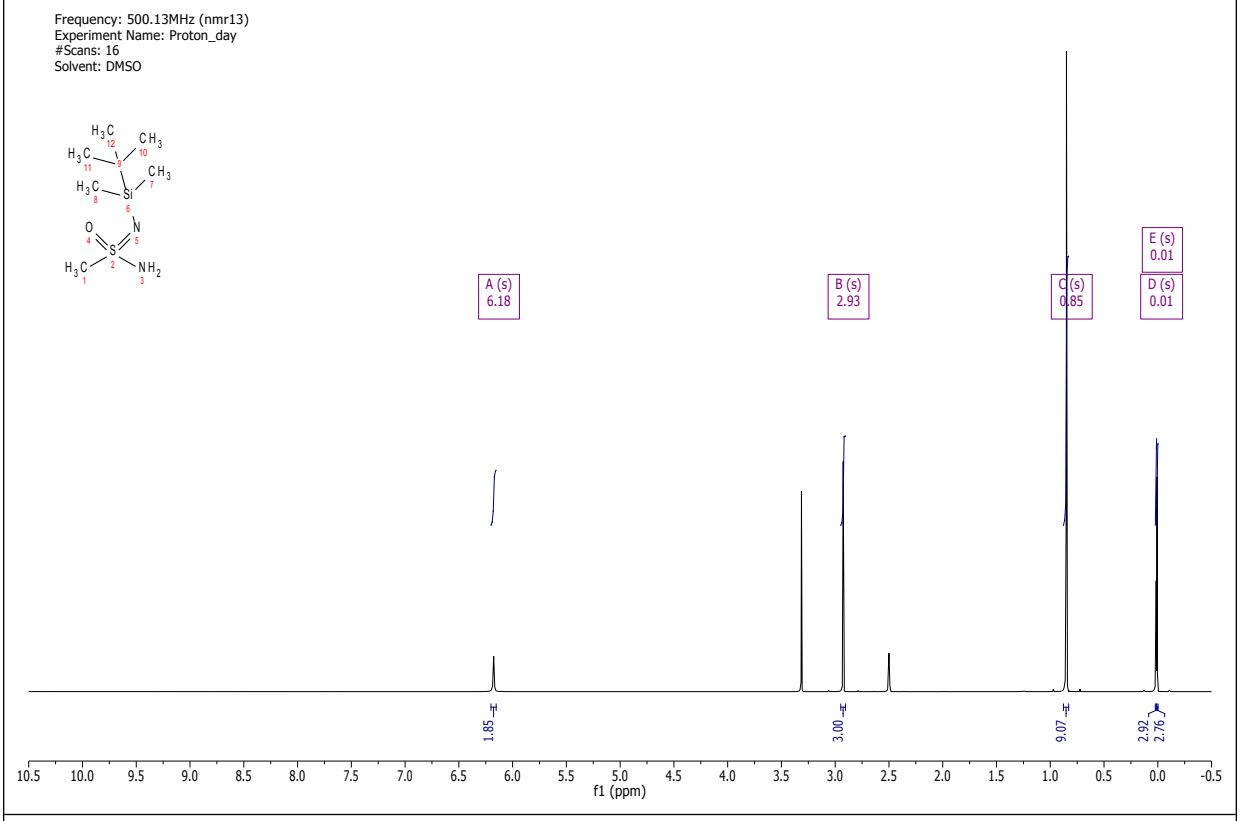

Frequency: 125.76MHz (nmr3)
Experiment Name: Carbon_day
#Scans: 296
Solvent: DMSO
143.24
141.78
141.03
139.19
129.32
128.97
126.58
125.98
20.96
20.91
f1 (ppm)

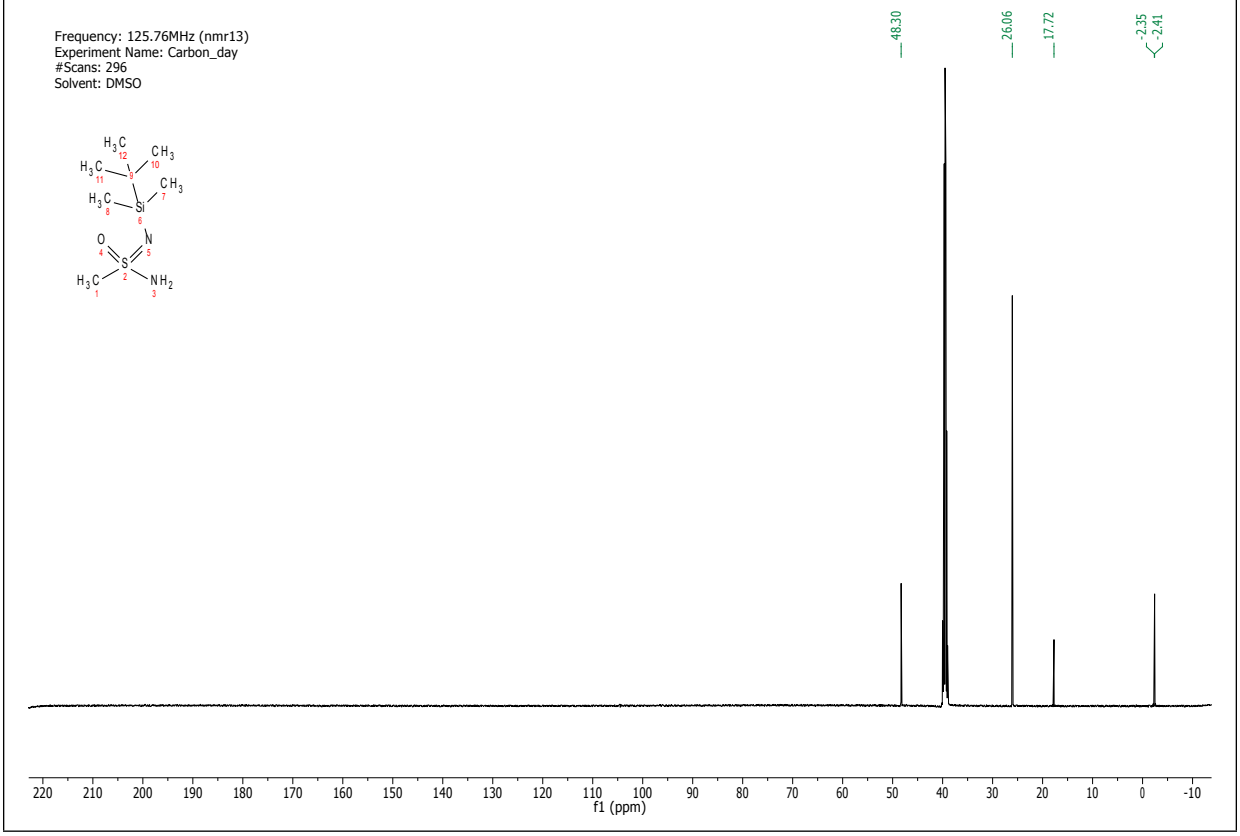
Compound 4k


Frequency: 500.13MHz (nmr13)
Experiment Name: Proton_day
#Scans: 16
Solvent: DMSO
B (s) 7.71
D (d) 7.10
A (d) 7.81
C (d) 7.38
E (d) 6.86
G (s) 2.37
2.04
1.85
2.03
0.94
0.92
3.00
f1 (ppm)

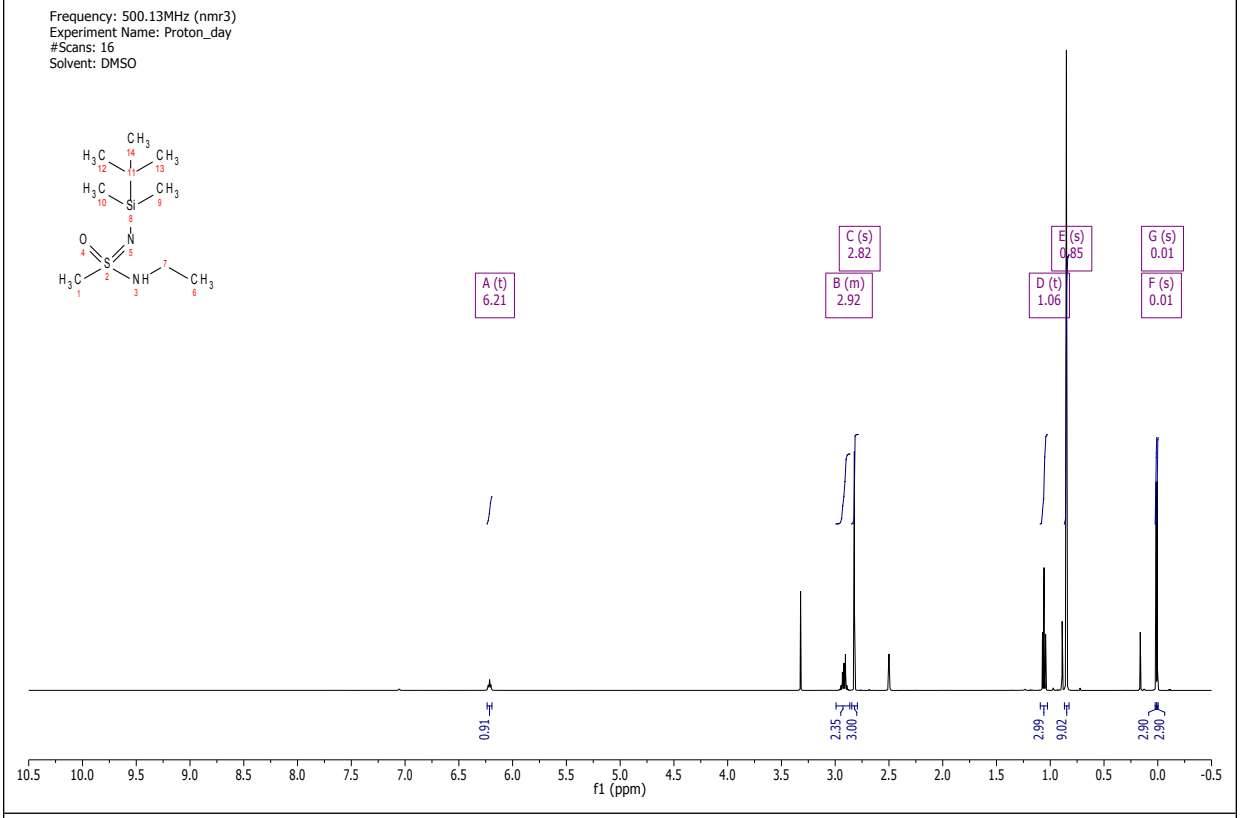

Frequency: 125.76MHz (nmr13)
Experiment Name: Carbon_day
#Scans: 296
Solvent: DMSO
165.67
142.61
139.47
138.55
129.35
126.83
111.77
20.92
f1 (ppm)

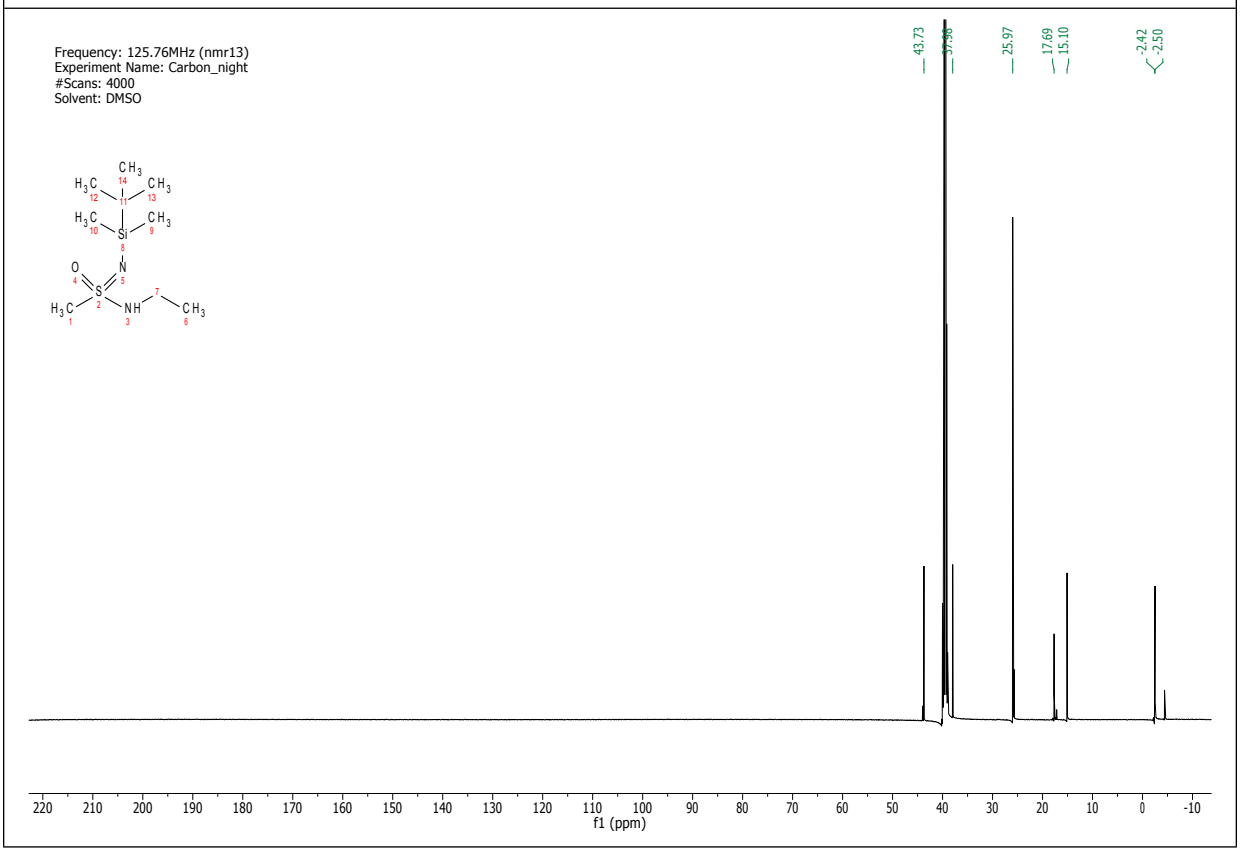
Compound 5a


Frequency: 500.13MHz (nmr13)
Experiment Name: Proton_day
#Scans: 16
Solvent: DMSO
A (s) 6.18
B (s) 2.93
C (s) 0.85
D (s) 0.01
E (s) 0.01
1.85
3.00
9.07
2.92
2.76
f1 (ppm)

