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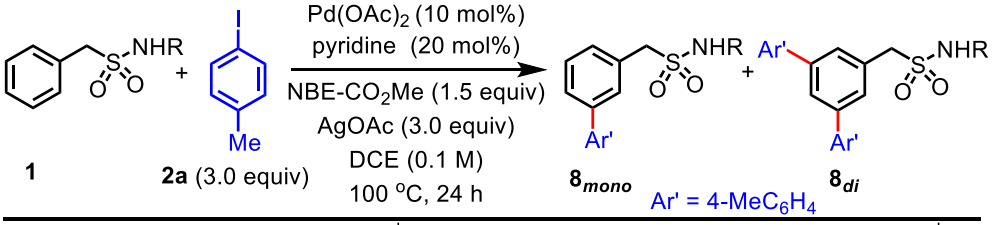
1. General Information

Solvents and chemicals were obtained from Sigma-Aldrich, Acros and Alfa Aesar and used directly without further purification. 2-Carbomethoxynorbornene (NBE-CO_2Me) was synthesized following the known procedure.[1] Analytical thin layer chromatography was performed on 0.25 mm silica gel 60-F254. Visualization was carried out with UV light and Vogel's permanganate. Preparative TLC was performed on 1.0 mm silica gel (Analtech). NMR spectra were recorded on a Varian Inova 400 instrument (400 MHz for ^{1}H; 100 MHz for ^{13}C), Bruker DRX-500 instrument (500 MHz for ^{1}H; 125 MHz for ^{13}C), Bruker DRX-600 instrument (600 MHz for ^{1}H; 150 MHz for ^{13}C). Chemical shifts were quoted in parts per million (ppm) referenced to 0.0 ppm for tetramethylsilane. The following abbreviations (or combinations thereof) were used to explain multiplicities: s = singlet, d = doublet, t = triplet, q = quartet, m = multiplet, br = broad. Coupling constants, J, were reported in Hertz unit (Hz). Chemical shifts were reported in ppm referenced to the center line at 77.0 ppm of chloroform-d, 29.84 ppm of acetone-d^6, 49.0 ppm of methanol-d^4 or 39.52 ppm of DMSO-d^6. High-resolution mass spectra (HRMS) were recorded on an Agilent Mass spectrometer using ESI-TOF (electrospray ionization-time of flight).

2. Experimental Section

2.1 Evaluation of Directing Groups for *meta*-Arylation of Benzylsulfonamides

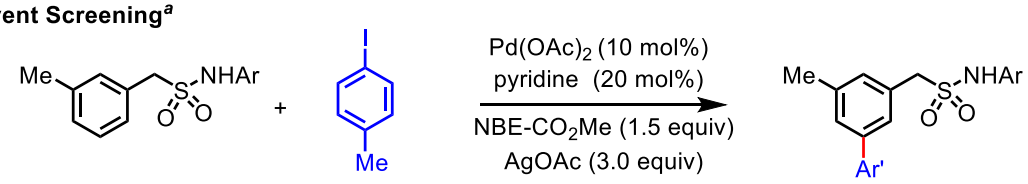


entry	R	yield (%)[b] mono	di	entry	R	yield (%)[b] mono	di
1	H	0	0	7	4-FC_6H_4	13	< 5
2	Me	0	0	8	4-$NO_2C_6H_4$	9	< 5
3	*i*-Pr	0	0	9	4-$CF_3C_6H_4$	15	< 5
4	*t*-Bu	0	0	10	C_6F_5	0	0
5	Ph	0	0	11	3,5-di$NO_2C_6H_3$	23	9
6	4-MeC_6H_4	0	0	12	3,5-di$CF_3C_6H_3$	34	16

[a]Reaction conditions: substrates **1** (0.1 mmol), **2a** (3.0 equiv), $Pd(OAc)_2$ (10 mol %), pyridine (20 mol%), NBE-CO_2Me (1.5 equiv), AgOAc (3.0 equiv), DCE (1.0 mL), 100 °C, 24 h. [b]The yields were determined by ^{1}H NMR analysis of the crude products using CH_2Br_2 as the internal standard.

2.2 Optimization Reaction Conditions

Solvent Screening[a]

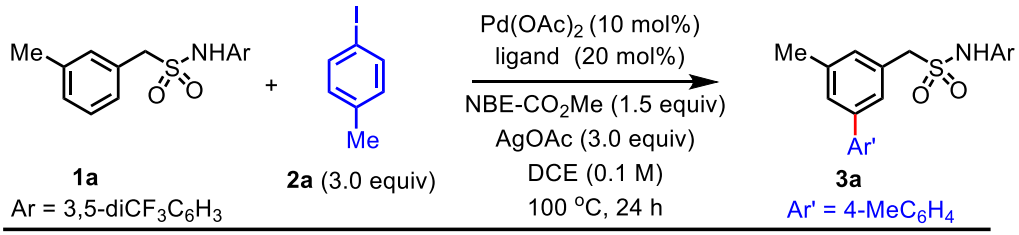


1a Ar = 3,5-di$CF_3C_6H_3$ | **2a** (3.0 equiv) | **3a** Ar' = 4-MeC_6H_4

entry	solvent	yield of (%)[b]
1	TBME	24
2	1,4-dioxane	25
3	toluene	10
4	DMF	0
5	DMSO	0
6	CH_3CN	0
7	CH_2Cl_2	21
8	$CHCl_3$	37
9	$ClCH_2CH_2Cl$	42
10	HFIP	0
11	t-*A*my-OH	0

[a]Reaction conditions: **1a** (0.1 mmol), **2a** (3.0 equiv), $Pd(OAc)_2$ (10 mol %), pyridine (20 mol%), NBE-CO_2Me (1.5 equiv), AgOAc (3.0 equiv), solvent (1 mL), 100 °C, 24 h. [b]The yields were determined by ^1H NMR analysis of the crude products using CH_2Br_2 as the internal standard.

Ligand Evaluation[a]



1a
Ar = 3,5-di$CF_3C_6H_3$

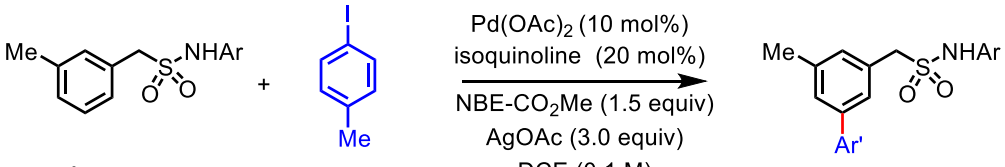
2a (3.0 equiv)

3a
Ar' = 4-MeC_6H_4

no ligand trace[b]	42%	69%	48%	23%
13%	20%	0%	45%	62%
53%	65%	32%	12%	trace
60%	65%	15%	38%	85%
54%	74%	71%	43%	
67%	37%	94%	75%	
48%	56%	65%	51%	

[a]Reaction conditions: **1a** (0.1 mmol), **2a** (3.0 equiv), $Pd(OAc)_2$ (10 mol %), ligand (20 mol%), NBE-CO_2Me (1.5 equiv), AgOAc (3.0 equiv), DCE (1 mL), 100 °C, 24 h. [b]The yields were determined by ^{1}H NMR analysis of the crude products using CH_2Br_2 as the internal standard.

Control experiments



1a
Ar = 3,5-di$CF_3C_6H_3$

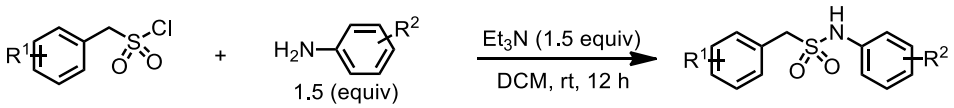
2a (3.0 equiv)

3a
Ar' = 4-MeC_6H_4

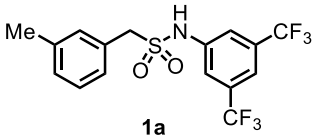
entry	deviation from standard conditions	yield of (%)[b]
1	none	94
2	2.0 equiv AgOAc	89
3	without AgOAc	<5
4	CsOAc instead of AgOAc	12
5	2.0 equiv **2a**	87
6	1.0 equiv NBE-CO_2Me	90
7	norbornene instead of NBE-CO_2Me	31
8	110 °C	93
9	90 °C	91
10	5 mol% $Pd(OAc)_2$, 10 mol% isoquinoline	77

[a]Reaction conditions: **1a** (0.1 mmol), **2a** (3.0 equiv), $Pd(OAc)_2$ (10 mol %), isoquinoline (20 mol%), NBE-CO_2Me (1.5 equiv), AgOAc (3.0 equiv), DCE (1 mL), 100 °C, 24 h. [b]The yields were determined by ^{1}H NMR analysis of the crude products using CH_2Br_2 as the internal standard.

