# Supporting Information

# Copper-catalyzed 1,3-aminothiocyanation of arylcylcopropanes

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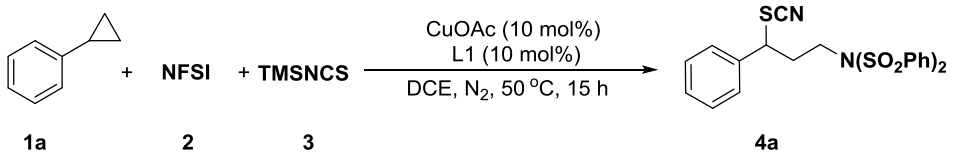
## 1. General information

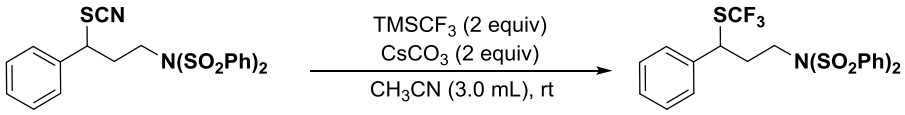
All reactions were performed under nitrogen atmosphere unless otherwise stated. Commercially available reagents were used without further purification. Cyclopropane substrates were synthesized according to procedures described in the literature.[1,2] All reactions were monitored by thin layer chromatography (TLC) using Macherey-Nagel 0.20 mm silica gel 60 plates. $^{1}H$ NMR spectra were recorded on 600 MHz spectrometer, $^{13}C$ NMR spectra were recorded on a 150 MHz instrument, and $^{19}F$ NMR spectra were recorded on a 470, and 565 MHz instrument. $^{1}H$ and $^{13}C$ NMR spectra are reported in parts per million (ppm) downfield from an internal standard, tetramethylsilane (0 ppm for $^{1}H$ NMR) and $CHCl_3$ (77.0 ppm for $^{13}C$ NMR), respectively. High-resolution mass spectra (HRMS) were recorded on Bruck microtof or Hybrid Quadrupole-Orbitrap GC-MS/MS system (Q Exactive GC).

## 2. General procedure for the synthesis of 4a-4ab



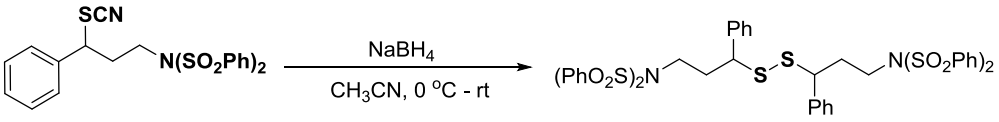

**Take 4a as an example:** In a nitrogen-filled glove box, a flame-dried screw-cap reaction tube equipped with a Teflon-coated magnetic stir bar was charged with CuOAc (10 mol%) and **L1** (10 mol%). Anhydrous DCE (2.0 mL) was added and the reaction mixture was stirred for 20 min and NFSI (2.0 equiv.) was added. Then cyclopropanes **1a** (0.3 mmol), TMSNCS (0.45 mmol, 1.5 equiv) was added at room temperature. The tube was sealed and removed from the glove box. The reaction mixture was stirred at 30 °C. After 15 h the reaction mixture was quenched with water and extracted with $CH_2Cl_2$ (3×10 mL) and the combined organic layers were concentrated in vacuo. The crude product was purified by flash column chromatography on silica gel (PE/EA, 1:10, PE = petroleum ether, EA = ethyl acetate) to obtain product **4a**.

## 3. Transformation of 4a




**4a** **5a** 56%

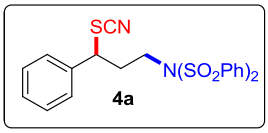
In a 25 mL round-bottom flask, **4a** (94.4 mg, 0.2 mmol) in $CH_3CN$ (3 mL) was added $CsCO_3$ (130.3 mg, 0.4 mmol) and cooled to 0 ℃. Then $TMSCF_3$ (56.9 mg, 0.4 mmol) was added at once and the mixture was then stirred at room temperature for 16 h and transformed to 30 $^oC$ over 2 h. The resulting mixture was filtered through a short pad of celite and extracted with $Et_2O$. The resulting organic solution was washed with water (10 mL) and brine (10 mL) and dried over $MgSO_4$. After the removal of solvent, the residue was further purified by flash chromatography affording **5a** (57.7 mg, 56%).




**4a** **5b** 65%

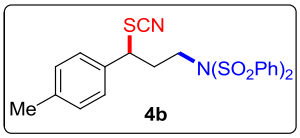
To a solution of **4a** (94.4 mg, 0.2 mmol) in 2 mL of MeCN was added $NaBH_4$ (11.3 mg, 0.3 mmol) at 0 ℃. After the mixture had been stirred at 0 ℃ for 4 h and transferred to room temperature overnight, the reaction was quenched with 20 mL of saturated aqueous $NaHCO_3$. The aqueous layer was extracted with EtOAc, washed with brine, dried over anhydrous $Na_2SO_4$, and concentrated. Column chromatography on silica gel (petroleum ether/EtOAc = 10:1) gave 115.9 mg of **5b** (65%).

## 4. Characterization data of all products



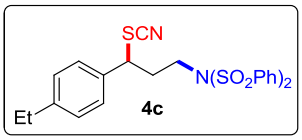

***N*-(3-phenyl-3-thiocyanatopropyl)-*N*-(phenylsulfonyl)benzenesulfonamide (4a)**

Yellow oil (94%, 133.1 mg); $R_f$ = 0.5 (petroleum ether/ethyl acetate = 10:1, v/v); **$^1$H NMR** (600 MHz, $CDCl_3$) $\delta$ = 7.94 (dd, *J* = 7.8 Hz, 1.2 Hz, 4H), 7.66 (t, *J* = 7.8 Hz, 2H), 7.53 (t, *J* = 8.4 Hz, 4H), 7.42-7.36 (m, 3H), 7.32-7.30 (m, 2H), 4.32 (t, *J* = 7.2 Hz, 1H), 3.78-3.73 (m, 1H), 3.61-3.55 (m, 1H), 2.66-2.60 (m, 1H), 2.57-2.51 (m, 1H); **$^{13}$C NMR** (150 MHz, $CDCl_3$) $\delta$ = 139.3, 136.9, 134.2, 129.4, 129.3, 129.3, 128.2, 127.6, 110.9, 50.1, 46.4, 35.2; **HRMS** (ESI) calcd for $C_{22}H_{20}N_2NaO_4S_3$ ([M + Na]$^+$), 495.0477, found 495.0471.




***N*-(phenylsulfonyl)-*N*-(3-thiocyanato-3-(p-tolyl)propyl)benzenesulfonamide (4b)**

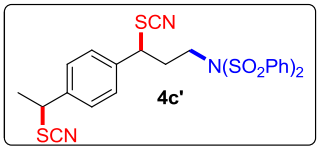
White solid (80%, 116.7 mg); $R_f$ = 0.5 (petroleum ether/ethyl acetate = 10:1, v/v); mp 93-94 $^o$C; **$^1$H NMR** (600 MHz, $CDCl_3$) δ = 7.95 (d, *J* = 7.8 Hz, 4H), 7.66 (t, *J* = 7.2 Hz, 2H), 7.54 (t, *J* = 7.8 Hz, 4H), 7.20 (s, 4H), 4.31 (t, *J* = 7.8 Hz, 1H), 3.77-3.72 (m, 1H), 3.61-3.56 (m, 1H), 2.63-2.59 (m, 1H), 2.55-2.52 (m, 1H); **$^{13}$C NMR** (150 MHz, $CDCl_3$) δ = 139.5, 139.4, 134.3, 133.8, 130.0, 129.4, 128.3, 127.5, 111.1, 50.2, 46.5, 35.3, 21.3; **HRMS** (ESI) calcd for $C_{23}H_{22}N_2NaO_4S_3$ ([M + Na]$^+$), 509.0634, found 509.0642.




***N*-(3-(4-ethylphenyl)-3-thiocyanatopropyl)-*N* (phenylsulfonyl)benzenesulfonamide (4c)**

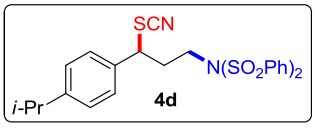
Yellow oil (41%, 61.5 mg); $R_f$ = 0.5 (petroleum ether/ethyl acetate = 10:1, v/v); **$^1$H NMR** (600 MHz, $CDCl_3$) $\delta$ = 7.95 (d, *J* = 7.8 Hz, 4H), 7.67 (t, *J* = 7.8 Hz, 2H), 7.54 (t, *J* = 7.8 Hz, 4H), 7.32 (s, 4H), 4.32 (dd, *J* = 7.2, 1.2 Hz, 1H), 3.77-3.72 (m, 1H), 3.60-3.55 (m, 1H), 2.87-2.60 (m, 3H), 2.57-2.52 (m, 1H), 1.26 (t, *J* = 7.2 Hz, 3H); **$^{13}$C NMR** (150 MHz, $CDCl_3$) $\delta$ = 145.6, 139.2,

134.1, 133.8, 129.2, 128.7, 128.1, 127.4, 110.9, 49.9, 46.3, 35.1, 28.5, 15.3; **HRMS** (ESI) calcd for $C_{24}H_{24}N_2NaO_4S_3$ ([M + Na]$^+$), 523.0790, found 523.0788.



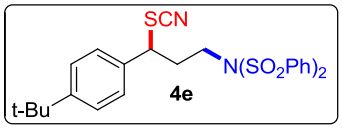

***N*-(phenylsulfonyl)-*N*-(3-thiocyanato-3-(4-(1-thiocyanatoethyl)phenyl)propyl)benzenesulfonamide (4c')**

Yellow oil (25%, 41.8 mg,); $R_f$ = 0.5 (petroleum ether/ethyl acetate = 6:1, v/v); **$^1$H NMR** (600 MHz, $CDCl_3$) $\delta$ = 7.95 (d, *J* = 7.2 Hz, 4H), 7.67 (t, *J* = 7.8 Hz, 2H), 7.56 (t, *J* = 7.8 Hz, 4H), 7.45 (d, *J* = 8.4 Hz, 2H), 7.36 (d, *J* = 7.8 Hz, 2H), 4.62 (q, *J* = 7.2 Hz, 1H), 4.32 (t, *J* = 7.8 Hz, 1H), 3.80-3.76 (m, 1H), 3.66-3.63 (m, 1H), 2.66-2.62 (m, 1H), 2.56-2.53 (m, 1H), 1.89 (d, *J* = 6.6 Hz, 3H); **$^{13}$C NMR** (150 MHz, $CDCl_3$) $\delta$ = 140.5, 139.1, 137.8, 134.2, 129.3, 128.2, 128.1, 127.9, 111.2, 110.5, 49.2, 47.8, 46.2, 34.8, 21.7; **HRMS** (ESI) calcd for $C_{24}H_{24}N_2NaO_4S_3$ ([M + Na]$^+$), 580.0464, found 580.0460.



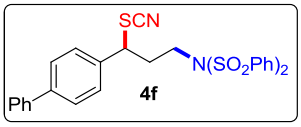

***N*-(3-(4-isopropylphenyl)-3-thiocyanatopropyl)-*N*-(phenylsulfonyl)benzenesulfonamide (4d)**

White solid (75%, 115.6 mg), $R_f$ = 0.5 (petroleum ether/ethyl acetate = 10:1, v/v), mp 103-104 $^o$C; **$^1$H NMR** (600 MHz, $CDCl_3$) 7.95 (d, *J* = 7.2 Hz, 4H), 7.66 (t, *J* = 7.8 Hz, 2H), 7.54 (t, *J* = 7.2 Hz, 4H), 7.27 (q, *J* = 7.8 Hz, 4H), 4.32-4.30 (t, *J* =7.8 Hz, 1H), 3.77-3.72 (m, 1H), 3.59-3.54 (m, 1H), 2.95-2.91 (m, 1H), 2.68-2.61 (m, 1H), 2.57-2.53 (m, 1H), 1.27 (d, *J* = 6.6 Hz, 6H); **$^{13}$C NMR** (150 MHz, $CDCl_3$) δ = 150.2, 139.2, 134.1, 133.9, 129.2, 128.1, 127.5, 127.3, 110.0, 49.9, 46.3, 35.1, 33.8, 23.8; **HRMS** (ESI) calcd for $C_{25}H_{26}N_2N_aO_4S_3$ ([M + Na]$^+$), 537.0947, found 537.0931.



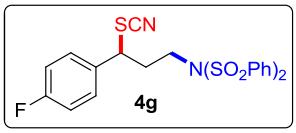

***N*-(3-(4-(tert-butyl)phenyl)-3-thiocyanatopropyl)-*N*-(phenylsulfonyl)benzenesulfonamide (4e)**

Light yellow solid (85%, 134.6 mg); $R_f$ = 0.5 (petroleum ether/ethyl acetate = 10:1, v/v); mp 103-104 °C; **$^1$H NMR** (600 MHz, $CDCl_3$) $\delta$ = 7.95 (d, $J$ = 8.4 Hz, 4H), 7.66 (t, $J$ = 7.2 Hz, 2H), 7.54 (t, $J$ = 8.4 Hz, 4H), 7.42 (d, $J$ = 7.8 Hz, 2H), 7.26 (d, $J$ = 8.4 Hz, 2H), 4.32 (t, $J$ = 7.2 Hz, 1H), 3.77-3.72 (m, 1H), 3.59-3.54 (m, 1H), 2.68-2.63 (m, 1H), 3.59-3.54 (m, 1H), 1.33 (s, 1H); **$^{13}$C NMR (150 MHz, $CDCl_3$)** δ = 152.6, 139.3, 134.2, 133.7, 129.3, 128.2, 127.3, 126.2, 111.1, 49.9, 46.4, 35.2, 34.8, 31.3; **HRMS** (ESI) calcd for $C_{26}H_{28}N_2NaO_4S_3$ ($[M + Na]^+$), 551.1103, found 551.1101.



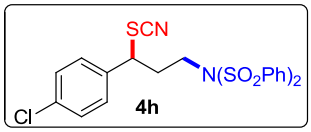

***N*-(3-([1,1'-biphenyl]-4-yl)-3-thiocyanatopropyl)-*N* (phenylsulfonyl)benzenesulfonamide (4f)**

Light yellow oil (69%, 113.4 mg); $R_f$ = 0.5 (petroleum ether/ethyl acetate = 10:1, v/v); **$^1$H NMR** (600 MHz, $CDCl_3$) $\delta$ = 7.96 (d, $J$ = 7.8 Hz, 4H), 7.67-7.63 (m, 4H), 7.61 (d, $J$ = 7.2 Hz, 2H), 7.55 (t, $J$ = 8.4 Hz, 4H), 7.48 (t, $J$ = 7.8 Hz, 2H), 7.40-7.38 (m, 3H), 4.38 (t, $J$ = 7.2 Hz, 1H), 3.82-3.77 (m, 1H), 3.65-3.60 (m, 1H), 2.71-2.66 (m, 1H), 2.61-2.56 (m, 1H); **$^{13}$C NMR** (150 MHz, $CDCl_3$) $\delta$ = 142.2, 139.9, 139.1, 135.6, 134.1, 129.2, 128.8, 128.1, 127.9, 127.8, 127.7, 127.0, 110.7, 49.8, 46.2, 35.0; **HRMS** (ESI) calcd for $C_{28}H_{24}N_2NaO_4S_3$ ($[M + Na]^+$), 571.0790, found 571.0792.



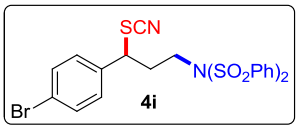

***N*-(3-(4-fluorophenyl)-3-thiocyanatopropyl)-*N*-(phenylsulfonyl)benzenesulfonamide (4g)**

Pale yellow oil (79%, 116.1 mg); $R_f$ = 0.5 (petroleum ether/ethyl acetate = 10:1, v/v); **$^1$H NMR** (600 MHz, $CDCl_3$) $\delta$ = 7.95 (d, *J* = 7.2 Hz, 4H), 7.68 (t, *J* = 7.2 Hz, 2H), 7.56 (t, *J* = 7.8 Hz, 4H), 7.31-7.30 (m, 2H), 7.11 (t, *J* = 8.4 Hz, 2H), 4.32(t, *J* = 7.8 Hz, 1H), 3.79-3.74 (m, 1H), 3.63-3.58 (m, 1H), 2.62-2.52 (m, 2H); **$^{13}$C NMR** (150 MHz, $CDCl_3$) $\delta$ = 163.8 (d, J = 247.95 Hz), 139.2, 134.2, 132.9 (d, *J* = 3.3 Hz), 129.4 (d, *J* = 8.25 Hz), 129.3, 128.1, 116.4 (d, *J* = 21.75 Hz), 110.6, 49.3, 46.3, 35.1; **$^{19}$F NMR** (565 MHz, $CDCl_3$) δ = -111.18 - -111.24 (m, 1F); **HRMS** (ESI) calcd for $C_{22}H_{19}FN_2NaO_4S_3$ ($[M + Na]^+$), 513.0383, found 513.0379.



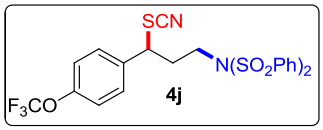

***N*-(3-(4-chlorophenyl)-3-thiocyanatopropyl)-*N*-(phenylsulfonyl)benzenesulfonamide (4h)**

Light yellow oil (yield 109.3 mg, 72%); $R_f$ = 0.5 (petroleum ether/ethyl acetate = 10:1, v/v); **$^1$H NMR** (600 MHz, $CDCl_3$) $\delta$ = 7.95 (d, *J* = 7.8 Hz, 4H), 7.68 (t, *J* = 7.2 Hz, 2H), 7.56 (t, *J* = 7.8 Hz, 4H), 7.40 (d, *J* = 8.4 Hz, 2H), 7.27 (d, *J* = 8.4 Hz, 2H), 4.29 (t, *J* = 7.2 Hz, 1H), 3.79-3.74 (m, 1H), 3.62-3.57 (m, 1H), 2.62-2.56 (m, 1H), 2.54-2.49 (m, 1H); **$^{13}$C NMR** (150 MHz, $CDCl_3$) $\delta$ = 139.3, 134.2, 133.8, 130.2, 129.3, 128.1, 127.7, 127.7, 110.3, 46.3, 45.4, 34.3; **HRMS** (ESI) calcd for $C_{22}H_{19}ClN_2NaO_4S_3$ ($[M + Na]^+$), 529.0088, found 529.0078.



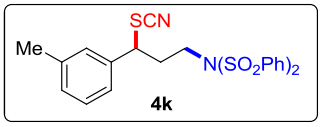

***N*-(3-(4-bromophenyl)-3-thiocyanatopropyl)-*N*-(phenylsulfonyl)benzenesulfonamide (4i)**

Light yellow oil (64%, 105.6 mg); $R_f$ = 0.5 (petroleum ether/ethyl acetate = 10:1, v/v); **$^1$H NMR** (600 MHz, $CDCl_3$) $\delta$ = 7.87 (d, *J* = 7.8 Hz, 4H), 7.61 (t, *J* = 7.2 Hz, 2H), 7.49-7.46 (m, 6H), 7.13 (d, *J* = 8.4 Hz, 2H), 4.21 (t, *J* = 7.8 Hz, 1H), 3.71-3.67 (m, 1H), 3.54-3.49 (m, 1H), 2.55-2.49 (m, 1H), 2.47-2.41 (m, 1H); **$^{13}$C NMR** (150 MHz, $CDCl_3$) $\delta$ = 139.1, 136.1, 134.2, 132.5, 129.3, 129.1, 128.1, 123.5, 110.4, 49.2, 46.2, 34.8; **HRMS** (ESI) calcd for $C_{22}H_{19}BrN_2NaO_4S_3$ ($[M + Na]^+$), 572.9583, found 572.9587.



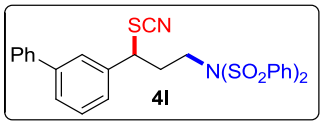

***N*-(phenylsulfonyl)-*N*-(3-thiocyanato-3-(4 (trifluoromethoxy)phenyl)propyl)benzenesulfonamide (4j)**

Yellow oil (yield 135.1 mg, 81%); $R_f$ = 0.5 (petroleum ether/ethyl acetate = 10:1, v/v); **$^1$H NMR** (600 MHz, $CDCl_3$) δ = 7.94 (d, *J* = 8.4 Hz, 4H), 7.67 (t, *J* = 7.2 Hz, 2H), 7.54 (t, *J* = 7.8 Hz, 4H), 7.37 (d, J = 8.4 Hz, 1H), 7.27 (d, *J* = 7.8 Hz, 1H), 4.32 (t, *J* = 7.8 Hz, 1H), 3.80-3.76 (m, 1H), 3.62-3.57 (m, 1H), 2.63-2.60 (m, 1H), 2.56-2.53 (m, 1H). **$^{13}$C NMR** (150 MHz, $CDCl_3$) δ = 149.7, 139.1, 135.8, 134.3, 129.4, 129.2, 129.0 (q, *J* = 256.2 Hz), 128.2, 121.6, 110.4, 48.9, 46.1, 34.9; **$^{19}$F NMR** (565 MHz, $CDCl_3$) δ = -57.76 (s, 1$CF_3O$); **HRMS** (ESI) calcd for $C_{23}H_{19}F_3N_2NaO_5S_3$ ([M + Na]$^+$), 579.0300, found 579.0300.



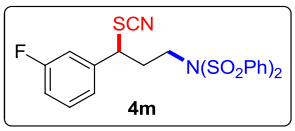

***N*-(phenylsulfonyl)-*N*-(3-thiocyanato-3-(m-tolyl)propyl)benzenesulfonamide (4k)**

White solid (65%, 94.7 mg); $R_f$ = 0.5 (petroleum ether/ethyl acetate = 10:1, v/v); mp 144-145 $^o$C; **$^1$H NMR** (600 MHz, $CDCl_3$) *δ* = 7.95 (d, *J* = 7.8 Hz, 4H), 7.67 (t, *J* = 7.8 Hz, 2H), 7.55 (t, *J* = 7.8 Hz, 4H), 7.31 (t, *J* = 7.8 Hz, 1H), 7.20 (d, *J* = 7.8 Hz, 1H), 7.11 (s, 1H), 4.29 (t, *J* = 7.8 Hz, 1H), 3.78-3.73 (m, 1H), 3.60-3.55 (m, 1H), 2.65-2.59 (m, 1H), 2.56-2.51 (m, 1H), 2.38 (s, 3H); **$^{13}$C NMR** (150 MHz, $CDCl_3$) *δ* = 139.3, 139.2, 136.7, 134.2, 130.2, 129.3, 129.2, 128.2, 124.6, 111.0, 50.2, 46.4, 35.3, 21.5; **HRMS** (ESI) calcd for $C_{22}H_{23}N_2NaO_4S_3$ ([M + Na]$^+$), 509.0634, found 509.0630.



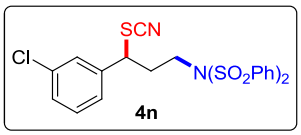

***N*-(3-([1,1'-biphenyl]-3-yl)-3-thiocyanatopropyl)-*N*-(phenylsulfonyl)benzenesulfonamide (4l)**

Pale yellow oil (80%, 132.1 mg); $R_f$ = 0.5 (petroleum ether); **$^1$H NMR** (600 MHz, $CDCl_3$) δ = 7.94 (d, *J* = 7.2 Hz, 4H), 7.63 (t, *J* = 7.8 Hz, 5H), 7.52-7.45 (m, 8H), 7.39 (t, *J* = 7.2 Hz, 1H), 7.29 (d, *J* = 7.8 Hz, 1H), 4.38 (t, *J* = 7.2 Hz, 1H), 3.82-3.77 (m, 1H), 3.64-3.59 (m, 1H), 2.71-2.69 (m, 1H), 2.63-2.59 (m, 1H); **$^{13}$C NMR** (150 MHz, $CDCl_3$) δ = 142.4, 140.2, 139.2, 137.4, 134.2, 129.3, 129.0, 128.2, 127.9, 127.2, 126.4, 126.3, 110.9, 50.0, 46.4, 35.2; **HRMS** (ESI) calcd for $C_{28}H_{24}N_2N_aO_4S_3$ ([M + Na]$^+$), 571.0790, found 571.0791.




***N*-(3-(3-fluorophenyl)-3-thiocyanatopropyl)-*N*-(phenylsulfonyl)benzenesulfonamide (4m)**

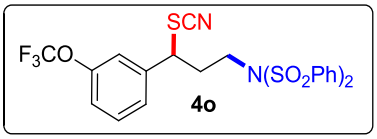
Light yellow oil (62%, 91.1 mg); $R_f$ = 0.5 (petroleum ether/ethyl acetate = 10:1, v/v); **$^1$H NMR** (600 MHz, $CDCl_3$) *δ* = 7.96 (d, *J* = 7.8 Hz, 4H), 7.68 (t, *J* = 7.8 Hz, 2H), 7.56 (t, *J* = 7.8 Hz, 4H), 7.41-7.37 (m, 1H), 7.12-7.08 (m, 2H), 7.02-7.00 (m, 1H), 4.29 (t, *J* = 7.8 Hz, 1H), 3.81-3.76 (m, 1H), 3.75-3.71 (m, 1H), 3.65-3.60 (m, 1H), 2.60-2.54 (m, 1H), 2.53-2.49 (m, 1H); **$^{13}$C NMR** (150 MHz, $CDCl_3$) *δ* = 163.7 (d, *J* = 246.9 Hz), 139.6 (d, *J* = 7.05 Hz), 139.2, 134.2, 131.0 (d, *J* = 8.25 Hz), 129.3, 128.2, 123.2 (d, *J* = 3.0 Hz), 116.5 (d, *J* = 20.85 Hz), 114.6 (d, *J* = 22.35 Hz), 110.3, 49.2, 46.2, 34.9; **$^{19}$F NMR** (565 MHz, $CDCl_3$) δ = -111.75 - -111.80 (m, 1F); **HRMS** (ESI) calcd for $C_{22}H_{19}FN_2NaO_4S_3$ ([M + Na]$^+$), 513.0383, found 513.0380.




***N*-(3-(3-chlorophenyl)-3-thiocyanatopropyl)-*N*-(phenylsulfonyl)benzenesulfonamide (4n)**

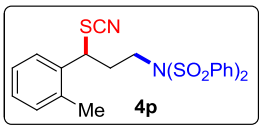
White solid (56%, 85.0 mg); $R_f$ = 0.5 (petroleum ether/ethyl acetate = 10:1, v/v); **$^1$H NMR** (600 MHz, $CDCl_3$) *δ* = 7.96 (d, *J* = 7.8 Hz, 4H), 7.69 (t, *J* = 8.4 Hz, 2H), 7.57 (t, *J* = 7.8 Hz, 4H), 7.37-7.34 (m, 2H), 7.27 (s, 1H), 7.23 (d, *J* = 6.6 Hz, 1H), 4.26 (t, *J* = 7.2 Hz, 1H), 3.78-3.76 (m, 1H), 3.63-3.59 (m, 1H), 2.59-2.50 (m, 2H); **$^{13}$C NMR** (150 MHz, $CDCl_3$) *δ* = 139.2, 139.1,

135.1, 134.2, 130.6, 129.6, 129.3, 128.2, 127.7, 125.6, 110.3, 49.1, 46.1, 34.9; **HRMS** (ESI) calcd for $C_{22}H_{19}ClN_2NaO_4S_3$ ([M + Na]$^+$), 529.0088, found 529.0084.



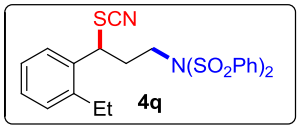

***N*-(phenylsulfonyl)-*N*-(3-thiocyanato-3-(3-(trifluoromethoxy)phenyl)propyl)benzenesulfonamide (4o)**

Light yellow oil (61%, 100 mg); $R_f$ = 0.5 (petroleum ether/ethyl acetate = 10:1, v/v); **$^1$H NMR** (600 MHz, $CDCl_3$) $\delta$ = 7.96 (d, $J$ = 7.8 Hz, 4H), 7.68 (t, $J$ = 7.8 Hz, 2H), 7.56 (t, $J$ = 7.2 Hz, 4H), 7.47 (t, $J$ = 7.2 Hz, 1H), 7.28 (t, $J$ = 8.4 Hz, 2H), 7.15 (s, 1H), 4.30 (t, $J$ = 7.2 Hz, 1H), 3.80-3.78 (m, 1H), 3.68-3.63 (m, 1H), 2.61-2.50 (m, 2H); **$^{13}$C NMR** (150 MHz, $CDCl_3$) $\delta$ = 149.7, 139.6, 139.2, 134.3, 130.8, 129.5 (q, $J$ =239.3 Hz), 129.3, 128.2, 125.8, 121.7, 120.1, 110.2, 49.1, 46.2, 34.8; **$^{19}$F NMR** (565 MHz, $CDCl_3$) δ = -57.83 (s, 1$CF_3O$); **HRMS** (ESI) calcd for $C_{23}H_{19}F_3N_2NaO_5S_3$ ([M + Na]$^+$), 579.0300, found 579.0304.



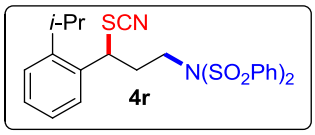

***N*-(phenylsulfonyl)-*N*-(3-thiocyanato-3-(o-tolyl)propyl)benzenesulfonamide (4p)**

White solid (82%, 119.6 mg); $R_f$ = 0.5 (petroleum ether/ethyl acetate = 10:1, v/v); mp 111-112 $^o$C; **$^1$H NMR** (600 MHz, $CDCl_3$) $\delta$ = 7.96 (d, $J$ = 8.4 Hz, 4H), 7.66 (t, $J$ = 7.8 Hz, 2H), 7.54 (t, $J$ = 7.2 Hz, 4H), 7.34-7.28 (m, 3H), 7.21 (d, $J$ = 7.2 Hz, 1H), 4.54 (dd, $J$ = 7.2 Hz, 1H), 3.83-3.79 (m, 1H), 3.69-3.64 (m, 1H), 2.73-2.69 (m, 1H), 3.69-3.64 (m, 1H), 2.30(s, 3H); **$^{13}$C NMR** (150 MHz, $CDCl_3$) $\delta$ = 139.2, 136.3, 134.6, 134.1, 131.1, 129.3, 129.1, 128.1, 127.0, 126.2, 110.9, 46.3, 45.8, 34.9, 19.2; **HRMS** (ESI) calcd for $C_{25}H_{22}N_2NaO_4S_3$ ([M + Na]$^+$), 509.0634, found 509.0634.



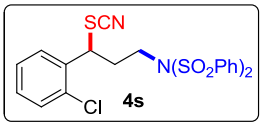

***N*-(3-(2-ethylphenyl)-3-thiocyanatopropyl)-*N* (phenylsulfonyl)benzenesulfonamide (4q)**

White solid (75%, 112.5 mg); $R_f$ = 0.5 (petroleum ether/ethyl acetate = 10:1, v/v); mp 110-111 $^oC$; **$^1$H NMR** (600 MHz, $CDCl_3$) $\delta$ = 7.95 (d, *J* = 7.8 Hz, 4H), 7.66 (t, *J* = 7.8 Hz, 2H), 7.54 (t, *J* = 7.8 Hz, 4H), 7.37 (dd, *J* = 6.0, 1.8 Hz,1H), 7.33-7.30 (m, 2H), 7.24-7.23 (m, 1H), 4.62 (t, *J* = 7.8 Hz, 1H), 3.83-3.78 (m, 1H), 3.63-3.59 (m, 1H), 2.71-2.66 (m, 1H), 2.65-2.60 (m, 3H), 1.21 (t, *J* = 7.2 Hz, 3H); **$^{13}$C NMR** (150 MHz, $CDCl_3$) $\delta$ = 142.1, 139.2, 134.1, 133.9, 129.3, 129.2, 128.1, 126.9, 126.3, 111.0, 46.3, 45.2, 35.4, 25.4, 15.1; **HRMS** (ESI) calcd for $C_{24}H_{24}N_2NaO_4S_3$ ($[M + Na]^+$), 523.0790, found 523.0761.