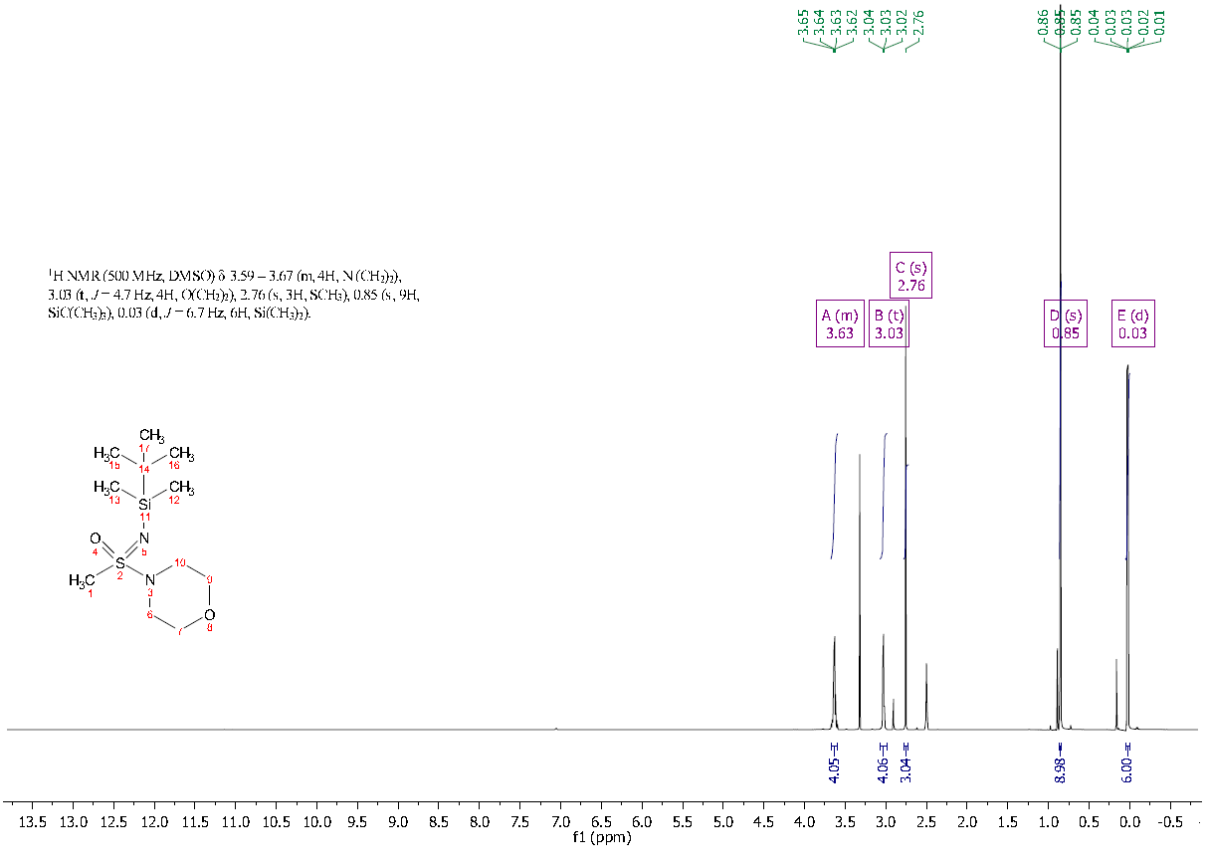

Frequency: 125.76MHz (nmr13)
Experiment Name: Carbon_day
#Scans: 296
Solvent: DMSO
48.30
26.06
17.72
2.35
2.41
f1 (ppm)

Compound 5b

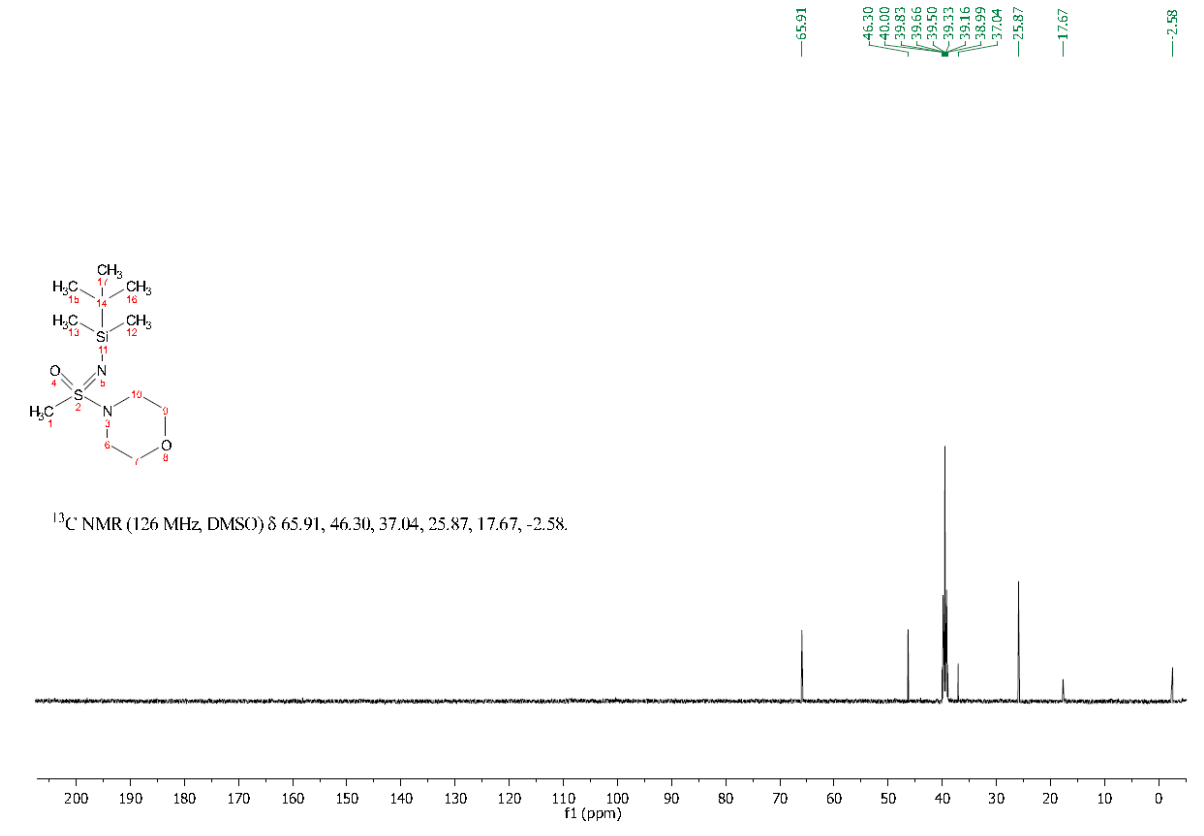

Frequency: 500.13MHz (nmr3)
Experiment Name: Proton_day
#Scans: 16
Solvent: DMSO
A (t)
6.21
B (m)
2.92
C (s)
2.82
D (t)
1.06
E (s)
0.85
F (s)
0.01
G (s)
0.01
0.91
2.35
3.00
2.99
9.02
2.90
2.90
f1 (ppm)


Frequency: 125.76MHz (nmr13)
Experiment Name: Carbon_night
#Scans: 4000
Solvent: DMSO
43.73
37.58
25.97
17.69
15.10
-2.42
-2.50
f1 (ppm)

Compound 5c

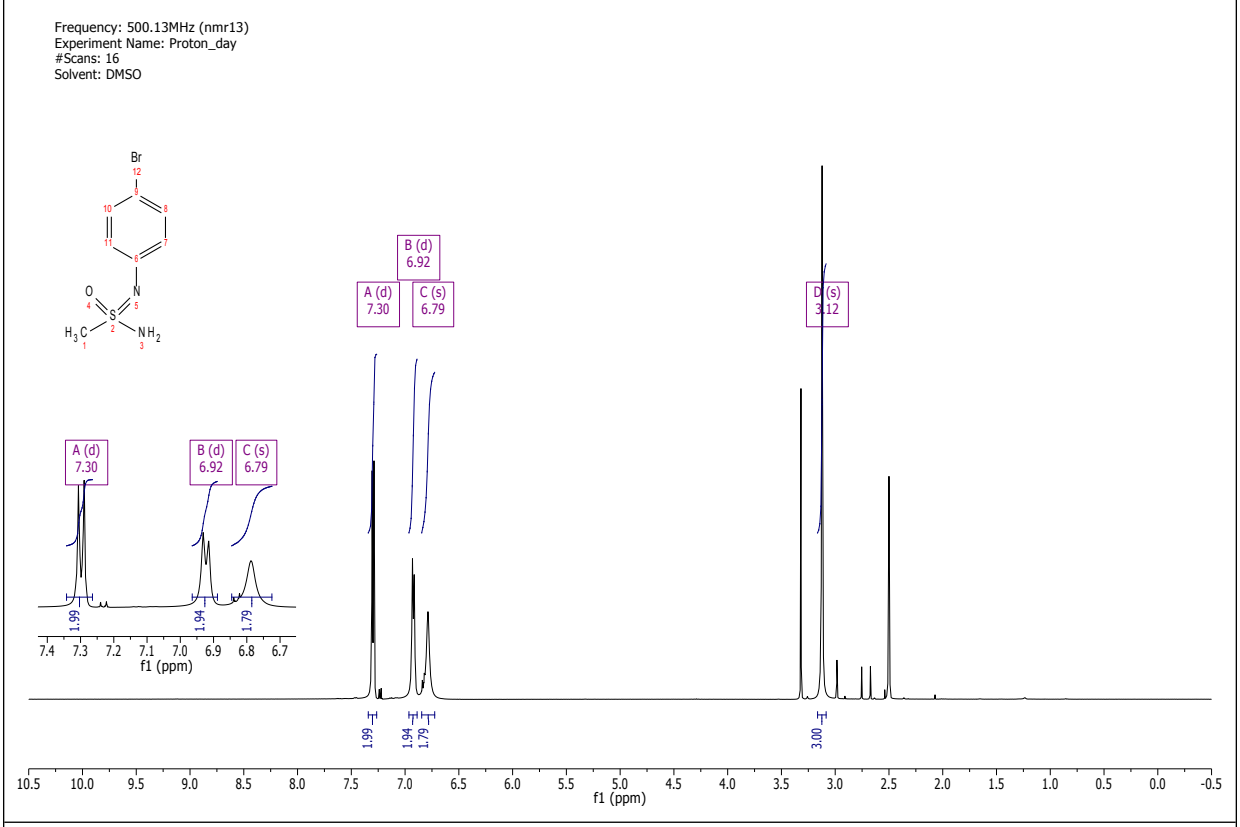


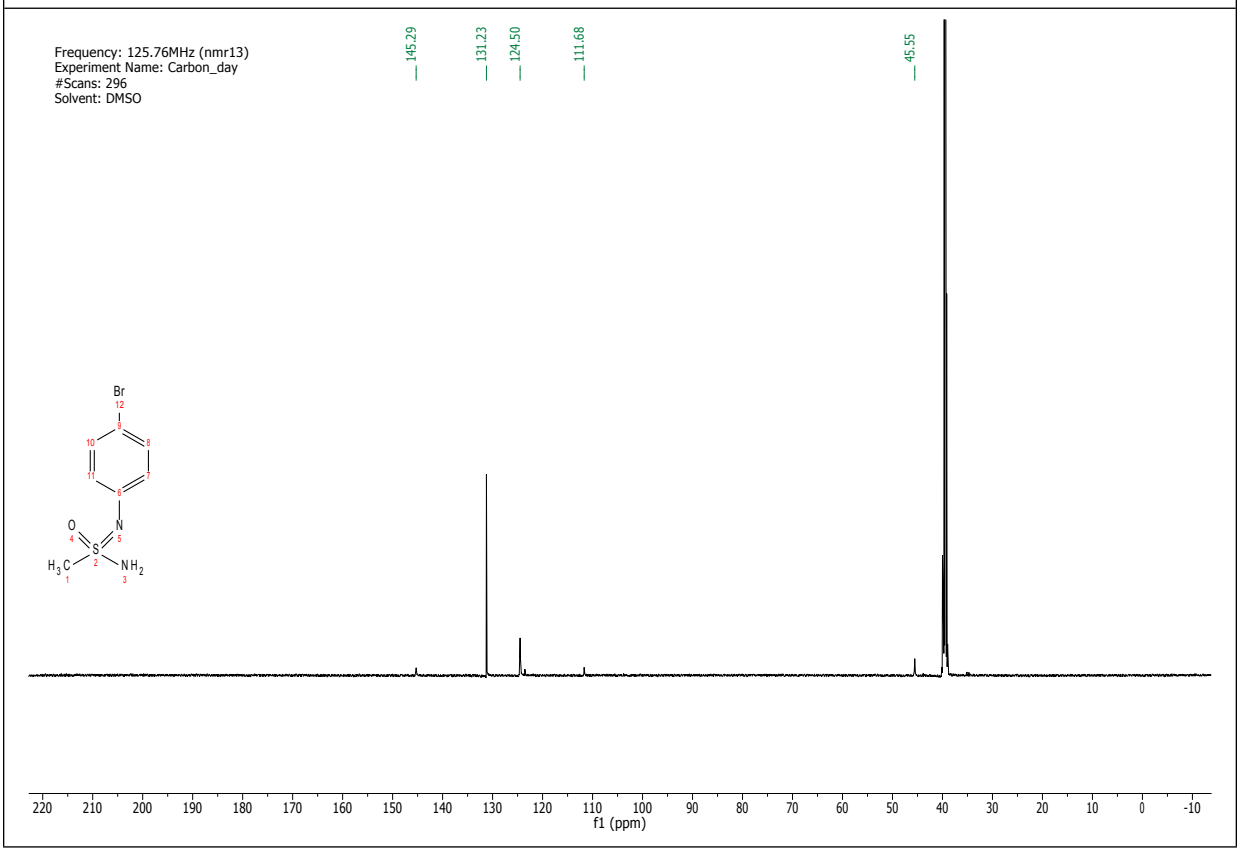
^{1}H NMR (500 MHz, DMSO) δ 3.59 – 3.67 (m, 4H, $N(CH_2)_2$), 3.03 (t, J = 4.7 Hz, 4H, $O(CH_2)_2$), 2.76 (s, 3H, SCH_3), 0.85 (s, 9H, $SiC(CH_3)_3$), 0.03 (d, J = 6.7 Hz, 6H, $Si(CH_3)_2$).



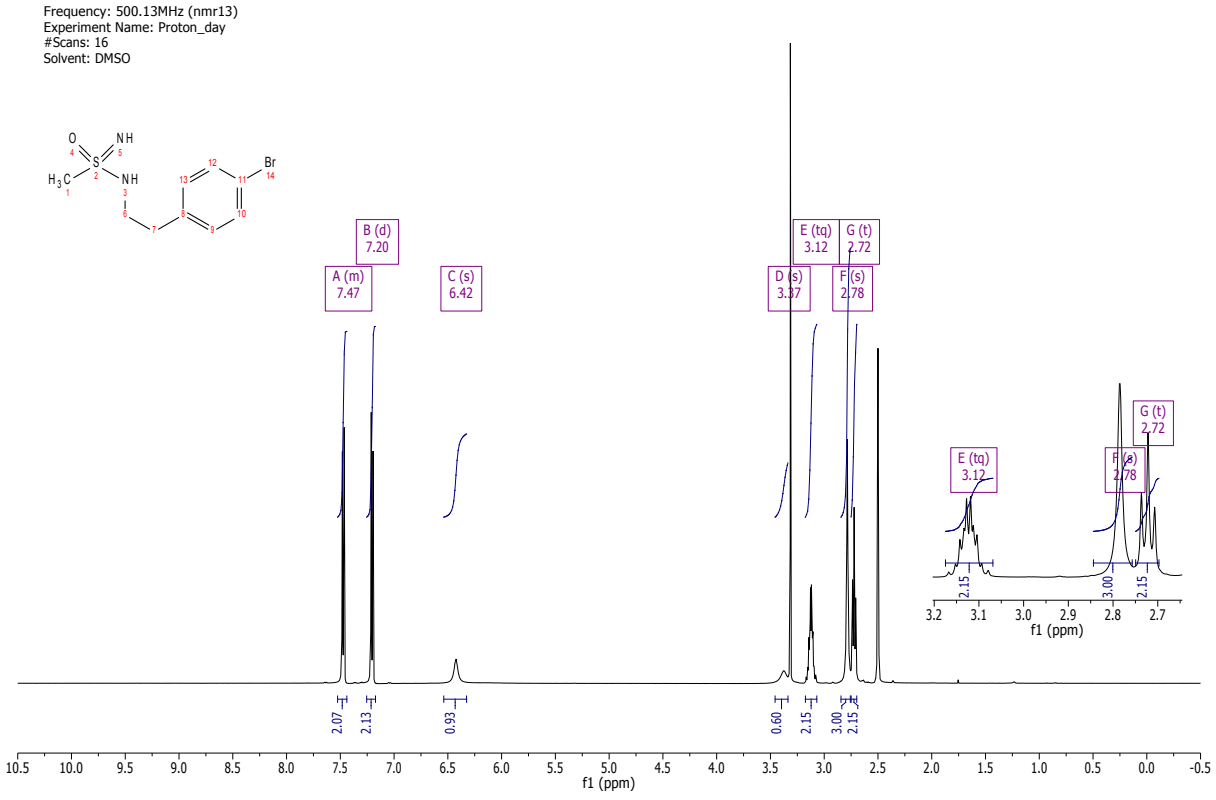
^{13}C NMR (126 MHz, DMSO) δ 65.91, 46.30, 37.04, 25.87, 17.67, -2.58.