2.3 General Procedure for Synthesis of Benzylsulfonamide Substrates.



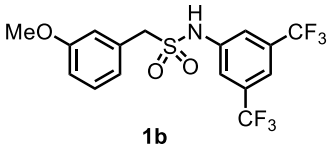
General procedure for synthesis of benzylsulfonamide:[2] benzylsulfonyl chloride (1.0 mmol) was added to a solution of aniline (1.5 mmol) and Et_3N (151.5 mg, 1.5 mmol) in dry dichloromethane (5.0 mL) at room temperature. Then, the solution was stirred for 12 hours. After the reaction finished, the organic layer was washed with saturated aqueous sodium bicarbonate (10.0 mL), dried over sodium sulfate, filtered and concentrated. The residue was purified by column chromatography (ethyl acetate/hexane = 1/4) to yield the desired benzylsulfonamindes.



1a

***N*-(3,5-Bis(trifluoromethyl)phenyl)-1-(*m*-tolyl)methanesulfonamide (1a)**

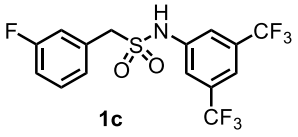
1a was obtained as white solid (361.3 mg, 91%);^{1}H NMR (500 MHz, $CDCl_3$) δ 7.56 (s, 1H), 7.38 (s, 2H), 7.23 (s, 1H), 7.19–7.10 (m, 2H), 7.06–7.01 (m, 2H), 4.36 (s, 2H), 2.23 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 139.10, 139.03, 132.78 (q, *J* = 33.7 Hz), 131.40, 130.28, 128.99, 127.87, 127.12, 122.76 (q, *J* = 273.0 Hz), 118.87 (q, *J* = 3.2 Hz), 117.91–117.68 (m), 59.53, 20.95; HRMS (ESI-TOF) Calcd for $C_{16}H_{12}F_6NO_2S^-$[M-H]$^-$: 396.0498; found: 396.0500.



1b

***N*-(3,5-Bis(trifluoromethyl)phenyl)-1-(3-methoxyphenyl)methanesulfonamide (1b)**

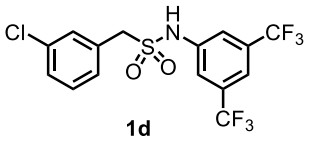
1b was obtained as white solid (392.6 mg, 95%); ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.57 (s, 1H), 7.38 (s, 2H), 7.24–7.20 (m, 1H), 6.89–6.86 (m, 1H), 6.82–6.79 (m, 2H), 6.74 (s, 1H), 4.39 (s, 2H), 3.74 (s, 3H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 160.03, 138.84, 132.84 (q, *J* = 33.9 Hz), 130.16, 128.71, 122.94, 122.73 (q, *J* = 272.9 Hz), 119.10 (q, *J* = 3.3 Hz, 2H), 118.10–117.84 (m), 116.42, 114.88, 59.53, 55.19; HRMS (ESI-TOF) Calcd for $C_{16}H_{12}F_6NO_3S^-$[M-H]$^-$: 412.0448; found: 412.0448.



1c

***N*-(3,5-Bis(trifluoromethyl)phenyl)-1-(3-fluorophenyl)methanesulfonamide (1c)**

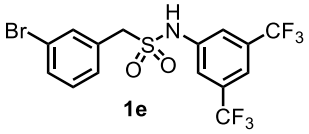
1c was obtained as white solid (341.0 mg, 85%);^{1}H NMR (400 MHz, $CDCl_3$) δ 7.60 (s, 1H), 7.41 (s, 2H), 7.33–7.26 (m, 1H), 7.10–7.00 (m, 4H), 4.42 (s, 2H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 162.77 (d, *J* = 248.8 Hz), 138.63, 132.96 (q, *J* = 33.9 Hz), 130.71 (d, *J* = 8.4 Hz), 129.53 (d, *J* = 7.8 Hz), 126.53 (d, *J* = 3.1 Hz), 122.67 (q, *J* = 273.0 Hz), 119.05 (q, *J* = 3.1 Hz), 118.25–118.02 (m), 117.83 (d, *J* = 22.3 Hz), 116.67 (d, *J* = 20.9 Hz), 58.98; ^{19}F NMR (376 MHz, $CDCl_3$) δ -63.41, -111.57; HRMS (ESI-TOF) Calcd for $C_{15}H_9F_7NO_2S^-$[M-H]$^-$: 400.0248; found: 400.0249.



1d

***N*-(3,5-Bis(trifluoromethyl)phenyl)-1-(3-chlorophenyl)methanesulfonamide (1d)**

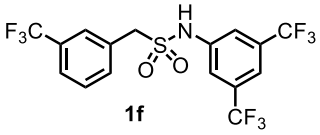
1d was obtained as white solid (380.1 mg, 91%); ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.52 (s, 1H), 7.80 (s, 2H), 7.67 (s, 1H), 7.41 (s, 1H), 7.37–7.28 (m, 3H), 4.72 (s, 2H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 139.13, 134.90, 132.79 (q, *J* = 33.6 Hz), 130.88, 130.22, 129.54, 129.38, 129.02, 122.75 (q, *J* = 273.1 Hz), 118.98 (q, *J* = 3.2 Hz), 117.99–117.77 (m), 58.97; HRMS (ESI-TOF) Calcd for $C_{15}H_9ClF_6NO_2S^-$[M-H]$^-$: 415.9952; found: 415.9951.



1e

***N*-(3,5-Bis(trifluoromethyl)phenyl)-1-(3-bromophenyl)methanesulfonamide (1e)**

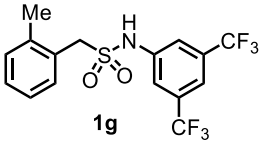
1e was obtained as white solid (315.9 mg, 90%); ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.60 (s, 1H), 7.50–7.44 (m, 3H), 7.40 (s, 1H), 7.25–7.18 (m, 3H), 4.39 (s, 2H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 138.77, 133.70, 133.01 (q, *J* = 33.9 Hz), 132.62, 130.56, 129.60, 129.44, 122.97, 122.70 (q, *J* = 273.0 Hz), 119.03 (q, *J* = 3.1 Hz), 118.42–117.99 (m), 58.81; HRMS (ESI-TOF) Calcd for $C_{15}H_9BrF_6NO_2S^-$[M-H]$^-$: 459.9447; found: 459.9450.



1f

***N*-(3,5-Bis(trifluoromethyl)phenyl)-1-(3-(trifluoromethyl)phenyl)methanesulfonamide (1f)**

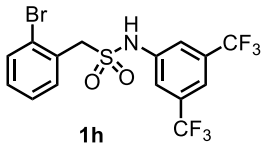
1f was obtained as white solid (392.6 mg, 87%); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.66–7.57 (m, 2H), 7.56–7.44 (m, 3H), 7.41 (s, 2H), 7.07 (s, 1H), 4.49 (s, 2H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 138.55, 134.23, 133.09 (q, *J* = 33.9 Hz), 131.65 (q, *J* = 32.9 Hz), 129.73, 128.57, 127.45 (q, *J* = 3.5 Hz), 126.34 (q, *J* = 3.5 Hz), 123.33 (q, *J* = 272.6 Hz), 122.61 (q, *J* = 272.9 Hz), 118.79 (q, *J* = 3.3 Hz), 118.43–118.08 (m), 58.93; ^{19}F NMR (376 MHz, $CDCl_3$) δ -63.35, -63.49; HRMS (ESI-TOF) Calcd for $C_{16}H_9F_9NO_2S^-$[M-H]$^-$: 450.0216; found: 450.0218.



1g

***N*-(3,5-Bis(trifluoromethyl)phenyl)-1-(o-tolyl)methanesulfonamide (1g)**

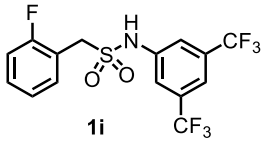
1g was obtained as white solid (349.3 mg, 88%); ^{1}H NMR (400 MHz, Acetone-d^6) δ 9.42 (s, 1H), 7.74 (s, 2H), 7.64 (s, 1H), 7.27 (d, *J* = 7.5 Hz, 1H), 7.22–7.13 (m, 2H), 7.13–7.05 (m, 1H), 4.71 (s, 2H), 2.41 (s, 3H); ^{13}C NMR (125 MHz, Acetone-d^6) δ 141.93, 139.39, 133.20, 132.88 (q, *J* = 33.3 Hz), 131.55, 129.89, 128.04, 124.19 (q, *J* = 272.2 Hz) 127.14–126.79 (m), 119.03 (q, *J* = 3.7 Hz), 117.30–116.97 (m), 57.56, 19.64; HRMS (ESI-TOF) Calcd for $C_{16}H_{12}F_6NO_2S^-$[M-H]$^-$: 396.0498; found: 396.0501.