***N*-(3-(2-isopropylphenyl)-3-thiocyanatopropyl)-*N*-(phenylsulfonyl)benzenesulfonamide (4r)**

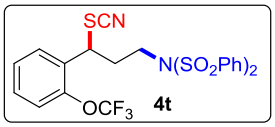
White solid (92%, 141.8 mg); $R_f$ = 0.5 (petroleum ether/ethyl acetate = 10:1, v/v); mp 111-112 $^oC$; **$^1$H NMR** (600 MHz, $CDCl_3$) $\delta$ = 7.96 (dd, *J* = 7.2, 1.2 Hz, 4H), 7.67 (t, *J* = 7.8 Hz, 2H), 7.55 (t, *J* = 7.8 Hz, 4H), 7.36-7.33 (m, 3H), 7.30-7.27 (m, 2H), 7.66 (t, *J* =7.8 Hz, 1H), 3.82-3.77 (m, 1H), 3.62-3.57 (m, 1H), 3.13-3.09 (m, 1H), 2.72-2.67 (m, 1H), 2.65-2.61 (m, 1H), 1.29 (d, *J* = 7.2 Hz, 3H), 1.16 (d, *J* = 6.6 Hz, 3H); **$^{13}$C NMR** (150 MHz, $CDCl_3$) $\delta$ = 147.0, 139.3, 134.2, 133.0, 129.5, 129.3, 128.2, 126.7, 126.4, 126.3, 111.0, 46.4, 35.7, 28.6, 24.4, 23.6; **HRMS** (ESI) calcd for $C_{25}H_{26}N_2NaO_4S_3$ ($[M + Na]^+$), 537.0947, found 537.0948.




***N*-(3-(2-chlorophenyl)-3-thiocyanatopropyl)-*N*-(phenylsulfonyl)benzenesulfonamide (4s)**

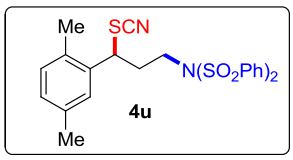
Light yellow oil (67%, 101.9 mg); $R_f$ = 0.5 (petroleum ether/ethyl acetate = 10:1, v/v); **$^1$H NMR** (600 MHz, $CDCl_3$) $\delta$ = 7.99 (d, *J* = 7.8 Hz, 4H), 7.67 (t, *J* = 7.2 Hz, 2H), 7.56 (t, *J* = 7.8 Hz,

4H), 7.41-7.32 (m, 4H), 4.71 (t, *J* = 7.8 Hz, 1H), 3.91-3.86 (m, 1H), 3.73-3.68 (m, 1H), 2.66-2.56 (m, 2H); **$^{13}$C NMR** (150 MHz, $CDCl_3$) $\delta$ = 139.3, 134.6, 134.2, 133.8, 130.3, 130.2, 129.3, 128.1, 127.7, 127.7, 110.3, 46.3, 45.4, 34.3; **HRMS** (ESI) calcd for $C_{22}H_{19}ClN_2NaO_4S_3$ ([M + Na]$^+$), 529.0088, found 529.0088.



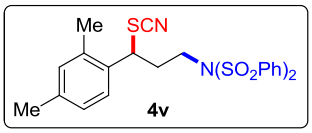

***N*-(phenylsulfonyl)-*N*-(3-thiocyanato-3-(2-(trifluoromethoxy)phenyl)propyl)benzenesulfonamide (4t)**

White solid (65%, yield 105.3 mg); $R_f$ = 0.5 (petroleum ether/ethyl acetate = 25:1, v/v); mp 52-53 $^o$C; **$^1$H NMR (600 MHz, $CDCl_3$)** $\delta$ = 7.98 (dd, *J* = 7.2, 1.2 Hz, 4H), 7.68 (t, *J* = 7.8 Hz, 2H), 7.56 (t, *J* = 7.8 Hz, 4H), 7.50 (dd, *J* = 6.0, 1.8 Hz, 1H), 7.46-7.43 (m, 1H), 7.32-7.31 (m, 1H), 4.61 (t, *J* = 7.2 Hz, 1H), 3.86-3.81 (m, 1H), 3.64-3.60 (m, 1H), 2.63-2.56 (m, 2H); **$^{13}$C NMR** (150 MHz, $CDCl_3$) $\delta$ = 146.6, 139.3, 134.2, 130.6, 129.4, 129.2 (q, *J* = 260.9 Hz), 129.3, 129.2, 128.2, 127.4, 120.2, 110.1, 46.2, 42.2, 34.6; **$^{19}$F NMR** (565 MHz, $CDCl_3$) δ = -56.71 (s, 1$CF_3O$); **HRMS** (ESI) calcd for $C_{23}H_{19}F_3N_2NaO_5S_3$ ([M + Na]$^+$), 579.0300, found 579.0304.



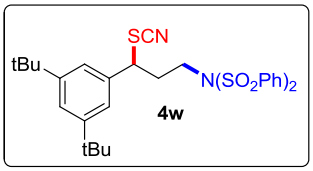

***N*-(3-(2,5-dimethylphenyl)-3-thiocyanatopropyl)-*N*-(phenylsulfonyl)benzenesulfonamide (4u)**

Yellow oil (yield 93 mg, 62%); $R_f$ = 0.5 (petroleum ether/ethyl acetate = 10:1, v/v); **$^1$H NMR** (600 MHz, $CDCl_3$) $\delta$ = 7.96 (dd, *J* = 8.4, 1.8 Hz, 4H), 7.67 (t, *J* = 7.2 Hz, 2H), 7.55 (t, *J* = 8.4 Hz, 4H), 7.15 (s, 1H), 7.09 (s, 2H), 4.53 (t, *J* = 7.2 Hz, 1H), 3.81-3.76 (m, 1H), 3.67-3.62 (m, 1H), 2.72-2.67 (m, 1H), 2.63-2.58 (m, 1H), 2.37 (s, 3H), 2.27 (s, 3H); **$^{13}$C NMR** (150 MHz, $CDCl_3$) $\delta$ = 139.3, 136.6, 134.2, 134.1, 133.2, 131.1, 129.9, 129.3, 128.2, 126.9, 111.0, 46.4, 46.0, 35.0, 21.1, 18.8; **HRMS** (ESI) calcd for $C_{24}H_{24}N_2NaO_4S_3$ ([M + Na]$^+$), 523.0790, found 523.0786.



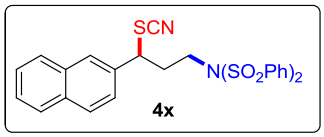

***N*-(3-(2,4-dimethylphenyl)-3-thiocyanatopropyl)-*N*-(phenylsulfonyl)benzenesulfonamide (4v)**

Yellow oil (52%, 78 mg); $R_f$ = 0.5 (petroleum ether/ethyl acetate = 10:1, v/v); **$^1$H NMR** (600 MHz, $CDCl_3$) $\delta$ = 7.93 (dd, $J$ = 7.2, 1.2 Hz, 4H), 7.66 (t, $J$ = 7.2 Hz, 2H), 7.53 (t, $J$ = 7.8 Hz, 4H), 7.15 (d, $J$ = 7.2 Hz, 1H), 7.08 (d, $J$ = 7.8 Hz, 1H), 7.02 (d, $J$ = 7.8 Hz, 1H), 5.10 (t, $J$ = 7.8 Hz, 1H), 3.80-3.75 (m, 1H), 3.53-3.48 (m, 1H), 2.76-2.69 (m, 1H), 2.58-2.53 (m, 1H), 2.47 (s, 3H), 2.33 (s, 3H); **$^{13}$C NMR** (150 MHz, $CDCl_3$) $\delta$ = 142.1, 139.2, 134.1, 133.9, 129.3, 129.2, 128.2, 126.9, 126.3, 111.0, 46.3, 45.2, 35.4, 25.4, 15.1; **HRMS** (ESI) calcd for $C_{24}H_{24}N_2NaO_4S_3$ ([M + Na]$^+$), 523.0790, found 523.0794.



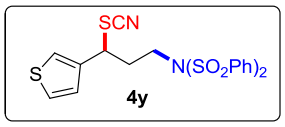

***N*-(3-(3,5-di-tert-butylphenyl)-3-thiocyanatopropyl)-*N*-(phenylsulfonyl)benzenesulfonamide (4w)**

Light yellow solid (50%, 74.7 mg); $R_f$ = 0.5 (petroleum ether/ethyl acetate = 25:1, v/v); mp 108-109 $^o$C; **$^1$H NMR** (600 MHz, $CDCl_3$) $\delta$ = 7.96 (d, $J$ = 8.4 Hz, 4H), 7.65 (t, $J$ = 7.8 Hz, 2H), 7.53 (t, $J$ = 7.8 Hz, 4H), 7.44 (s, 1H), 7.14 (s, 1H), 4.34 (t, $J$ = 7.8 Hz, 1H), 3.77-3.74 (m, 1H), 3.58-3.53 (m, 1H), 2.73-2.68 (m, 1H), 2.60-2.55 (m, 1H), 1.34 (s, 18H); **$^{13}$C NMR** (150 MHz, $CDCl_3$) $\delta$ = 152.0, 139.4, 135.7, 134.1, 129.3, 128.2, 123.5, 111.2, 51.0, 46.5, 35.4, 35.0, 31.4; **HRMS** (ESI) calcd for $C_{30}H_{36}N_2NaO_4S_3$ ([M + Na]$^+$), 607.1729, found 607.1749.



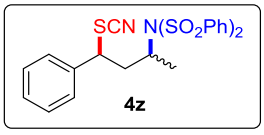

***N*-(3-(naphthalen-2-yl)-3-thiocyanatopropyl)-*N* (phenylsulfonyl)benzenesulfonamide (4x)**

Light yellow oil (66%, 103.3 mg); $R_f$ = 0.5 (petroleum ether/ethyl acetate = 10:1, v/v); **$^1$H NMR** (600 MHz, $CDCl_3$) $\delta$ = 7.92 (dd, $J$ = 7.8 Hz, 5H), 7.87-7.85 (m, 2H), 7.77 (s, 1H), 7.64 (t, $J$ = 8.4 Hz, 2H), 7.56-7.55 (q, $J$ = 3.6 Hz, 2H), 7.50 (t, $J$ = 7.8 Hz, 4H), 7.44 (dd, $J$ = 6.6, 1.8 Hz, 1H), 4.51(t, $J$ = 7.2 Hz, 1H), 3.83-3.78 (m, 1H), 3.63-3.58 (m, 1H), 2.78-2.73 (m, 1H), 2.67-2.62 (m, 1H); **$^{13}$C NMR** (150 MHz, $CDCl_3$) $\delta$ = 139.2, 134.1, 134.0, 133.5, 133.0, 129.5, 129.2, 128.20, 128.16, 127.8, 127.11, 127.09, 126.9, 124.5, 110.8, 50.4, 46.3, 35.1; **HRMS** (ESI) calcd for $C_{26}H_{22}N_2NaO_4S_3$ ([M + Na]$^+$), 545.0634, found 545.0621.




***N*-(phenylsulfonyl)-*N*-(3-thiocyanato-3-(thiophen-3-yl)propyl)benzenesulfonamide (4y)**

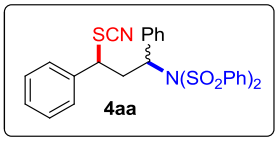
Light yellow oil (49%, 70.2 mg); $R_f$ = 0.5 (petroleum ether/ethyl acetate = 10:1, v/v); **$^1$H NMR** (600 MHz, $CDCl_3$) $\delta$ = 7.98 (dd, $J$ = 7.8, 1.2 Hz, 4H), 7.69 (t, $J$ = 7.8 Hz, 2H), 7.57 (t, $J$ = 7.2 Hz, 4H), 7.41-7.40 (m, 1H), 7.34-7.33 (m, 1H), 7.11 (dd, $J$ = 3.6, 1.2 Hz, 1H), 4.48 (t, $J$ = 7.8 Hz, 1H), 3.81-3.76 (m, 1H), 3.70-3.65 (m, 1H), 2.66-2.61 (m, 1H), 2.56-2.53 (m, 1H); **$^{13}$C NMR** (150 MHz, $CDCl_3$) $\delta$ = 139.2, 137.5, 134.2, 129.3, 128.2, 127.5, 126.1, 124.2, 110.7, 46.3, 45.3, 35.5; **HRMS** (ESI) calcd for $C_{20}H_{18}N_2NaO_4S_4$ ([M + Na]$^+$), 501.0042, found 501.0039.




***N*-(4-phenyl-4-thiocyanatobutan-2-yl)-*N*-(phenylsulfonyl)benzenesulfonamide (4z)**

A mixture of two diastereoisomers which are inseparable. The ratio of the two diastereoisomers was determined by $^1$H NMR spectroscopy (d.r. = 1:2). The mixture was white solid (65%, 94.7 mg); mp 94-95 $^o$C; $R_f$ = 0.5 (petroleum ether/ethyl acetate = 10:1, v/v);. **$^1$H NMR** (600 MHz, $CDCl_3$) $\delta$ = 7.91 (d, $J$ = 7.8 Hz, 4.19H), 7.68-7.65 (m, 3.25H), 7.57-7.54 (m, 3.03H), 7.51-7.48 (m, 3.08H), 7.43-7.35 (m, 5.41H), 7.30 (d, $J$ = 6.6 Hz, 1.14H), 7.25-7.23 (m, 2.22H), 4.24-4.17 (m, 2.58H), 4.15-4.11 (m, 0.57H), 3.01-2.96 (m, 1H), 2.82-2.77 (m, 0.57H), 2.74-2.71 (m, 0.55H), 2.68-2.63 (m, 1.01H), 1.32 (d, $J$ = 7.2 Hz, 3.14H), 1.28 (d, $J$ = 6.6 Hz, 1.60H); **$^{13}$C NMR** (150

MHz, $CDCl_3$) $\delta$ = 137.8, 137.4, 134.1, 129.3, 129.2, 128.3, 127.6, 127.5, 110.8, 57.3, 50.1, 39.7, 19.6; **HRMS** (ESI) calcd for $C_{23}H_{22}N_2NaO_4S_3$ ([M + Na]$^+$), 509.0634, found 509.0643.

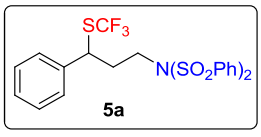



***N*-(1,3-diphenyl-3-thiocyanatopropyl)-*N*-(phenylsulfonyl)benzenesulfonamide (4aa)**

**4aa** and **4aa'**are diastereomers and can be separated by column chromatography.

White solid (41%, 67.4 mg); mp 146-147 $^o$C ;$R_f$ = 0.5 (petroleum ether/ethyl acetate = 10:1, v/v); **$^1$H NMR** (600 MHz, $CDCl_3$) $\delta$ = 7.60 (s, 2H), 7.46 (d, *J* = 7.2 Hz, 6H), 7.41-7.31(m, 8H), 7.17-7.16 (m, 2H), 5.86(dd, *J* = 12, 3.0 Hz, 1H), 4.04 (dd, *J* = 10.8, 1.8 Hz, 1H), 3.70-3.65 (m, 1H), 2.37-2.32 (m, 1H); **$^{13}$C NMR** (150 MHz, $CDCl_3$) $\delta$ = 138.5, 133.4, 130.0, 129.2, 129.0, 128.8, 128.3, 127.2, 110.3, 62.2, 51.3, 37.7; **HRMS** (ESI) calcd for $C_{28}H_{24}N_2NaO_4S_3$ ([M + Na]$^+$), 571.0790, found 571.0785.

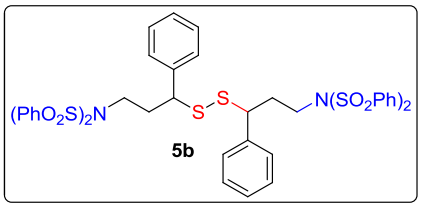
White solid (29%, 44.2 mg); $R_f$ = 0.5 (petroleum ether/ethyl acetate = 8:1, v/v); mp 144-145 $^o$C; **$^1$H NMR** (600 MHz, $CDCl_3$) $\delta$ = 7.57 (s, 2H), 7.46-7.33 (m, 15H), 6.92 (d, *J* = 7.8 Hz, 2H), 5.08 (dd, *J* = 11.4, 3.6 Hz, 1H), 4.18 (dd, *J* = 10.8, 4.2 Hz, 1H), 3.73-3.69 (m, 1H), 2.45-2.40 (m, 1H); **$^{13}$C NMR** (150 MHz, $CDCl_3$) $\delta$ = 136.4, 133.7, 133.5, 129.9, 129.43, 129.36, 129.1, 128.9, 128.1, 127.6, 110.9, 61.6, 50.0, 38.8; **HRMS** (ESI) calcd for $C_{28}H_{24}N_2NaO_4S_3$ ([M + Na]$^+$), 571.0790, found 571.0784.




***N*-(3-phenyl-3-((trifluoromethyl)thio)propyl)-*N*-(phenylsulfonyl)benzenesulfonamide (5a)**

Light yellow solid (56%, 57.7 mg); $R_f$ = 0.5 (petroleum ether/ethyl acetate = 10:1, v/v); mp 76-77 $^o$C; **$^1$H NMR** (600 MHz, $CDCl_3$) $\delta$ = 7.91 (d, *J* = 8.4 Hz, 4H), 7.69 (t, *J* = 7.8 Hz, 2H), 7.57 (t, *J* = 7.2 Hz, 4H), 7.41-7.40 (m, 1H), 7.34-7.33 (m, 1H), 7.11(dd, *J* = 3.6, 1.2 Hz, 1H), 4.48 (t, *J* = 7.8 Hz, 1H), 3.81-3.76 (m, 1H), 3.70-3.65 (m, 1H), 2.66-2.61 (m, 1H), 2.56-2.53 (m, 1H); **$^{13}$C NMR**

(150 MHz, $CDCl_3$) $\delta$ = 139.2, 137.5, 134.2, 129.3, 128.2, 127.5, 126.1, 124.1, 110.7, 46.3, 45.3, 35.5; **$^{19}$F NMR** (565 MHz, $CDCl_3$) $\delta$ = -39.69 (s, 1$SCF_3$); **HRMS** (ESI) calcd for $C_{20}H_{18}N_2NaO_4S_4$ ([M + Na]$^+$), 501.0042, found 501.0039.




**5b**

***N*,*N*'-(disulfanediylbis(3-phenylpropane-3,1-diyl))bis(*N*-(phenylsulfonyl)benzenesulfonamide) (5b)**

Yellow oil (65%, 115.9 mg); $R_f$ = 0.5 (petroleum ether/ethyl acetate = 4:1, v/v); **$^1$H NMR** (600 MHz, $CDCl_3$) $\delta$ = 7.93 (t, *J* = 7.8 Hz, 8H), 7.60 (q, *J* = 7.2 Hz, 4H), 7.54-7.48 (m, 8H), 7.36-7.29 (m, 6H), 7.15-7.12 (m, 4H), 3.57-3.52 (m, 2H), 3.39-3.31 (m, 2H), 3.20-3.18 (m, 1H), 3.13-3.10 (m, 1H), 5.69 (dd, *J* = 9.6, 4.8 Hz, 1H), 3.81-3.76 (m, 1H), 3.65-3.60 (m, 1H), 3.07-3.00 (m, 1H), 2.42-2.34 (m, 2H), 2.26-2.21 (m, 2H); **$^{13}$C NMR** (150 MHz, $CDCl_3$) $\delta$ = 139.51, 139.49, 139.3, 139.2, 133.90, 133.86, 129.11, 129.08, 128.7, 128.6, 128.3, 128.2, 128.1, 128.0, 127.9, 51.5, 51.3, 47.02, 47.01, 34.0, 33.8; **HRMS** (ESI) calcd for $C_{42}H_{40}N_2NaO_8S_8$ ([M + Na]$^+$), 915.1001, found 915.0996.

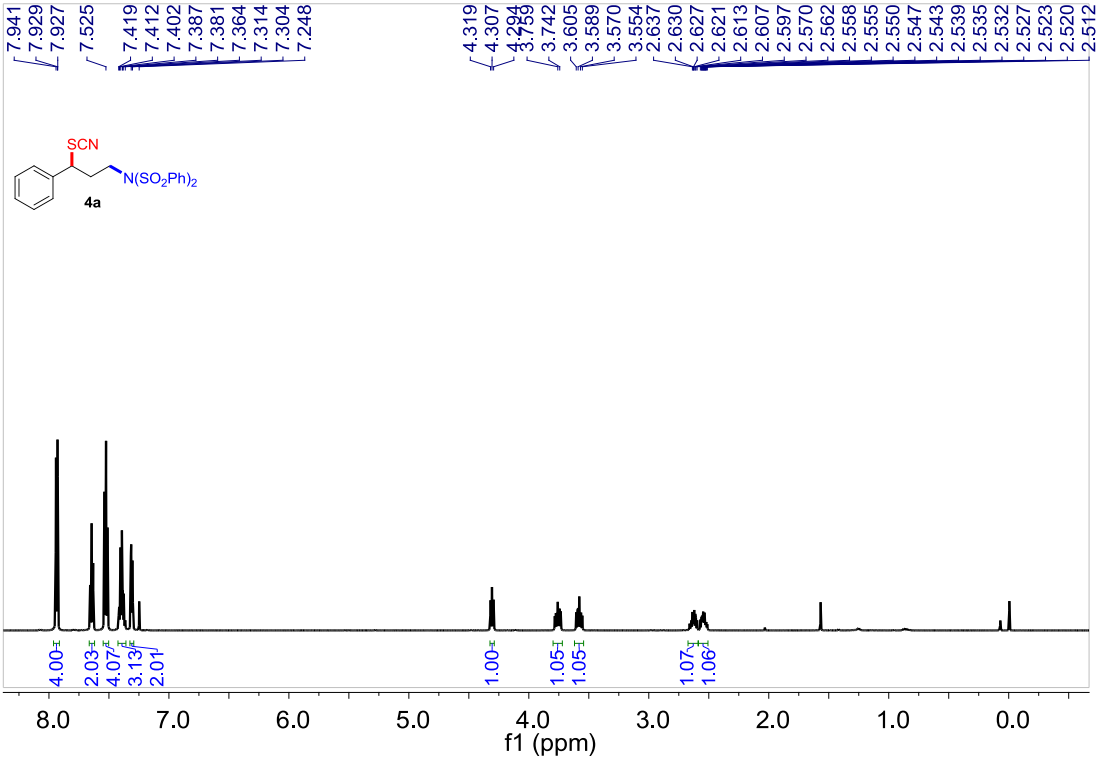
## 5. Reference

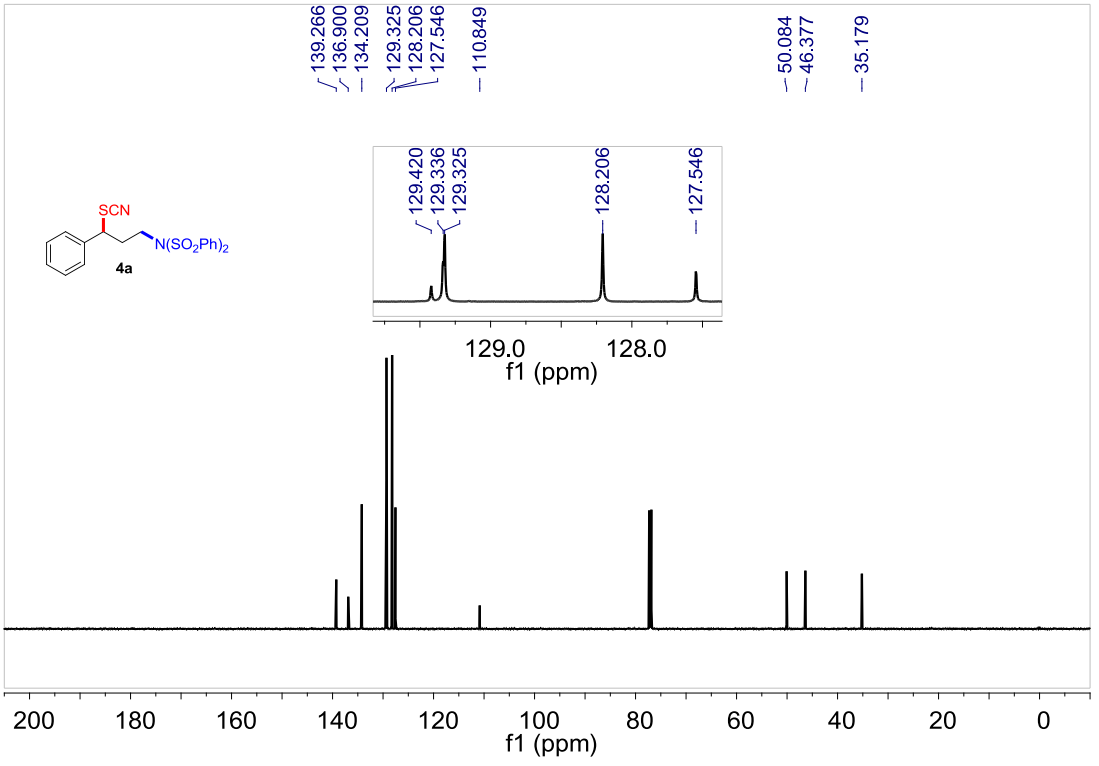

1 C. R. Pitts, B. Ling, J. Snyder, A. Bragg and T. Lectka, *J. Am. Chem. Soc.*, 2016, **138**, 6598.

2 Z. Yang, J. C. Lorenz and Y. Shi, *Tetrahedron Lett.*, 1998, **39**, 8621.

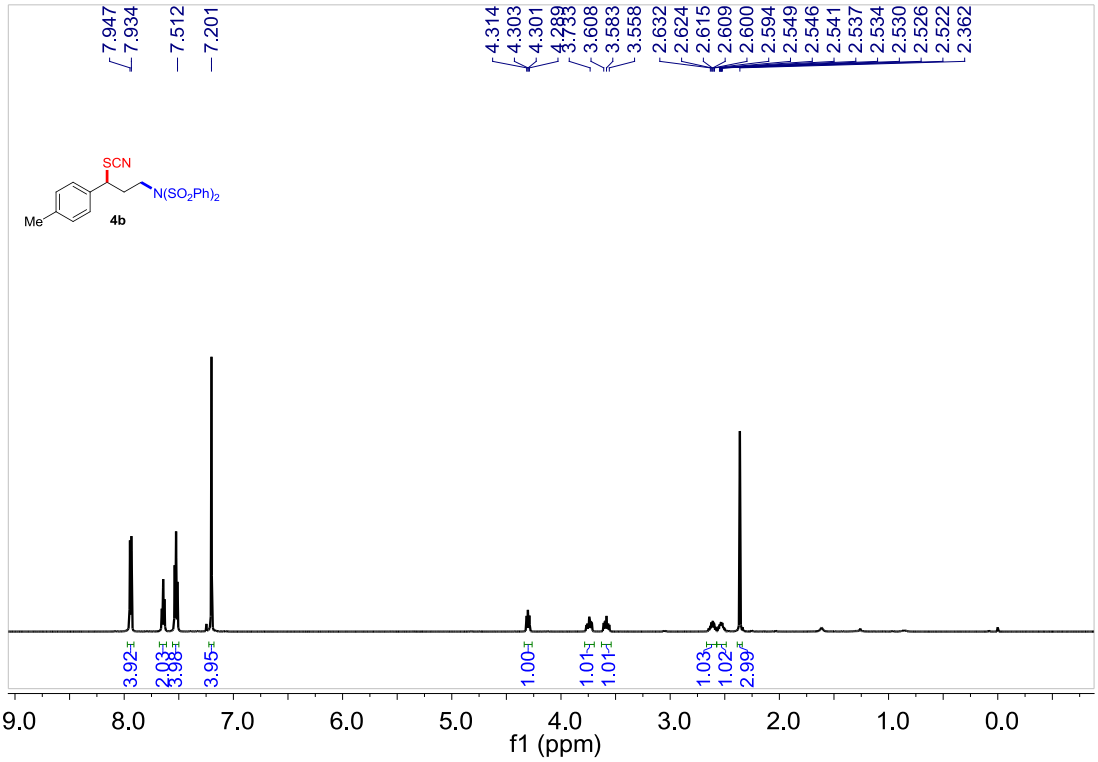
## 6. Copies of NMR Spectra

### Compound 4a



## Compound 4b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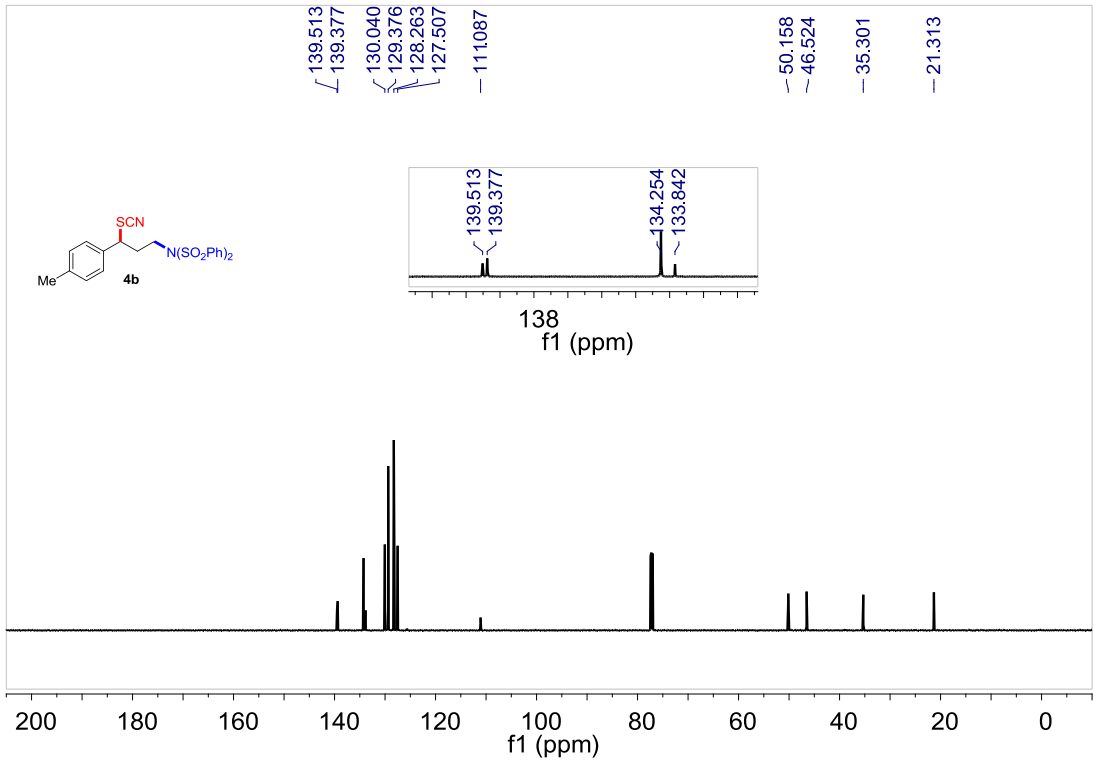
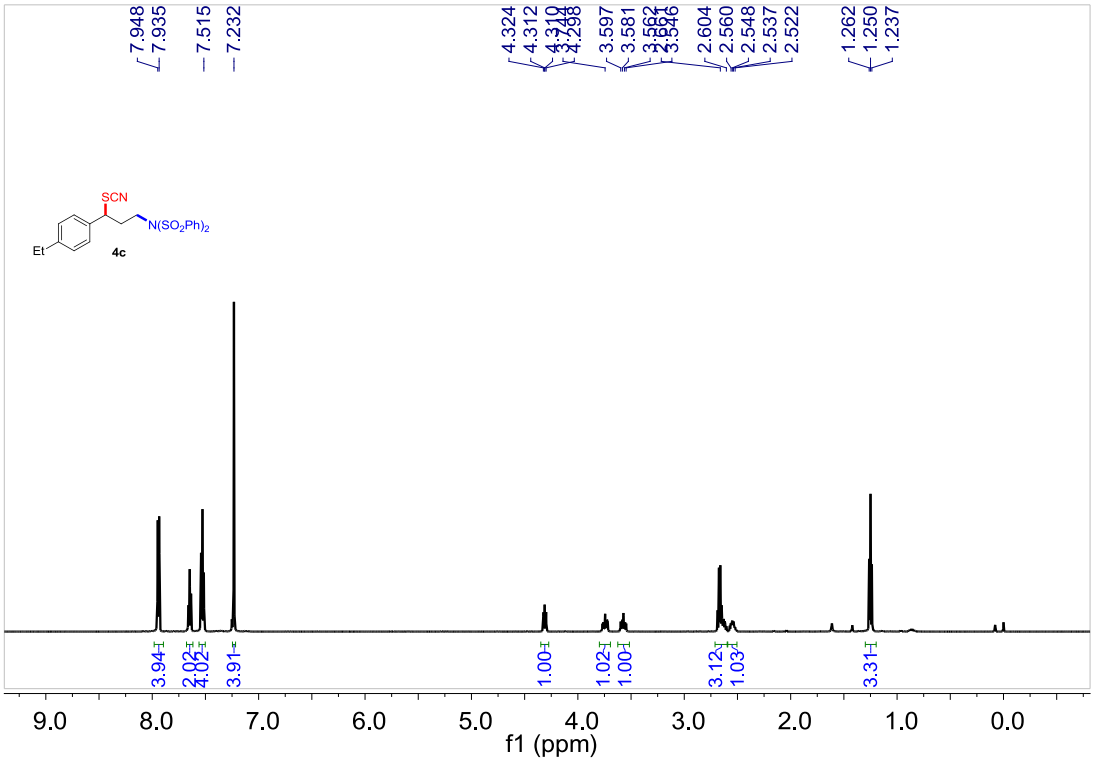
7.512
7.201
4.314
4.303
4.301
4.289
4.283
3.733
3.608
3.583
3.558
2.632
2.624
2.615
2.609
2.600
2.594
2.549
2.546
2.541
2.537
2.534
2.530
2.526
2.522
2.362
SCN
N(SO2Ph)2
Me
4b
3.92
2.03
3.98
3.95
1.00
1.01
1.01
1.03
1.02
2.99
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
f1 (ppm)