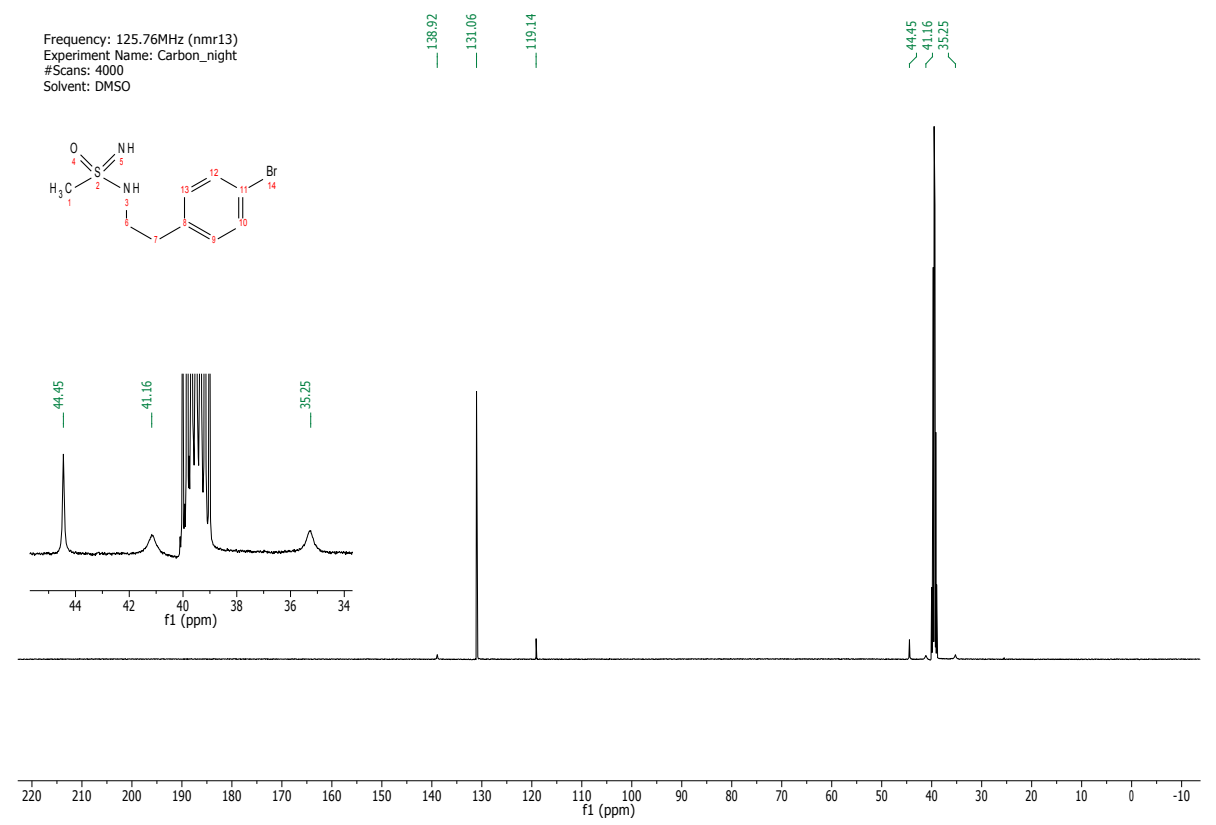
Compound 5d

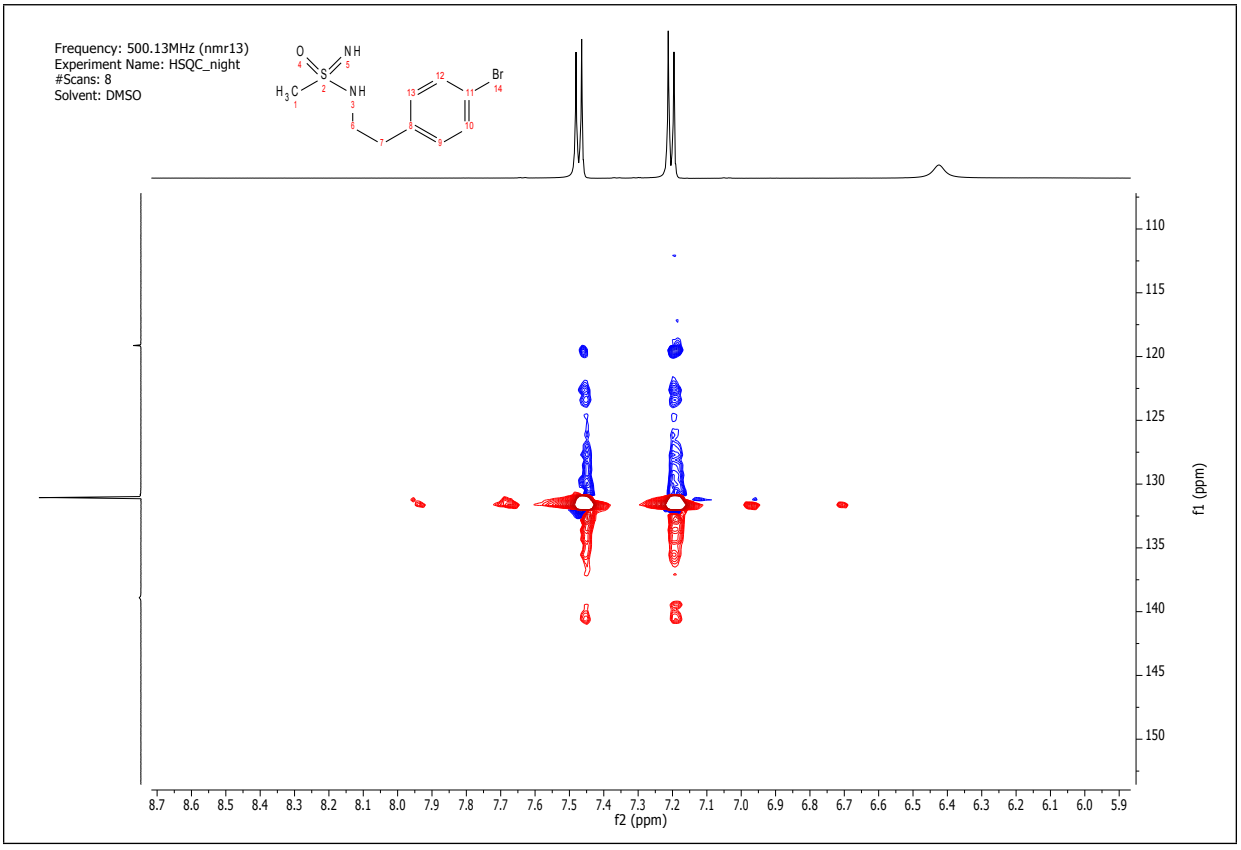

Frequency: 500.13MHz (nmr13)
Experiment Name: Proton_day
#Scans: 16
Solvent: DMSO
A (d) 7.30
B (d) 6.92
C (s) 6.79
D (s) 3.12
1.99
1.94
1.79
3.00
f1 (ppm)


Frequency: 125.76MHz (nmr13)
Experiment Name: Carbon_day
#Scans: 296
Solvent: DMSO
145.29
131.23
124.50
111.68
45.55
f1 (ppm)

Compound 5e

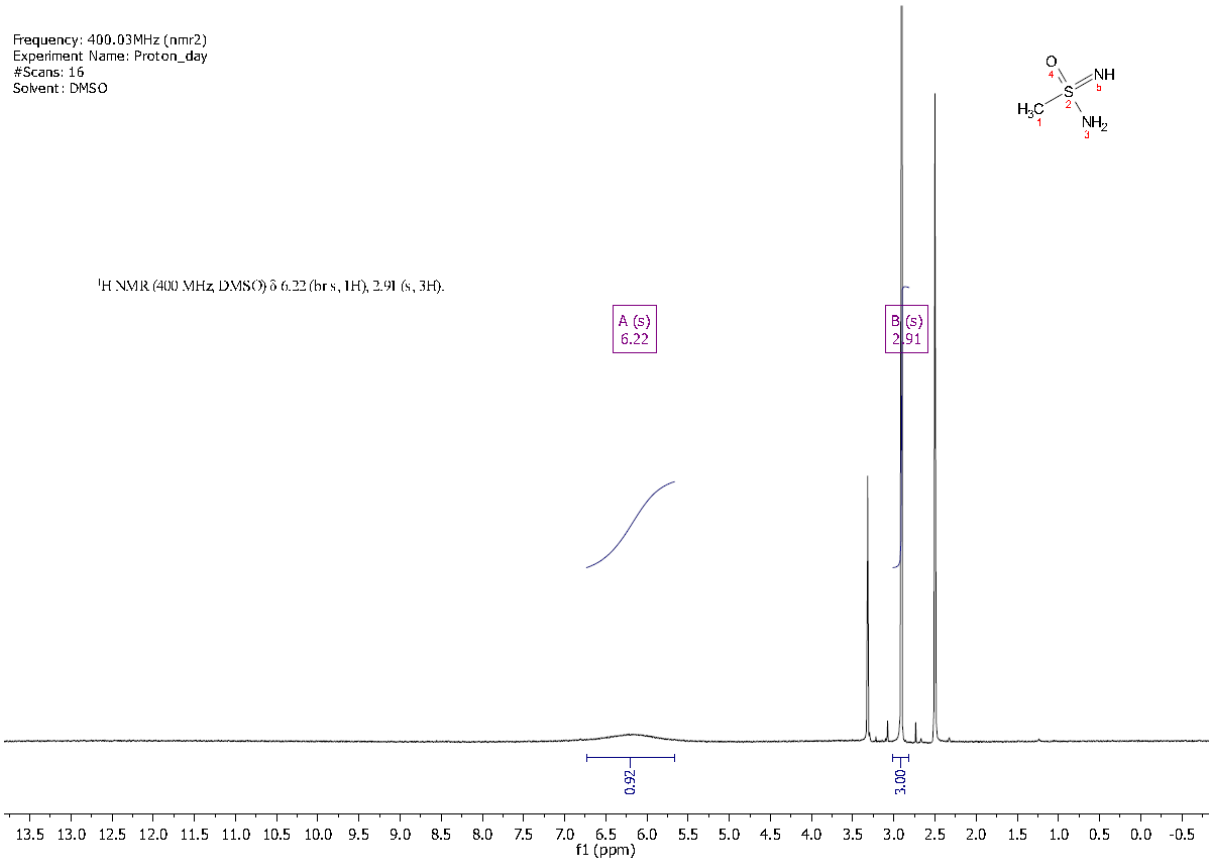

Frequency: 500.13MHz (nmr13)
Experiment Name: Proton_day
#Scans: 16
Solvent: DMSO
A (m) 7.47
B (d) 7.20
C (s) 6.42
D (s) 3.37
E (tq) 3.12
F (s) 2.78
G (t) 2.72
2.07
2.13
0.93
0.60
2.15
3.00
2.15
f1 (ppm)


Frequency: 125.76MHz (nmr13)
Experiment Name: Carbon_night
#Scans: 4000
Solvent: DMSO
138.92
131.06
119.14
44.45
41.16
35.25
f1 (ppm)

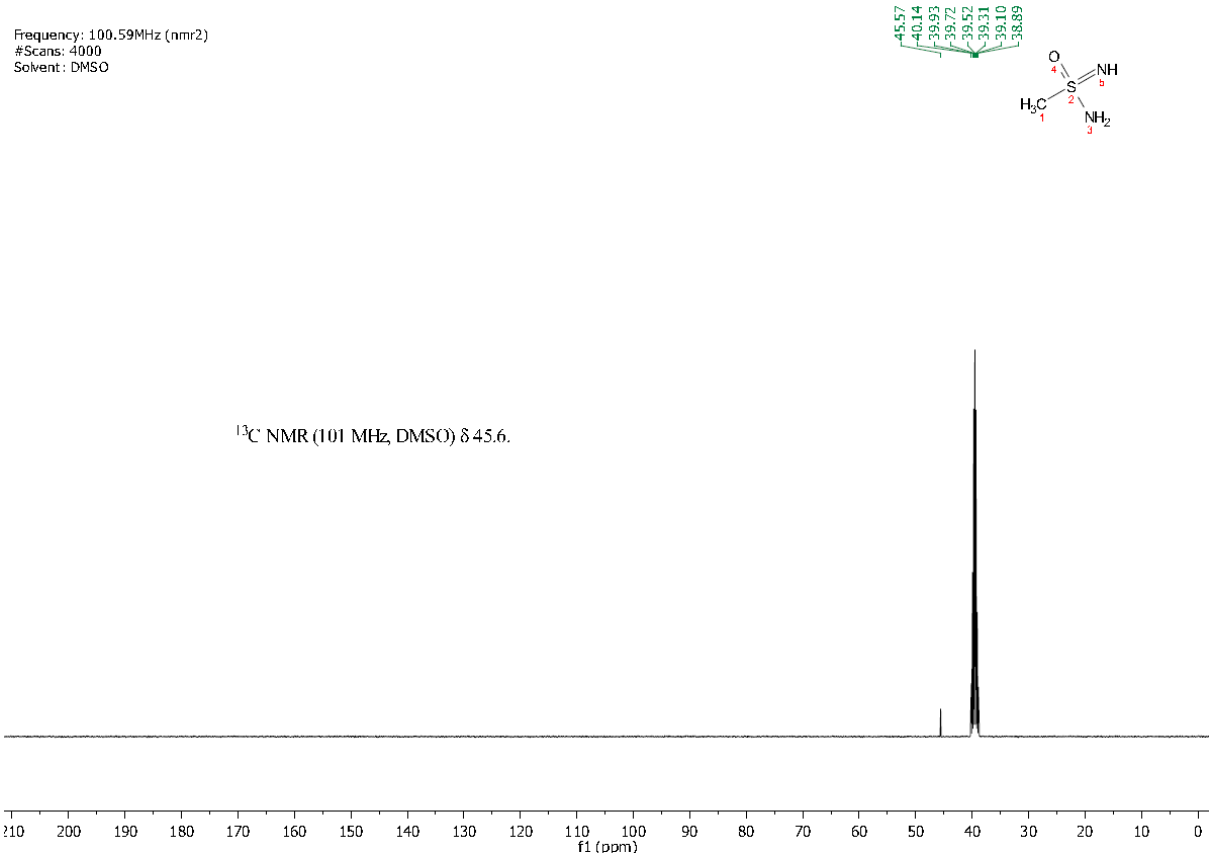


One ^{13}C peak accounts for two aromatic carbon environments, it correlates to two ^{1}H aromatic resonances as demonstrated by HSQC