1h

***N*-(3,5-Bis(trifluoromethyl)phenyl)-1-(2-bromophenyl)methanesulfonamide (1h)**

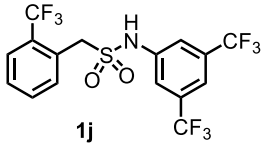
1h was obtained as white solid (383.6 mg, 83%);^{1}H NMR (400 MHz, Acetone-d^{6}) δ 7.78 (s, 2H), 7.66–7.58 (m, 2H), 7.50 (d, *J* = 8.0 Hz, 1H), 7.36 (t, *J* = 7.4 Hz, 1H), 7.33–7.13 (m, 2H), 4.87 (s, 2H); ^{13}C NMR (100 MHz, Acetone-d^{6}) δ 141.56, 134.37, 133.93, 132.73 (q, *J* = 33.3 Hz), 131.66, 129.51, 128.76, 126.23, 124.14 (q, *J* = 272.1 Hz), 118.84 (q, *J* = 3.3 Hz), 117.29–116.96 (m), 59.43; HRMS (ESI-TOF) Calcd for $C_{15}H_9BrF_6NO_2S^-$[M-H]$^-$: 459.9447; found: 459.9447.



1i

***N*-(3,5-Bis(trifluoromethyl)phenyl)-1-(2-fluorophenyl)methanesulfonamide (1i)**

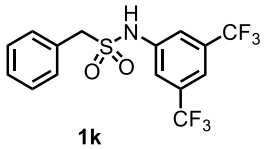
1i was obtained as white solid (333.0 mg, 83%);^{1}H NMR (400 MHz, $CDCl_3$) δ 7.55 (s, 1H), 7.46–7.37 (m, 3H), 7.34–7.26 (m, 1H), 7.13 (t, *J* = 7.5 Hz, 1H), 7.04 (s, 1H), 6.94 (t, *J* = 9.1 Hz, 1H), 4.52 (s, 2H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 160.99 (d, *J* = 249.3 Hz), 138.67, 132.69 (q, *J* = 33.8 Hz), 132.68 (d, *J* = 2.5 Hz), 131.75 (d, *J* = 8.4 Hz), 124.86 (d, *J* = 3.6 Hz), 122.73 (q, *J* = 273.0 Hz), 118.74 (q, *J* = 3.1 Hz), 118.02–117.80 (m), 115.76 (d, *J* = 21.3 Hz), 115.07 (d, *J* = 14.5 Hz), 52.67 (d, *J* = 2.8 Hz); ^{19}F NMR (376 MHz, $CDCl_3$) δ -63.39, -116.95; HRMS (ESI-TOF) Calcd for $C_{15}H_9F_7NO_2S^-$[M-H]$^-$: 400.0248; found: 400.0251.



1j

***N*-(3,5-Bis(trifluoromethyl)phenyl)-1-(2-(trifluoromethyl)phenyl)methanesulfonamide (1j)**

1j was obtained as white solid (383.6 mg, 85%); ^{1}H NMR (400 MHz, Acetone-d_6) δ 9.64 (s, 1H), 7.83–7.76 (m, 3H), 7.76–7.61 (m, 3H), 7.57 (t, *J* = 7.6 Hz, 1H), 4.88 (s, 2H); ^{13}C NMR (100 MHz, Acetone-d^{6}) δ 141.50, 134.84, 133.21 (d, *J* = 0.9 Hz), 132.97 (q, *J* = 33.3 Hz), 130.30, 130.25 (q, *J* = 30.0 Hz), 127.84–127.69 (m), 127.47 (q, *J* = 5.5 Hz), 125.10 (q, *J* = 273.6 Hz), 124.13 (q, *J* = 272.2 Hz), 119.39 (q, *J* = 3.5 Hz), 117.90–117.12 (m), 56.46; ^{19}F NMR (376 MHz, Acetone-d^{6}) δ -58.73, -63.99; HRMS (ESI-TOF) Calcd for $C_{16}H_9F_9NO_2S^-$[M-H]$^-$: 450.0216; found: 450.0218.

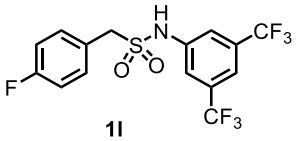


1k

***N*-(3,5-Bis(trifluoromethyl)phenyl)-1-phenylmethanesulfonamide (1k)**

1k was obtained as white solid (367.1 mg, 96%); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.56 (s, 1H), 7.37 (s, 2H), 7.35–7.27 (m, 4H), 7.26–7.23 (m, 2H), 4.41 (s, 2H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 138.89, 132.80 (q, *J* = 33.7 Hz),

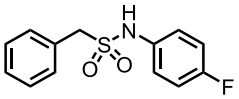
130.81, 129.56, 129.10, 127.28, 122.74 (q, J = 272.9 Hz), 118.93 (q, J = 3.2 Hz), 117.92–117.76 (m), 59.56; HRMS (ESI-TOF) Calcd for $C_{15}H_{10}F_6NO_2S^-$[M-H]$^-$: 382.0342; found: 382.0341.



1l

***N*-(3,5-Bis(trifluoromethyl)phenyl)-1-(4-fluorophenyl)methanesulfonamide (1l)**

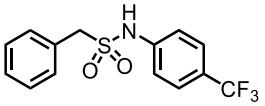
1l was obtained as white solid (361.0 mg, 90%); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.60 (s, 1H), 7.38 (s, 2H), 7.29–7.22 (m, J = 8.4, 5.4 Hz, 2H), 7.02 (t, J = 8.5 Hz, 2H), 6.89 (s, 1H), 4.41 (s, 2H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 163.39 (d, J = 250.7 Hz), 138.65, 132.97 (q, J = 33.9 Hz), 132.66 (d, J = 8.5 Hz), 123.30 (d, J = 3.3 Hz), 122.67 (q, J = 272.9 Hz), 119.00 (q, J = 3.4 Hz), 118.22–117.91 (m), 116.27 (d, J = 21.9 Hz), 58.69; ^{19}F NMR (376 MHz, $CDCl_3$) δ -63.44, -111.26; HRMS (ESI-TOF) Calcd for $C_{15}H_9F_7NO_2S^-$[M-H]$^-$: 400.0248; found: 400.0248.



1m

***N*-(4-fluorophenyl)-1-phenylmethanesulfonamide (1m)**

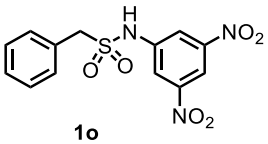
1m was obtained as colorless crystal (238.5 mg, 90%); ^{1}H NMR (400 MHz, $CDCl_3$) δ7.41–7.33 (m, 3H), 7.32–7.26 (m, 2H), 7.14–7.07 (m, 2H), 7.07–7.00 (m, 2H), 6.28 (s, 1H), 4.30 (s, 2H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 160.09 (d, J = 244.8 Hz), 132.72 (d, J = 2.7 Hz), 130.76, 128.97, 128.85, 128.28, 122.53 (d, J = 8.0 Hz), 116.25 (d, J = 22.9 Hz), 57.55; HRMS (ESI-TOF) Calcd for $C_{13}H_{11}FNO_2S^-$[M-H]$^-$: 264.0500; found264.0503.



1n

1-Phenyl-*N*-(4-(trifluoromethyl)phenyl)methanesulfonamide (1n)

1n was obtained as colorless crystal (293.2 mg, 93%); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.55 (d, J = 8.5 Hz, 2H), 7.36–7.27 (m, 3H), 7.36–7.27 (m, 5H), 4.34 (s, 2H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 140.38, 130.78, 129.19, 128.94, 127.90, 126.79 (q, J = 3.7 Hz), 126.35 (q, J = 32.9 Hz), 123.92 (q, J = 271.6 Hz), 118.56, 58.20; HRMS (ESI-TOF) Calcd for $C_{14}H_{11}F_3NO_2S^-$[M-H]$^-$: 314.0468; found: 314.0469.

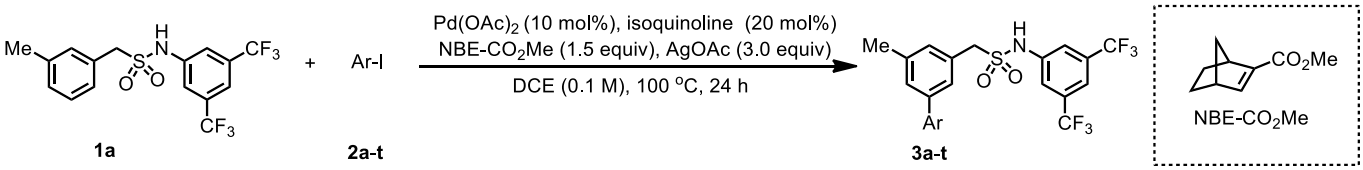


1o

***N*-(3,5-Dinitrophenyl)-1-phenylmethanesulfonamide (1o)**

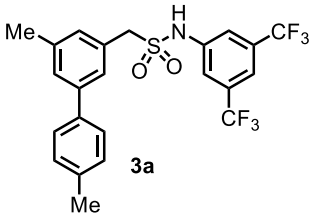
1o was obtained as yellow powder (300.0 mg, 89%);^{1}H NMR (500 MHz, DMSO-d^6) δ 10.94 (s, 1H), 8.41 (t, J = 2.0 Hz, 1H), 8.16 (d, J = 2.0 Hz, 2H), 7.35–7.22 (m, 5H), 4.74 (s, 2H); ^{13}C NMR (125 MHz, DMSO-d^6) δ 148.39, 141.27, 131.17, 128.59, 128.49, 117.29, 111.79, 58.29; HRMS (ESI-TOF) Calcd for $C_{13}H_{10}N_3O_6S^-$[M-H]$^-$: 336.0296; found: 336.0301.