139.513
139.377
130.040
129.376
128.263
127.507
111.087
50.158
46.524
35.301
21.313
134.254
133.842
SCN
N(SO2Ph)2
Me
4b
138
f1 (ppm)
200
180
160
140
120
100
80
60
40
20
0
f1 (ppm)

## Compound 4c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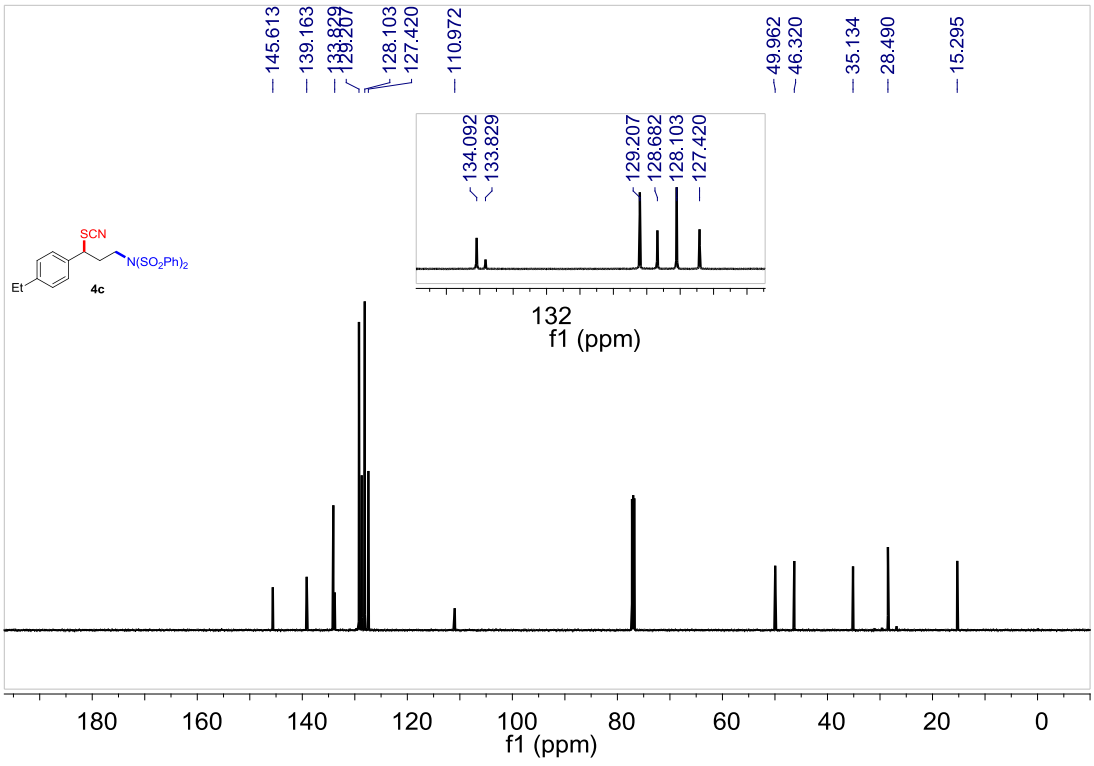
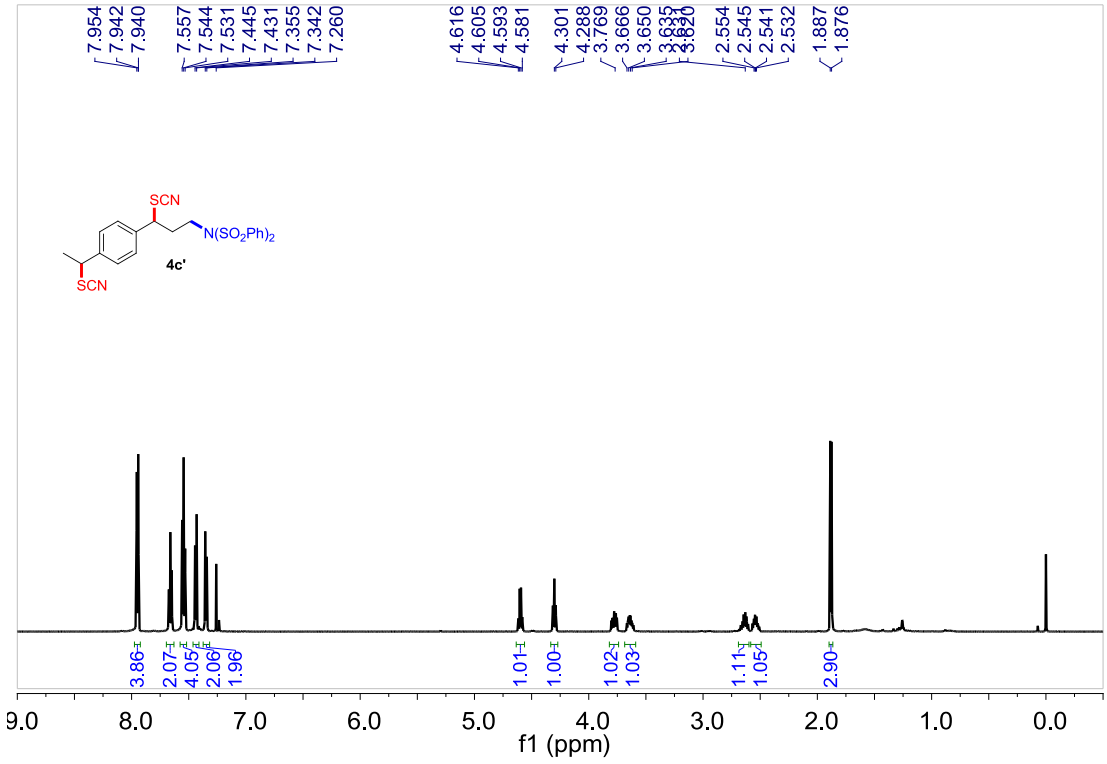
7.935
7.515
7.232
4.324
4.312
3.597
3.581
2.604
2.560
2.548
2.537
2.522
1.262
1.250
1.237
SCN
N(SO2Ph)2
Et
4c
3.94
2.02
4.02
3.91
1.00
1.02
1.00
3.12
1.03
3.31
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
f1 (ppm)


145.613
139.163
133.829
129.207
128.103
127.420
110.972
49.962
46.320
35.134
28.490
15.295
134.092
133.829
129.207
128.682
128.103
127.420
SCN
N(SO2Ph)2
Et
4c
132
f1 (ppm)
180
160
140
120
100
80
60
40
20
0
f1 (ppm)

**Compound 4c'**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7.942
7.940
7.557
7.544
7.531
7.445
7.431
7.355
7.342
7.260
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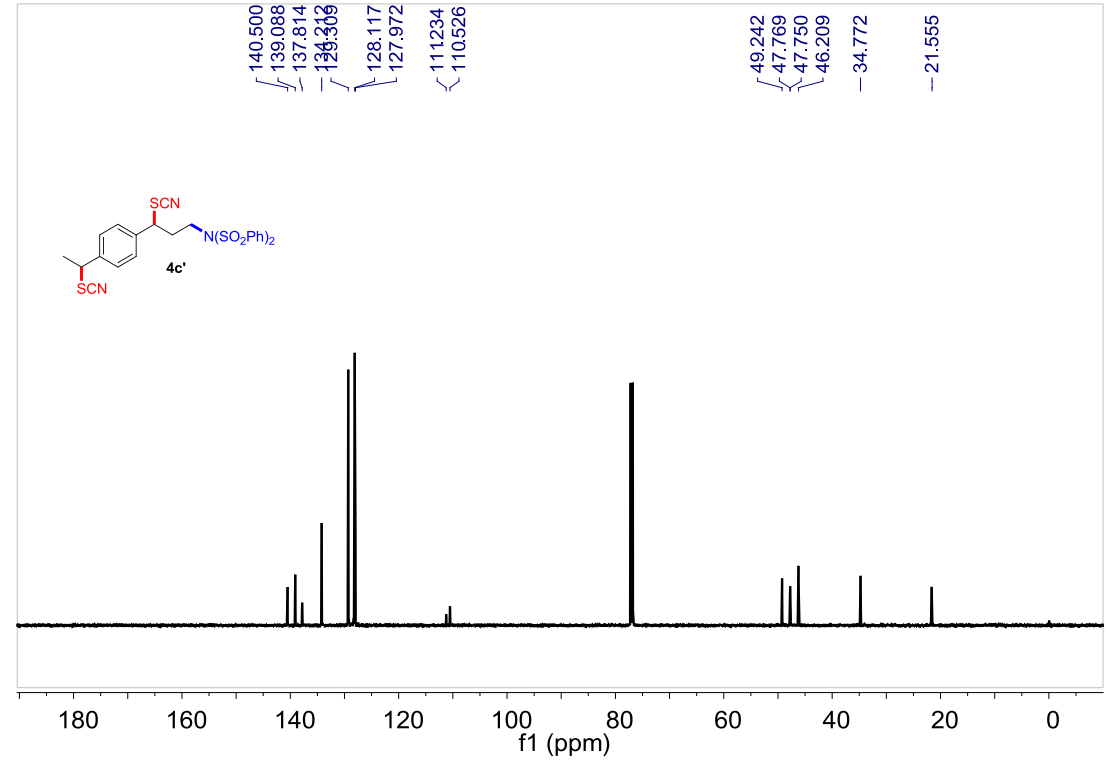
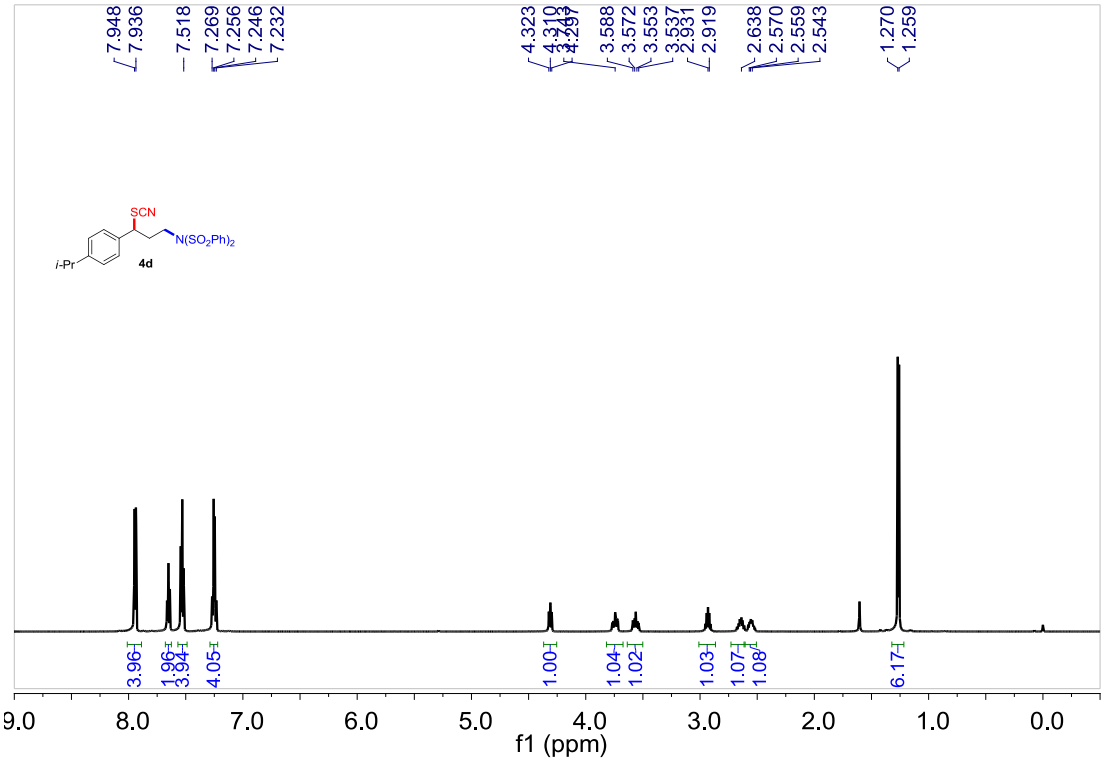
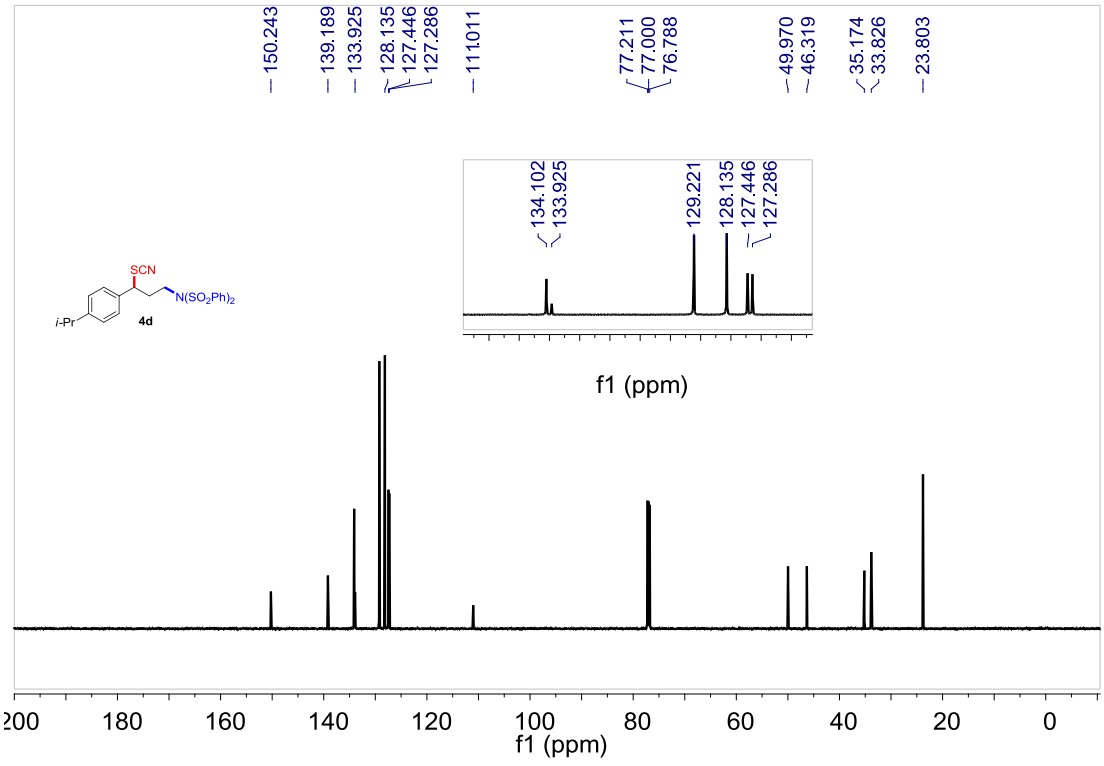
4.605
4.593
4.581
4.301
4.288
3.769
3.666
3.650
2.554
2.545
2.541
2.532
1.887
1.876
SCN
N(SO2Ph)2
SCN
4c'
3.86
2.07
4.05
2.06
1.96
1.01
1.00
1.02
1.03
1.11
1.05
2.90
f1 (ppm)

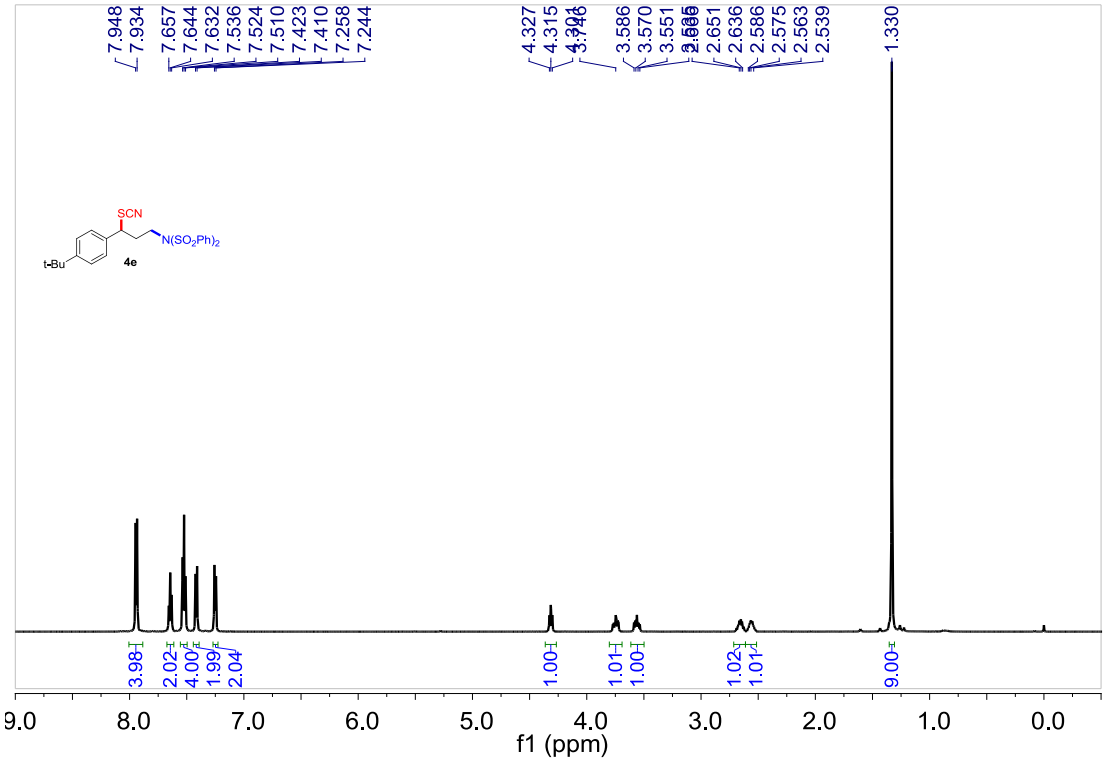

140.500
139.088
137.814
128.117
127.972
111.234
110.526
49.242
47.769
47.750
46.209
34.772
21.555
SCN
N(SO2Ph)2
SCN
4c'
f1 (ppm)

## Compound 4d


7.948
7.936
7.518
7.269
7.256
7.246
7.232
4.323
4.310
4.297
3.588
3.572
3.553
3.537
2.931
2.919
2.638
2.570
2.559
2.543
1.270
1.259
SCN
N(SO2Ph)2
i-Pr
4d
3.96
1.96
3.94
4.05
1.00
1.04
1.02
1.03
1.07
1.08
6.17
f1 (ppm)


150.243
139.189
133.925
128.135
127.446
127.286
111.011
77.211
77.000
76.788
49.970
46.319
35.174
33.826
23.803
134.102
133.925
129.221
128.135
127.446
127.286
SCN
N(SO2Ph)2
i-Pr
4d
f1 (ppm)
f1 (ppm)

## Compound 4e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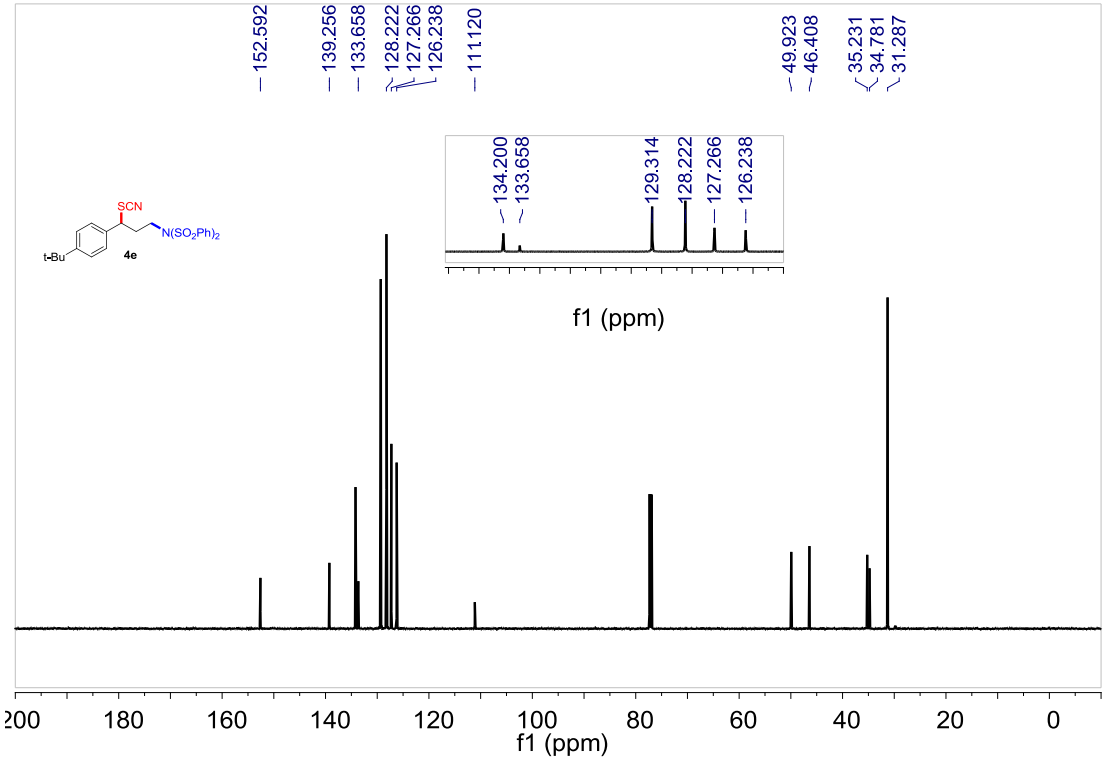
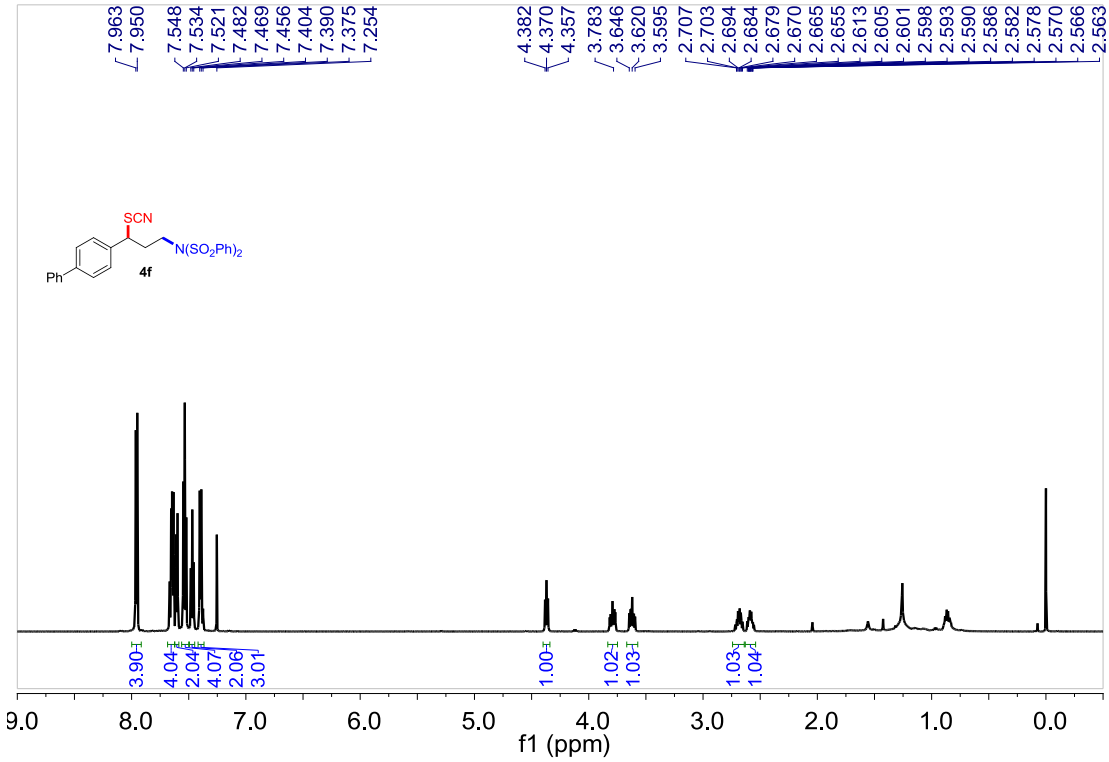
7.657
7.644
7.632
7.536
7.524
7.510
7.423
7.410
7.258
7.244
4.327
4.315
3.586
3.570
3.551
2.651
2.636
2.586
2.575
2.563
2.539
1.330
SCN
N(SO2Ph)2
t-Bu
4e
3.98
2.02
4.00
1.99
2.04
1.00
1.01
1.00
1.02
1.01
9.00
f1 (ppm)


152.592
139.256
133.658
128.222
127.266
126.238
111120
49.923
46.408
35.231
34.781
31.287
134.200
133.658
129.314
128.222
127.266
126.238
SCN
N(SO2Ph)2
t-Bu
4e
f1 (ppm)
f1 (ppm)

## Compound 4f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7.950
7.548
7.534
7.521
7.482
7.469
7.456
7.404
7.390
7.375
7.254
4.382
4.370
4.357
3.783
3.646
3.620
3.595
2.707
2.703
2.694
2.684
2.679
2.670
2.665
2.655
2.613
2.605
2.601
2.598
2.593
2.590
2.586
2.582
2.578
2.570
2.566
2.563
SCN
N(SO2Ph)2
Ph
4f
3.90
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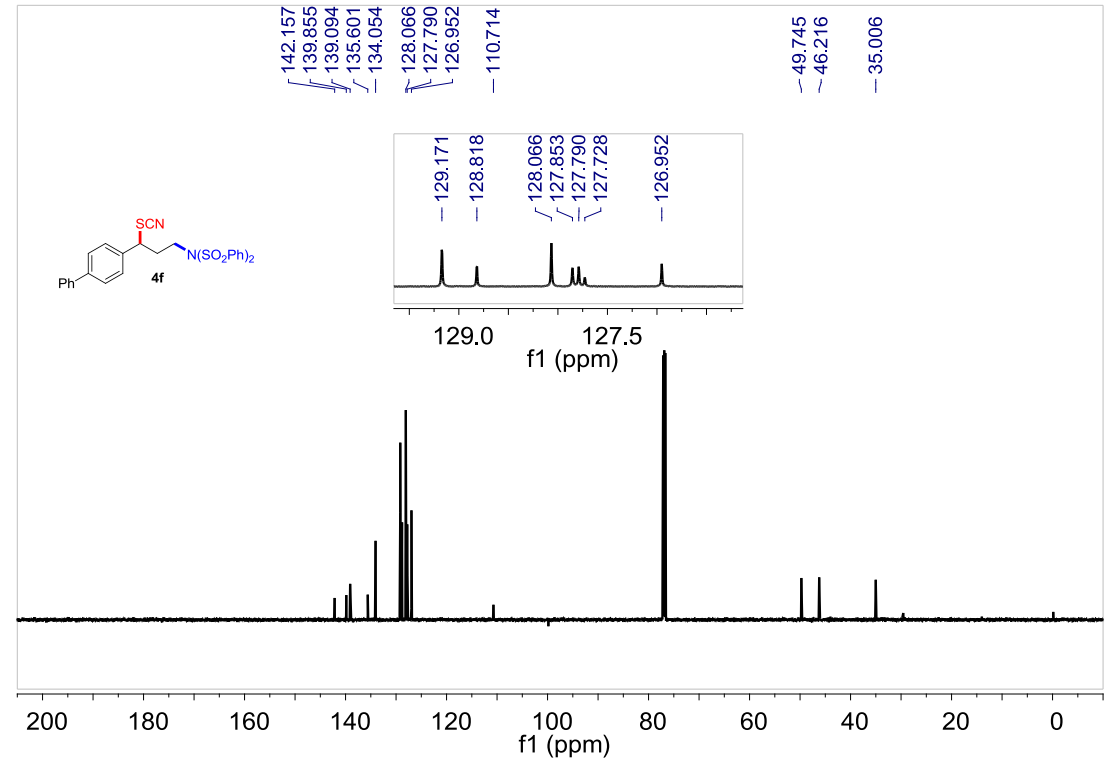
2.04
4.07
2.06
3.01
1.00
1.02
1.03
1.03
1.04
f1 (ppm)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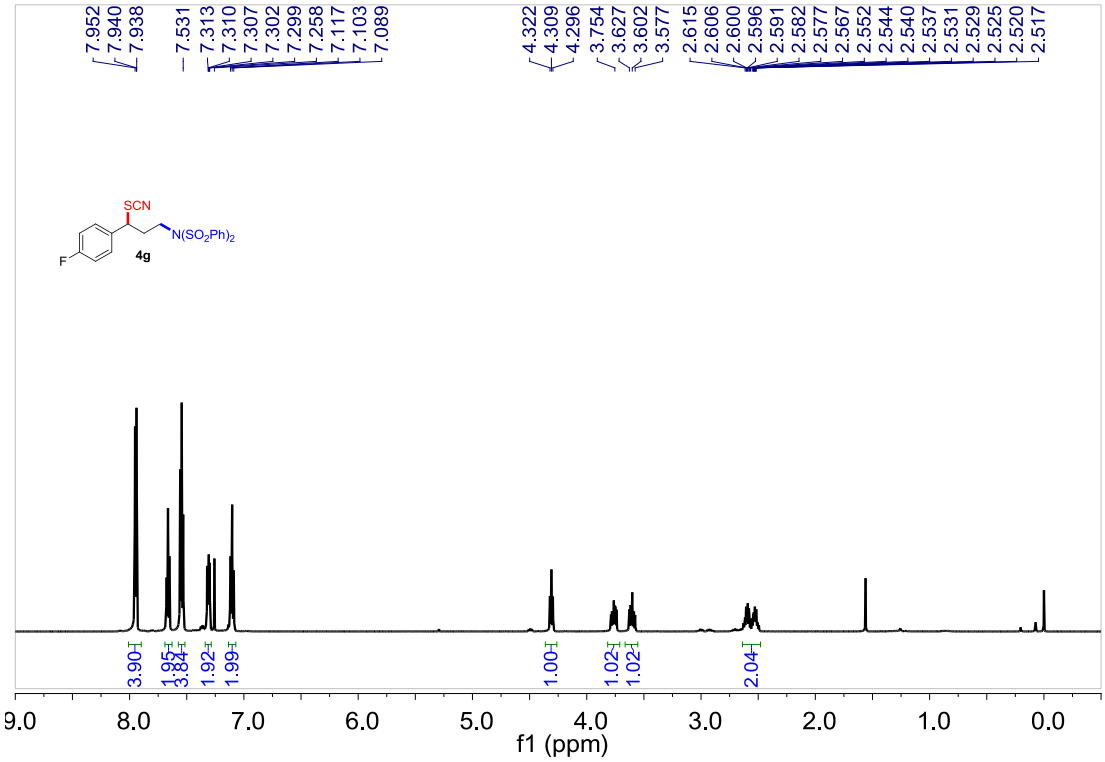
139.094
135.601
134.054
128.066
127.790
126.952
110.714
49.745
46.216
35.006
129.171
128.818
128.066
127.853
127.790
127.728
126.952
SCN
N(SO2Ph)2
Ph
4f
129.0
127.5
f1 (ppm)
f1 (ppm)