Compound 5f

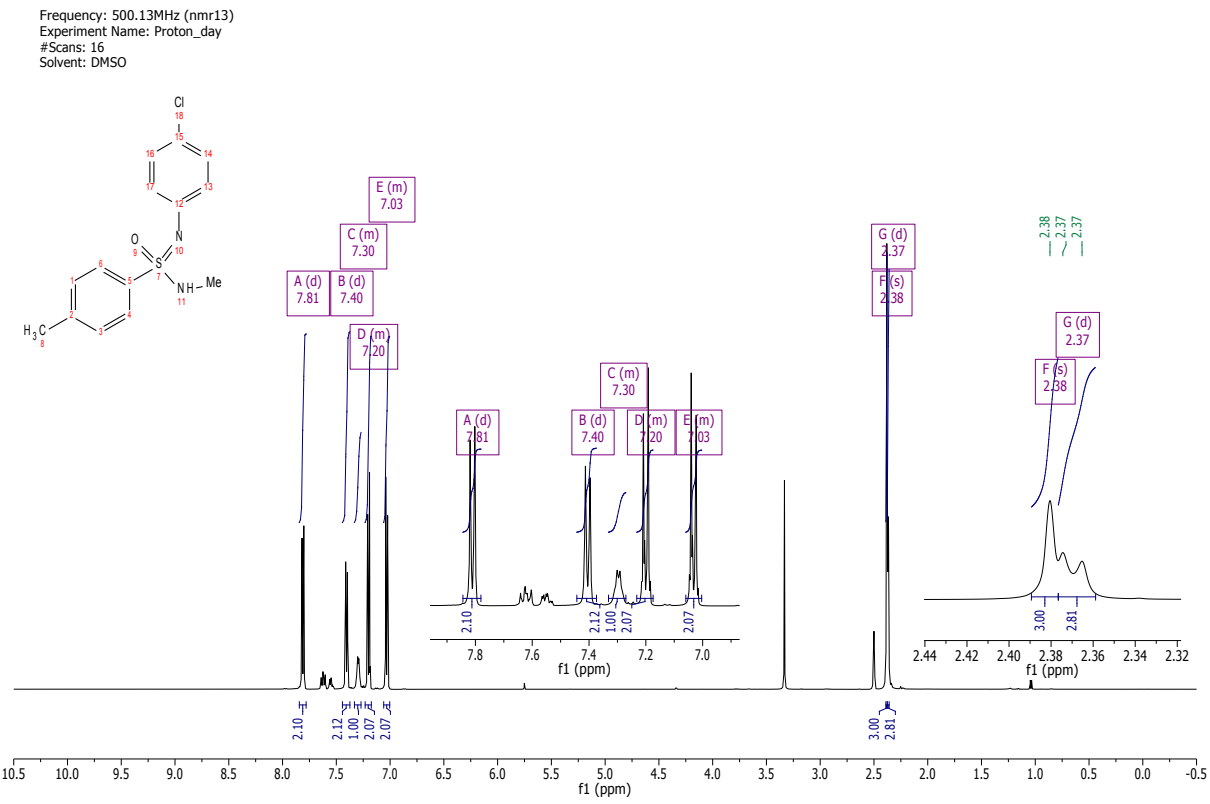


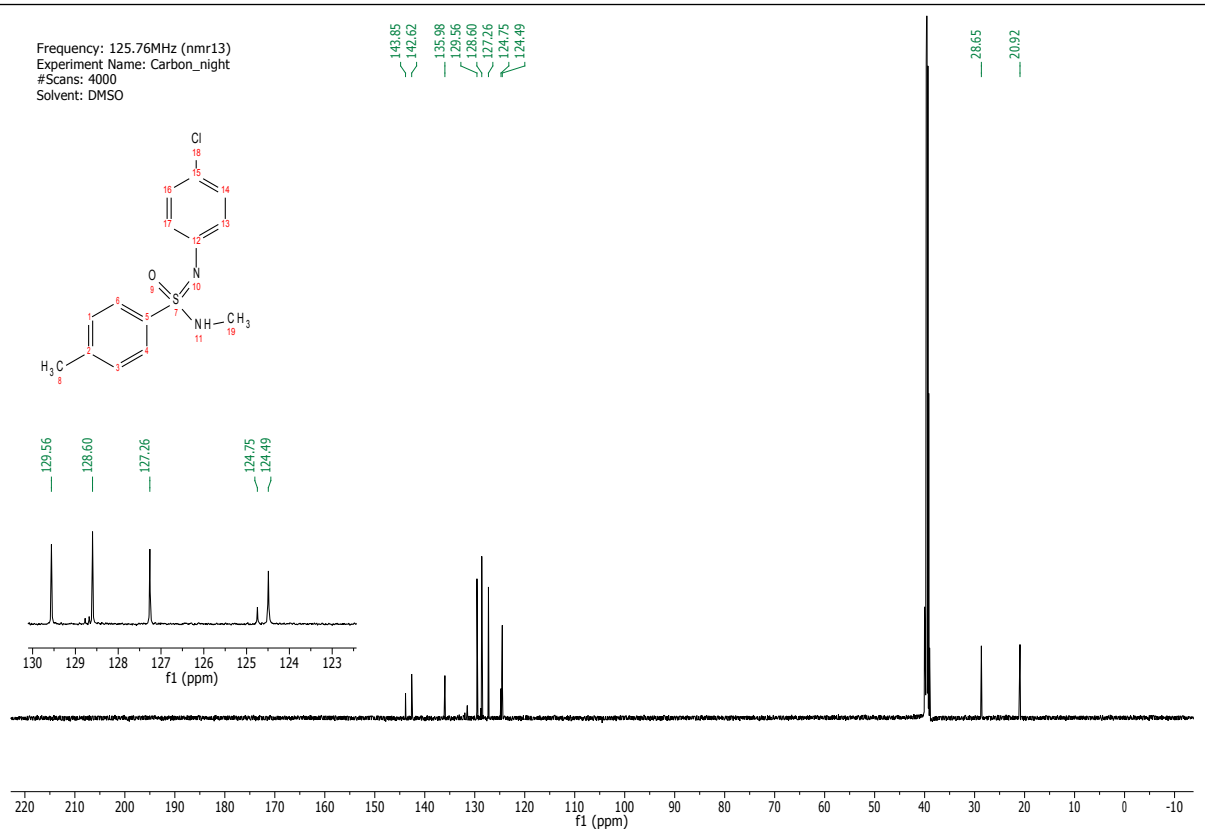
^{1}H NMR (400 MHz, DMSO) δ 6.22 (br s, 1H), 2.91 (s, 3H).



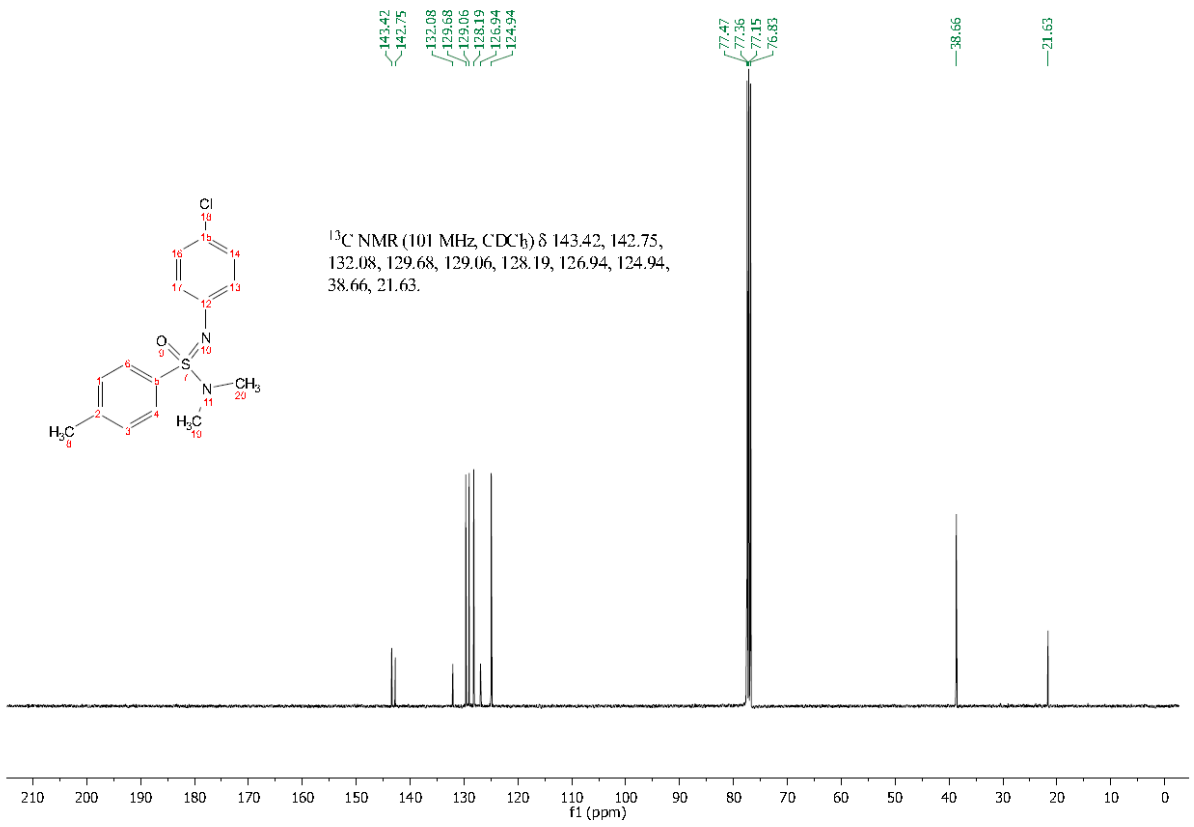
^{13}C NMR (101 MHz, DMSO) δ 45.6.

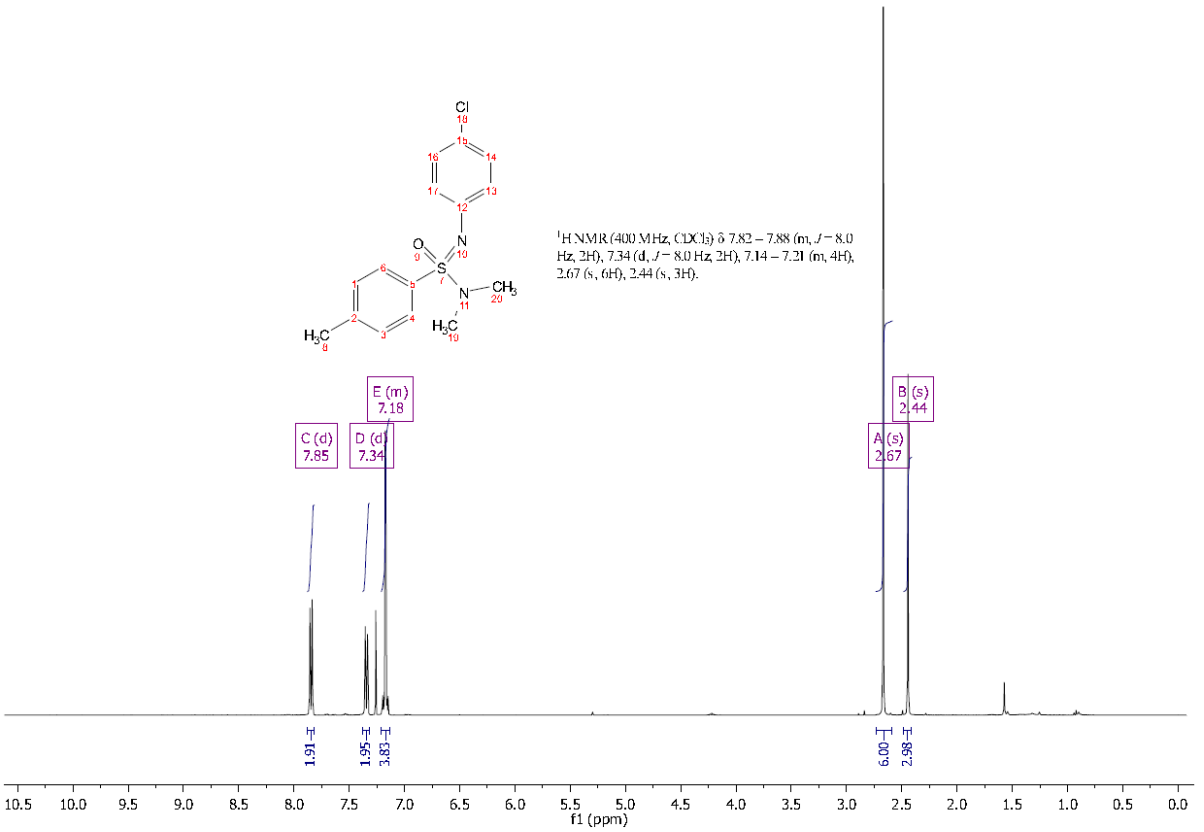
Compound 6a


Frequency: 500.13MHz (nmr13)
Experiment Name: Proton_day
#Scans: 16
Solvent: DMSO
A (d) 7.81
B (d) 7.40
C (m) 7.30
D (m) 7.20
E (m) 7.03
F (s) 2.38
G (d) 2.37
f1 (ppm)