2.4 General Procedure for the *meta*-C–H Arylation/Alkylation of Benzylsulfonamides.



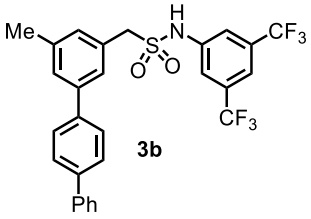
To a 10 mL sealed tube were added substrate **1a** (38.4 mg, 0.1 mmol), $Pd(OAc)_2$ (2.2 mg, 0.01 mmol), and AgOAc (50.0 mg, 0.3 mmol), isoquinoline (2.6 mg, 0.02 mmol, 2.4 μL), NBE-CO_2Me (22.8 mg, 0.15 mmol), aryl halide **2a-t** (0.3 mmol), and DCE (1.0 mL). The reaction mixture was heated to 100 °C for 24 hours under vigorous stirring. Upon completion, the reaction mixture was cooled to room temperature, diluted with ethyl acetate, and filtered through a pad of Celite. The filtrate was concentrated under vacuum, and the resulting residue was purified by preparative TLC using an eluent of ethyl acetate/hexanes (1/4) to give the desired products **3a-t**.

All remaining products 4a-h, 5a-l, and 7a-h were prepared using a procedure similar to that used to synthesize 3a-t.



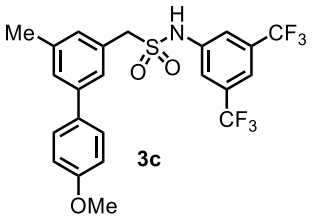
***N*-(3,5-Bis(trifluoromethyl)phenyl)-1-(4',5-dimethyl-[1,1'-biphenyl]-3-yl)methanesulfonamide (3a)**

3a was obtained as white solid (43.8 mg, 90%); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.51 (s, 1H), 7.38 (s, 2H), 7.34 (s, 1H), 7.26 (d, *J* = 8.0 Hz, 2H), 7.22 (s, 1H), 7.19 (s, 1H), 7.15 (d, *J* = 7.9 Hz, 2H), 6.93 (s, 1H), 4.38 (s, 2H), 2.35 (s, 3H), 2.29 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 142.19, 139.48, 139.09, 137.56, 136.82, 132.80 (q, *J* = 33.7 Hz), 129.93, 129.48, 128.77, 127.66, 126.68, 126.43, 122.72 (q, *J* = 273.1 Hz), 118.54 (q, *J* = 3.2 Hz), 117.81–117.60 (m), 59.26, 21.06, 21.00; HRMS (ESI-TOF) Calcd for $C_{23}H_{18}F_6NO_2S^-$[M-H]$^-$: 486.0968; found: 486.0972.



***N*-(3,5-Bis(trifluoromethyl)phenyl)-1-(5-methyl-[1,1':4',1''-terphenyl]-3-yl)methanesulfonamide (3b)**

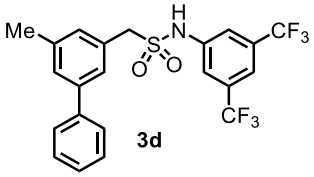
3b was obtained as white solid (48.3 mg, 88%); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.62–7.55 (m, 4H), 7.51 (s, 1H), 7.47–7.42 (m, 4H), 7.42–7.33 (m, 4H), 7.27–7.23 (m, 2H), 6.98 (s, 1H), 4.41 (s, 2H), 2.31 (s, 3H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 141.74, 140.57, 140.44, 139.64, 139.04, 138.56, 132.83 (q, *J* = 33.7 Hz), 130.29, 128.87, 128.82, 127.77), 127.48, 127.46, 127.21, 127.00, 126.53, 122.70 (q, *J* = 273.1 Hz), 118.55 (q, *J* = 3.2 Hz), 117.85–117.74 (m), 59.29, 21.11; HRMS (ESI-TOF) Calcd for $C_{28}H_{20}F_6NO_2S^-$[M-H]$^-$: 548.1124; found: 548.1125.



3c

***N*-(3,5-Bis(trifluoromethyl)phenyl)-1-(4'-methoxy-5-methyl-[1,1'-biphenyl]-3-yl)methanesulfonamide (3c)**

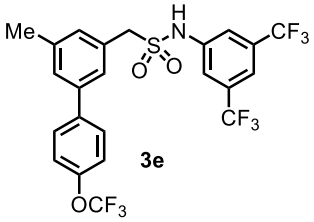
3c was obtained as white solid (35.7 mg, 71%); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.52 (s, 1H), 7.38 (s, 2H), 7.34–7.28 (m, 3H), 7.17 (s, 2H), 6.91 (s, 1H), 6.88 (d, *J* = 8.6 Hz, 2H), 4.38 (s, 2H), 3.82 (s, 3H), 2.29 (s, 3H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 159.45, 141.87, 139.48, 139.03, 132.83 (q, *J* = 33.6 Hz), 132.23 129.61, 128.56, 127.93, 127.69, 126.18, 122.71 (q, *J* = 273.1 Hz), 118.66 (q, *J* = 3.0 Hz), 117.92–117.75 (m), 114.22, 59.33, 55.30, 21.10; HRMS (ESI-TOF) Calcd for $C_{23}H_{18}F_6NO_3S^-$[M-H]$^-$: 502.0917; found: 502.0917.



3d

***N*-(3,5-Bis(trifluoromethyl)phenyl)-1-(5-methyl-[1,1'-biphenyl]-3-yl)methanesulfonamide (3d)**

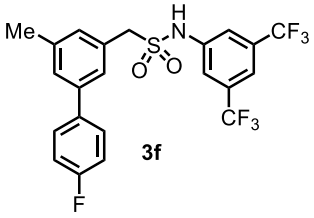
3d was obtained as white solid (43.0 mg, 91%); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.52 (s, 1H), 7.41–7.28 (m, 8H), 7.22 (s, 1H), 7.10 (s, 1H), 6.98 (s, 1H), 4.41 (s, 2H), 2.31 (s, 3H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 142.30, 139.74, 139.56, 139.01, 132.85 (q, *J* = 33.8 Hz), 130.22, 129.04, 128.78, 127.74), 127.72, 126.88, 126.64, 122.70 (q, *J* = 273.1 Hz), 118.62 (q, *J* = 3.2 Hz), 117.90–117.78 (m), 59.31, 21.09; HRMS (ESI-TOF) Calcd for $C_{22}H_{16}F_6NO_2S^-$ [M-H]$^-$: 472.0811; found: 472.0814.



3e

***N*-(3,5-Bis(trifluoromethyl)phenyl)-1-(5-methyl-4'-(trifluoromethoxy)-[1,1'-biphenyl]-3-yl)methane-sulfonamide (3e)**

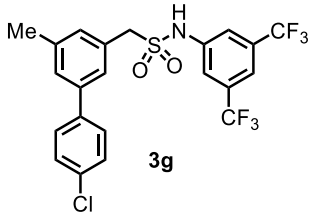
3e was obtained as white solid (29.0 mg, 52%); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.52 (s, 1H), 7.41–7.34 (m, 4H), 7.32 (s, 1H), 7.23–7.11 (m, 4H), 7.00 (s, 1H), 4.41 (s, 2H), 2.31 (s, 3H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 148.90, 140.86, 139.83, 139.01, 138.41, 132.87 (q, *J* = 33.7 Hz), 130.60, 128.97, 128.20, 127.86, 126.60, 122.64 (q, *J* = 273.0 Hz), 121.21, 120.61 (q, *J* = 204.1 Hz), 118.42 (q, *J* = 3.3 Hz), 117.88–117.69 (m), 59.18, 21.05; ^{19}F NMR (376 MHz, $CDCl_3$) δ -58.21, -63.44; HRMS (ESI-TOF) Calcd for $C_{23}H_{15}F_9NO_3S^-$[M-H]$^-$: 556.0634; found: 556.0638.