## Compound 4g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7.310
7.307
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7.258
7.117
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7.089
4.322
4.309
4.296
3.754
3.627
3.602
3.577
2.615
2.606
2.600
2.596
2.591
2.582
2.577
2.567
2.552
2.544
2.540
2.537
2.531
2.529
2.525
2.520
2.517
SCN
N(SO2Ph)2
F
4g
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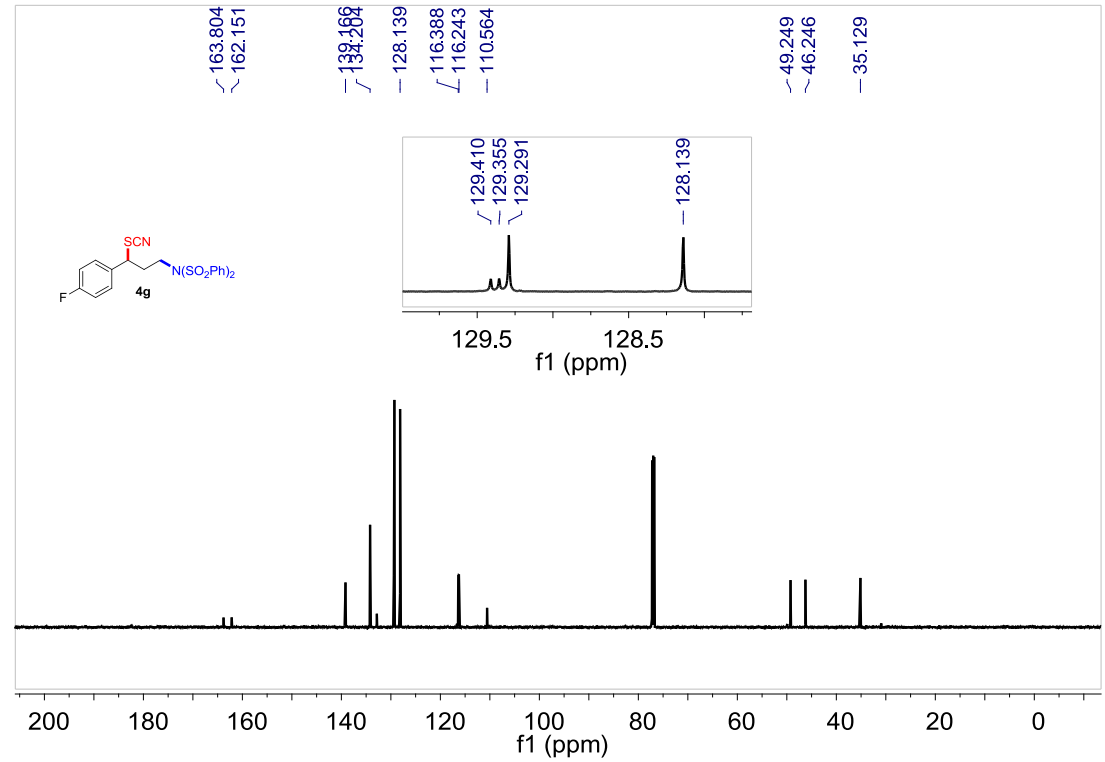
1.95
3.84
1.92
1.99
1.00
1.02
1.02
2.04
f1 (ppm)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139.166
134.204
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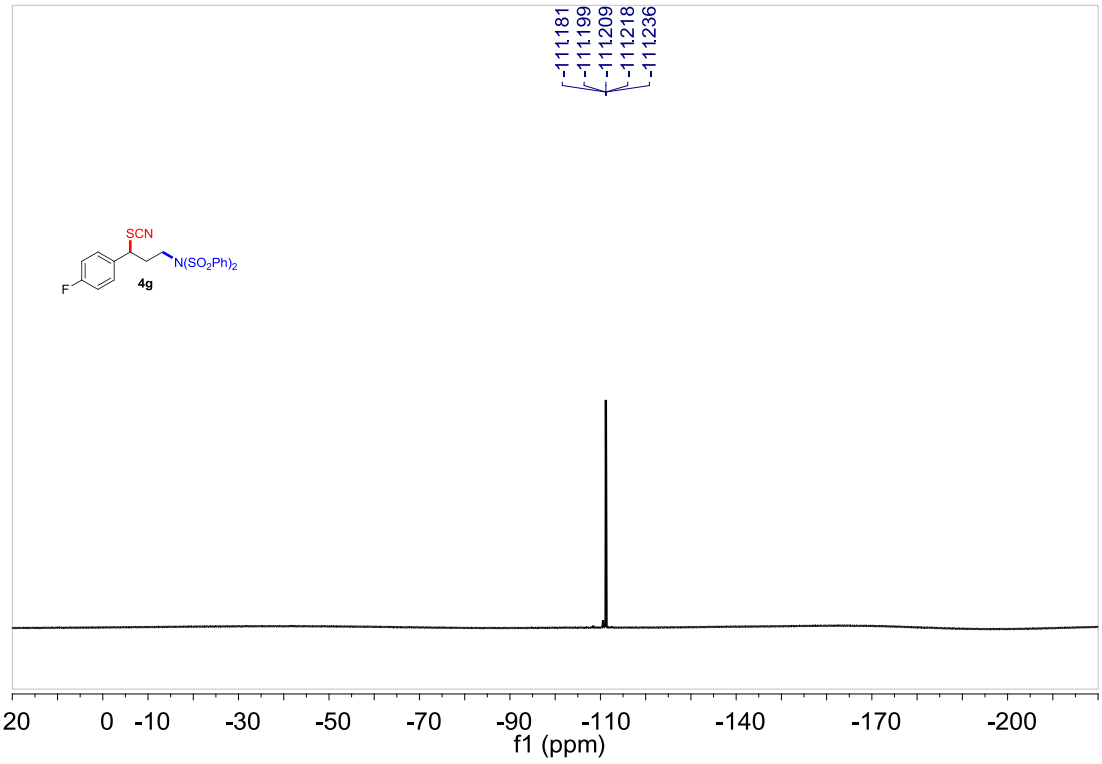
116.388
116.243
110.564
49.249
46.246
35.129
129.410
129.355
129.291
128.139
SCN
N(SO2Ph)2
F
4g
129.5
128.5
f1 (ppm)
f1 (ppm)


-111181
-111199
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-111218
-111236
SCN
N(SO2Ph)2
F
4g
20
0
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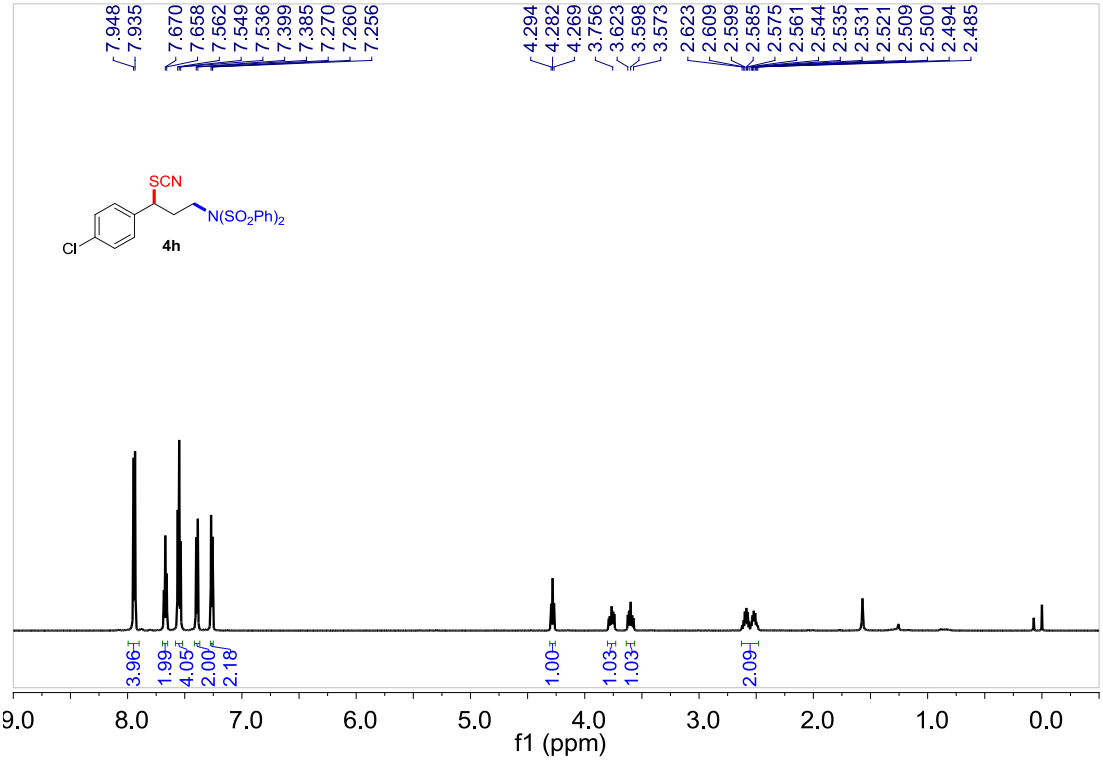
-30
-50
-70
-90
-110
-140
-170
-200
f1 (ppm)

**Compound 4h**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7.549
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7.385
7.270
7.260
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4.282
4.269
3.756
3.623
3.598
3.573
2.623
2.609
2.599
2.585
2.575
2.561
2.544
2.535
2.531
2.521
2.509
2.500
2.494
2.485
SCN
N(SO2Ph)2
Cl
4h
3.96
1.99
4.05
2.00
2.18
1.00
1.03
1.03
2.09
9.0
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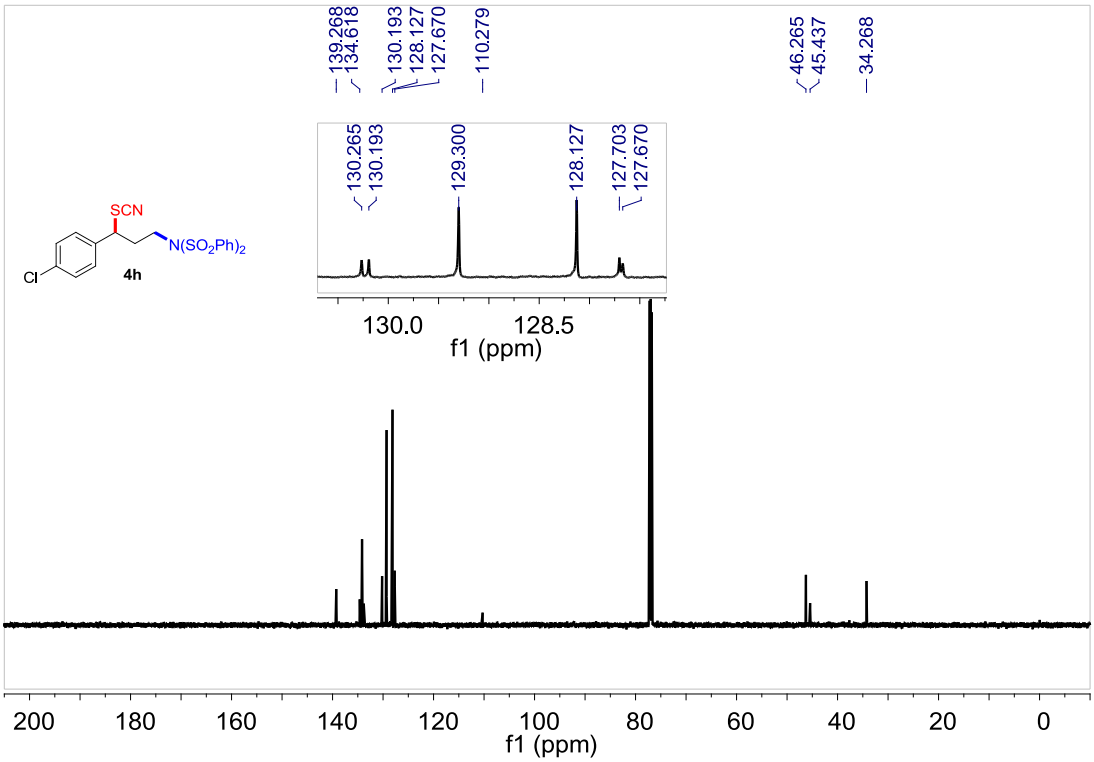
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
f1 (ppm)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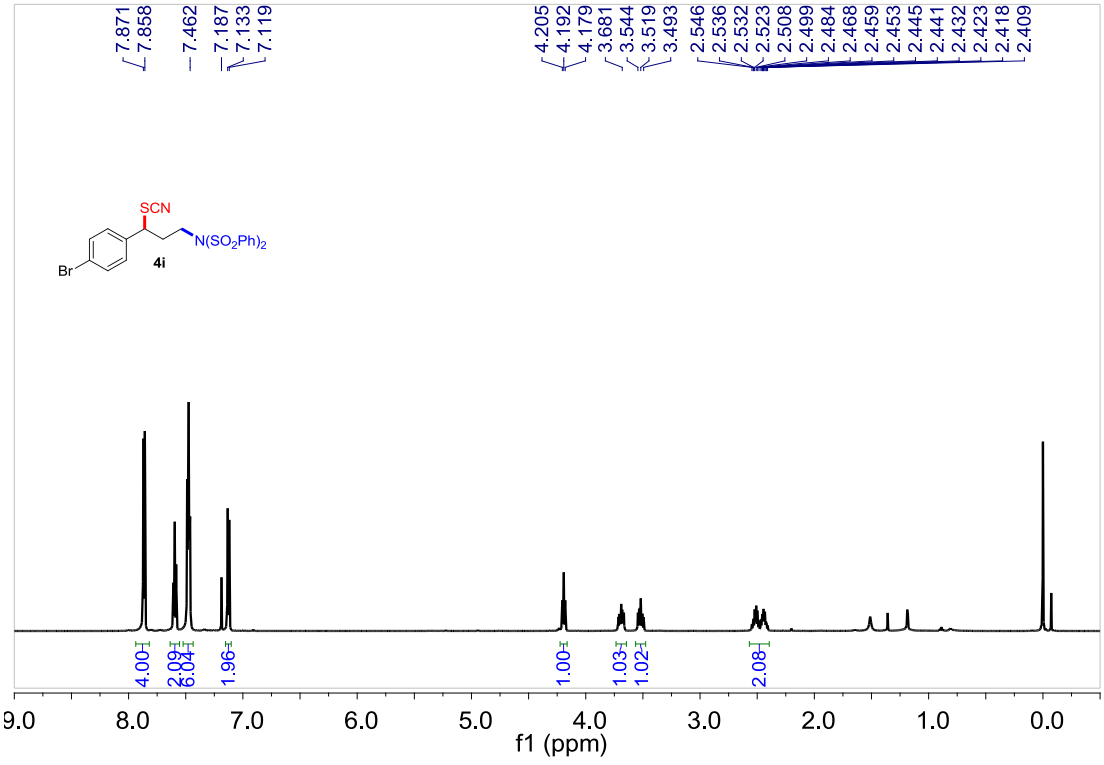
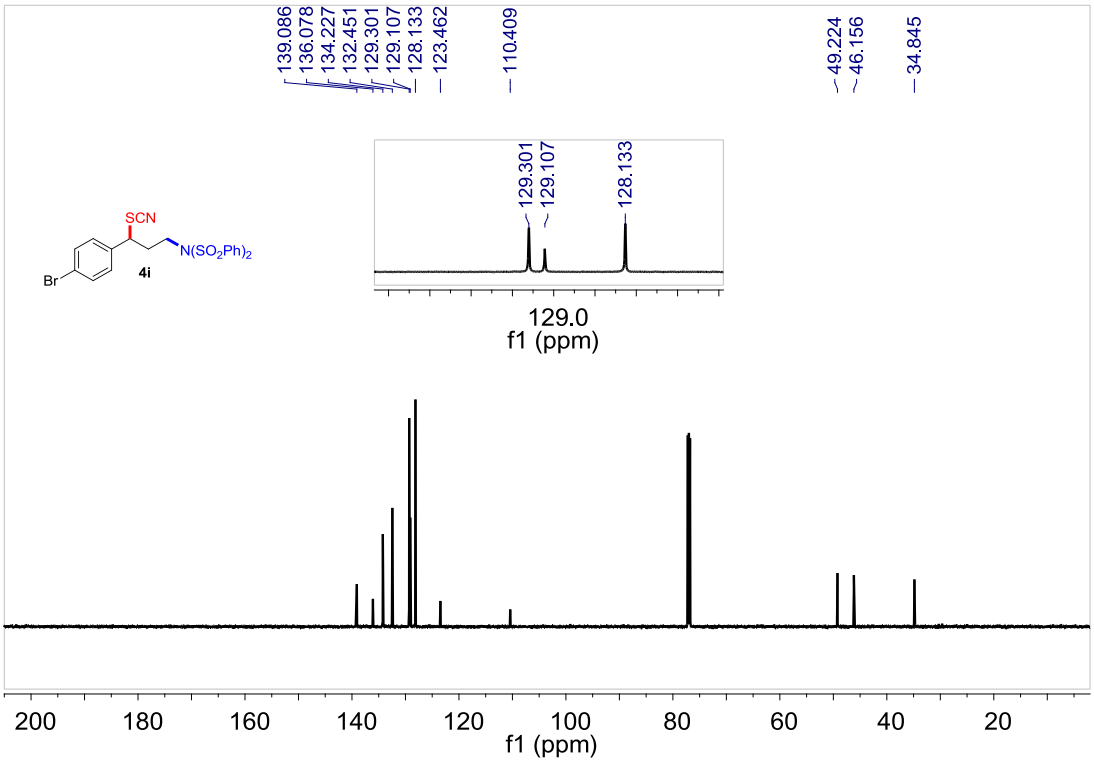
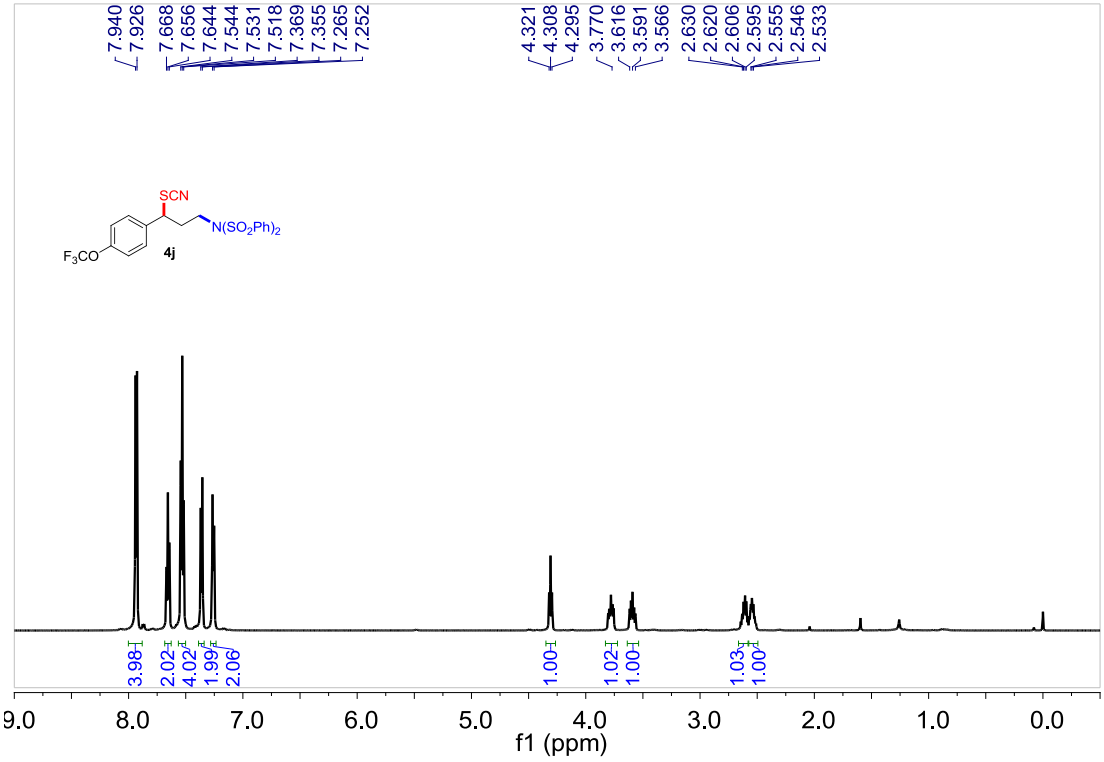
134.618
130.193
128.127
127.670
110.279
46.265
45.437
34.268
130.265
130.193
129.300
128.127
127.703
127.670
SCN
N(SO2Ph)2
Cl
4h
130.0
128.5
f1 (ppm)
200
180
160
140
120
100
80
60
40
20
0
f1 (ppm)

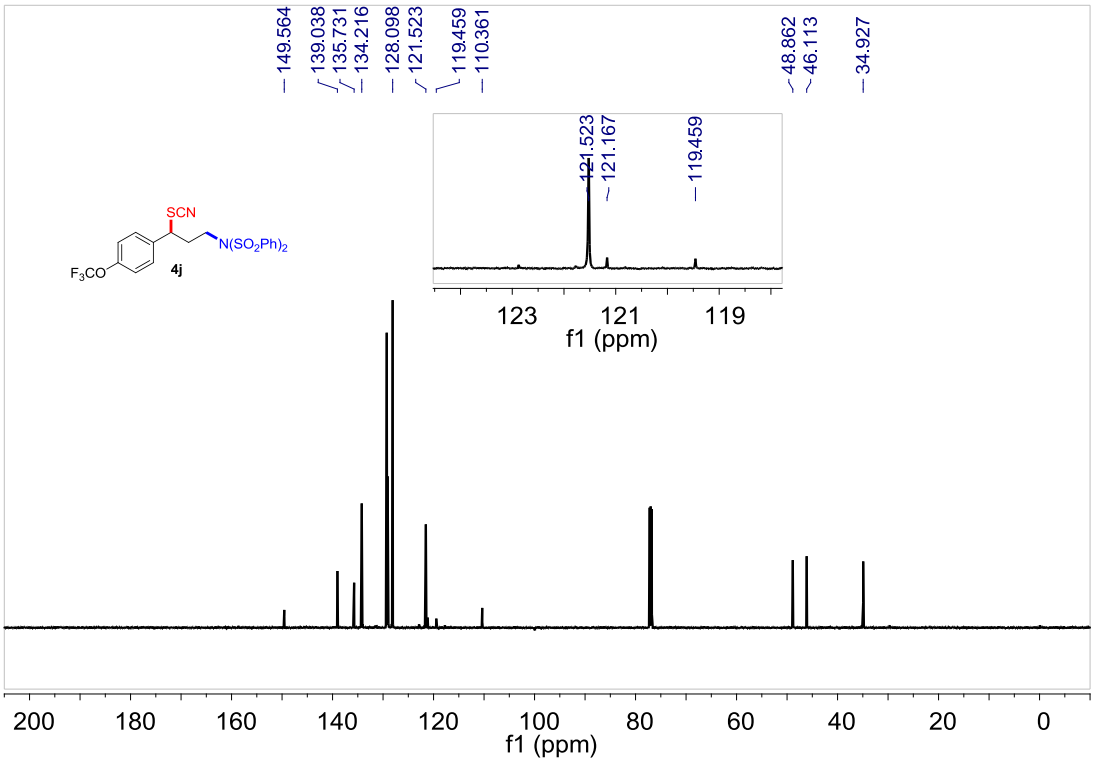
**Compound 4i**

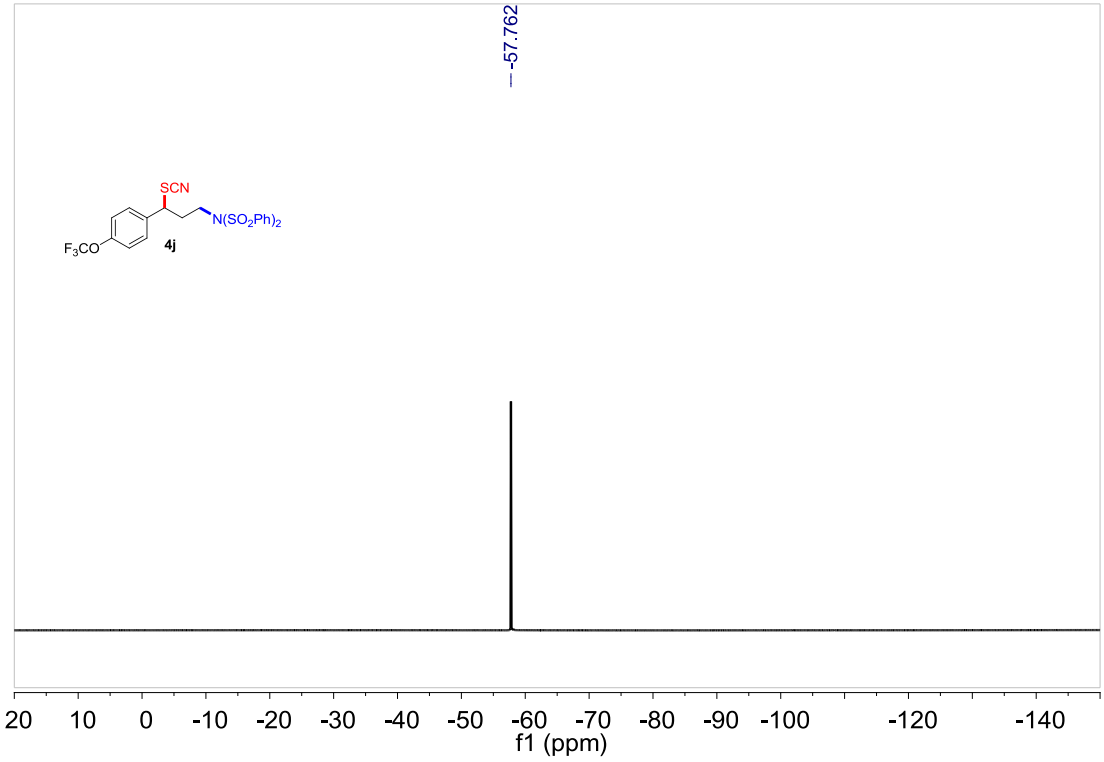

7.871
7.858
7.462
7.187
7.133
7.119
4.205
4.192
4.179
3.681
3.544
3.519
3.493
2.546
2.536
2.532
2.523
2.508
2.499
2.484
2.468
2.459
2.453
2.445
2.441
2.432
2.423
2.418
2.409
SCN
N(SO2Ph)2
Br
4i
4.00
2.09
6.04
1.96
1.00
1.03
1.02
2.08
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
f1 (ppm)


139.086
136.078
134.227
132.451
129.301
129.107
128.133
123.462
110.409
49.224
46.156
34.845
SCN
N(SO2Ph)2
Br
4i
129.301
129.107
128.133
129.0
f1 (ppm)
200
180
160
140
120
100
80
60
40
20
f1 (ppm)

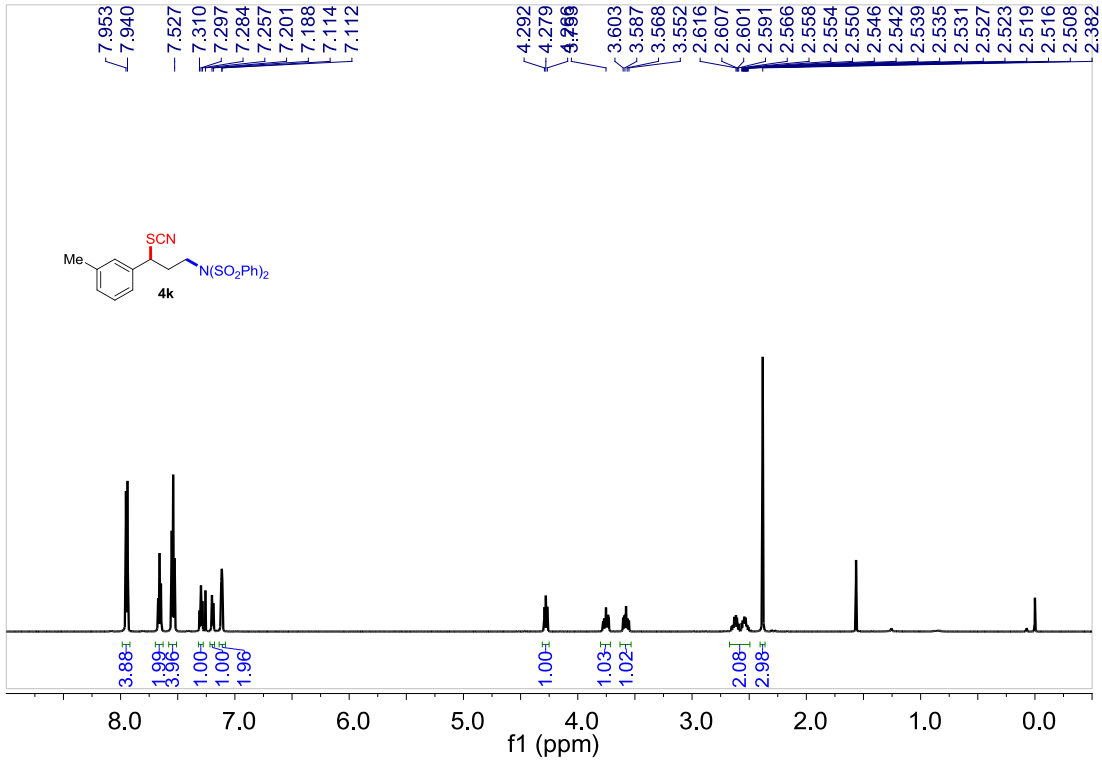
**Compound 4j**

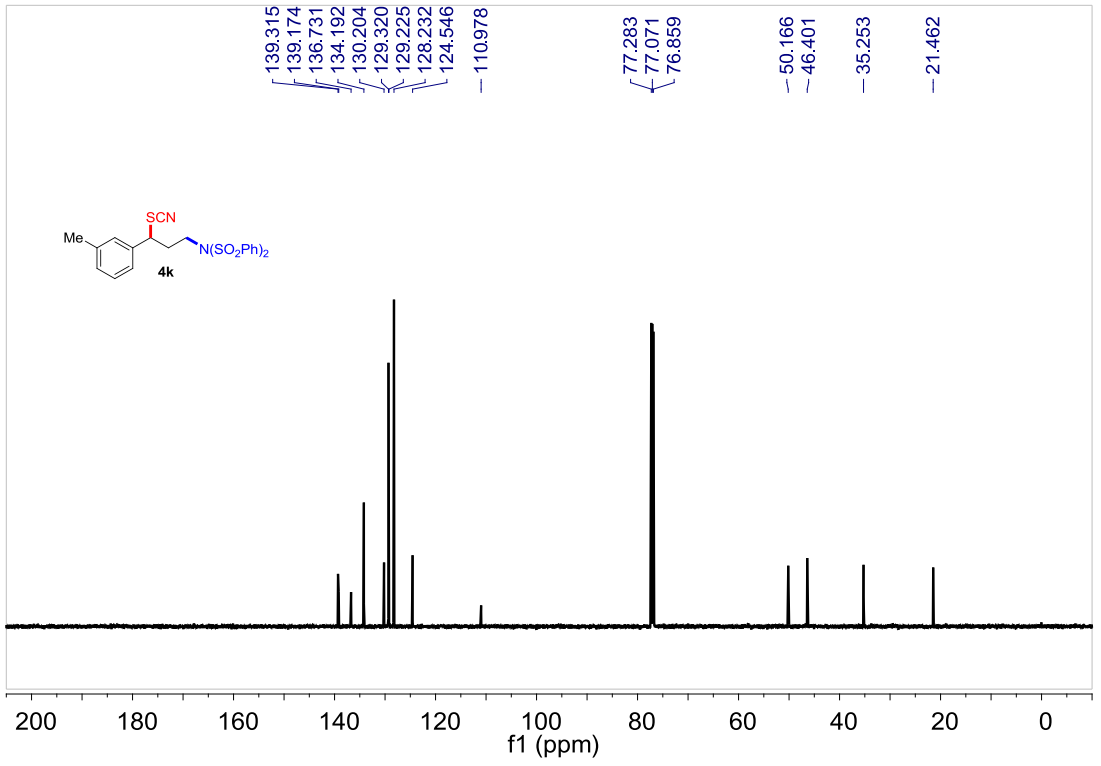

7.940
7.926
7.668
7.656
7.644
7.544
7.531
7.518
7.369
7.355
7.265
7.252
4.321
4.308
4.295
3.770
3.616
3.591
3.566
2.630
2.620
2.606
2.595
2.555
2.546
2.533
SCN
N(SO2Ph)2
F3CO
4j
3.98
2.02
4.02
1.99
2.06
1.00
1.02
1.00
1.03
1.00
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
f1 (ppm)


149.564
139.038
135.731
134.216
128.098
121.523
119.459
110.361
48.862
46.113
34.927
121.523
121.167
119.459
SCN
N(SO2Ph)2
F3CO
4j
123
121
119
f1 (ppm)
200
180
160
140
120
100
80
60
40
20
0
f1 (ppm)