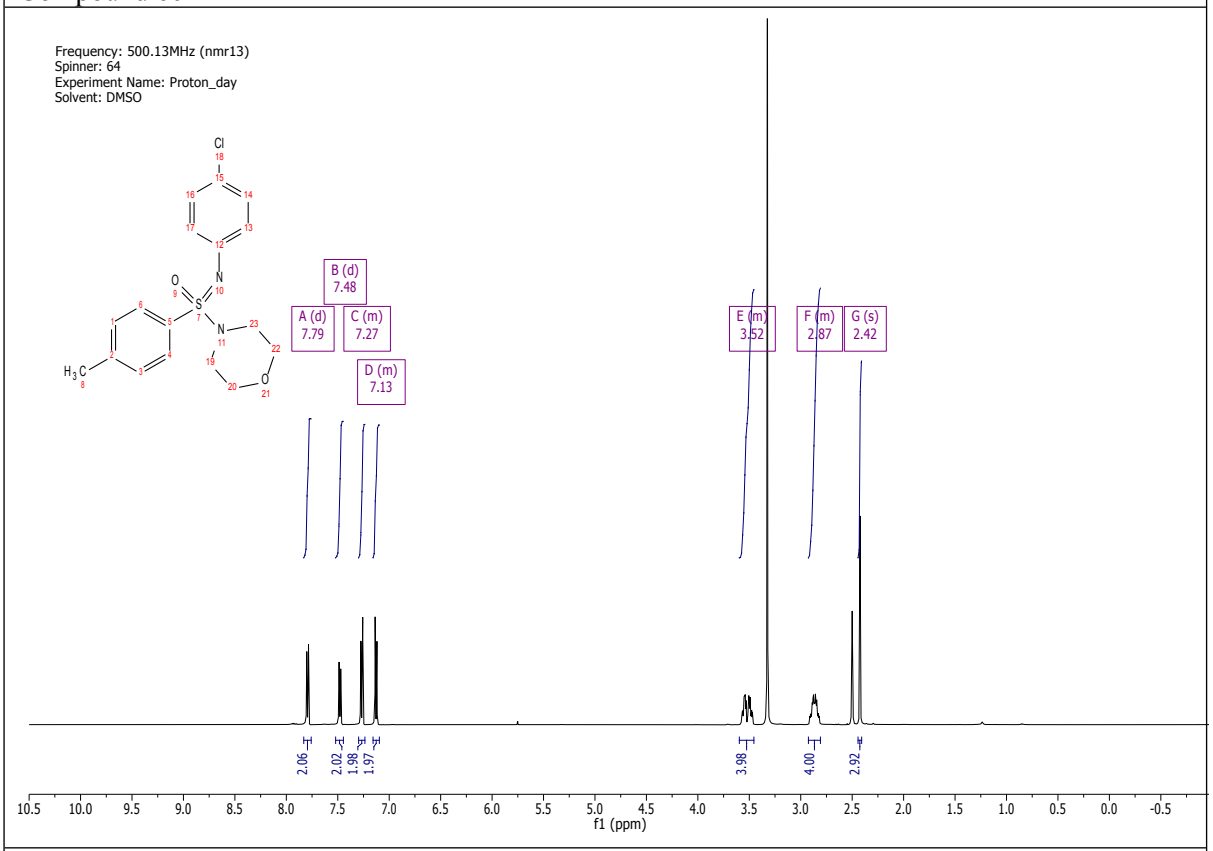

Frequency: 125.76MHz (nmr13)
Experiment Name: Carbon_night
#Scans: 4000
Solvent: DMSO
143.85
142.62
135.98
129.56
128.60
127.26
124.75
124.49
28.65
20.92
f1 (ppm)

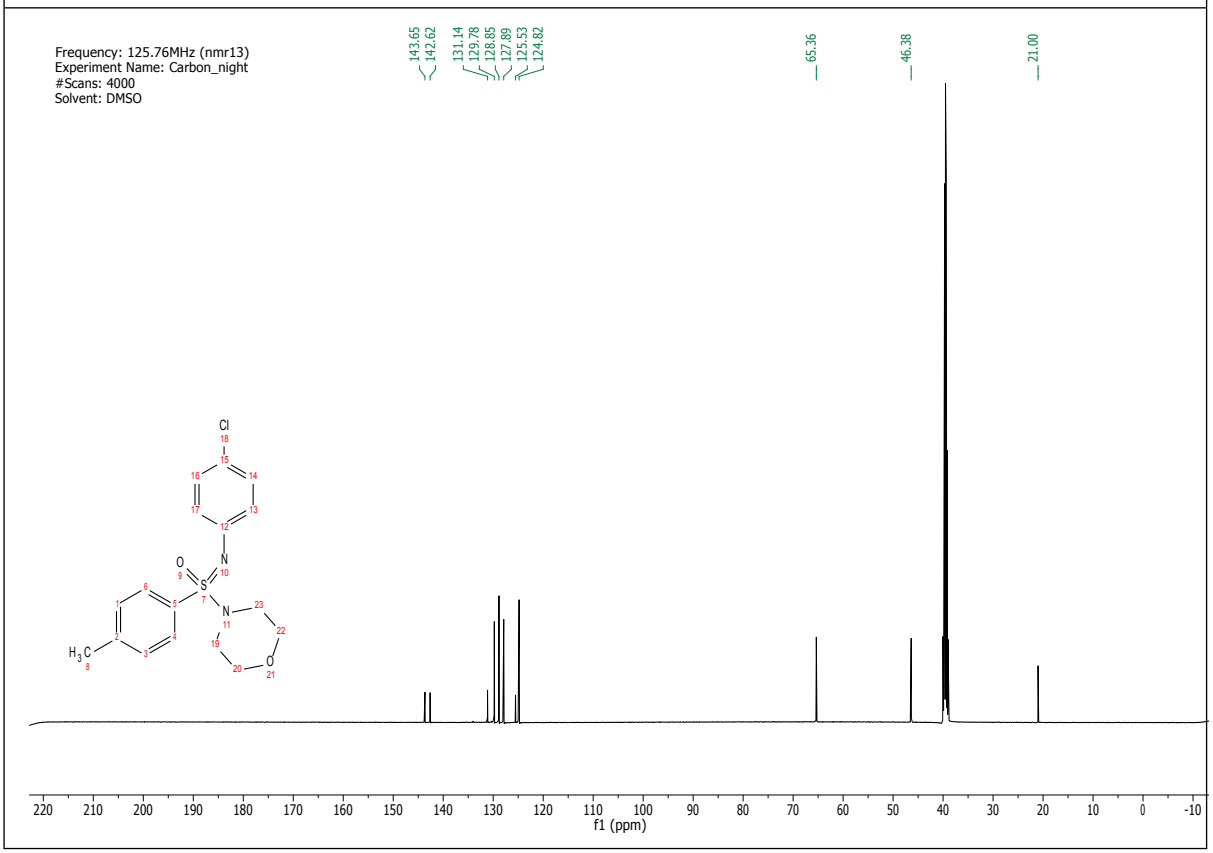
Compound 6b


143.42
142.75
132.08
129.68
129.06
128.19
126.94
124.94
77.47
77.36
77.15
76.83
38.66
21.63
Cl
O
S
N
CH3
H3C
H3C
^{13}C NMR (101 MHz, CDCl$_3$) δ 143.42, 142.75, 132.08, 129.68, 129.06, 128.19, 126.94, 124.94, 38.66, 21.63.
f1 (ppm)

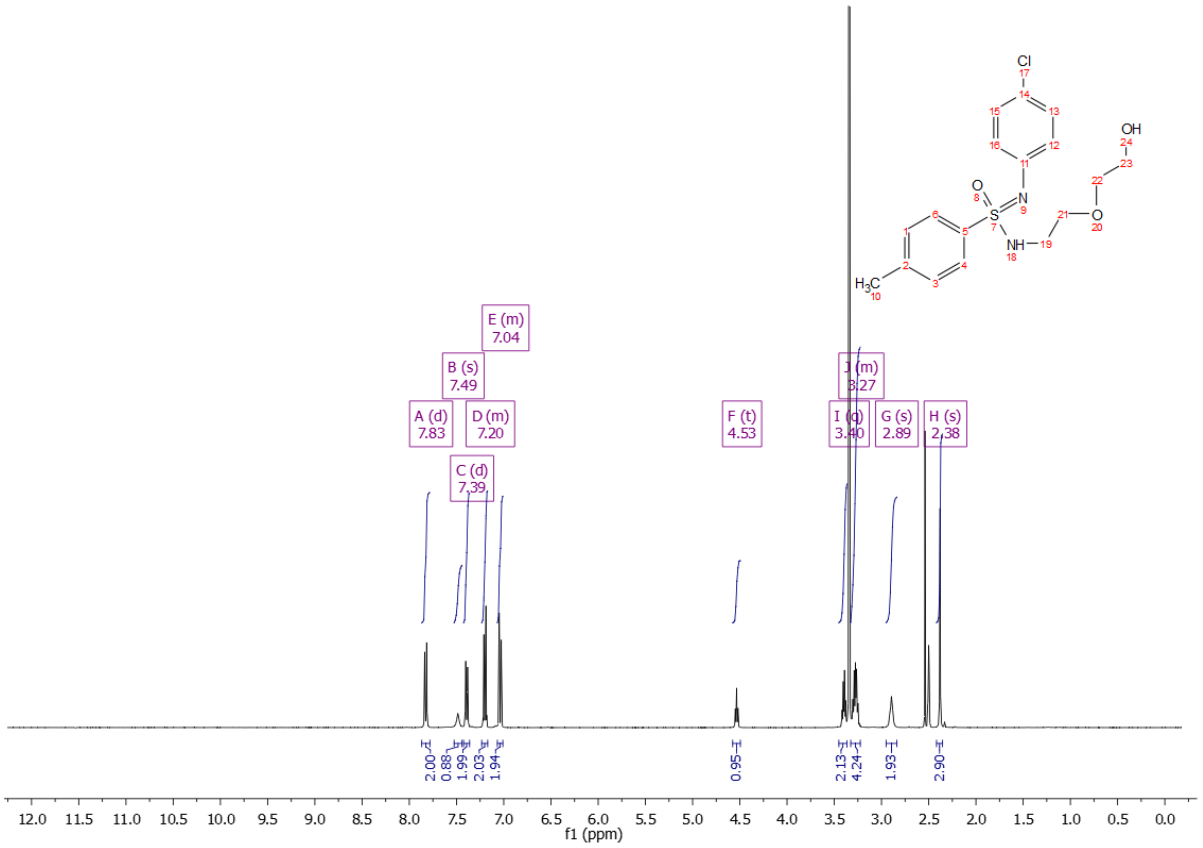

Cl
O
S
N
CH3
H3C
H3C
^{1}H NMR (400 MHz, CDCl$_3$) δ 7.82 – 7.88 (m, J = 8.0 Hz, 2H), 7.34 (d, J = 8.0 Hz, 2H), 7.14 – 7.21 (m, 4H), 2.67 (s, 6H), 2.44 (s, 3H).
E (m) 7.18
C (d) 7.85
D (d) 7.34
B (s) 2.44
A (s) 2.67
1.91
1.95
3.83
6.00
2.98
f1 (ppm)

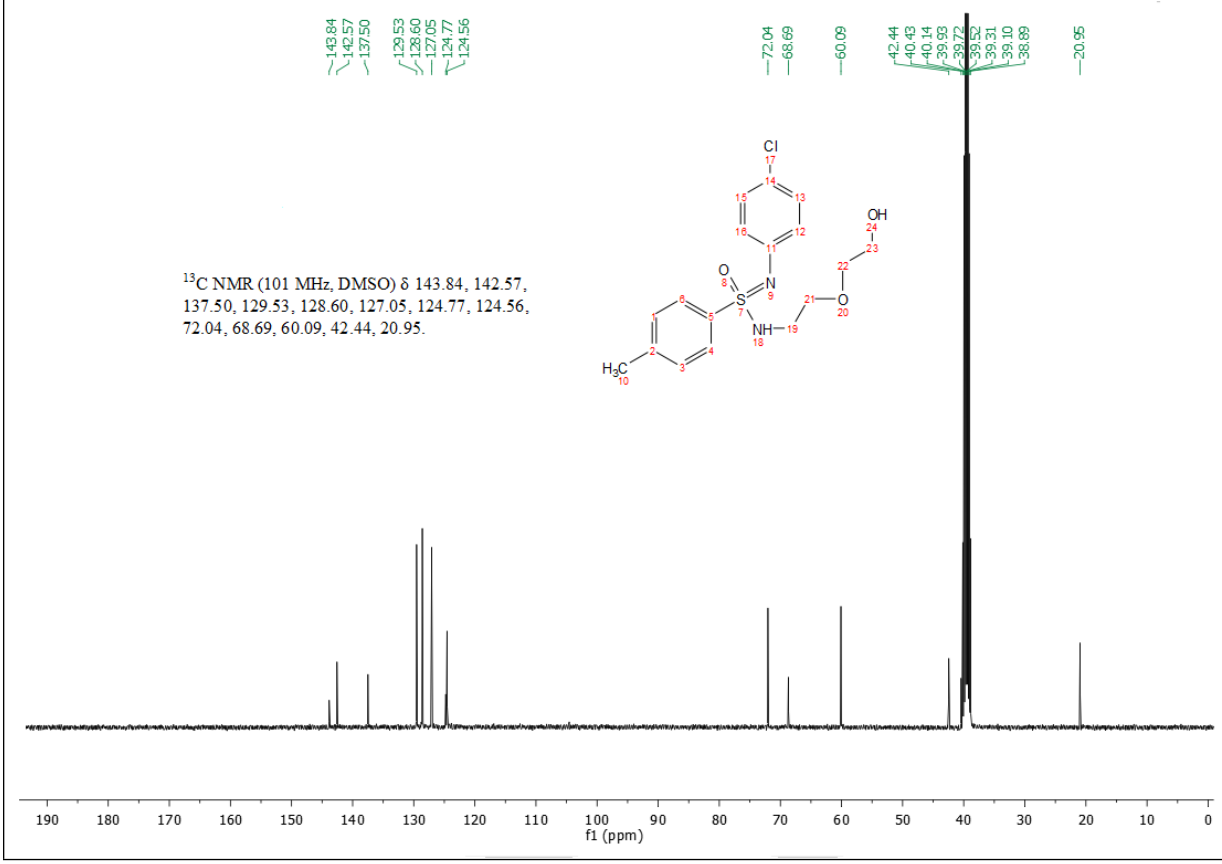
Compound 6c


Frequency: 500.13MHz (nmr13)
Spinner: 64
Experiment Name: Proton_day
Solvent: DMSO
A (d) 7.79
B (d) 7.48
C (m) 7.27
D (m) 7.13
E (m) 3.52
F (m) 2.87
G (s) 2.42
2.06
2.02
1.98
1.97
3.98
4.00
2.92
f1 (ppm)


Frequency: 125.76MHz (nmr13)
Experiment Name: Carbon_night
#Scans: 4000
Solvent: DMSO
143.65
142.62
131.14
129.78
128.85
127.89
125.53
124.82
65.36
46.38
21.00
f1 (ppm)