3f

***N*-(3,5-Bis(trifluoromethyl)phenyl)-1-(4'-fluoro-5-methyl-[1,1'-biphenyl]-3-yl)methanesulfonamide (3f)**

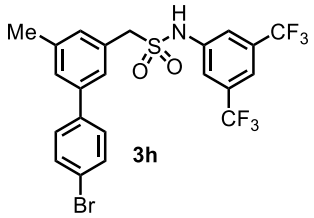
3f was obtained as white solid (40.3 mg, 82%); ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.54 (s, 1H), 7.40–7.35 (m, 4H), 7.33 (s, 1H), 7.20 (s, 1H), 7.10–7.05 (m,2H), 7.01 (s, 1H), 6.86 (s, 1H), 4.43 (s, 2H), 2.34 (s, 3H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 162.69 (d, *J* = 247.4 Hz), 141.30, 139.65, 138.99, 135.94, 132.88 (q, *J* = 33.8 Hz), 130.26, 128.90, 128.54 (d, *J* = 8.1 Hz), 127.94, 126.53, 122.68 (q, *J* = 273.4 Hz), 118.80 (q, *J* = 3.2 Hz), 117.98–117.84 (m), 59.40, 21.11; ^{19}F NMR (376 MHz, $CDCl_3$) δ -63.36, -115.15; ^{19}F NMR (376 MHz, $CDCl_3$) δ -63.36, -115.15; HRMS (ESI-TOF) Calcd for $C_{22}H_{15}F_7NO_2S^-$[M-H]$^-$: 490.0717; found: 490.0720.



3g

***N*-(3,5-Bis(trifluoromethyl)phenyl)-1-(4'-chloro-5-methyl-[1,1'-biphenyl]-3-yl)methanesulfonamide (3g)**

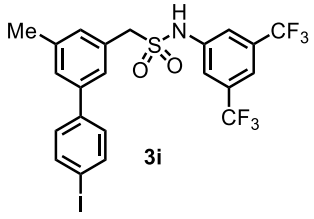
3g was obtained as white solid (46.1 mg, 91%); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.55 (s, 1H), 7.40–7.32 (m, 7H), 7.22 (s, 1H), 7.03 (s, 1H), 6.74 (s, 1H), 4.44 (s, 2H), 2.34 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 141.04, 139.77, 139.03, 138.15, 133.89, 132.87 (q, *J* = 33.7 Hz), 130.52, 128.93, 128.83, 128.09, 127.85, 126.46, 122.68 (q, *J* = 273.1 Hz), 118.48 (q, *J* = 3.3 Hz), 117.87–117.73 (m), 59.26, 21.04; HRMS (ESI-TOF) Calcd for $C_{22}H_{15}ClF_6NO_2S^-$ [M-H]$^-$: 506.0422; found: 506.0422.



3h

***N*-(3,5-Bis(trifluoromethyl)phenyl)-1-(4'-bromo-5-methyl-[1,1'-biphenyl]-3-yl)methanesulfonamide (3h)**

3h was obtained as white solid (50.2 mg, 91%); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.55 (s, 1H), 7.50 (d, *J* = 8.4 Hz, 2H), 7.37 (s, 2H), 7.33 (s, 1H), 7.27 (d, *J* = 8.4 Hz, 2H), 7.21 (s, 1H), 7.01 (s, 1H), 6.85 (s, 1H), 4.43 (s, 2H), 2.33 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 141.05, 139.75, 139.07, 138.69, 132.86 (q, *J* = 33.8 Hz), 131.91, 130.61, 128.76, 128.46, 128.00, 126.44, 122.69 (q, *J* = 273.0 Hz), 122.07, 118.62 (q, *J* = 3.3 Hz), 117.92–117.71 (m), 59.31, 21.07; HRMS (ESI-TOF) Calcd for $C_{22}H_{15}BrF_6NO_2S^-$[M-H]$^-$: 549.9917; found: 549.9919.

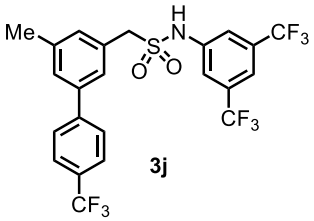


3i

***N*-(3,5-Bis(trifluoromethyl)phenyl)-1-(4'-iodo-5-methyl-[1,1'-biphenyl]-3-yl)methanesulfonamide (3i)**

3i was obtained as white solid (43.1 mg, 72%); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.69 (d, *J* = 8.2 Hz, 2H), 7.54 (s, 1H), 7.37 (s, 2H), 7.32 (s, 1H), 7.20 (s, 1H), 7.13 (d, *J* = 8.2 Hz, 2H), 7.02 (s, 1H), 7.00 (s, 1H), 4.41 (s, 2H), 2.32 (s, 3H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 141.15, 139.79, 139.26, 138.95, 137.90, 132.89 (q, *J* = 33.8 Hz), 130.63,

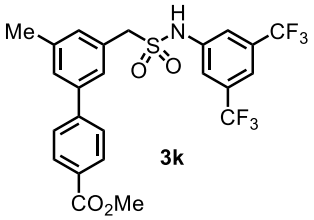
128.75, 128.68, 127.96, 126.38, 122.67 (q, J = 273.2 Hz), 118.64 (q, J = 3.3 Hz), 117.97–117.83 (m), 93.60, 59.30, 21.08; HRMS (ESI-TOF) Calcd for $C_{22}H_{15}F_6INO_2S^-$[M-H]$^-$: 597.9778; found: 597.9778.



3j

***N*-(3,5-Bis(trifluoromethyl)phenyl)-1-(5-methyl-4'-(trifluoromethyl)-[1,1'-biphenyl]-3-yl)methane-sulfonamide (3j)**

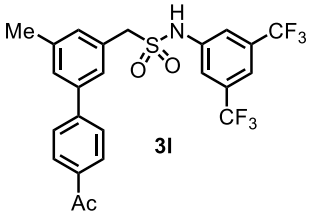
3j was obtained as white solid (50.9 mg, 94%); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.58 (d, J = 8.2 Hz, 2H), 7.51 (s, 1H), 7.46 (d, J = 8.2 Hz, 2H), 7.37 (s, 2H), 7.36 (s, 1H), 7.28 (s, 1H), 7.22 (s, 1H), 7.01 (s, 1H), 4.42 (s, 2H), 2.31 (s, 3H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 143.18, 140.81, 139.98, 138.97, 132.92 (q, J = 33.7 Hz), 131.08, 129.78 (q, J = 32.5 Hz), 129.14, 127.97, 127.15, 126.77, 125.70 (q, J = 3.5 Hz), 124.08 (q, J = 272.0 Hz,), 122.64 (q, J = 273.0 Hz), 118.38 (q, J = 3.1 Hz), 117.91–117.76 (m), 59.17, 21.05; ^{19}F NMR (376 MHz, $CDCl_3$) δ -62.92, -63.41; HRMS (ESI-TOF) Calcd for $C_{23}H_{15}F_9NO_2S^-$[M-H]$^-$: 540.0685; found: 540.0686.



3k

Methyl 3'-((*N*-(3,5-bis(trifluoromethyl)phenyl)sulfamoyl)methyl)-5'-methyl-[1,1'-biphenyl]-4-carboxylate (3k)

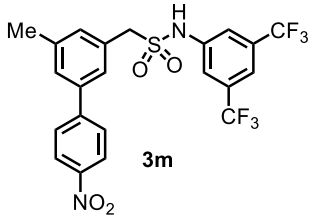
3k was obtained as white solid (46.2 mg, 87%); ^{1}H NMR (400 MHz, Acetone-d^6) δ 9.39 (brs, 1H), 8.05 (d, J = 8.2 Hz, 2H), 7.75 (s, 2H), 7.64 (d, J = 8.2 Hz, 2H), 7.62 (s, 1H), 7.49 (s, 2H), 7.24 (s, 1H), 4.73 (s, 2H), 3.91 (s, 3H), 2.34 (s, 3H); ^{13}C NMR (100 MHz, Acetone-d^6) δ 167.00, 145.46, 142.10, 140.89, 139.95, 132.83 (q, J = 33.3 Hz), 132.57, 130.71, 130.54, 130.15, 128.97, 128.09, 127.70, 124.12 (q, J = 272.2 Hz), 119.07 (q, J = 3.3 Hz), 117.38–117.16 (m), 59.65, 52.37), 21.14; HRMS (ESI-TOF) Calcd for $C_{24}H_{20}F_6NO_4S$[M+H]$^+$: 532.1012; found: 532.1016.