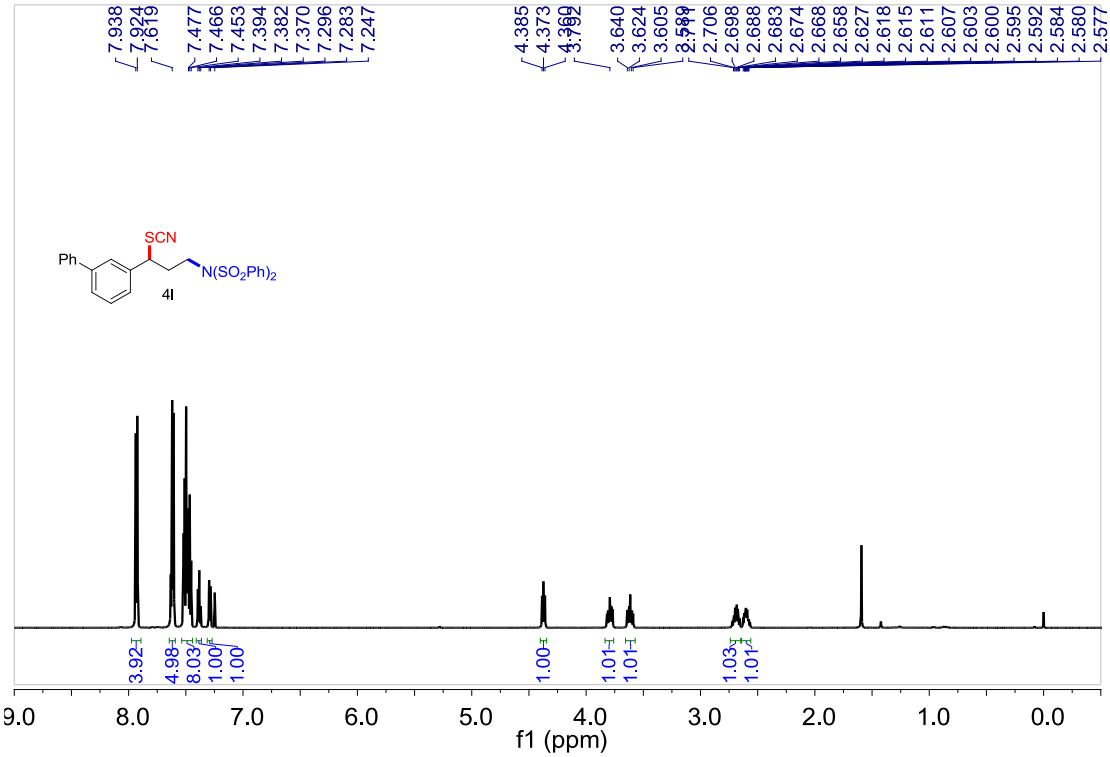

-57.762
SCN
N(SO2Ph)2
F3CO
4j
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-120
-140
f1 (ppm)

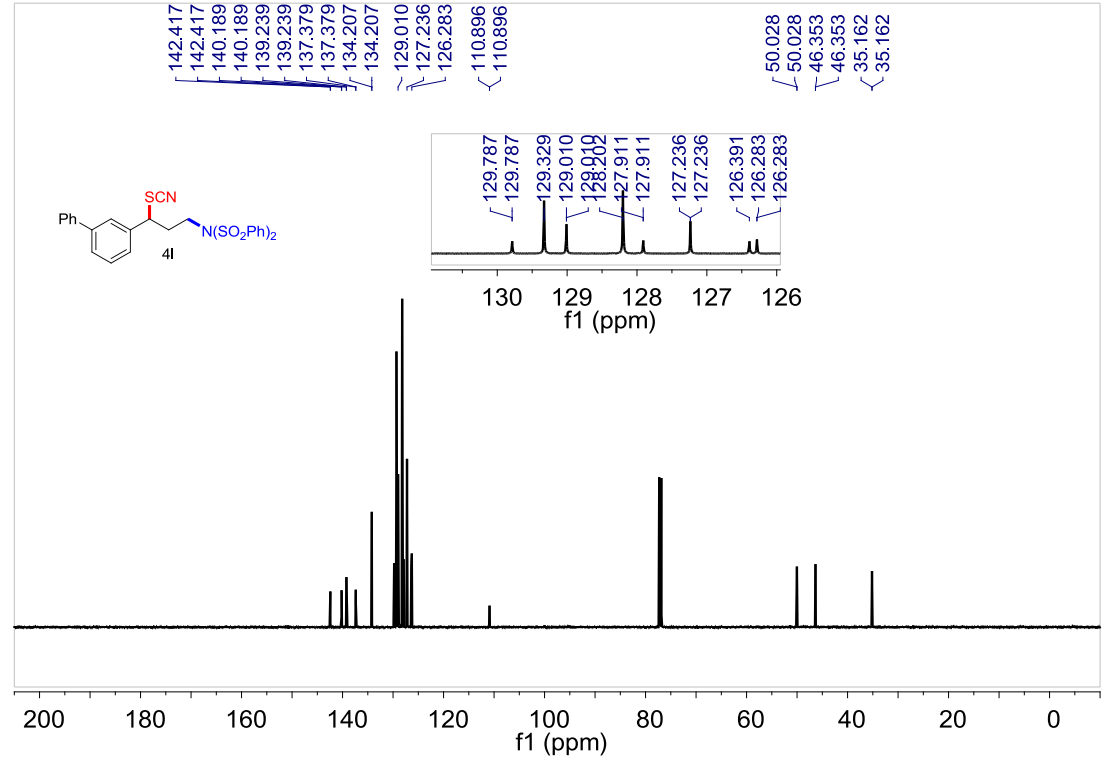
## Compound 4k


7.953
7.940
7.527
7.310
7.297
7.284
7.257
7.201
7.188
7.114
7.112
4.292
4.279
3.603
3.587
3.568
3.552
2.616
2.607
2.601
2.591
2.566
2.558
2.554
2.550
2.546
2.542
2.539
2.535
2.531
2.527
2.523
2.519
2.516
2.508
2.382
SCN
Me
N(SO2Ph)2
4k
3.88
1.99
3.96
1.00
1.00
1.96
1.00
1.03
1.02
2.08
2.98
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
f1 (ppm)

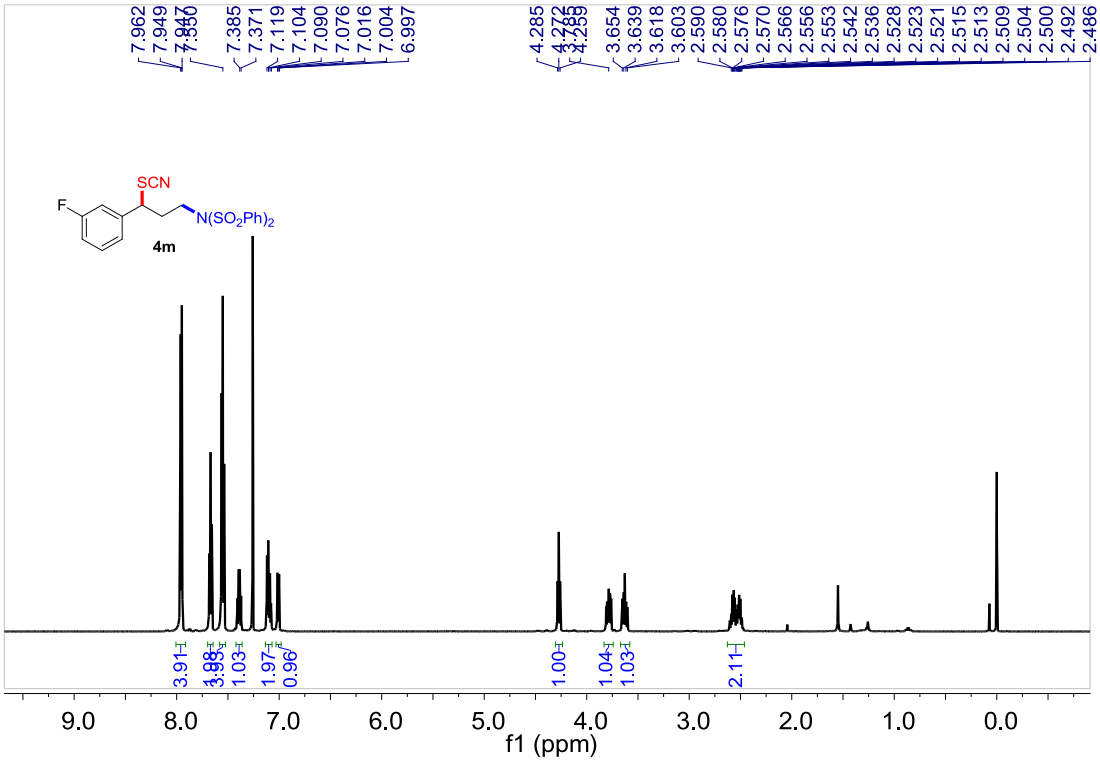

139.315
139.174
136.731
134.192
130.204
129.320
129.225
128.232
124.546
110.978
77.283
77.071
76.859
50.166
46.401
35.253
21.462
SCN
Me
N(SO2Ph)2
4k
200
180
160
140
120
100
80
60
40
20
0
f1 (ppm)

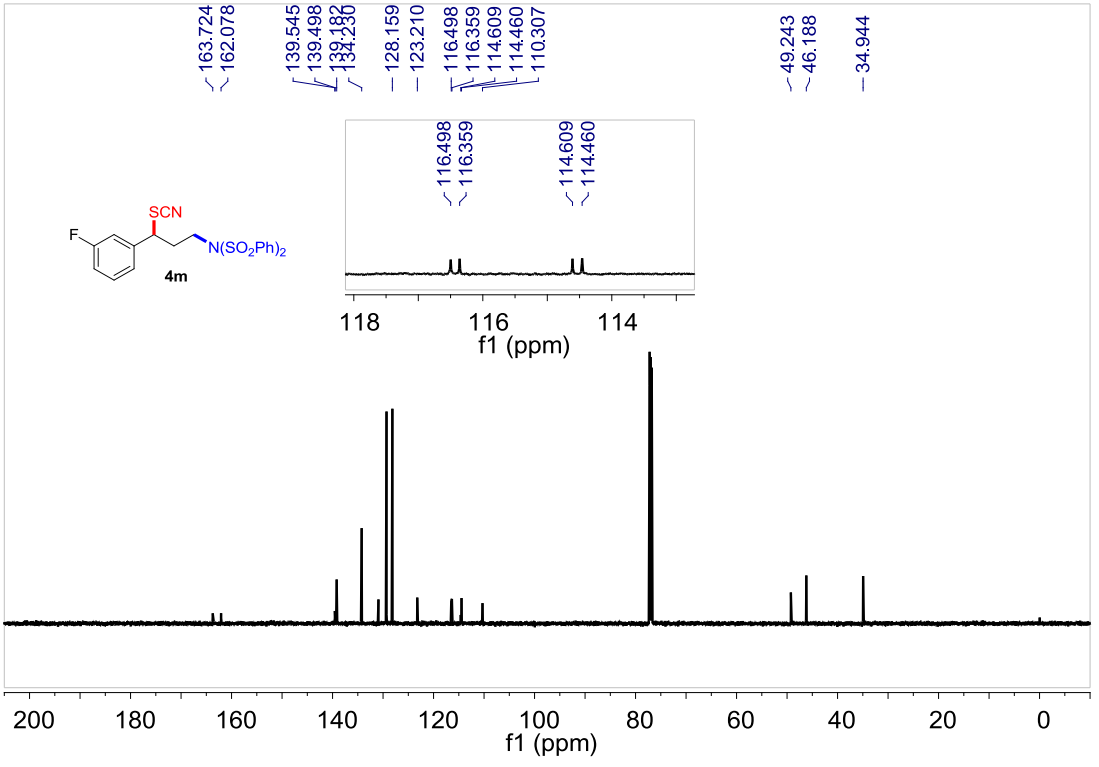
## Compound 4l

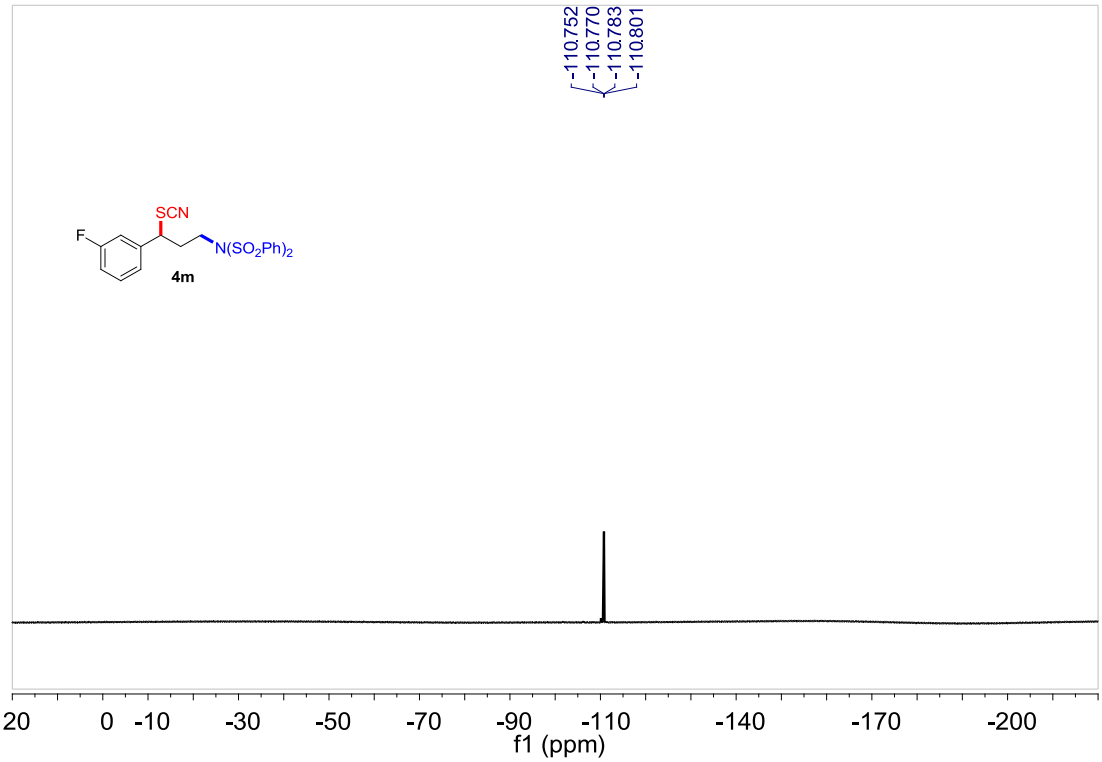

7.938
7.924
7.619
7.477
7.466
7.453
7.394
7.382
7.370
7.296
7.283
7.247
4.385
4.373
3.640
3.624
3.605
2.706
2.698
2.688
2.683
2.674
2.668
2.658
2.627
2.618
2.615
2.611
2.607
2.603
2.600
2.595
2.592
2.584
2.580
2.577
SCN
Ph
N(SO2Ph)2
4l
3.92
4.98
8.03
1.00
1.00
1.01
1.01
1.03
1.01
f1 (ppm)


142.417
142.417
140.189
140.189
139.239
139.239
137.379
137.379
134.207
134.207
129.010
127.236
126.283
110.896
110.896
50.028
50.028
46.353
46.353
35.162
35.162
129.787
129.787
129.329
129.010
128.202
127.911
127.911
127.236
127.236
126.391
126.283
126.283
SCN
Ph
N(SO2Ph)2
4l
f1 (ppm)
f1 (ppm)

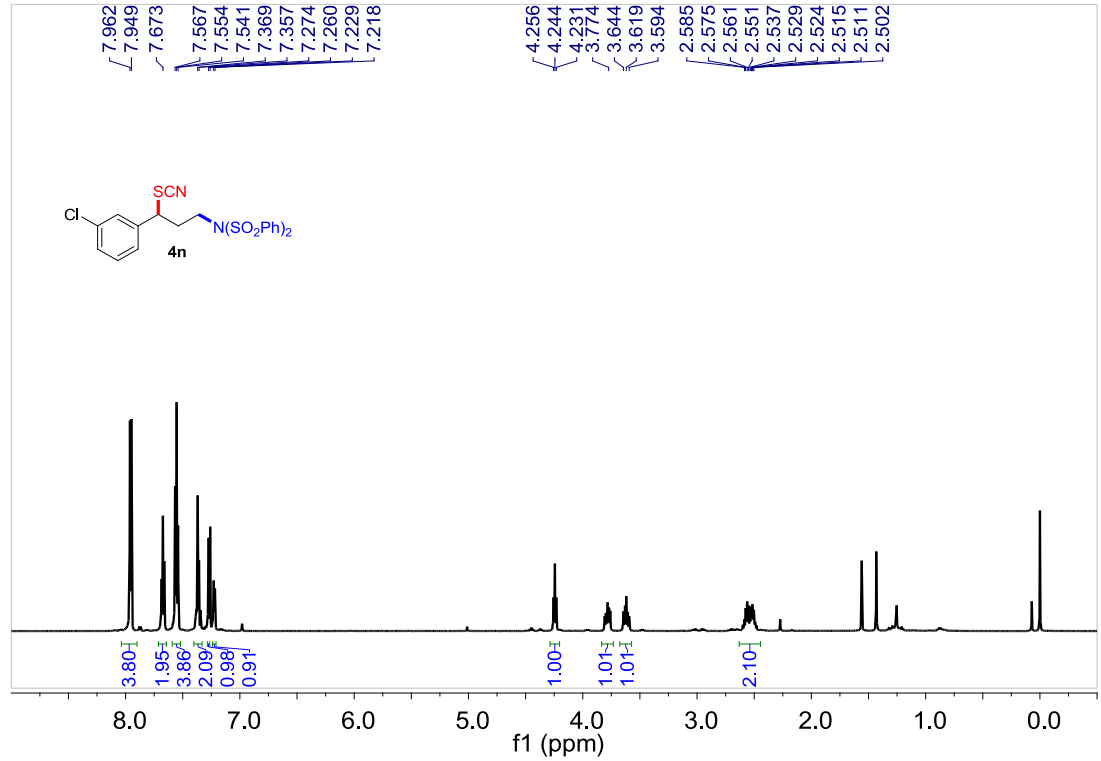
## Compound 4m

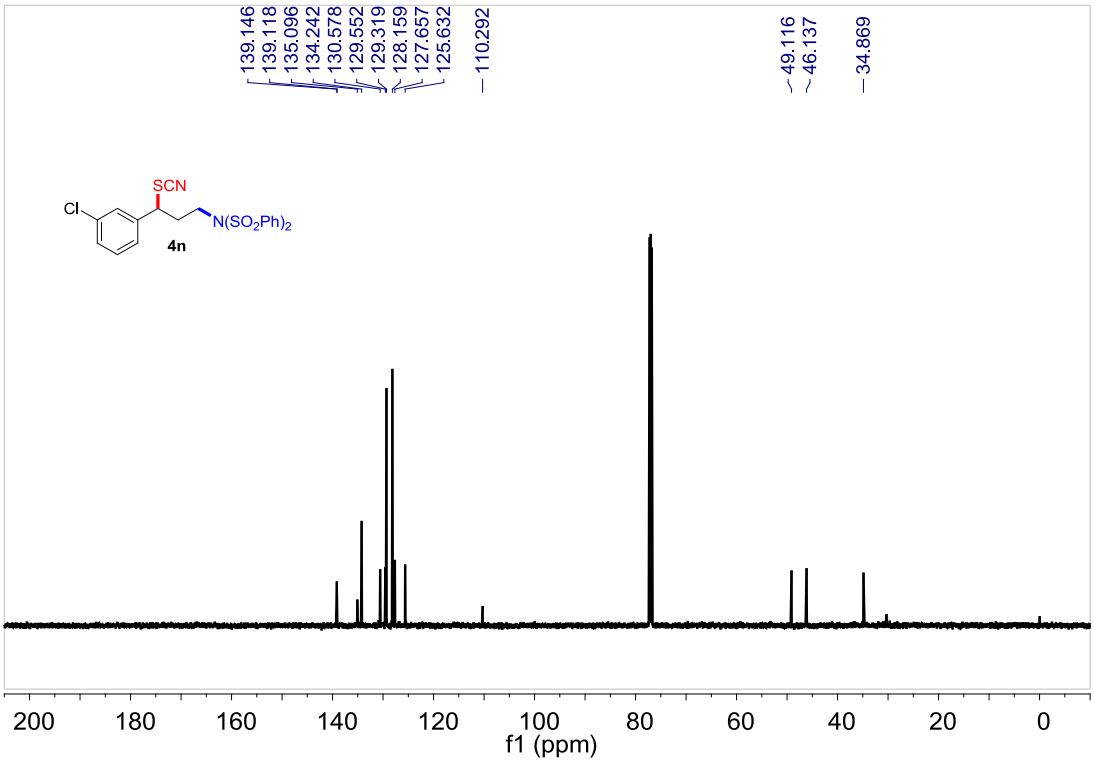

7.962
7.949
7.385
7.371
7.119
7.104
7.090
7.076
7.016
7.004
6.997
4.285
3.654
3.639
3.618
3.603
2.590
2.580
2.576
2.570
2.566
2.556
2.553
2.542
2.536
2.528
2.523
2.521
2.515
2.513
2.509
2.504
2.500
2.492
2.486
SCN
F
N(SO2Ph)2
4m
3.91
1.03
1.97
0.96
1.00
1.04
1.03
2.11
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
f1 (ppm)


163.724
162.078
139.545
139.498
128.159
123.210
116.498
116.359
114.609
114.460
110.307
49.243
46.188
34.944
SCN
F
N(SO2Ph)2
4m
118
116
114
f1 (ppm)
200
180
160
140
120
100
80
60
40
20
0
f1 (ppm)

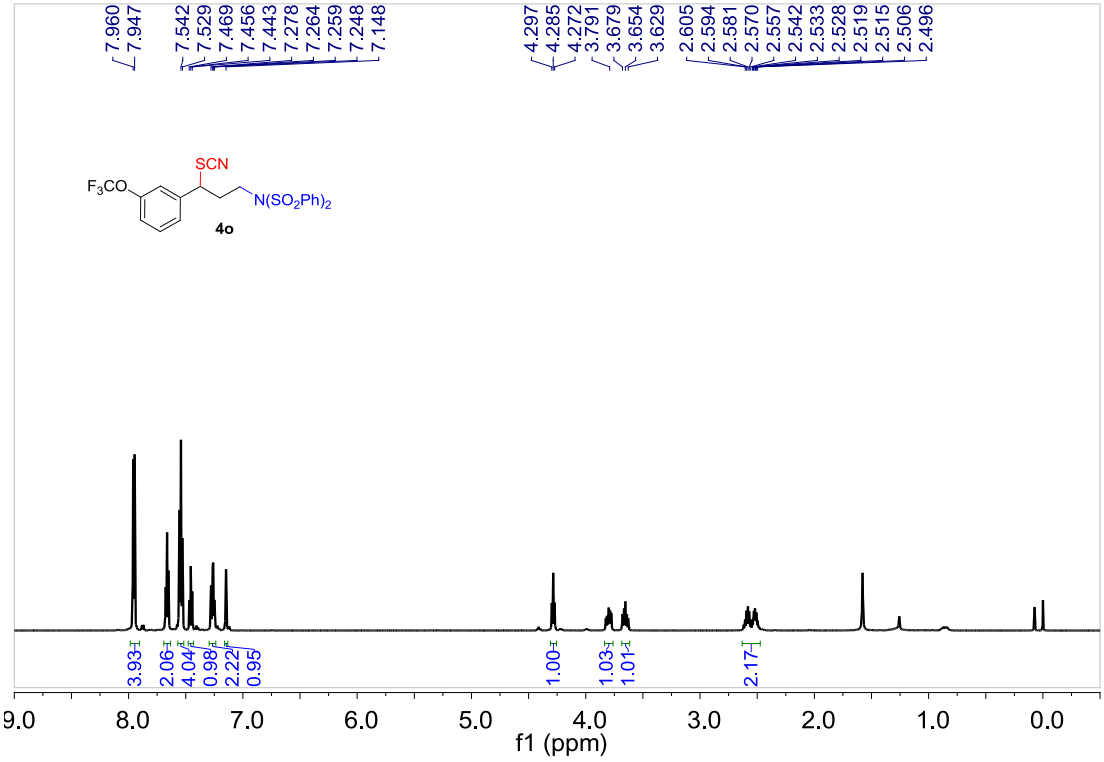

-110.752
-110.770
-110.783
-110.801
SCN
F
N(SO2Ph)2
4m
20
0
-10
-30
-50
-70
-90
-110
-140
-170
-200
f1 (ppm)

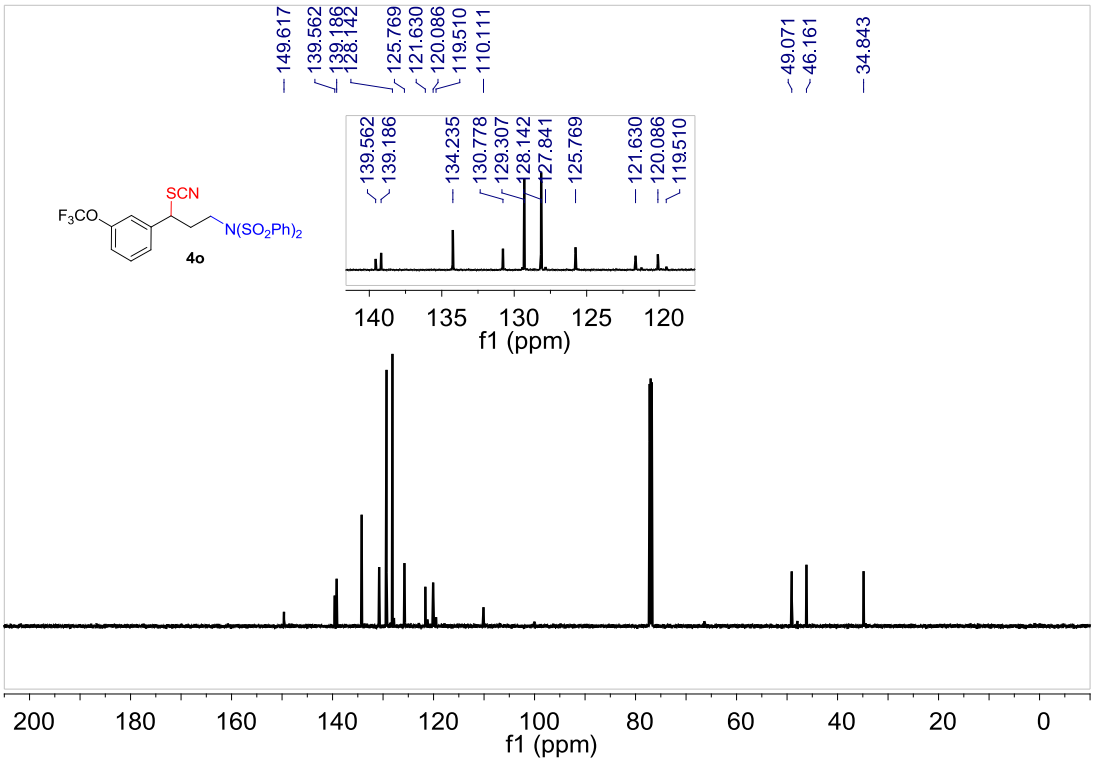
**Compound 4n**

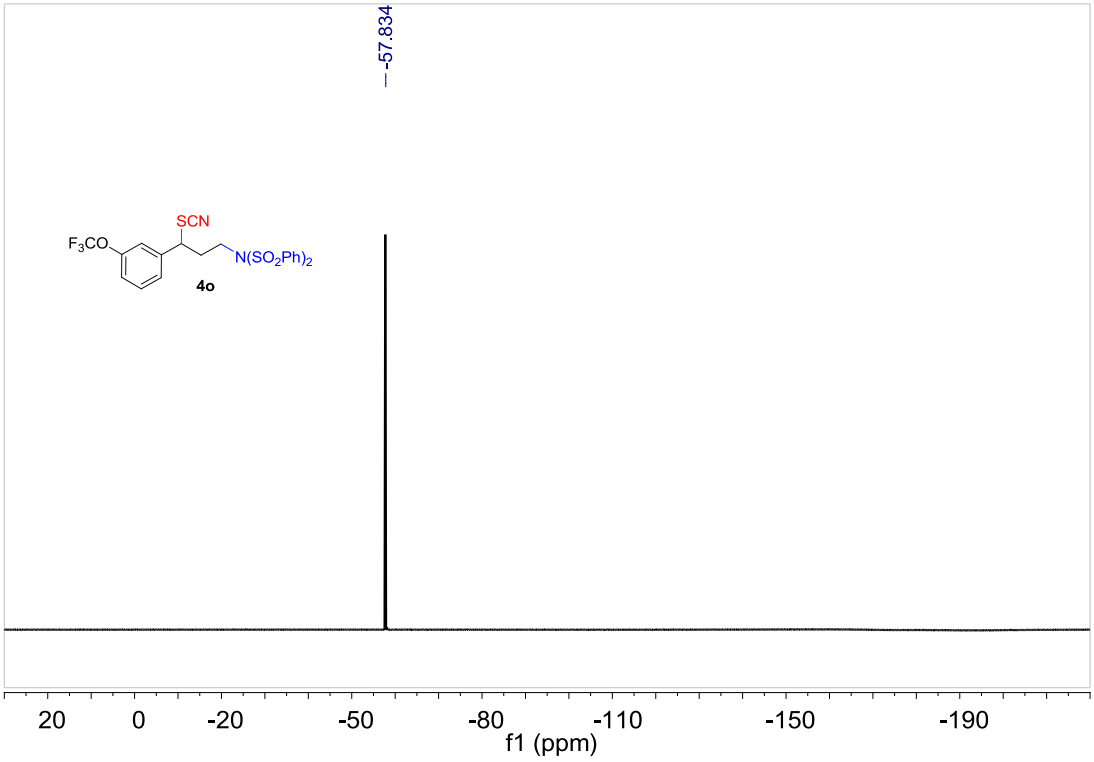

7.962
7.949
7.673
7.567
7.554
7.541
7.369
7.357
7.274
7.260
7.229
7.218
4.256
4.244
4.231
3.774
3.644
3.619
3.594
2.585
2.575
2.561
2.551
2.537
2.529
2.524
2.515
2.511
2.502
SCN
Cl
N(SO2Ph)2
4n
3.80
1.95
3.86
2.09
0.98
0.91
1.00
1.01
1.01
2.10
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
f1 (ppm)


139.146
139.118
135.096
134.242
130.578
129.552
129.319
128.159
127.657
125.632
110.292
49.116
46.137
34.869
SCN
Cl
N(SO2Ph)2
4n
200
180
160
140
120
100
80
60
40
20
0
f1 (ppm)

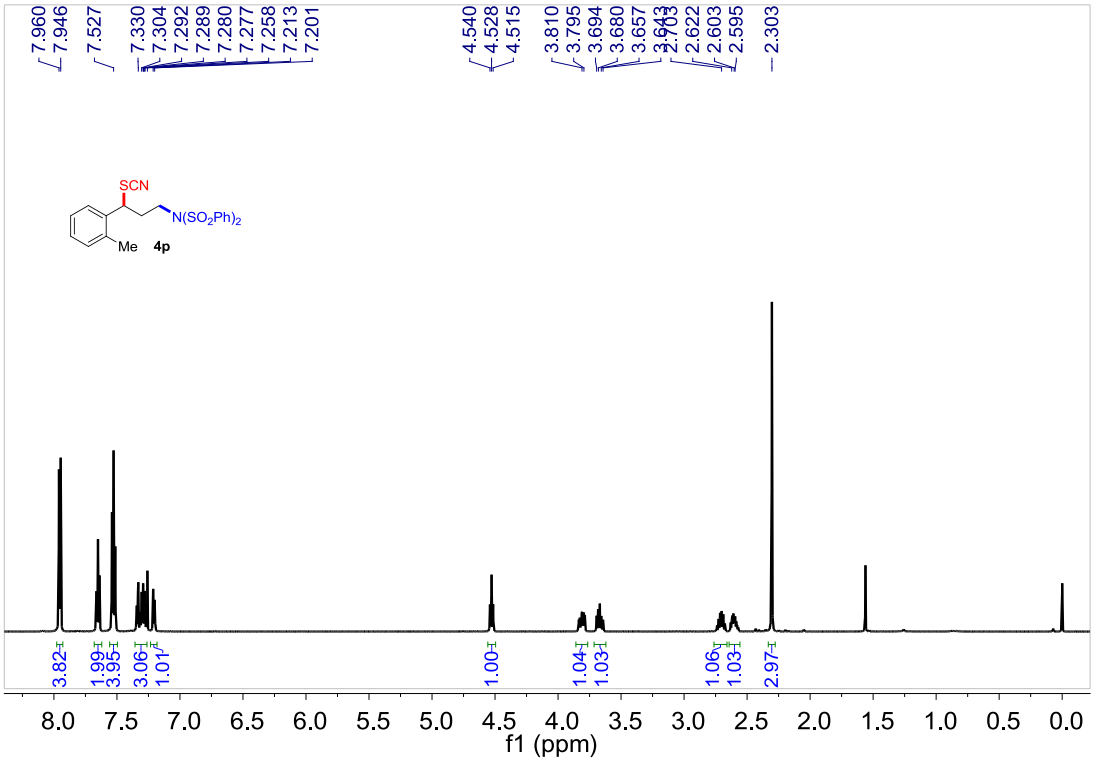
**Compound 4o**

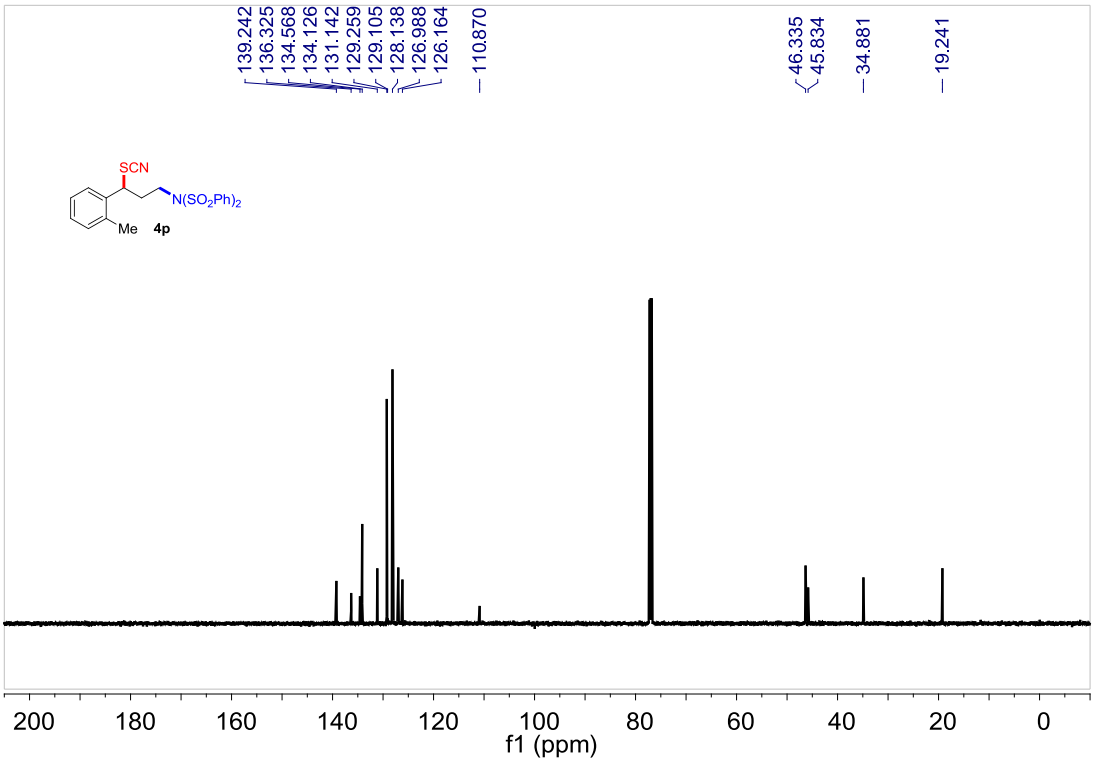

7.960
7.947
7.542
7.529
7.469
7.456
7.443
7.278
7.264
7.259
7.248
7.148
4.297
4.285
4.272
3.791
3.679
3.654
3.629
2.605
2.594
2.581
2.570
2.557
2.542
2.533
2.528
2.519
2.515
2.506
2.496
SCN
F3CO
N(SO2Ph)2
4o
3.93
2.06
4.04
0.98
2.22
0.95
1.00
1.03
1.01
2.17
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
f1 (ppm)