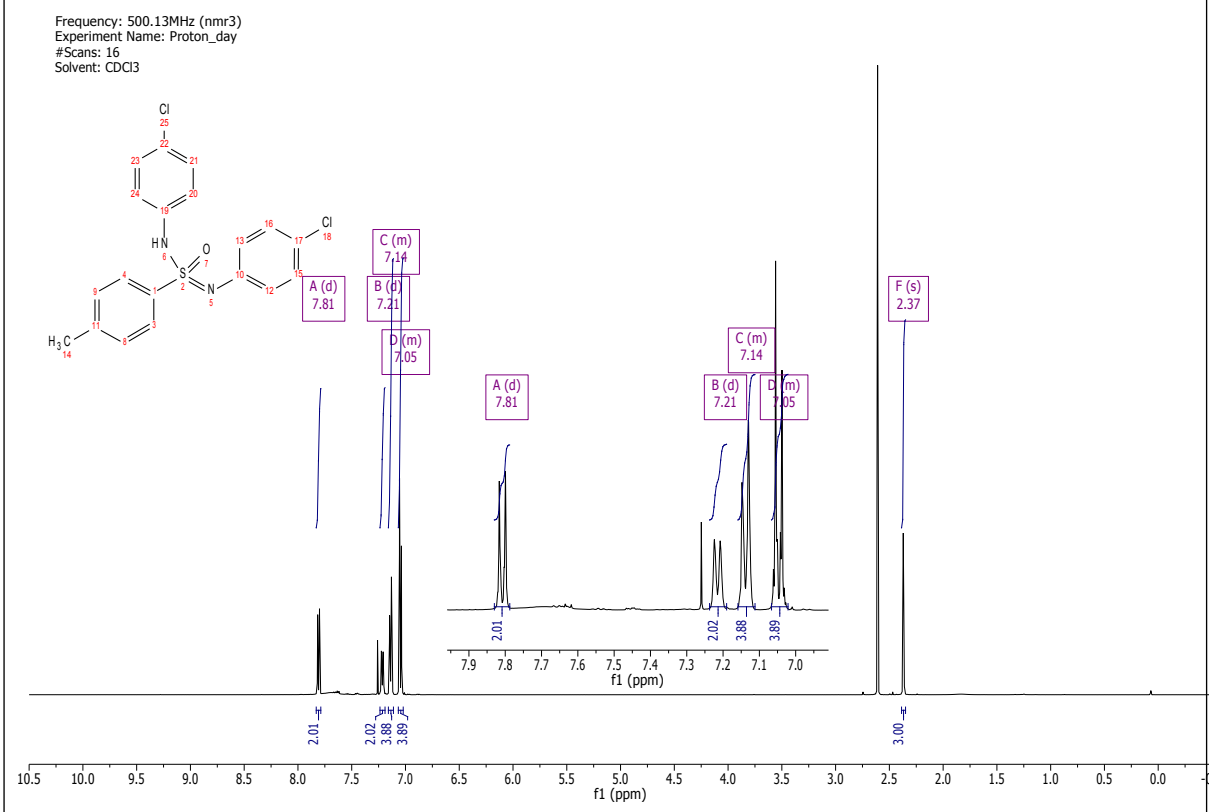
Compound 6d

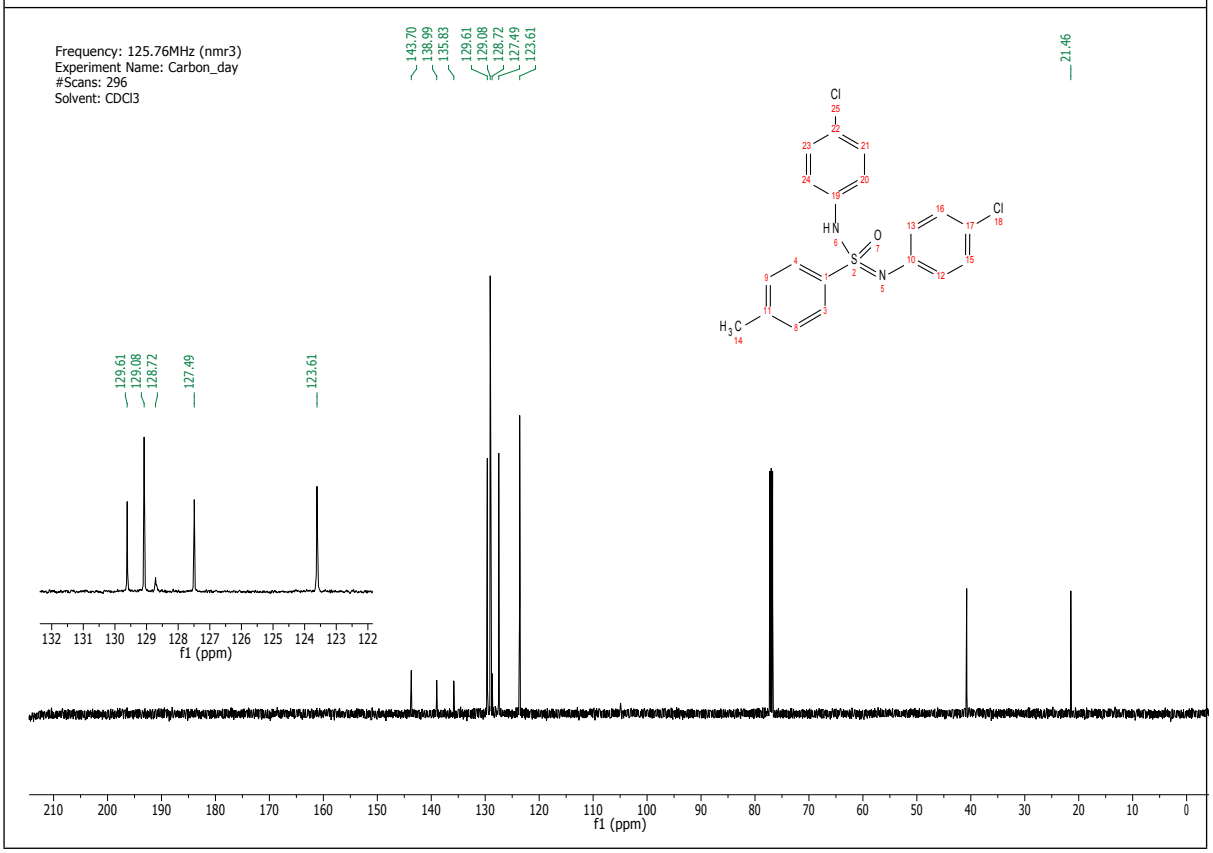




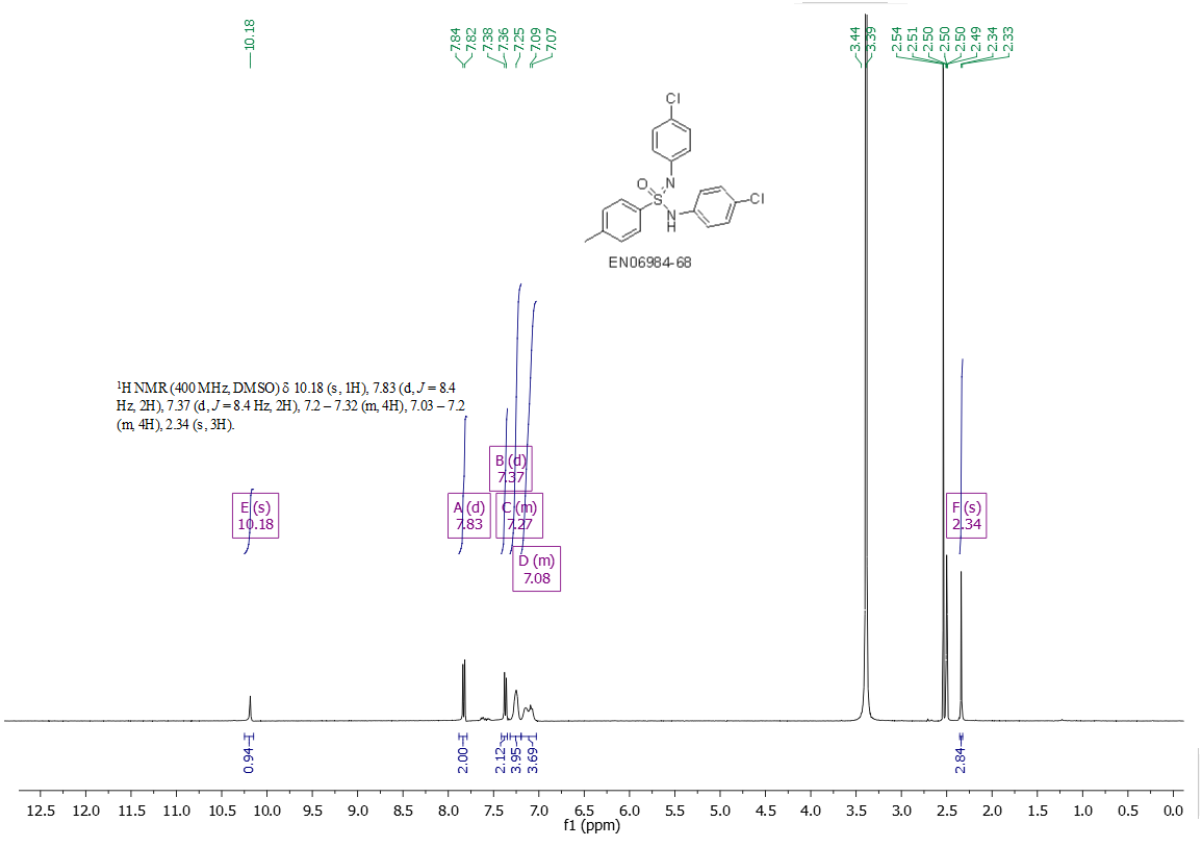
^{13}C NMR (101 MHz, DMSO) δ 143.84, 142.57, 137.50, 129.53, 128.60, 127.05, 124.77, 124.56, 72.04, 68.69, 60.09, 42.44, 20.95.

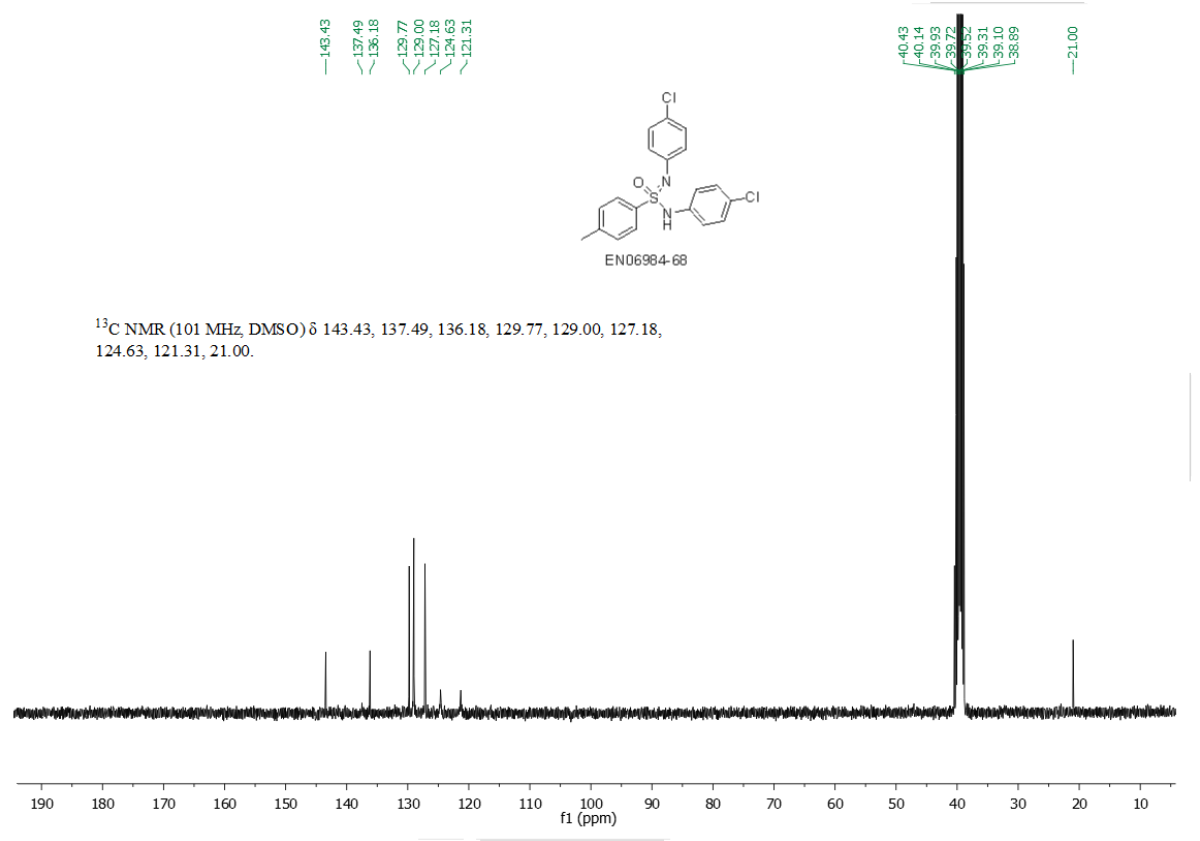
Compound 6e ($CDCl_3$ as solvent, the NH peak is very broad)