3l

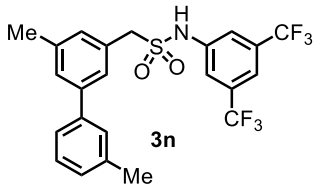
1-(4'-Acetyl-5-methyl-[1,1'-biphenyl]-3-yl)-*N*-(3,5-bis(trifluoromethyl)phenyl)methanesulfonamide (3l)

3l was obtained as white solid (41.7 mg, 81%); ^{1}H NMR (400 MHz, Acetone-d^6) δ 9.40 (s, 1H), 8.04 (d, J = 8.3 Hz, 2H), 7.75 (s, 2H), 7.65 (d, J = 8.3 Hz, 2H), 7.62 (s, 1H), 7.50 (s, 2H), 7.23 (s, 1H), 4.73 (s, 2H), 2.61 (s, 3H), 2.34 (s, 3H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 197.49, 145.31, 142.11, 140.96, 139.94, 137.18, 132.83 (q, J = 33.3 Hz), 132.55, 130.53, 129.71–129.58 (m), 128.96, 128.12, 127.74, 124.13 (q, J = 272.1 Hz), 119.05, 117.25, 59.68, 26.72, 21.14; HRMS (ESI-TOF) Calcd for $C_{24}H_{20}F_6NO_3S$[M+H]$^+$: 516.1063; found: 516.1064.



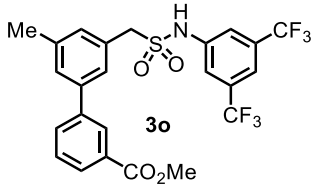
***N*-(3,5-Bis(trifluoromethyl)phenyl)-1-(5-methyl-4'-nitro-[1,1'-biphenyl]-3-yl)methanesulfonamide (3m)**

3m was obtained as white solid (42.5 mg, 82%); ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.23 (d, *J* = 8.7 Hz, 2H), 7.56 (d, *J* = 8.7 Hz, 2H), 7.54 (s, 1H), 7.39 (s, 3H), 7.30 (s, 1H), 7.10 (s, 1H), 7.04 (s, 1H), 4.47 (s, 2H), 2.35 (s, 3H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 147.28, 146.15, 140.14, 139.78, 138.94, 132.90 (q, *J* = 33.7 Hz), 131.83, 129.20, 128.31, 127.67, 126.88, 124.09, 122.62 (q, *J* = 273.0 Hz), 118.64 (q, *J* = 3.2 Hz), 118.00–117.86 (m), 59.30, 21.08; HRMS (ESI-TOF) Calcd for $C_{22}H_{15}F_6N_2O_4S^-$[M-H]$^-$: 517.0662; found: 517.0664.



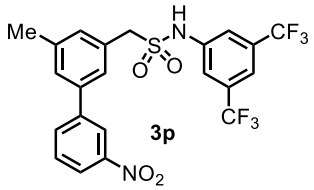
***N*-(3,5-Bis(trifluoromethyl)phenyl)-1-(3',5-dimethyl-[1,1'-biphenyl]-3-yl)methanesulfonamide (3n)**

3n was obtained as white solid (45.3 mg, 92%); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.51 (s, 1H), 7.37 (s, 2H), 7.34 (s, 1H), 7.28–7.20 (m, 3H), 7.20–7.09 (m, 3H), 6.94 (s, 1H), 4.39 (s, 2H), 2.35 (s, 3H), 2.30 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 142.41, 139.71, 139.46, 139.06, 138.41, 132.77 (q, *J* = 33.7 Hz), 130.10, 129.01, 128.64, 128.44, 127.61, 127.59, 126.65, 123.98, 122.70 (q, *J* = 273.1 Hz), 118.54 (q, *J* = 3.0 Hz), 117.82–117.59 (m), 59.33, 21.35, 21.06; HRMS (ESI-TOF) Calcd for $C_{23}H_{18}F_6NO_2S^-$[M-H]$^-$: 486.0968; found: 486.0971.



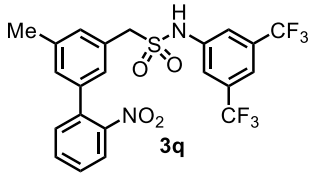
Methyl 3'-((*N*-(3,5-bis(trifluoromethyl)phenyl)sulfamoyl)methyl)-5'-methyl-[1,1'-biphenyl]-3-carboxylate (3o)

3o was obtained as white solid (46.7 mg, 88%); ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.06 (s, 1H), 7.95 (d, *J* = 7.4 Hz, 1H), 7.55 (d, *J* = 7.6 Hz, 1H), 7.50 (s, 2H), 7.45 (s, 2H), 7.41 (t, *J* = 7.7 Hz, 1H), 7.35 (s, 1H), 7.32 (s, 1H), 7.01 (s, 1H), 4.46 (s, 2H), 3.91 (s, 3H), 2.31 (s, 3H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 167.13, 140.81, 139.95, 139.65, 139.29, 132.71 (q, *J* = 33.6 Hz), 131.22, 130.76, 130.47, 128.88, 128.75, 128.71, 128.07, 127.89, 126.65, 122.72 (q, *J* = 273.0 Hz), 118.59 (q, *J* = 3.3 Hz), 117.71–117.57 (m), 59.27, 52.28, 21.03; HRMS (ESI-TOF) Calcd for $C_{24}H_{19}F_6NNaO_4S$[M+Na]$^+$: 554.0831; found: 554.0832.



***N*-(3,5-Bis(trifluoromethyl)phenyl)-1-(5-methyl-3'-nitro-[1,1'-biphenyl]-3-yl)methanesulfonamide (3p)**

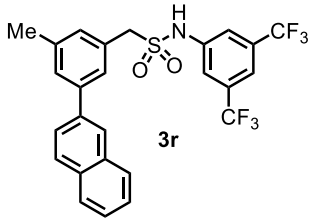
3p was obtained as white solid (48.7 mg, 94%); ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.28 (s, 1H), 8.19 (d, *J* = 8.1 Hz, 1H), 7.73 (d, *J* = 7.7 Hz, 1H), 7.56 (t, *J* = 8.0 Hz, 1H), 7.53 (s, 1H), 7.40 (s, 1H), 7.37 (s, 2H), 7.30 (s, 1H), 7.10 (s, 1H), 7.00 (s, 1H), 4.48 (s, 2H), 2.36 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 148.60, 141.43, 140.19, 139.62, 139.05, 132.84 (q, *J* = 33.6 Hz), 132.78, 131.51, 129.79, 128.96, 128.27, 126.70, 122.64 (q, *J* = 273.3 Hz), 122.45, 121.70, 118.53 (q, *J* = 2.9 Hz), 117.89–117.75 (m), 59.39, 21.04; HRMS (ESI-TOF) Calcd for $C_{22}H_{15}F_6N_2O_4S^-$[M-H]$^-$: 517.0662; found: 517.0665.



3q

***N*-(3,5-Bis(trifluoromethyl)phenyl)-1-(5-methyl-2'-nitro-[1,1'-biphenyl]-3-yl)methanesulfonamide (3q)**

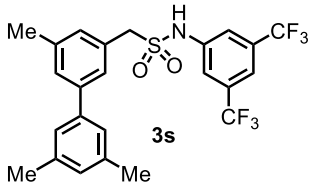
3q was obtained as white solid (50.8 mg, 98%); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.86 (d, *J* = 8.1 Hz, 1H), 7.61–7.54 (m, 2H), 7.49 (t, *J* = 7.8 Hz, 1H), 7.46 (s, 2H), 7.27–7.19 (m, 2H), 7.12 (s, 1H), 7.08 (s, 1H), 6.99 (s, 1H), 4.40 (s, 2H), 2.30 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 148.89, 139.66, 138.95, 138.49, 135.31, 132.83 (q, *J* = 33.7 Hz), 132.60, 131.60, 131.31, 129.59, 128.63, 128.01, 127.19, 124.27, 122.73 (q, *J* = 273.2 Hz), 118.97 (q, *J* = 3.4 Hz), 117.91–117.69 (m), 58.82, 20.99; HRMS (ESI-TOF) Calcd for $C_{22}H_{15}F_6N_2O_4S^-$[M-H]$^-$: 517.0662; found: 517.0663.



3r

***N*-(3,5-Bis(trifluoromethyl)phenyl)-1-(3-methyl-5-(naphthalen-2-yl)phenyl)methanesulfonamide (3r)**

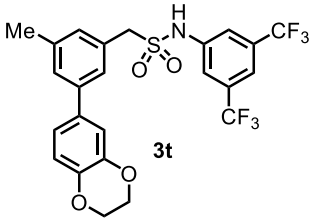
3r was obtained as white solid (47.1 mg, 90%); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.88–7.73 (m, 4H), 7.56–7.41 (m, 5H), 7.37 (s, 3H), 7.18 (s, 1H), 6.95 (s, 1H), 4.42 (s, 2H), 2.32 (s, 3H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 142.14, 139.64, 138.99, 136.99, 133.42, 132.73 (q, *J* = 33.5 Hz), 132.66, 130.25, 129.22, 128.51, 128.10, 127.75, 127.57, 126.86, 126.38, 126.15, 125.71, 124.97, 122.65 (q, *J* = 273.0 Hz), 118.47 (q, *J* = 3.1 Hz), 117.78–117.58 (m), 59.26, 21.08; HRMS (ESI-TOF) Calcd for $C_{26}H_{18}F_6NO_2S^-$[M-H]$^-$: 522.0968; found: 522.0967.