149.617
139.562
139.186
128.142
125.769
121.630
120.086
119.510
110.111
49.071
46.161
34.843
SCN
F3CO
N(SO2Ph)2
4o
139.562
139.186
134.235
130.778
129.307
128.142
127.841
125.769
121.630
120.086
119.510
140
135
130
125
120
f1 (ppm)
200
180
160
140
120
100
80
60
40
20
0
f1 (ppm)

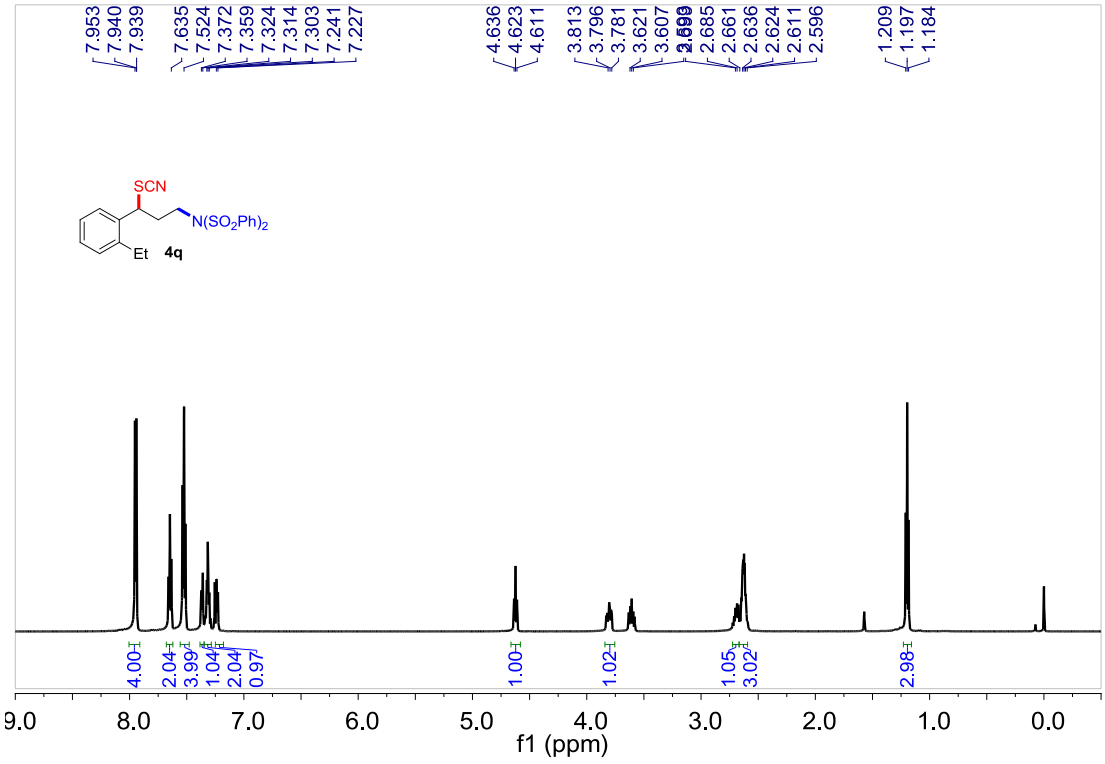

-57.834
SCN
F3CO
N(SO2Ph)2
4o
20
0
-20
-50
-80
-110
-150
-190
f1 (ppm)

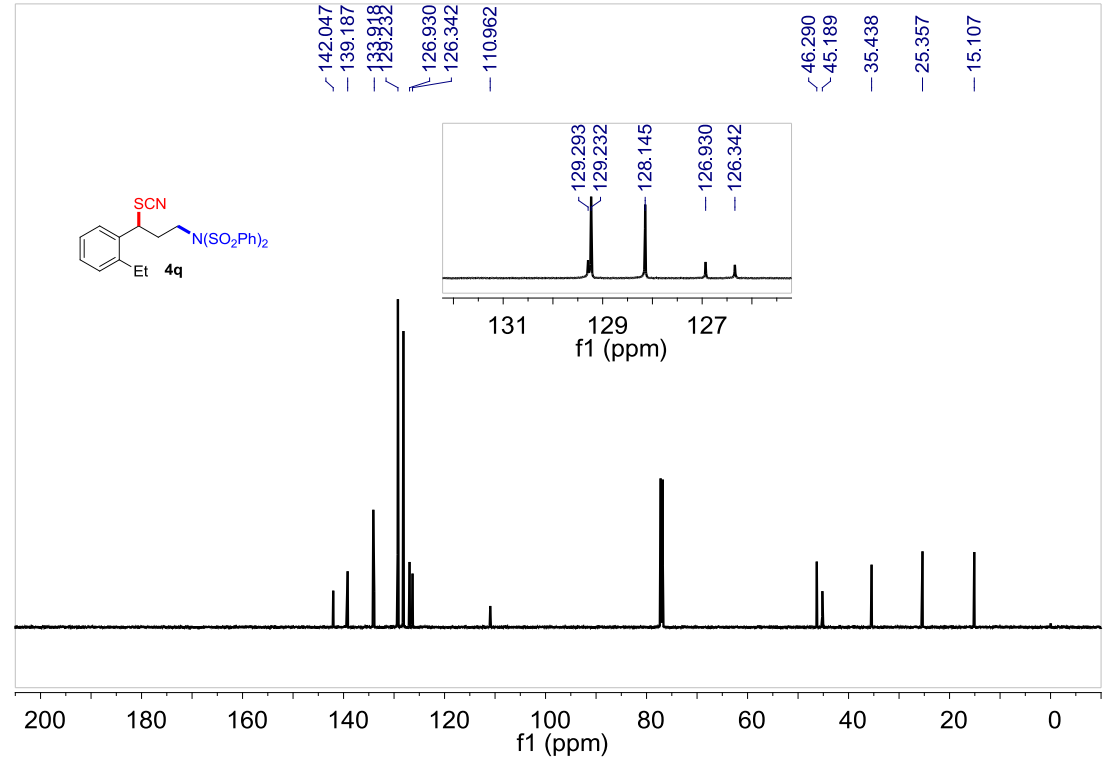
## Compound 4p


7.960
7.946
7.527
7.330
7.304
7.292
7.289
7.280
7.277
7.258
7.213
7.201
4.540
4.528
4.515
3.810
3.795
3.694
3.680
3.657
2.622
2.603
2.595
2.303
SCN
N(SO2Ph)2
Me 4p
3.82
1.99
3.95
3.06
1.01
1.00
1.04
1.03
1.06
1.03
2.97
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)

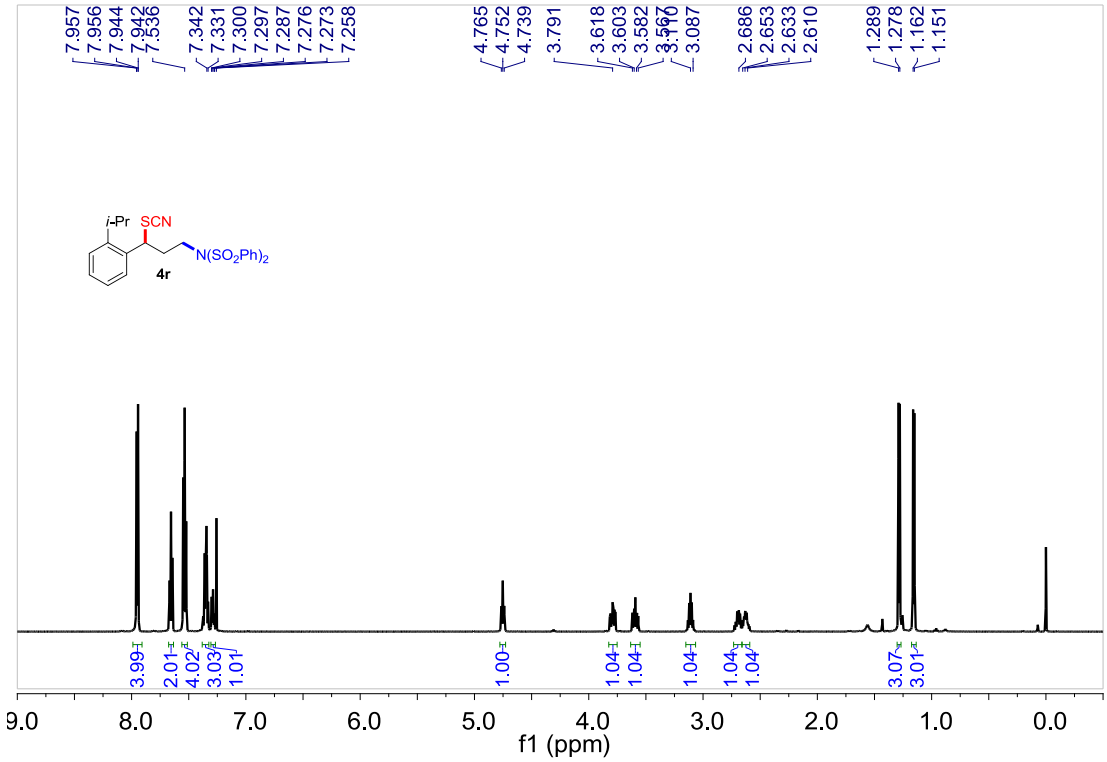

139.242
136.325
134.568
134.126
131.142
129.259
129.105
128.138
126.988
126.164
110.870
46.335
45.834
34.881
19.241
SCN
N(SO2Ph)2
Me 4p
200 180 160 140 120 100 80 60 40 20 0
f1 (ppm)

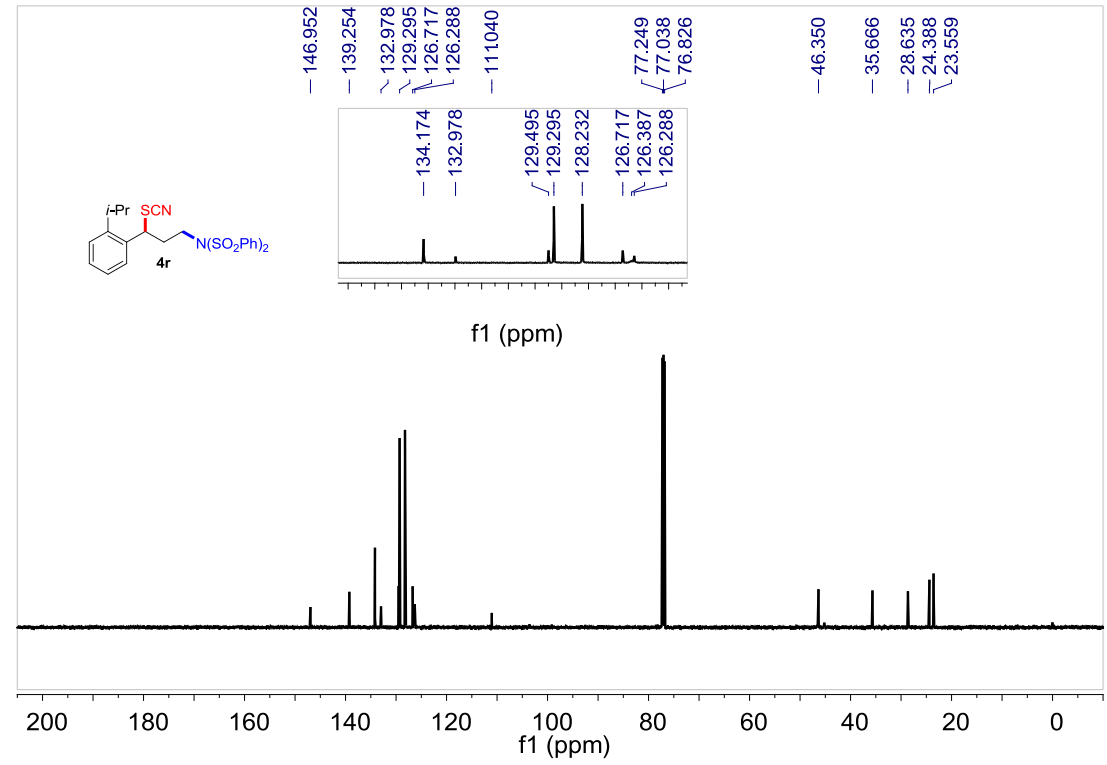
## Compound 4q


7.953
7.940
7.939
7.635
7.524
7.372
7.359
7.324
7.314
7.303
7.241
7.227
4.636
4.623
4.611
3.813
3.796
3.781
3.621
3.607
2.685
2.661
2.636
2.624
2.611
2.596
1.209
1.197
1.184
SCN
N(SO2Ph)2
Et 4q
4.00
2.04
3.99
1.04
2.04
0.97
1.00
1.02
1.05
3.02
2.98
f1 (ppm)

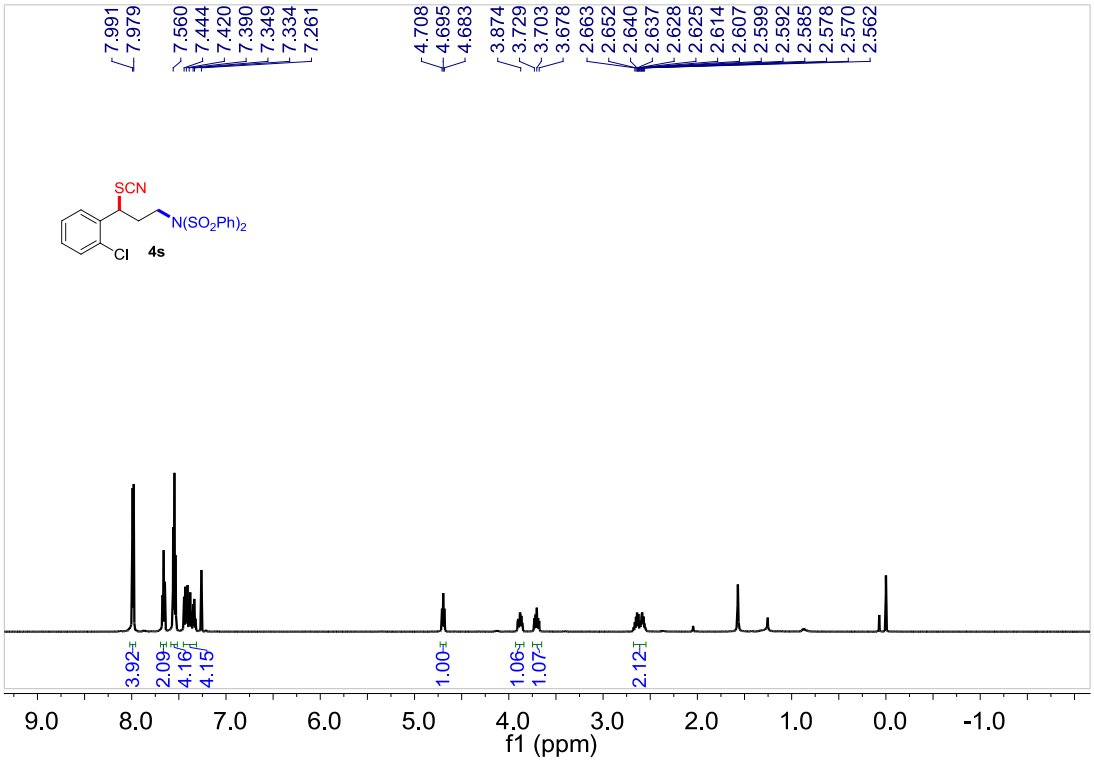

142.047
139.187
133.918
129.232
126.930
126.342
110.962
46.290
45.189
35.438
25.357
15.107
129.293
129.232
128.145
126.930
126.342
SCN
N(SO2Ph)2
Et 4q
131
129
127
f1 (ppm)
f1 (ppm)

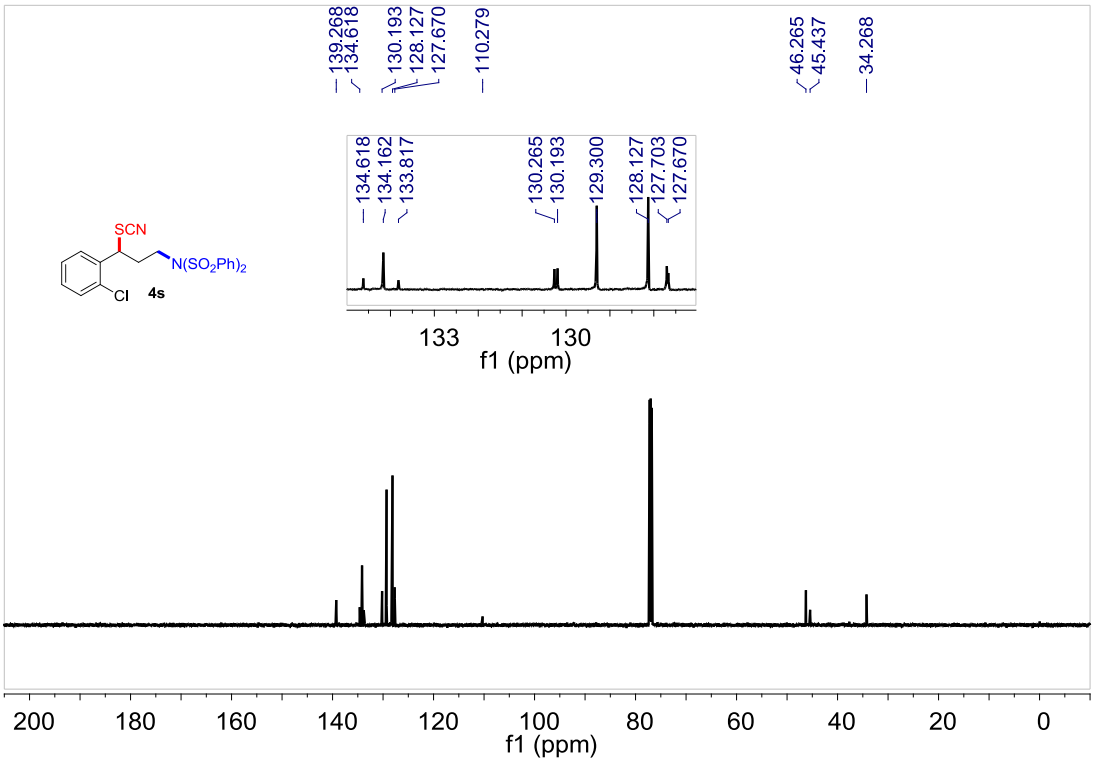
## Compound 4r


7.957
7.956
7.944
7.942
7.536
7.342
7.331
7.300
7.297
7.287
7.276
7.273
7.258
4.765
4.752
4.739
3.791
3.618
3.603
3.582
3.567
3.087
2.686
2.653
2.633
2.610
1.289
1.278
1.162
1.151
i-Pr
SCN
N(SO2Ph)2
4r
3.99
2.01
4.02
3.03
1.01
1.00
1.04
1.04
1.04
1.04
1.04
3.07
3.01
f1 (ppm)

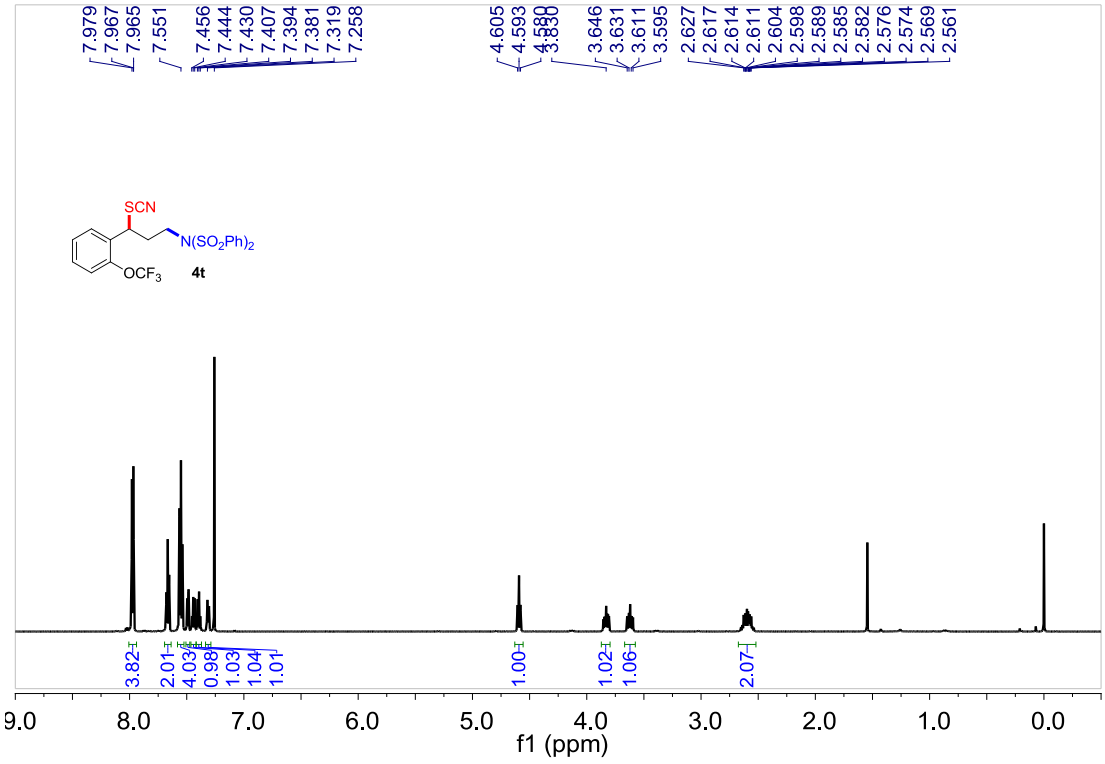

146.952
139.254
132.978
129.295
126.717
126.288
111.040
77.249
77.038
76.826
46.350
35.666
28.635
24.388
23.559
134.174
132.978
129.495
129.295
128.232
126.717
126.387
126.288
i-Pr
SCN
N(SO2Ph)2
4r
f1 (ppm)
f1 (ppm)

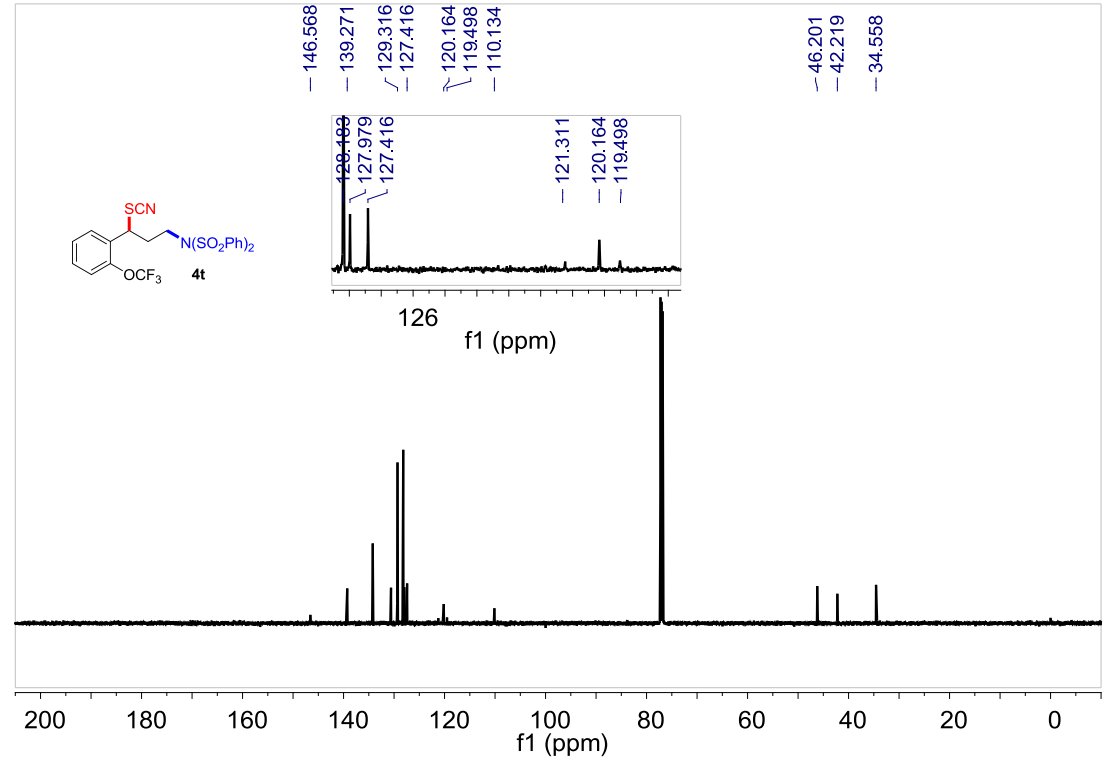
## Compound 4s

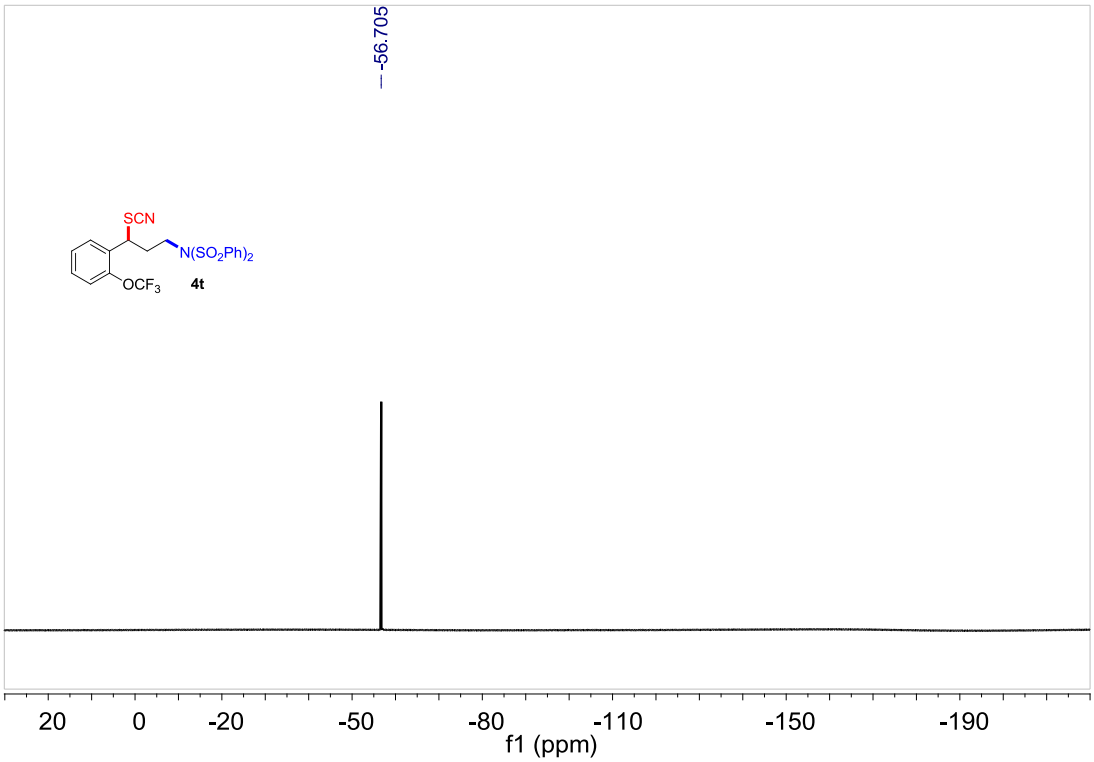

7.991
7.979
7.560
7.444
7.420
7.390
7.349
7.334
7.261
4.708
4.695
4.683
3.874
3.729
3.703
3.678
2.663
2.652
2.640
2.637
2.628
2.625
2.614
2.607
2.599
2.592
2.585
2.578
2.570
2.562
SCN
N(SO2Ph)2
Cl
4s
3.92
2.09
4.16
4.15
1.00
1.06
1.07
2.12
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
-1.0
f1 (ppm)


139.268
134.618
130.193
128.127
127.670
110.279
46.265
45.437
34.268
134.618
134.162
133.817
130.265
130.193
129.300
128.127
127.703
127.670
SCN
N(SO2Ph)2
Cl
4s
133
130
f1 (ppm)
200
180
160
140
120
100
80
60
40
20
0
f1 (ppm)