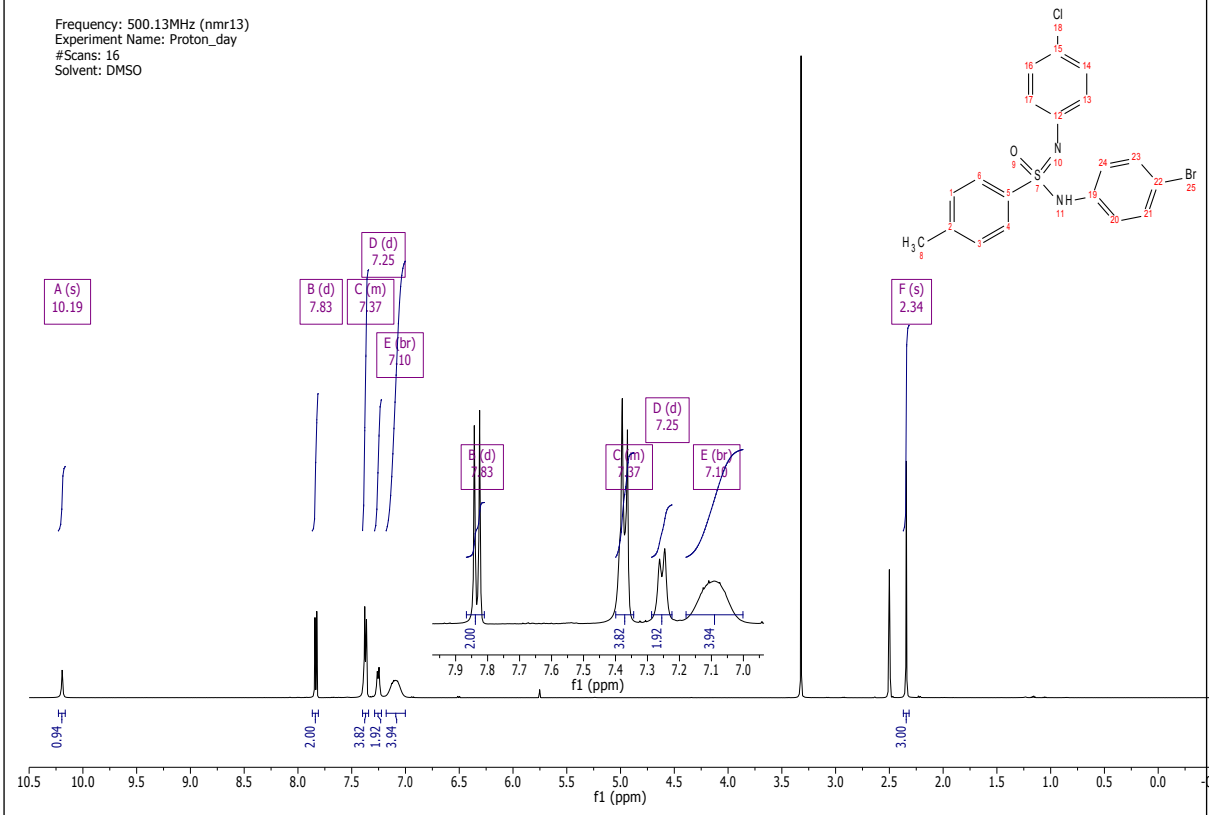


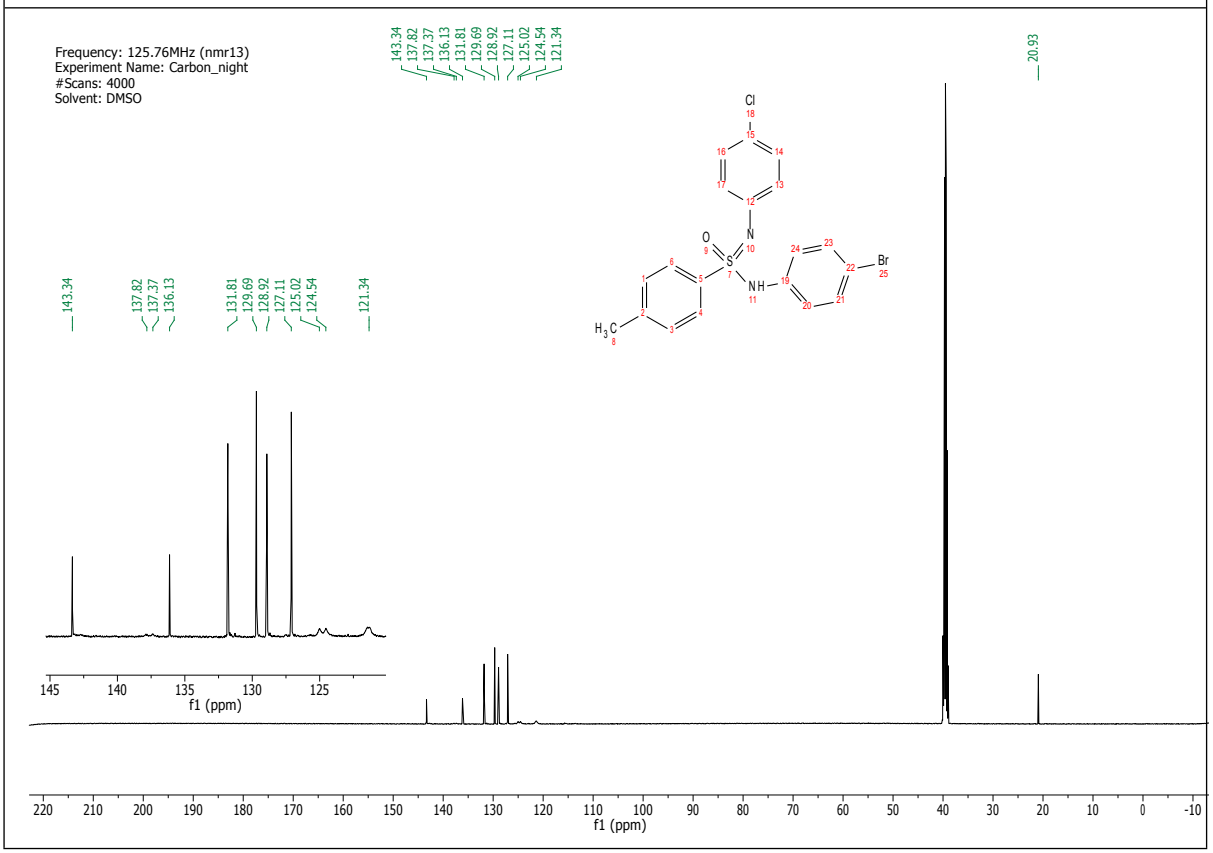
Compound 6e (DMSO-d_6 as solvent)



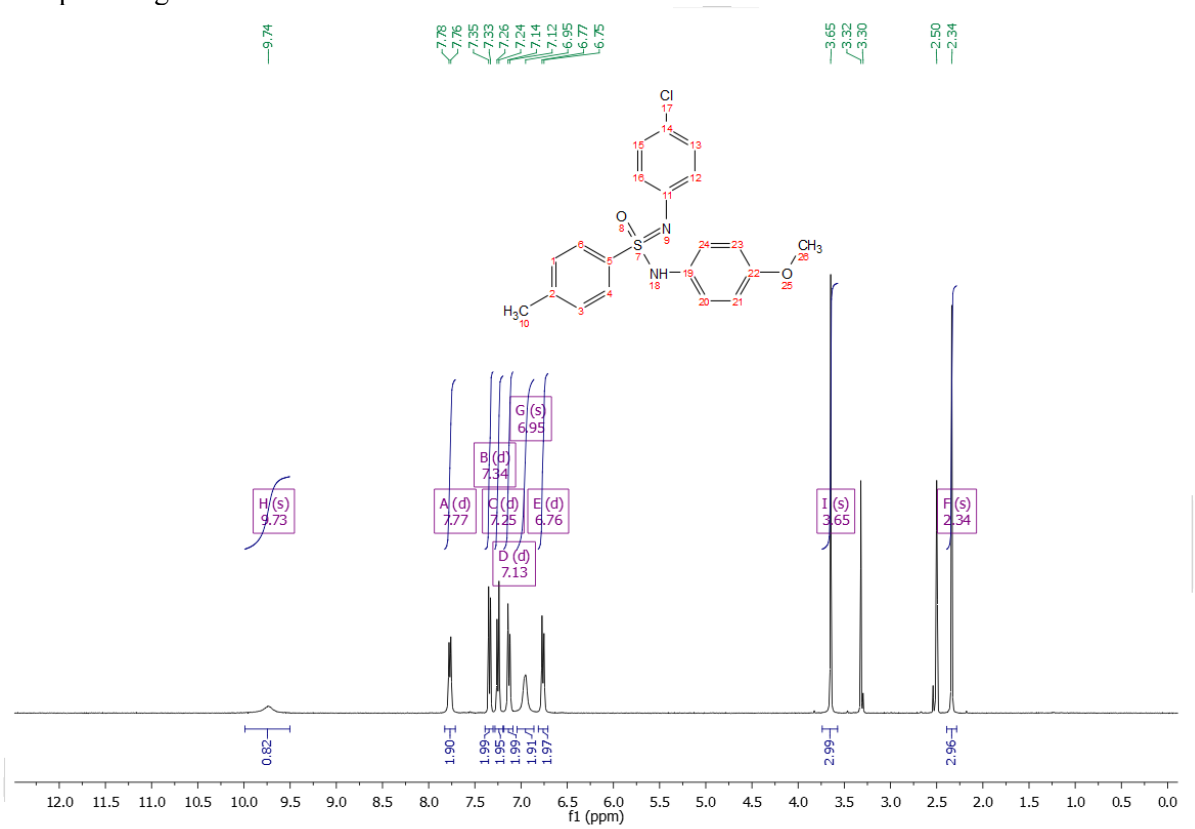


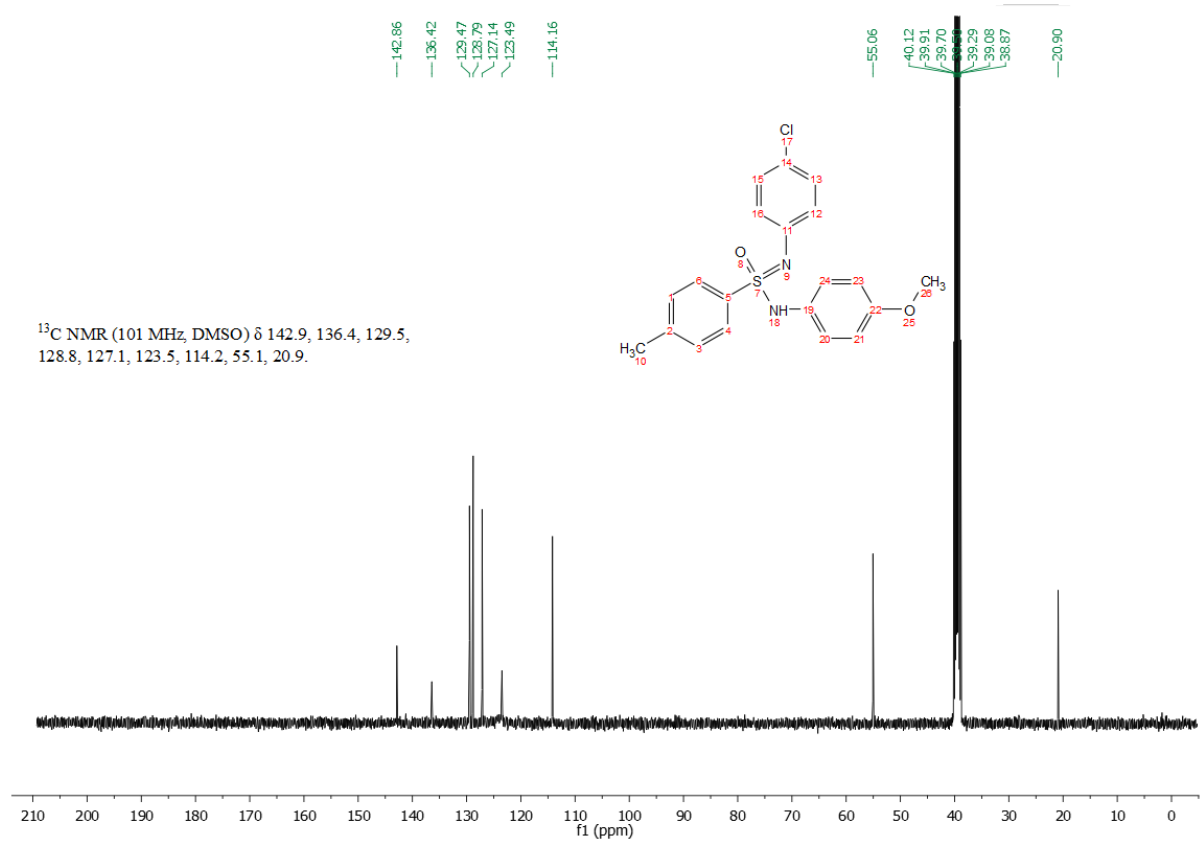
Compound 6f


Frequency: 500.13MHz (nmr13)
Experiment Name: Proton_day
#Scans: 16
Solvent: DMSO
A (s) 10.19
B (d) 7.83
C (m) 7.37
D (d) 7.25
E (br) 7.10
F (s) 2.34
0.94
2.00
3.82
1.92
3.94
3.00
f1 (ppm)


Frequency: 125.76MHz (nmr13)
Experiment Name: Carbon_night
#Scans: 4000
Solvent: DMSO
143.34
137.82
137.37
136.13
131.81
129.69
128.92
127.11
125.02
124.54
121.34
20.93
f1 (ppm)