3s

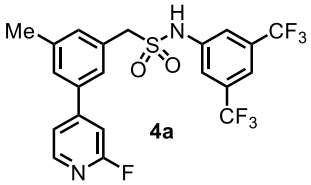
***N*-(3,5-Bis(trifluoromethyl)phenyl)-1-(3',5,5'-trimethyl-[1,1'-biphenyl]-3-yl)methanesulfonamide (3s)**

3s was obtained as white solid (45.1 mg, 90%); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.52 (s, 1H), 7.37 (s, 2H), 7.34 (s, 1H), 7.23 (s, 1H), 7.07 (s, 1H), 6.99 (s, 2H), 6.95 (d, *J* = 3.6 Hz, 2H), 4.40 (s, 2H), 2.35–2.28 (m, 9H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 142.55, 139.77, 139.37, 139.02, 138.32, 132.76 (q, *J* = 33.6 Hz), 130.02, 129.34, 129.05, 127.57, 126.68, 124.79, 122.70 (q, *J* = 273.0 Hz), 118.66 (q, *J* = 2.9 Hz), 117.82–117.64 (m), 59.40, 21.23, 21.07; HRMS (ESI-TOF) Calcd for $C_{24}H_{20}F_6NO_2S^-$[M-H]$^-$: 500.1124; found: 500.1128.



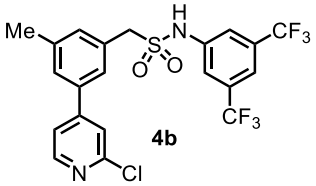
***N*-(3,5-Bis(trifluoromethyl)phenyl)-1-(3-(2,3-dihydrobenzo[b][1,4]dioxin-6-yl)-5-methylphenyl)methanesulfonamide (3t)**

3t was obtained as white solid (46.7 mg, 88%); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.52 (s, 1H), 7.37 (s, 2H), 7.28 (s, 1H), 7.18 (s, 1H), 7.15 (s, 1H), 6.92 (s, 1H), 6.90 (s, 1H), 6.88–6.81 (m, 2H), 4.38 (s, 2H), 4.25 (s, 4H), 2.28 (s, 3H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 143.69, 143.47, 141.61, 139.46, 139.07, 133.24, 132.79 (q, *J* = 33.8 Hz), 129.78, 128.56, 127.62, 126.28, 122.72 (q, *J* = 273.1 Hz), 119.86, 118.57 (q, *J* = 3.1 Hz), 117.85–117.69 (m), 117.54, 115.61, 64.41, 64.32, 59.36, 21.07; HRMS (ESI-TOF) Calcd for $C_{24}H_{20}F_6NO_4S[M+H]^+$: 532.1012; found: 532.1012.



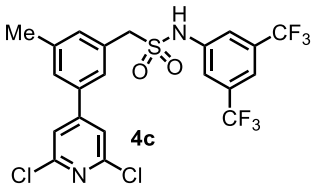
***N*-(3,5-Bis(trifluoromethyl)phenyl)-1-(3-(2-fluoropyridin-4-yl)-5-methylphenyl)methanesulfonamide (4a)**

4a was obtained as white solid (31.0 mg, 63%); ^{1}H NMR (400 MHz, Acetone- d^6) δ 9.39 (brs, 1H), 8.26 (d, *J* = 5.2 Hz, 1H), 7.73 (s, 2H), 7.63–7.55 (m, 3H), 7.47 (d, *J* = 5.2 Hz, 1H), 7.34 (s, 1H), 7.19 (s, 1H), 4.75 (s, 2H), 2.35 (s, 3H); ^{13}C NMR (125 MHz, Acetone-d^6) δ 165.48 (d, *J* = 235.2 Hz), 153.98, 153.92, 149.08 (d, *J* = 16.0 Hz), 142.11, 140.37, 137.97 (d, *J* = 3.4 Hz), 134.04, 132.83 (q, *J* = 33.1 Hz), 128.89, 128.08, 124.11 (q, *J* = 272.0 Hz), 120.26 (d, *J* = 3.9 Hz), 119.05 (q, *J* = 3.7 Hz), 117.43–117.17 (m), 107.32 (d, *J* = 39.3 Hz), 59.68, 21.08; ^{19}F NMR (376 MHz, Acetone-d^6) δ -63.94, -70.26; HRMS (ESI-TOF) Calcd for $C_{21}H_{16}F_7N_2O_2S[M+H]^+$: 493.0815; found: 493.0816.



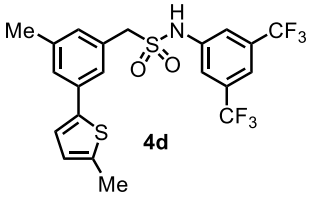
***N*-(3,5-Bis(trifluoromethyl)phenyl)-1-(3-(2-chloropyridin-4-yl)-5-methylphenyl)methanesulfonamide (4b)**

4b was obtained as white solid (25.5 mg, 50%); ^{1}H NMR (400 MHz, Acetone-d^6) δ 9.40 (s, 1H), 8.42 (d, *J* = 5.2 Hz, 1H), 7.71 (s, 2H), 7.61–7.54 (m, 4H), 7.52 (dd, *J* = 5.2, 1.5 Hz, 1H), 7.33 (s, 1H), 4.75 (s, 2H), 2.35 (s, 3H); ^{13}C NMR (150 MHz, Acetone-d^6) δ 152.80, 151.47, 151.13, 142.09, 140.41, 137.65, 134.03, 132.80 (q, *J* = 33.2 Hz), 130.92, 128.89, 128.09, 124.10 (q, *J* = 272.3 Hz), 122.28, 121.28, 119.03 (q, *J* = 3.3 Hz), 117.41–117.11 (m), 59.70, 21.06; HRMS (ESI-TOF) Calcd for $C_{21}H_{16}ClF_6N_2O_2S[M+H]^+$: 509.0520; found: 509.0520.



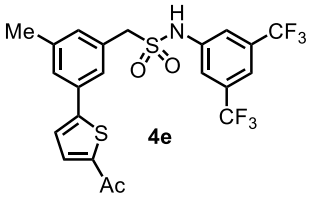
***N*-(3,5-Bis(trifluoromethyl)phenyl)-1-(3-(2,6-dichloropyridin-4-yl)-5-methylphenyl)methanesulfonamide (4c)**

4c was obtained as white solid (45.1 mg, 83%); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.56 (s, 1H), 7.39–7.34 (m, 3H), 7.28 (s, 3H), 7.17 (s, 1H), 7.15 (s, 1H), 4.47 (s, 2H), 2.34 (s, 3H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 152.60, 151.16, 140.56, 138.83, 136.85, 133.10, 132.99 (d, *J* = 32.7 Hz), 128.87, 128.67, 126.61, 122.60 (q, *J* = 273.0 Hz), 120.60, 118.67 (q, *J* = 3.1 Hz), 118.14–117.98 (m), 59.32, 21.03; HRMS (ESI-TOF) Calcd for $C_{21}H_{15}Cl_2F_6N_2O_2S[M+H]^+$: 543.0130; found: 543.0133.



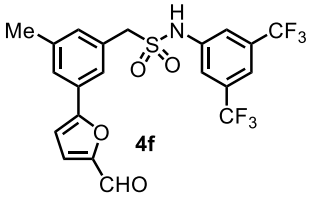
***N*-(3,5-Bis(trifluoromethyl)phenyl)-1-(3-methyl-5-(5-methylthiophen-2-yl)phenyl)methanesulfonamide (4d)**

4d was obtained as white solid (35.0 mg, 71%); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.54 (s, 1H), 7.43 (s, 2H), 7.31 (s, 1H), 7.14 (s, 1H), 7.08 (s, 1H), 6.95 (d, *J* = 3.4 Hz, 1H), 6.86 (s, 1H), 6.66–6.63(m, 1H), 4.34 (s, 2H), 2.45 (s, 3H), 2.28 (s, 3H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 140.22, 140.19, 139.68, 139.00, 135.63, 132.88 (q, *J* = 33.7 Hz), 129.87, 127.95, 126.99, 126.24, 124.71, 123.39, 122.74 (q, *J* = 273.1 Hz), 118.63 (q, *J* = 3.1 Hz), 117.93–117.75 (m), 58.94, 21.03, 15.29; HRMS (ESI-TOF) Calcd for $C_{21}H_{16}F_6NO_2S^-[M-H]^-$: 492.0532; found: 492.0533.