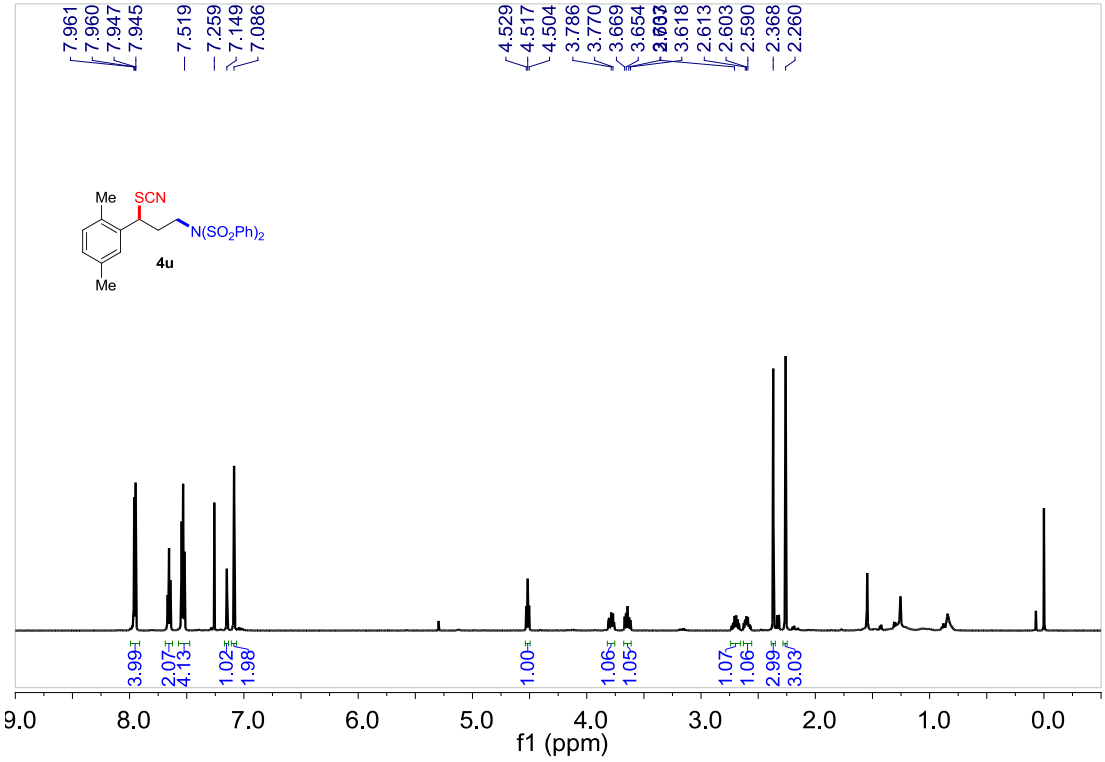
## Compound 4t

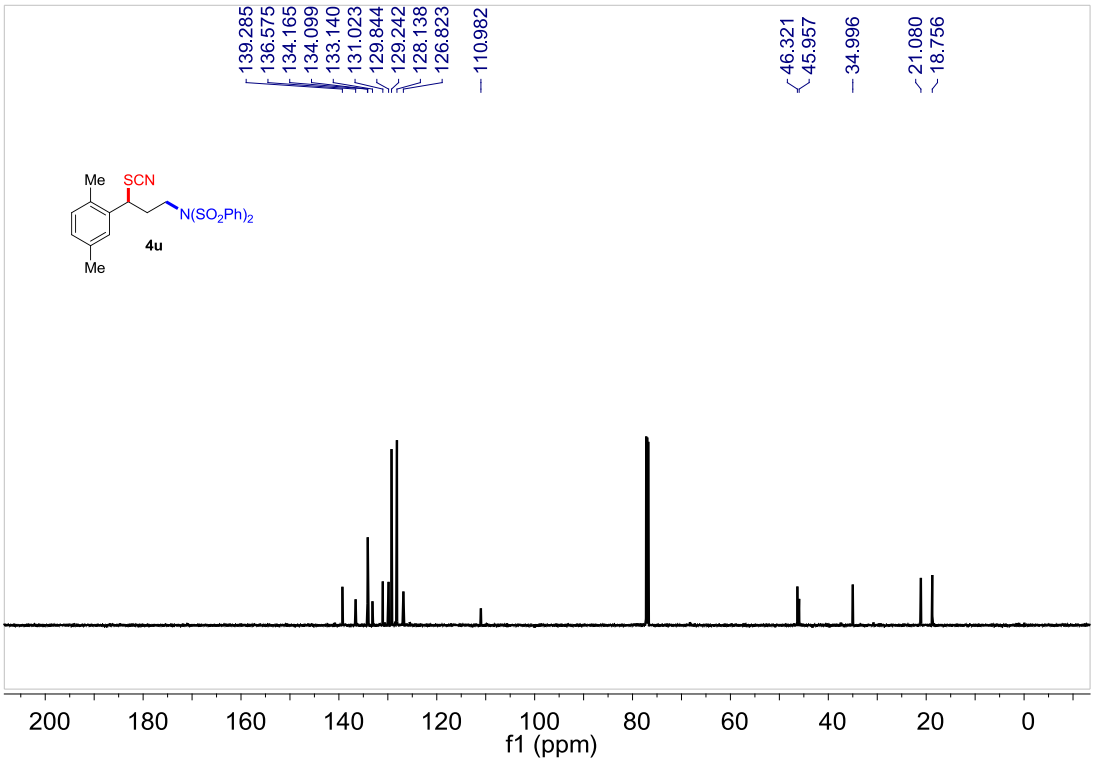

7.979
7.967
7.965
7.551
7.456
7.444
7.430
7.407
7.394
7.381
7.319
7.258
4.605
4.593
3.646
3.631
3.611
3.595
2.627
2.617
2.614
2.611
2.604
2.598
2.589
2.585
2.582
2.576
2.574
2.569
2.561
SCN
N(SO2Ph)2
OCF3
4t
3.82
2.01
4.03
0.98
1.03
1.04
1.01
1.00
1.02
1.06
2.07
f1 (ppm)


146.568
139.271
129.316
127.416
120.164
119.498
110.134
46.201
42.219
34.558
128.193
127.979
127.416
121.311
120.164
119.498
SCN
N(SO2Ph)2
OCF3
4t
126
f1 (ppm)
f1 (ppm)

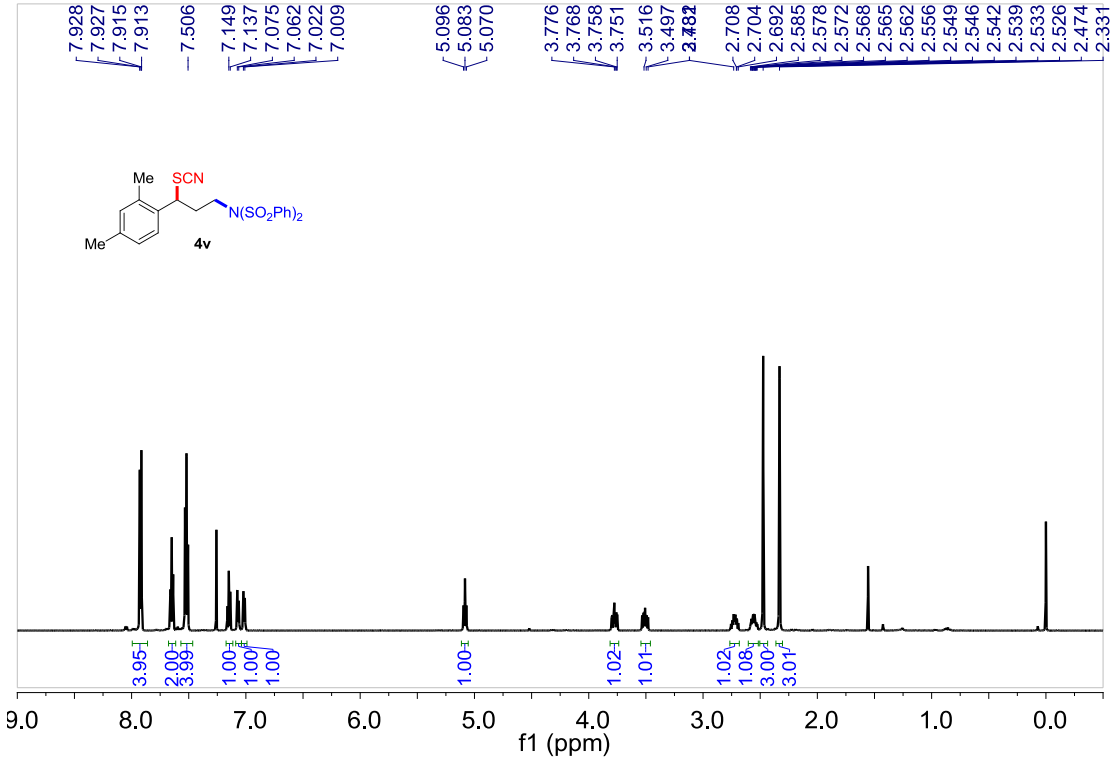

-56.705
SCN
N(SO2Ph)2
OCF3
4t
20
0
-20
-50
-80
-110
-150
-190
f1 (ppm)

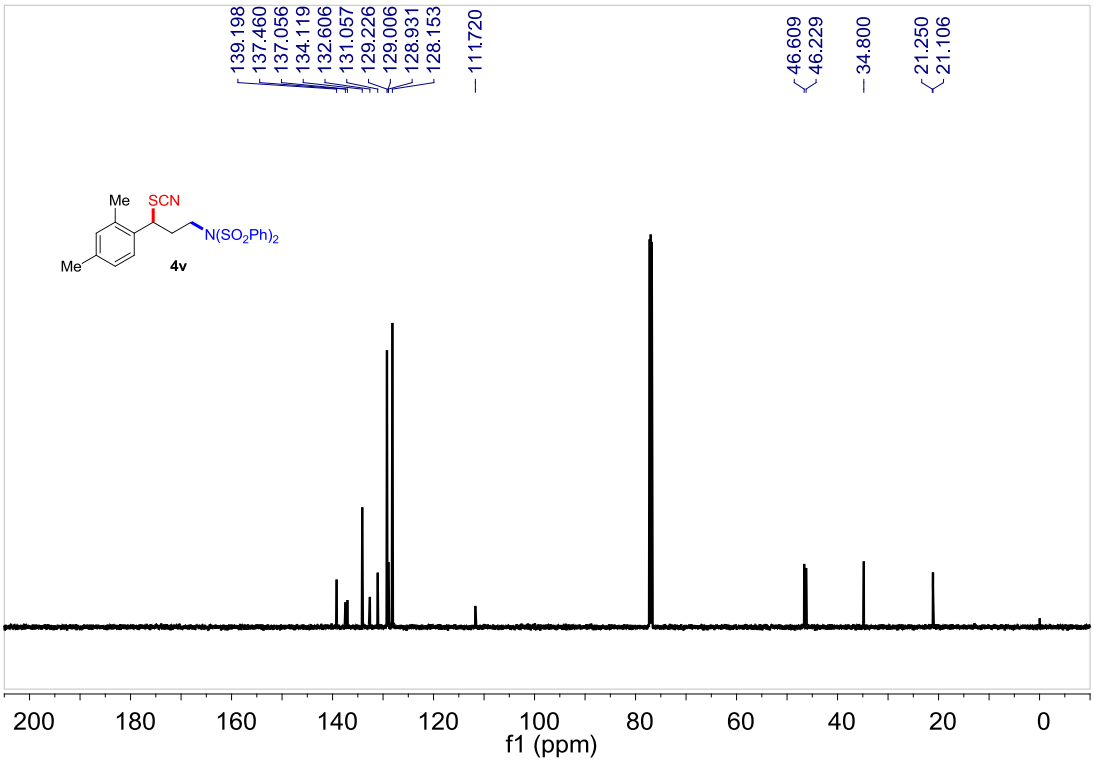
**Compound 4u**


7.961
7.960
7.947
7.945
7.519
7.259
7.149
7.086
4.529
4.517
4.504
3.786
3.770
3.669
3.654
3.618
2.613
2.603
2.590
2.368
2.260
Me
SCN
N(SO2Ph)2
4u
Me
3.99
2.07
4.13
1.02
1.98
1.00
1.06
1.05
1.07
1.06
2.99
3.03
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
f1 (ppm)

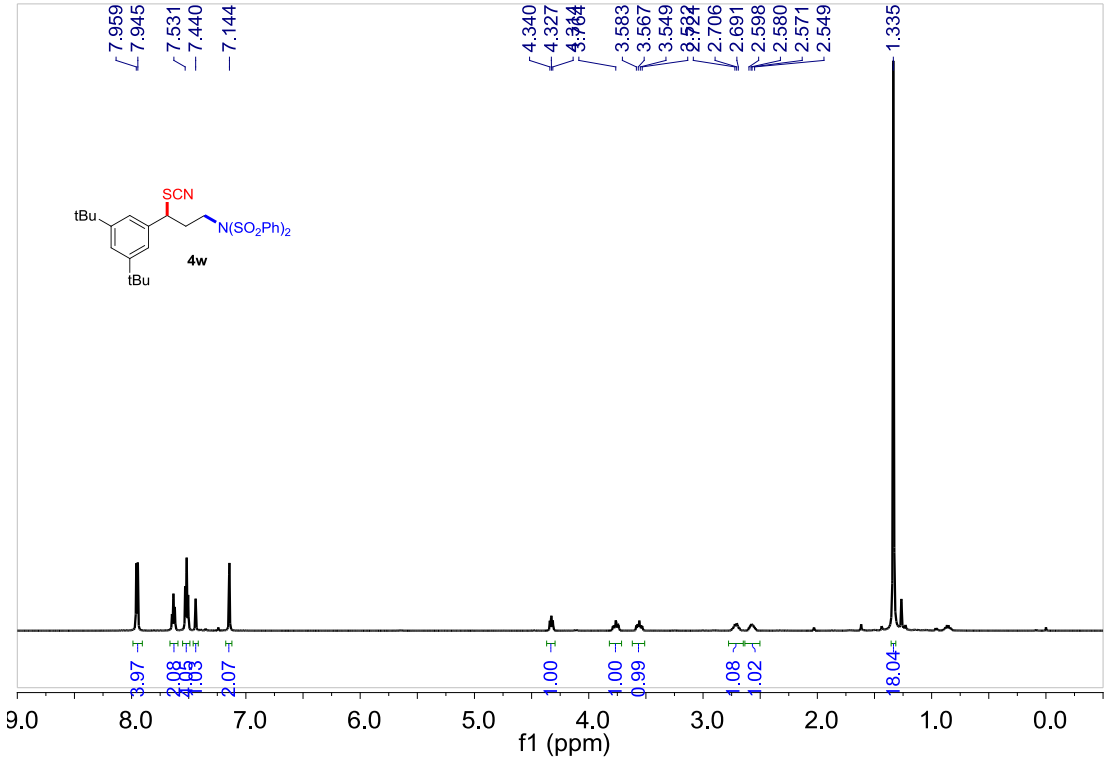

139.285
136.575
134.165
134.099
133.140
131.023
129.844
129.242
128.138
126.823
110.982
46.321
45.957
34.996
21.080
18.756
Me
SCN
N(SO2Ph)2
Me
4u
200
180
160
140
120
100
80
60
40
20
0
f1 (ppm)

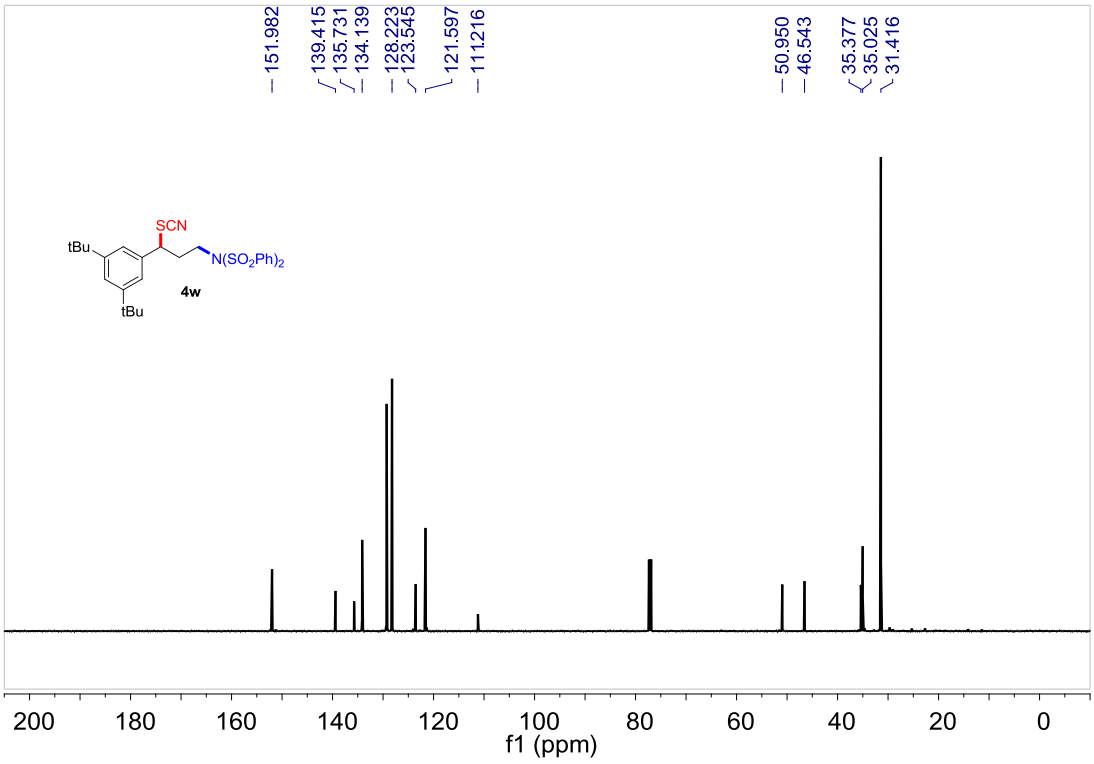
**Compound 4v**


7.928
7.927
7.915
7.913
7.506
7.149
7.137
7.075
7.062
7.022
7.009
5.096
5.083
5.070
3.776
3.768
3.758
3.751
3.516
3.497
2.708
2.704
2.692
2.585
2.578
2.572
2.568
2.565
2.562
2.556
2.549
2.546
2.542
2.539
2.533
2.526
2.474
2.331
Me
SCN
N(SO2Ph)2
Me
4v
3.95
2.00
3.99
1.00
1.00
1.00
1.00
1.02
1.01
1.02
1.08
3.00
3.01
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
f1 (ppm)

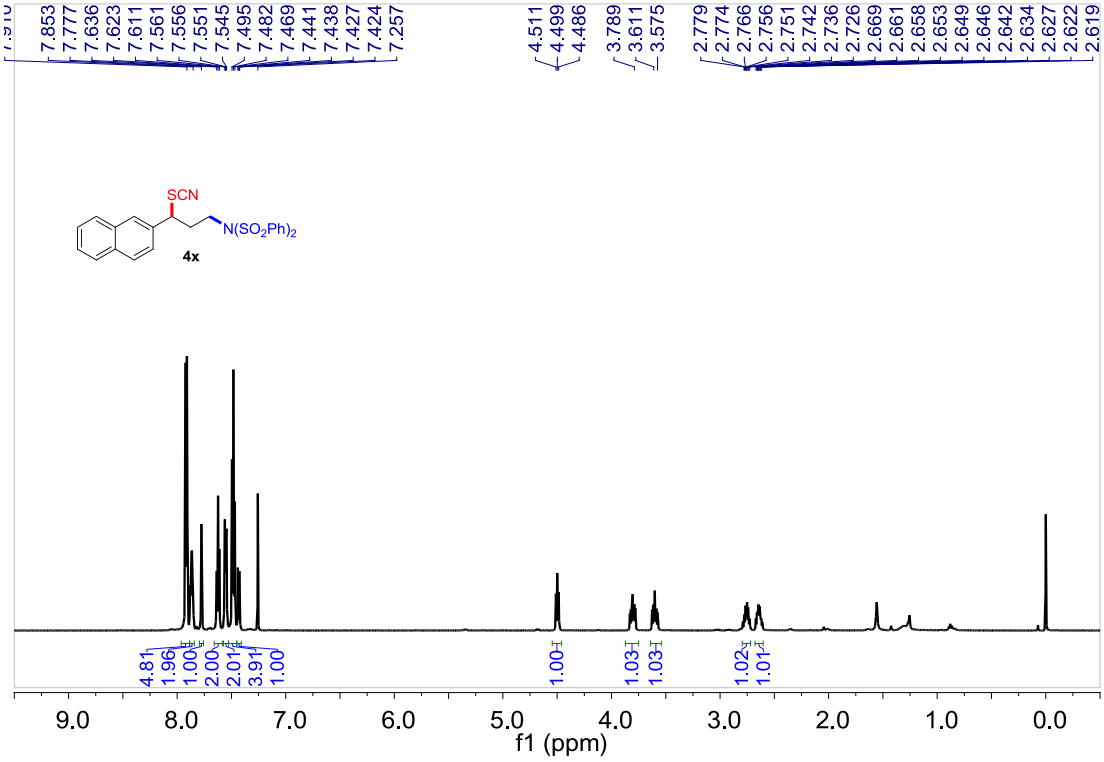

139.198
137.460
137.056
134.119
132.606
131.057
129.226
129.006
128.931
128.153
111.720
46.609
46.229
34.800
21.250
21.106
Me
SCN
N(SO2Ph)2
Me
4v
200
180
160
140
120
100
80
60
40
20
0
f1 (ppm)

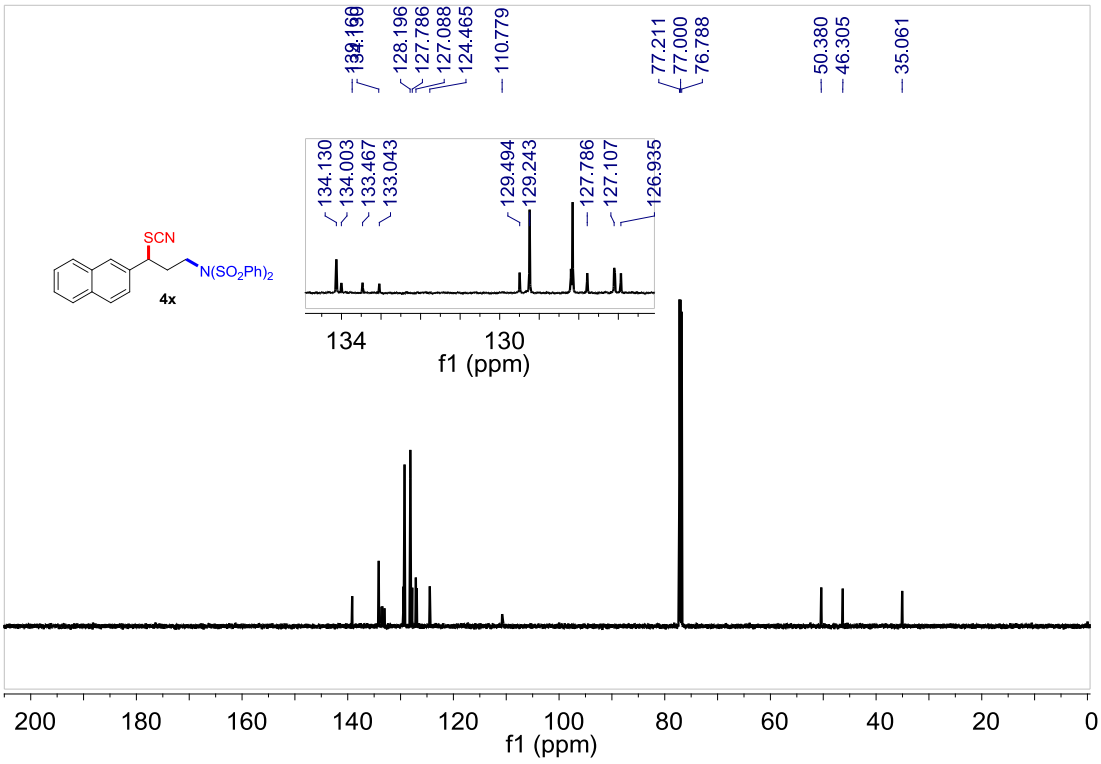
**Compound 4w**


7.959
7.945
7.531
7.440
7.144
4.340
4.327
3.583
3.567
3.549
2.706
2.691
2.598
2.580
2.571
2.549
1.335
SCN
tBu
N(SO2Ph)2
4w
tBu
3.97
2.08
2.07
1.00
1.00
0.99
1.08
1.02
18.04
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
f1 (ppm)

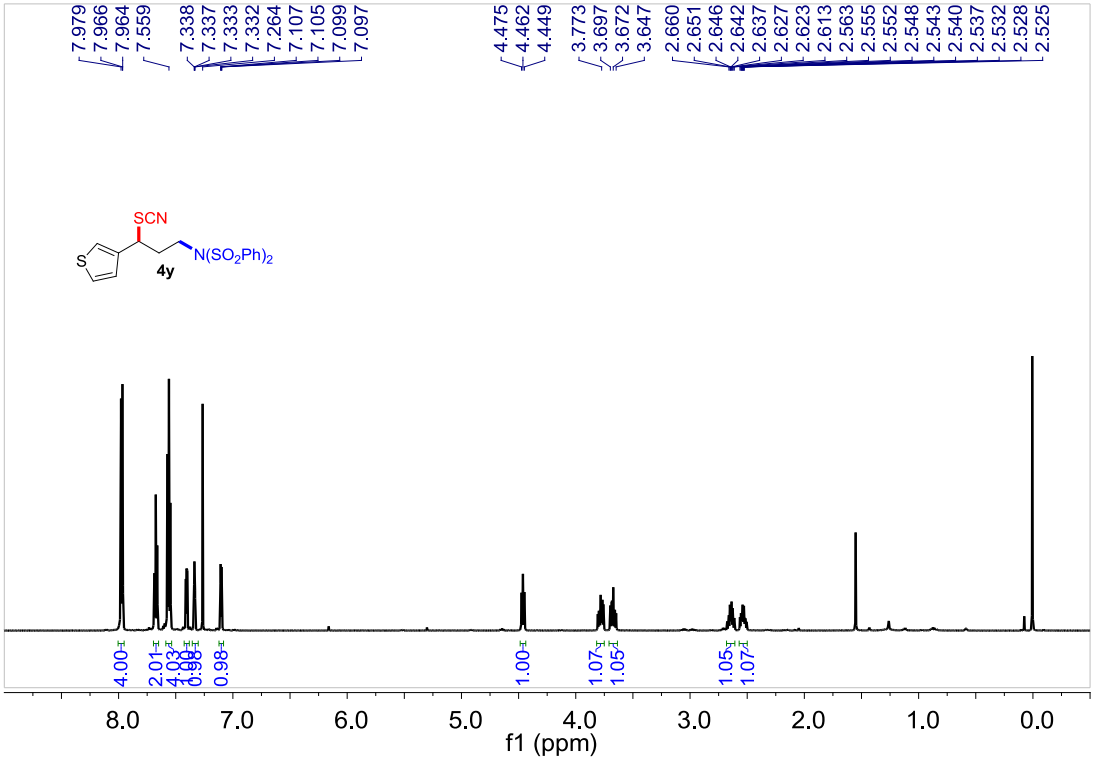

151.982
139.415
135.731
134.139
128.223
123.545
121.597
111.216
50.950
46.543
35.377
35.025
31.416
SCN
tBu
tBu
N(SO2Ph)2
4w
200
180
160
140
120
100
80
60
40
20
0
f1 (ppm)

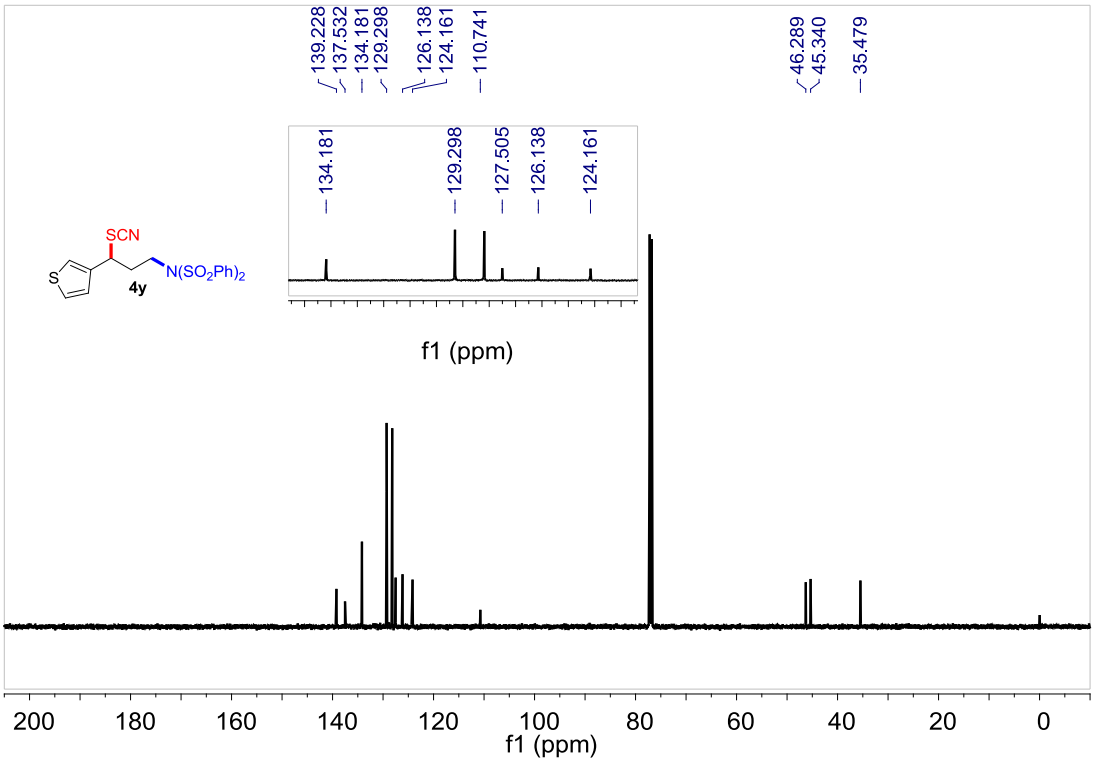
**Compound 4x**


7.853
7.777
7.636
7.623
7.611
7.561
7.556
7.551
7.545
7.495
7.482
7.469
7.441
7.438
7.427
7.424
7.257
4.511
4.499
4.486
3.789
3.611
3.575
2.779
2.774
2.766
2.756
2.751
2.742
2.736
2.726
2.669
2.661
2.658
2.653
2.649
2.646
2.642
2.634
2.627
2.622
2.619
SCN
N(SO2Ph)2
4x
4.81
1.96
1.00
2.00
2.01
3.91
1.00
1.00
1.03
1.03
1.02
1.01
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
f1 (ppm)

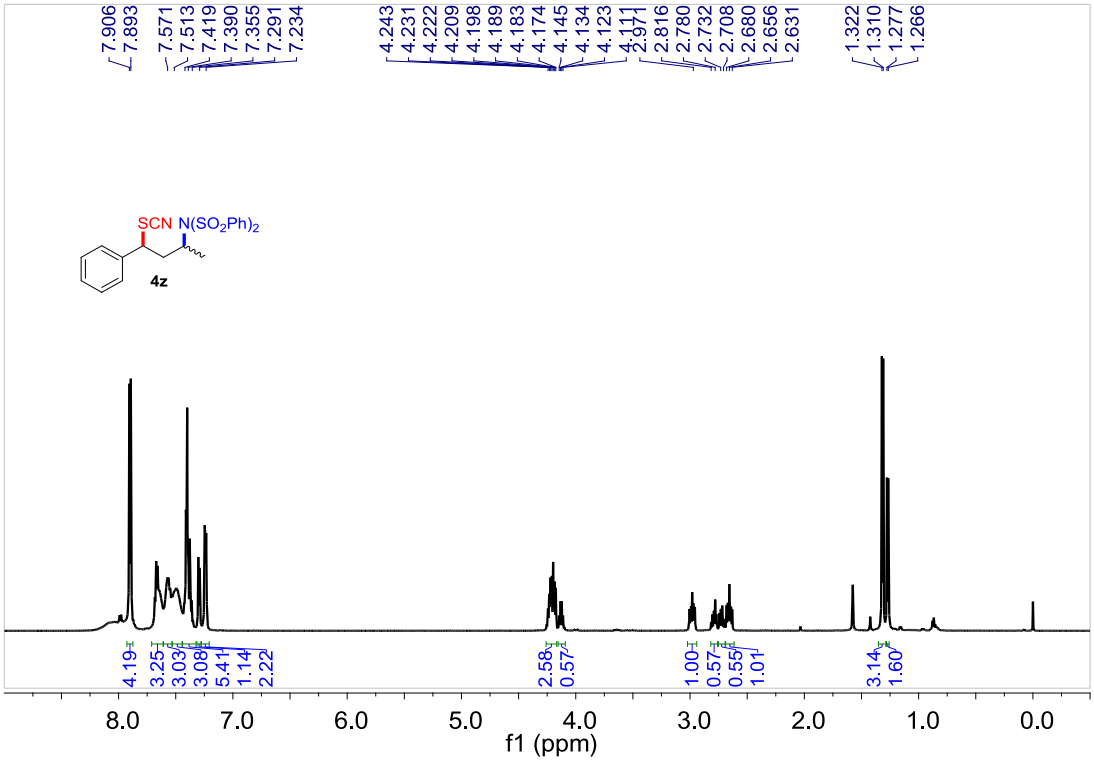

SCN
N(SO2Ph)2
4x
134.130
134.003
133.467
133.043
129.494
129.243
127.786
127.107
126.935
134
130
f1 (ppm)
134.160
128.196
127.786
127.088
124.465
110.779
77.211
77.000
76.788
50.380
46.305
35.061
200
180
160
140
120
100
80
60
40
20
0
f1 (ppm)