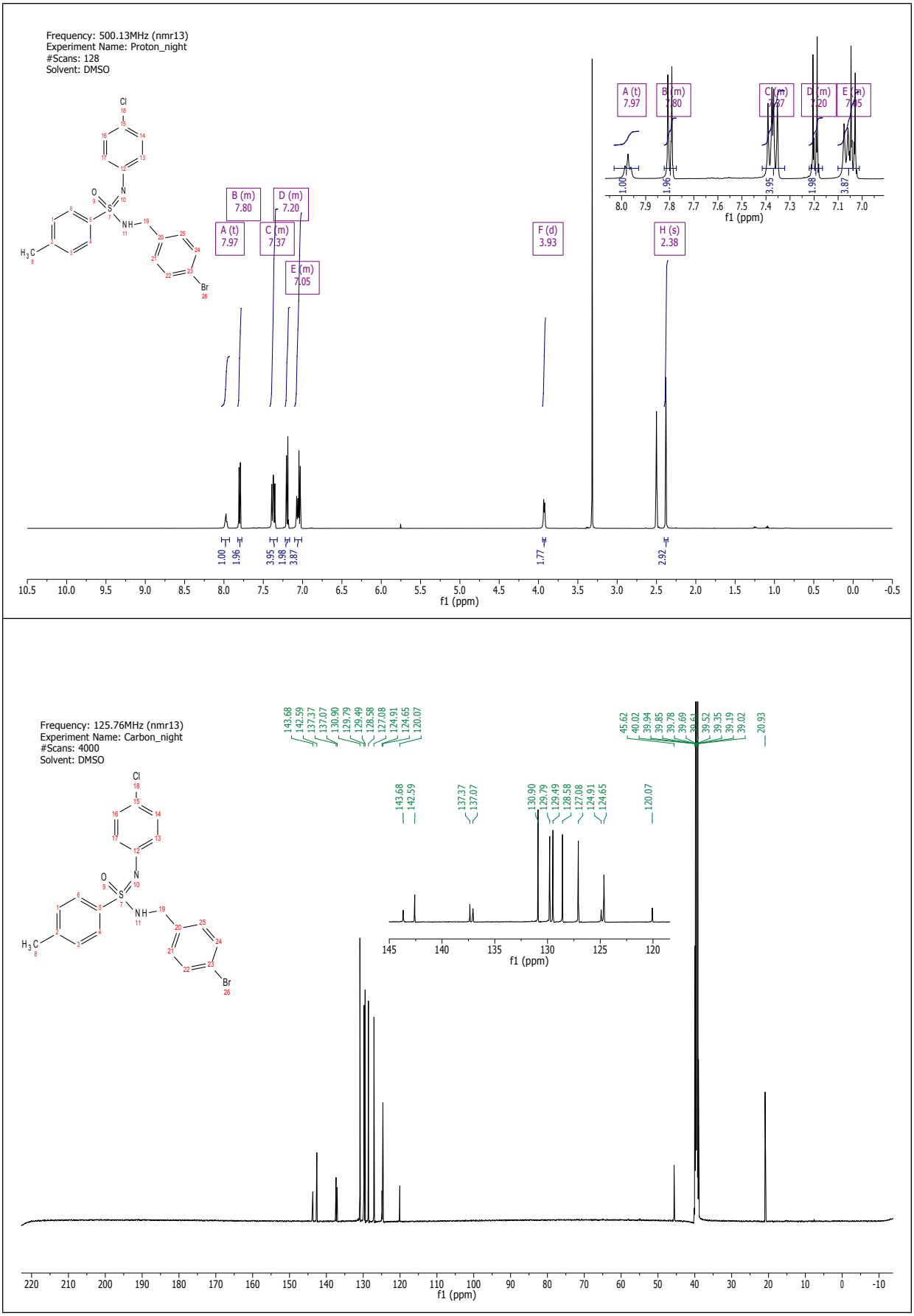
Compound 6g



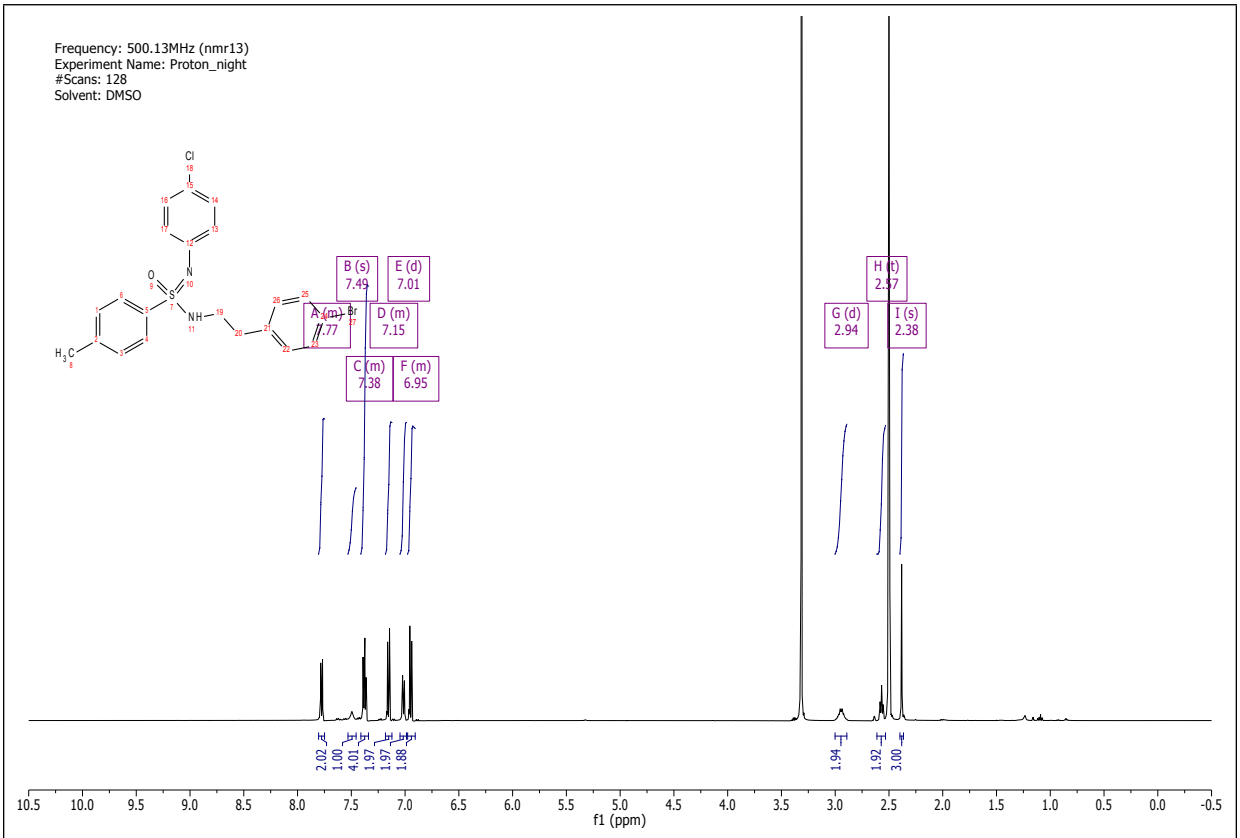


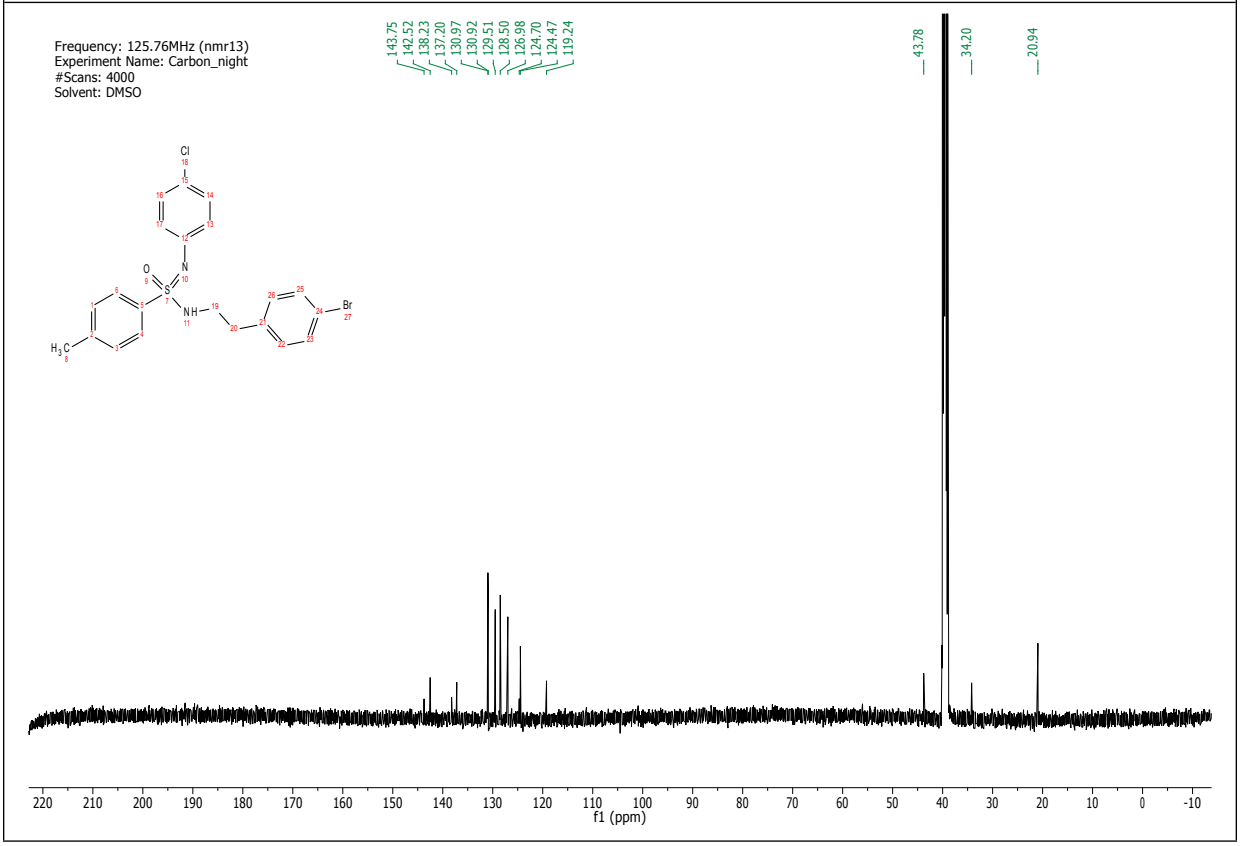
^{13}C NMR (101 MHz, DMSO) δ 142.9, 136.4, 129.5, 128.8, 127.1, 123.5, 114.2, 55.1, 20.9.

Compound 6h

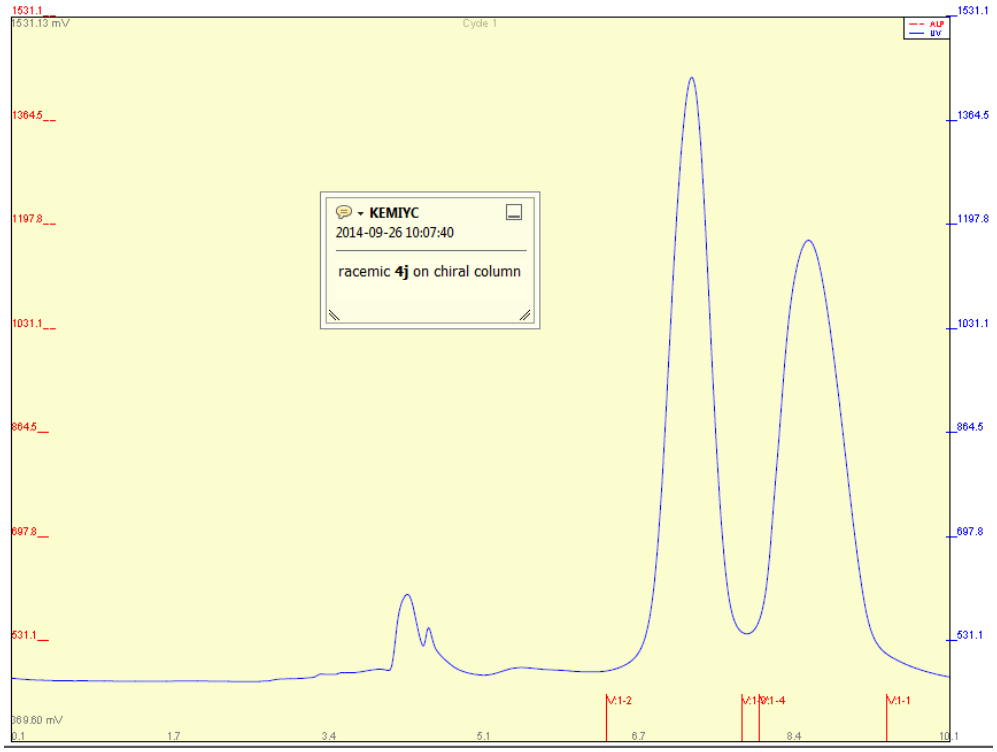

Frequency: 500.13MHz (nmr13)
Experiment Name: Proton_night
#Scans: 128
Solvent: DMSO
A (t) 7.97
B (m) 7.80
C (m) 7.37
D (m) 7.20
E (m) 7.05
F (d) 3.93
H (s) 2.38
1.00
1.96
3.95
1.98
3.87
1.77
2.92
f1 (ppm)
Frequency: 125.76MHz (nmr13)
Experiment Name: Carbon_night
#Scans: 4000
Solvent: DMSO
143.68
142.59
137.37
137.07
130.90
129.79
129.49
128.58
127.08
124.91
124.65
120.07
45.62
40.02
39.94
39.85
39.78
39.69
39.61
39.52
39.35
39.19
39.02
20.93
f1 (ppm)

Compound 6i


Frequency: 500.13MHz (nmr13)
Experiment Name: Proton_night
#Scans: 128
Solvent: DMSO
B (s) 7.49
E (d) 7.01
A (m) 7.77
D (m) 7.15
C (m) 7.38
F (m) 6.95
H (t) 2.97
G (d) 2.94
I (s) 2.38
2.02
1.00
4.01
1.97
1.97
1.88
1.94
1.92
3.00
f1 (ppm)


Frequency: 125.76MHz (nmr13)
Experiment Name: Carbon_night
#Scans: 4000
Solvent: DMSO
143.75
142.52
138.23
137.20
130.97
130.92
129.51
128.50
126.98
124.70
124.47
119.24
43.78
34.20
20.94
f1 (ppm)

Chiral separation of 4j on prep. chiral HPLC

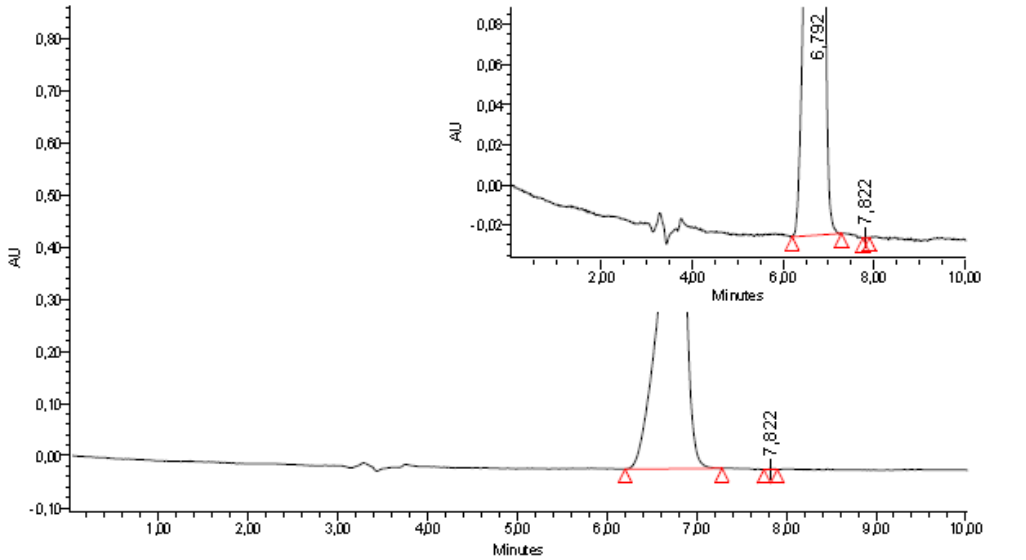


Enantiomer 1:

Project x
Sample Name: 11725_peak1

Project Name: Stenbocken\Stenbocken_
Date Acquired: 2014-01-13 16:25:05

Column:	Chiralpak IC	**Column ID:**	KG090
Mobile Phase A:	Heptan/EtOH/TEA 40/60/0.1	**Column Dimension:**	4.6 * 250
Mobile Phase B:		**Particle Size:**	5
Gradient:		**Injection volume:**	10,00 ul
		Flow:	1 ml/min
Temperature:	RT	**Wavelength:**	PDA 230,0 nm
Sample Concentration:	Sample in EtOH	**Vial:**	61



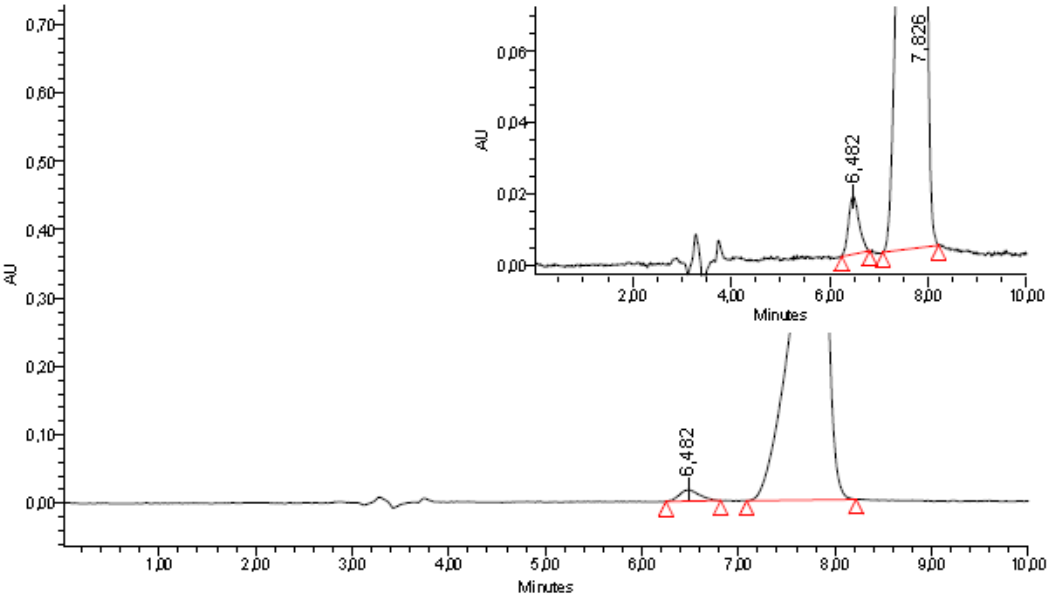
	Retention Time	Area	% Area	k	N	USP Resolution
1	6,792	14269740	99,98	0,000	3223,1	
2	7,822	2745	0,02	0,152	20835,0	3,297

Enantiomer 2:

Project x
Sample Name: 11725_peak2

Project Name: Stenbocken\Stenbocken_
Date Acquired: 2014-01-13 16:35:55

Column:	Chiralpak IC	**Column ID:**	KG090
Mobile Phase A:	Heptan/EtOH/TEA 40/60/0.1	**Column Dimension:**	4.6 * 250
Mobile Phase B:		**Particle Size:**	5
Gradient:		**Injection volume:**	10,00 ul
		Flow:	1 ml/min
Temperature:	RT	**Wavelength:**	PDA 230,0 nm
Sample Concentration:	Sample in EtOH	**Vial:**	62



	Retention Time	Area	% Area	k	N	USP Resolution
1	6,482	239399	1,65	0,000	4909,9	
2	7,826	14298460	98,35	0,207	2738,6	2,542

ee = 96,7

Notes and references:

[1] A. K. Roy, *J. Am. Chem. Soc.* **1993**, *115*, 2598-603.

[2] G. C. Nandi, S. R. Kota, T. Govender, H. G. Kruger, P. I. Arvidsson, *Tetrahedron* **2014**, *70*, 5428-5433.

[3] C. Liang, F. Collet, F. Robert-Peillard, P. Mueller, R. H. Dodd, P. Dauban, *J. Am. Chem. Soc.* **2008**, *130*, 343.