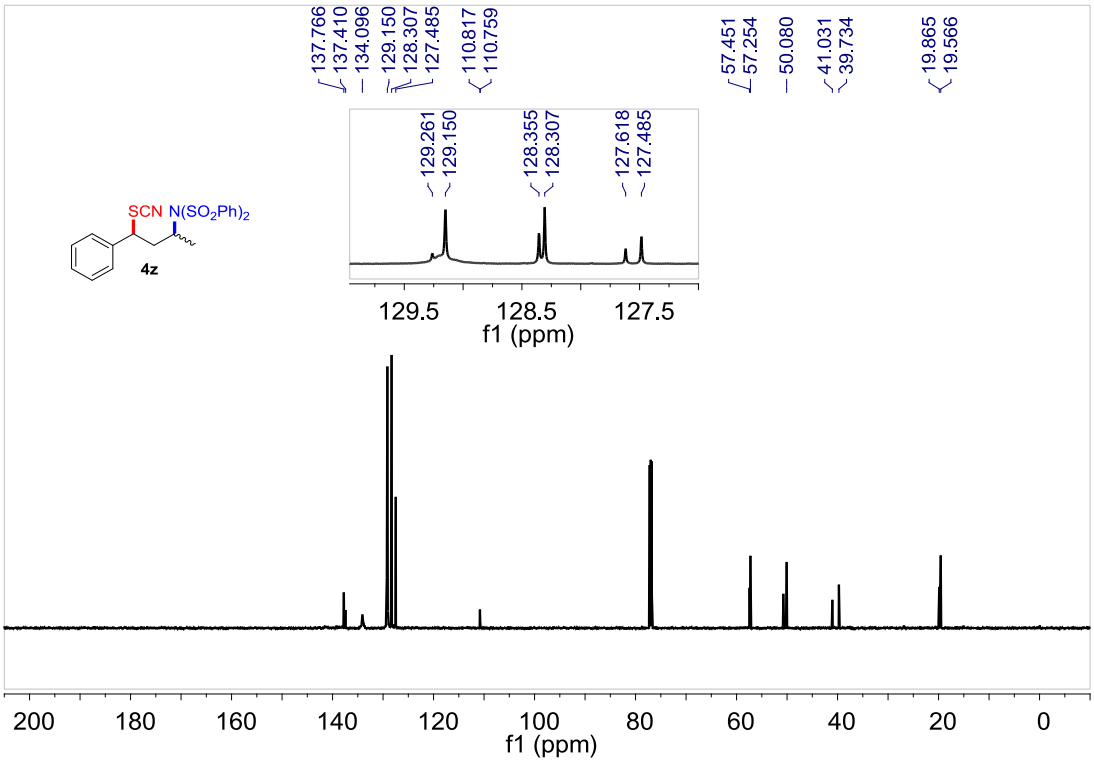
**Compound 4y**


SCN
S
N(SO2Ph)2
4y
7.979
7.966
7.964
7.559
7.338
7.337
7.333
7.332
7.264
7.107
7.105
7.099
7.097
4.475
4.462
4.449
3.773
3.697
3.672
3.647
2.660
2.651
2.646
2.642
2.637
2.627
2.623
2.613
2.563
2.555
2.552
2.548
2.543
2.540
2.537
2.532
2.528
2.525
4.00
2.01
0.98
1.00
1.07
1.05
1.05
1.07
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
f1 (ppm)

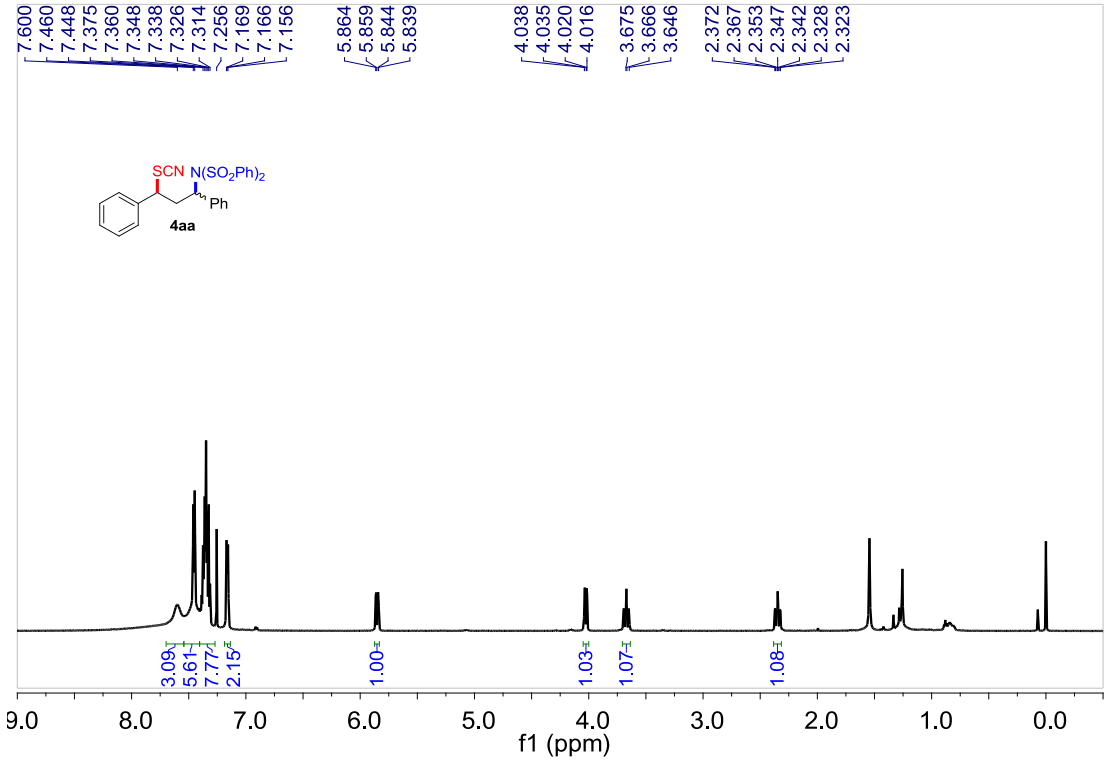

139.228
137.532
134.181
129.298
126.138
124.161
110.741
46.289
45.340
35.479
SCN
N(SO2Ph)2
S
4y
f1 (ppm)
200
180
160
140
120
100
80
60
40
20
0

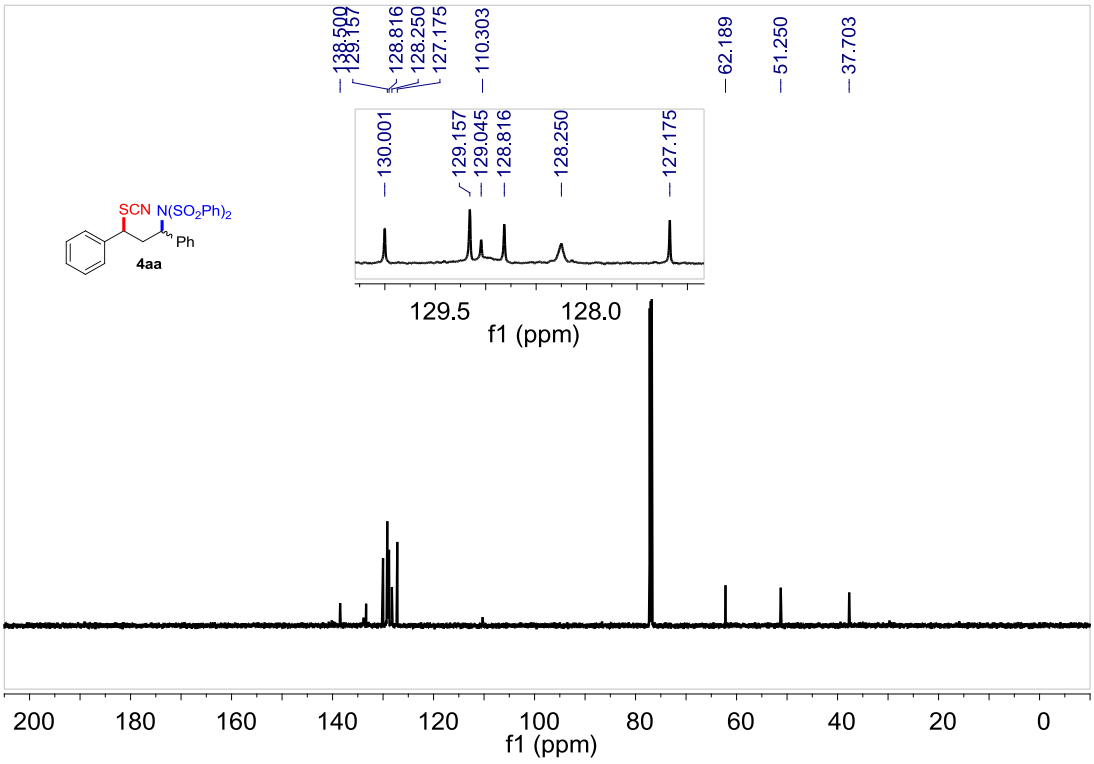
**Compound 4z**


7.906
7.893
7.571
7.513
7.419
7.390
7.355
7.291
7.234
4.243
4.231
4.222
4.209
4.198
4.189
4.183
4.174
4.145
4.134
4.123
4.111
2.971
2.816
2.780
2.732
2.708
2.680
2.656
2.631
1.322
1.310
1.277
1.266
SCN
N(SO2Ph)2
4z
4.19
3.25
3.03
3.08
5.41
1.14
2.22
2.58
0.57
1.00
0.57
0.55
1.01
3.14
1.60
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
f1 (ppm)

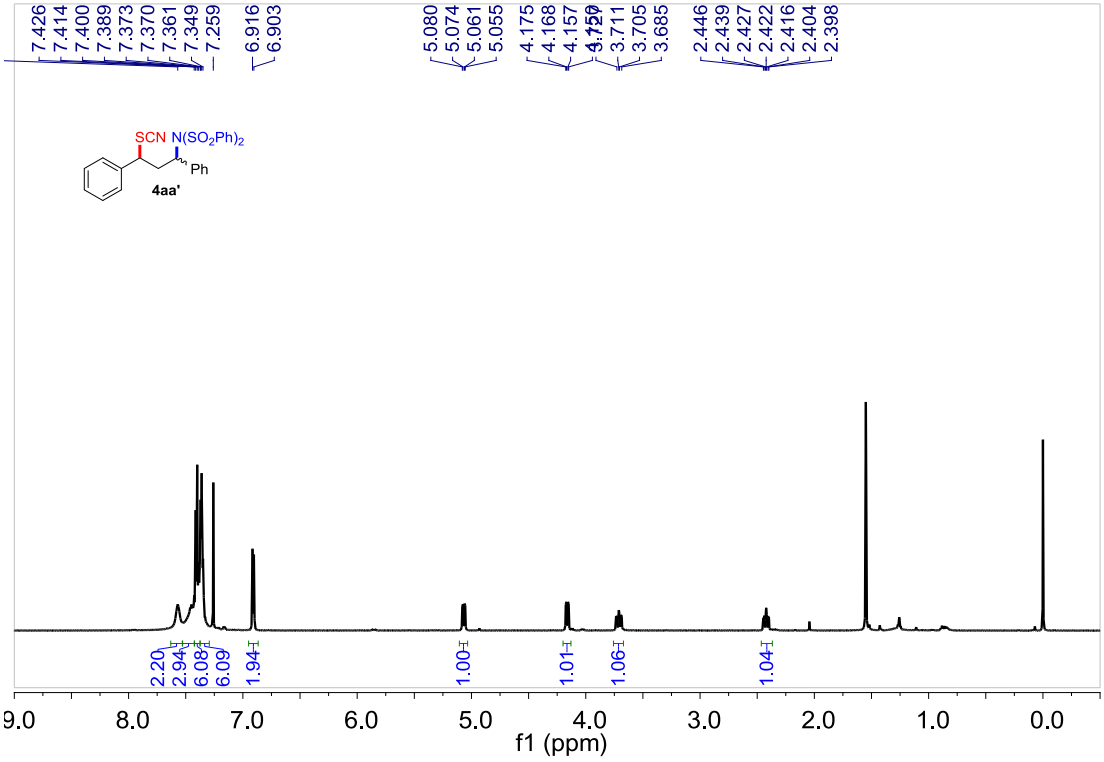


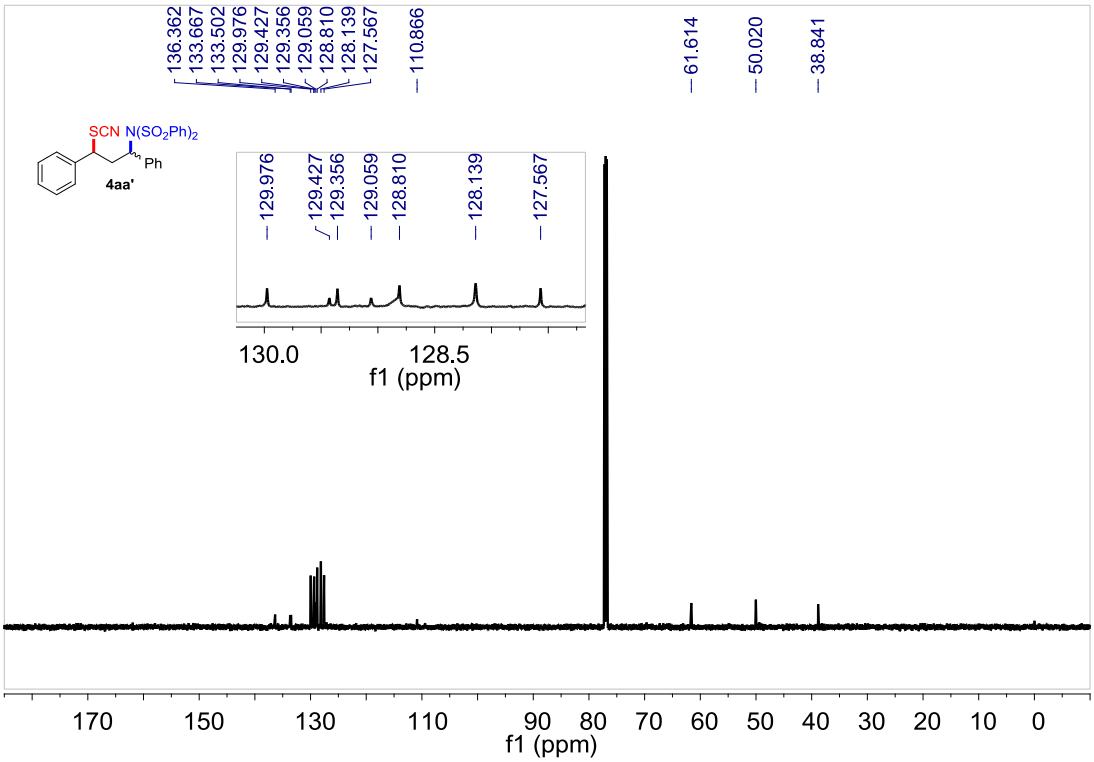

**Compound 4aa**



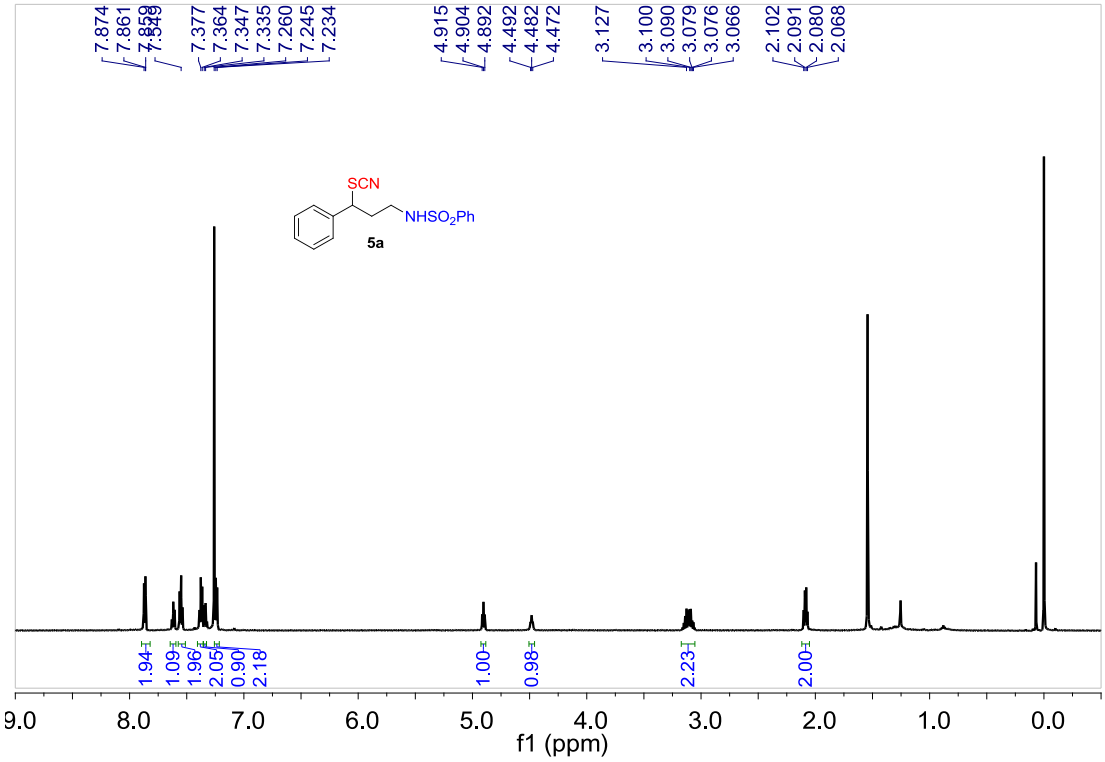



**Compound 4aa'**

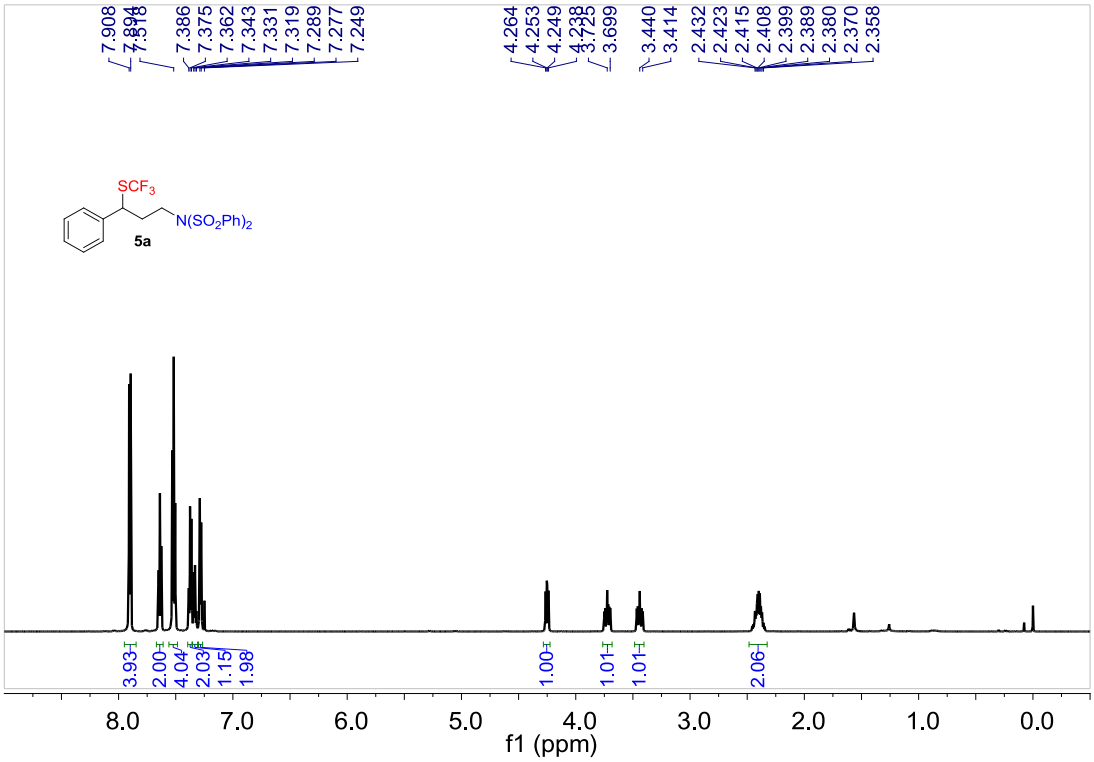


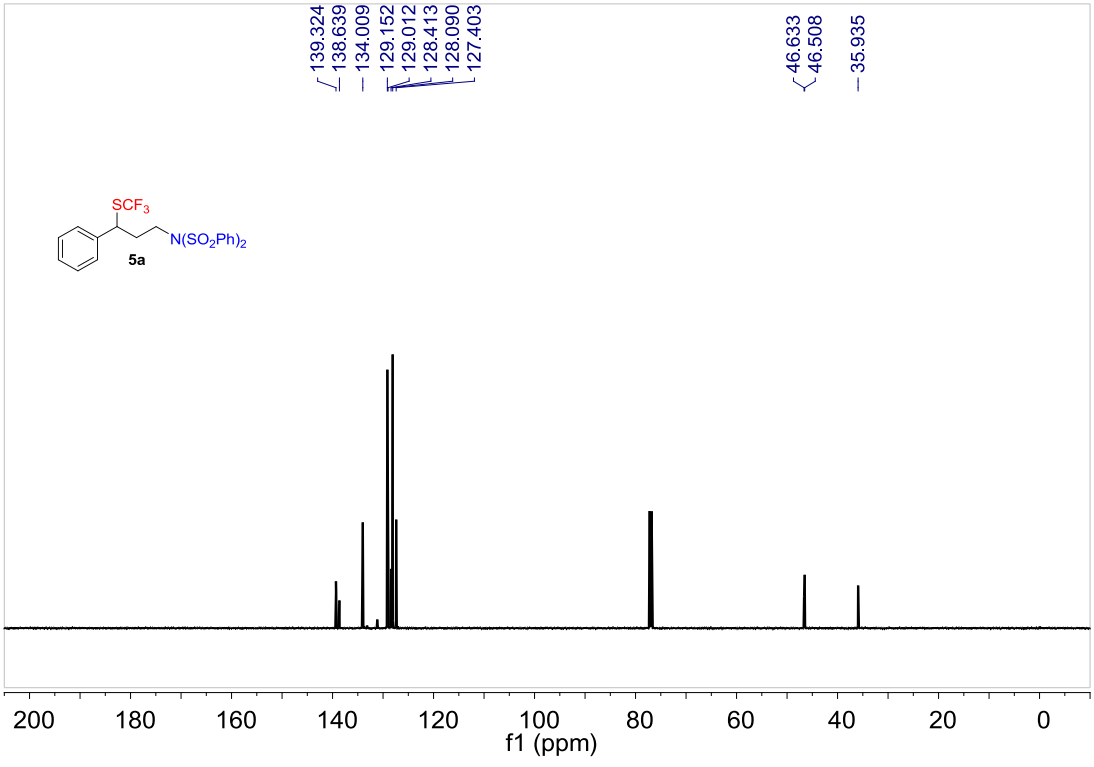

136.362
133.667
133.502
129.976
129.427
129.356
129.059
128.810
128.139
127.567
110.866
61.614
50.020
38.841
SCN N(SO2Ph)2
Ph
4aa'
129.976
129.427
129.356
129.059
128.810
128.139
127.567
130.0
128.5
f1 (ppm)
170
150
130
110
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

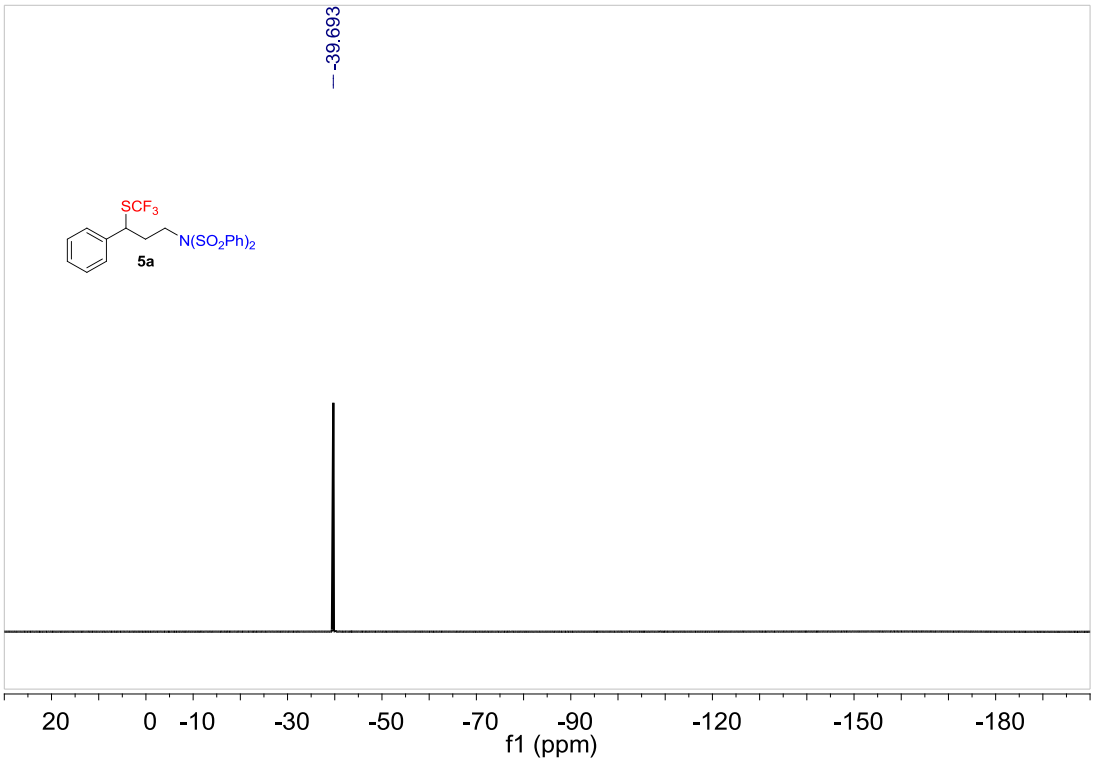
**Compound 5a**


7.874
7.861
7.377
7.364
7.347
7.335
7.260
7.245
7.234
4.915
4.904
4.892
4.492
4.482
4.472
3.127
3.100
3.090
3.079
3.076
3.066
2.102
2.091
2.080
2.068
SCN
NHSO2Ph
5a
1.94
1.09
1.96
2.05
0.90
2.18
1.00
0.98
2.23
2.00
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
f1 (ppm)

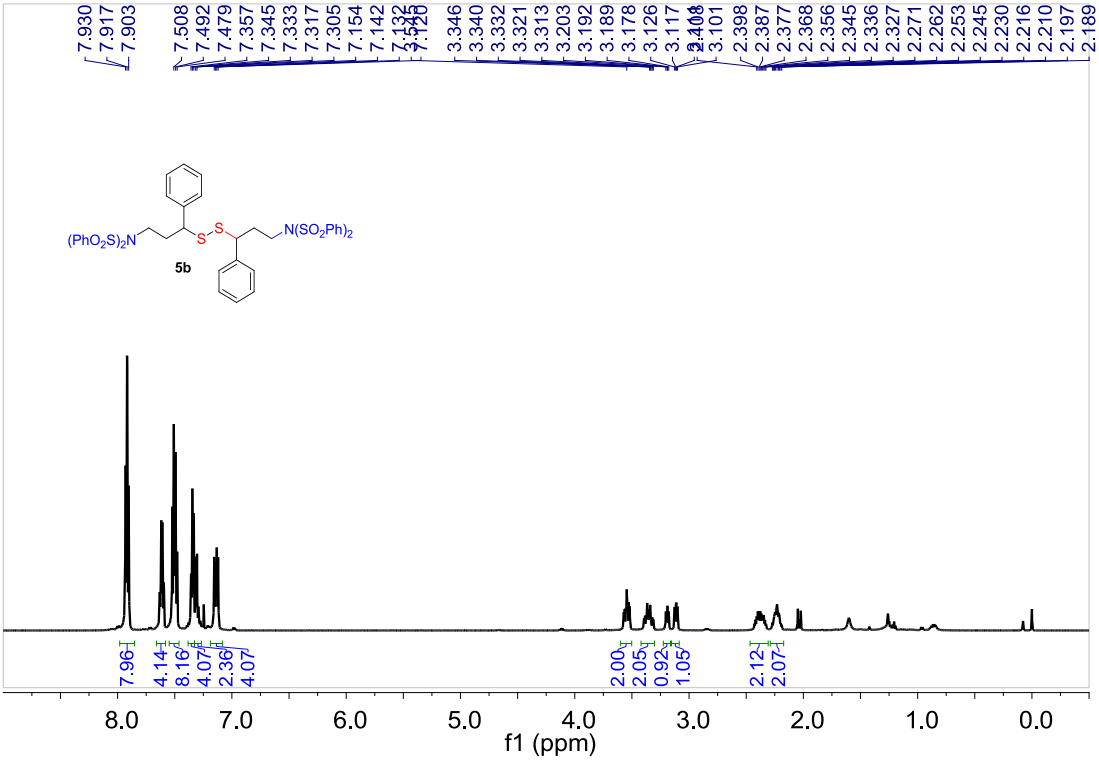
## Compound 5a

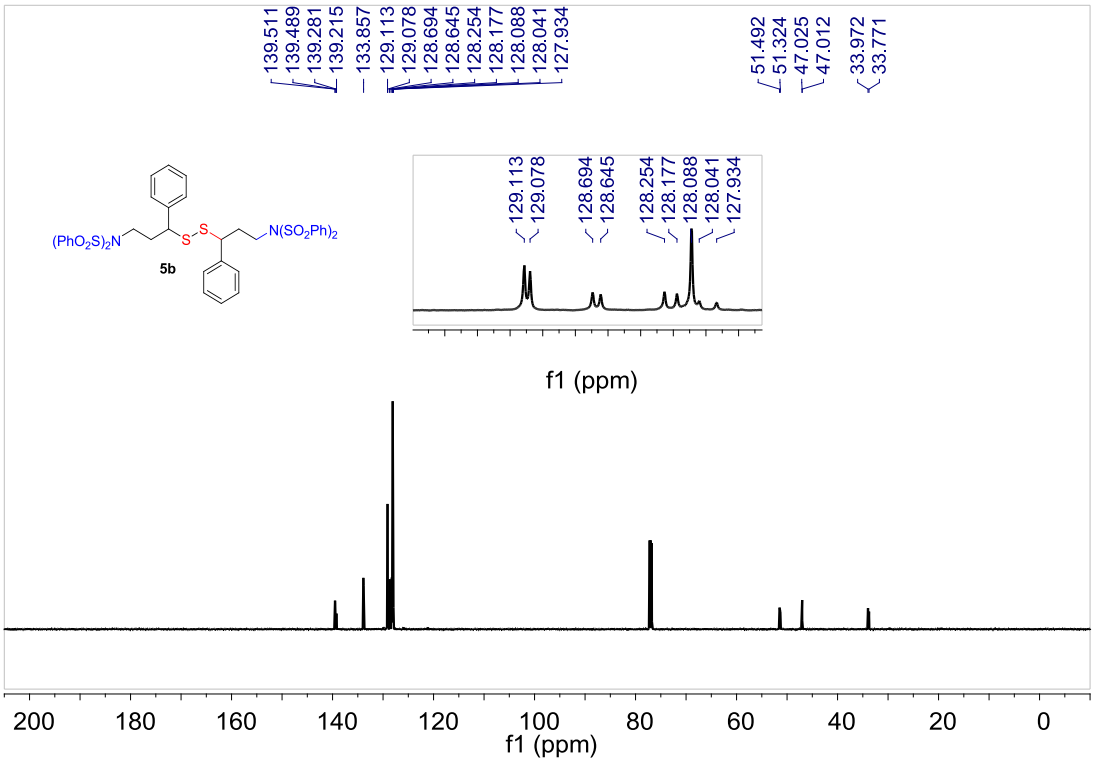

7.908
7.894
7.518
7.386
7.375
7.362
7.343
7.331
7.319
7.289
7.277
7.249
4.264
4.253
4.249
4.238
3.725
3.699
3.440
3.414
2.432
2.423
2.415
2.408
2.399
2.389
2.380
2.370
2.358
SCF3
N(SO2Ph)2
5a
3.93
2.00
4.04
2.03
1.15
1.98
1.00
1.01
1.01
2.06
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
f1 (ppm)


139.324
138.639
134.009
129.152
129.012
128.413
128.090
127.403
46.633
46.508
35.935
SCF3
N(SO2Ph)2
5a
200
180
160
140
120
100
80
60
40
20
0
f1 (ppm)


-39.693
SCF3
N(SO2Ph)2
5a
20
0
-10
-30
-50
-70
-90
-120
-150
-180
f1 (ppm)

**Compound 5b**


7.930
7.917
7.903
7.508
7.492
7.479
7.357
7.345
7.333
7.317
7.305
7.154
7.142
3.346
3.340
3.332
3.321
3.313
3.203
3.192
3.189
3.178
3.126
3.117
3.101
2.398
2.387
2.377
2.368
2.356
2.345
2.336
2.327
2.271
2.262
2.253
2.245
2.230
2.216
2.210
2.197
2.189
(PhO2S)2N
S
S
N(SO2Ph)2
5b
7.96
4.14
8.16
4.07
2.36
4.07
2.00
2.05
0.92
1.05
2.12
2.07
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
f1 (ppm)


139.511
139.489
139.281
139.215
133.857
129.113
129.078
128.694
128.645
128.254
128.177
128.088
128.041
127.934
51.492
51.324
47.025
47.012
33.972
33.771
(PhO2S)2N
S
S
N(SO2Ph)2
5b
129.113
129.078
128.694
128.645
128.254
128.177
128.088
128.041
127.934
f1 (ppm)
200
180
160
140
120
100
80
60
40
20
0
f1 (ppm)