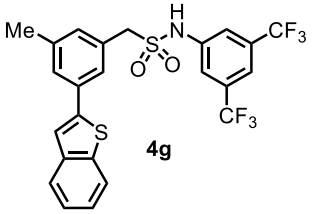
1-(3-(5-Acetylthiophen-2-yl)-5-methylphenyl)-N-(3,5-bis(trifluoromethyl)phenyl)methanesulfonamide (4e)

4e was obtained as white solid (31.8 mg, 61%); ^{1}H NMR (400 MHz, Acetone-d^6) δ 9.39 (s, 1H), 7.82 (d, *J* = 3.9 Hz, 1H), 7.75 (s, 2H), 7.61 (s, 1H), 7.54 (s, 1H), 7.51 (s, 1H), 7.42 (d, *J* = 3.9 Hz, 1H), 7.20 (s, 1H), 4.71 (s, 2H), 2.54 (s, 3H), 2.31 (s, 3H); ^{13}C NMR (150 MHz, Acetone-d^6) δ 190.77, 151.81, 144.41, 142.10, 140.27, 134.78, 134.55, 133.26, 132.81 (q, *J* = 33.3 Hz), 130.84, 127.75, 127.01, 125.43, 124.12 (q, *J* = 272.2 Hz), 119.07 (q, *J* = 1.8 Hz), 117.26, 59.56, 26.47, 20.99; HRMS (ESI-TOF) Calcd for $C_{22}H_{18}F_6NO_3S_2[M+H]^+$: 522.0627; found: 522.0628.



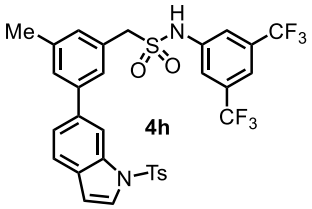
***N*-(3,5-Bis(trifluoromethyl)phenyl)-1-(3-(5-formylfuran-2-yl)-5-methylphenyl)methanesulfonamide (4f)**

4f was obtained as white solid (37.3 mg, 71%); ^{1}H NMR (400 MHz, Acetone-d^{6}) δ 9.66 (s, 1H), 9.37 (s, 1H), 7.74 (s, 2H), 7.67 (s, 1H), 7.63 (s, 1H), 7.60 (s, 1H), 7.51 (d, *J* = 3.7 Hz, 1H), 7.23 (s, 1H), 7.05 (d, *J* = 3.7 Hz, 1H), 4.74 (s, 2H), 2.31 (s, 3H); ^{13}C NMR (150 MHz, Acetone-d^{6}) δ 177.89, 158.83, 153.34, 142.09, 140.15, 133.78, 132.77 (q, *J* = 33.3 Hz), 130.79, 130.4, 126.69, 125.89, 124.71, 124.10 (q, *J* = 272.1 Hz), 119.17 (q, *J* = 3.6 Hz), 117.37–117.16 (m), 109.18, 59.64, 21.00; HRMS (ESI-TOF) Calcd for $C_{21}H_{16}F_6NO_4S[M+H]^+$: 492.0699; found: 492.0702.



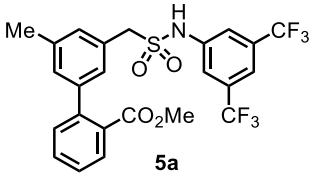
1-(3-(Benzo[*b*]thiophen-2-yl)-5-methylphenyl)-*N*-(3,5-bis(trifluoromethyl)phenyl)methanesulfonamide (4g)

4g was obtained as white solid (22.7 mg, 43%); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.78 (d, *J* = 7.5 Hz, 1H), 7.72 (d, *J* = 8.2 Hz, 1H), 7.52 (s, 1H), 7.48 (s,1H), 7.45 (s, 2H), 7.40 (s, 1H), 7.37–7.28 (m, 3H), 6.99 (s, 1H), 6.97 (s, 1H), 4.39 (s, 2H), 2.33 (s, 3H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 142.47, 140.38, 139.92, 139.40, 138.89, 135.29, 132.93 (q, *J* = 33.7 Hz), 131.15, 128.22, 128.10, 125.70, 124.67, 124.66, 123.69, 122.70 (q, *J* = 273.2 Hz), 122.22, 120.04, 118.71 (q, *J* = 3.1 Hz), 118.07–117.89 (m), 58.92, 21.06; HRMS (ESI-TOF) Calcd for $C_{24}H_{16}F_6NO_2S_2^-[M-H]^-$: 528.0532; found: 528.0534.



***N*-(3,5-Bis(trifluoromethyl)phenyl)-1-(3-methyl-5-(1-tosyl-1*H*-indol-6-yl)phenyl)methanesulfonamide (4h)**

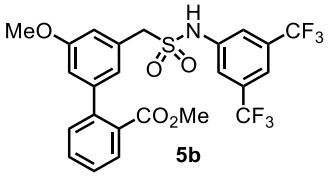
4h was obtained as white solid (34.0 mg, 51%); ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.10 (s, 1H), 7.77 (s, 1H), 7.75 (s, 1H), 7.57 (d, *J* = 3.6 Hz, 1H), 7.50 (s, 1H), 7.49 (d, *J* = 7.9 Hz, 1H), 7.39 (s, 3H), 7.34 (s, 1H), 7.28–7.17 (m, 4H), 6.99 (s, 1H), 6.65 (d, *J* = 3.7 Hz, 1H), 4.47 (s, 2H), 2.33 (s, 3H), 2.31 (s, 3H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 145.12, 142.37, 139.53, 139.10, 136.73, 135.36, 135.18, 132.72 (q, *J* = 33.6 Hz), 130.23, 130.21, 129.94, 129.22, 127.88, 127.08, 126.99, 126.76, 122.69, 122.69 (q, *J* = 273.0 Hz), 121.59, 118.82 (q, *J* = 3.1 Hz), 117.92–117.67 (m), 111.87, 108.88, 59.53, 21.50, 21.12; HRMS (ESI-TOF) Calcd for $C_{31}H_{25}F_6N_2O_4S_2[M+H]^+$: 667.1154; found: 667.1151.



Methyl 3'-((*N*-(3,5-bis(trifluoromethyl)phenyl)sulfamoyl)methyl)-5'-methyl-[1,1'-biphenyl]-2-carboxylate (5a)

5a was obtained as white solid (52.0 mg, 98%); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.93 (d, *J* = 7.8 Hz, 1H), 7.74 (s, 1H), 7.60–7.52 (m, 2H), 7.49–7.41 (m, 3H), 7.33 (d, *J* = 7.6 Hz, 1H), 7.27 (s, 1H), 7.18 (s, 1H), 6.66 (s, 1H), 4.41 (s, 2H), 3.85 (s, 3H), 2.25 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 169.25, 142.40, 141.84, 139.26, 138.94, 132.58 (q, *J* = 33.6 Hz), 131.98, 130.52, 130.43, 130.20, 129.76, 129.65, 127.6, 127.49, 127.18, 122.82 (q, *J* = 272.9 Hz),

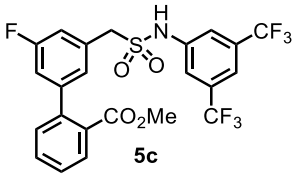
119.62 (q, *J* = 2.5 Hz), 117.88–117.61 (m), 58.66, 52.61, 20.9; HRMS (ESI-TOF) Calcd for $C_{24}H_{19}F_6NNaO_4S[M+Na]^+$: 554.0831; found: 554.0832.



5b

Methyl 3'-((*N*-(3,5-bis(trifluoromethyl)phenyl)sulfamoyl)methyl)-5'-methoxy-[1,1'-biphenyl]-2-carboxylate (5b)

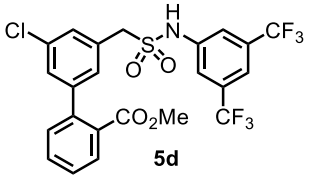
5b was obtained as white solid (46.5 mg, 85%);^{1}H NMR (400 MHz, Acetone-d^6) δ 9.36 (s, 1H), 7.81–7.73 (m, 3H), 7.66 (s, 1H), 7.59–7.53 (m, 1H), 7.50–7.44 (m, 1H), 7.22 (d, *J* = 7.6 Hz, 1H), 6.95 (s, 1H), 6.86 (s, 1H), 6.85–6.82 (m, 1H), 4.69 (s, 2H), 3.78 (s, 3H), 3.62 (s, 3H); ^{13}C NMR (150 MHz, Acetone-d^6) δ 169.25, 160.50, 143.78, 141.97, 141.90, 132.94 (q, *J* = 33.2 Hz), 132.22, 132.02, 131.20, 130.92, 130.37, 128.45, 124.39, 124.17 (q, *J* = 272.1 Hz), 119.28 (q, *J* = 3.4 Hz), 117.65–117.05 (m), 116.48, 115.04, 59.38, 55.66, 52.30; HRMS (ESI-TOF) Calcd for $C_{24}H_{19}F_6NNaO_5S[M+Na]^+$: 570.0780; found: 570.0781.



5c

Methyl 3'-((*N*-(3,5-bis(trifluoromethyl)phenyl)sulfamoyl)methyl)-5'-fluoro-[1,1'-biphenyl]-2-carboxylate (5c)

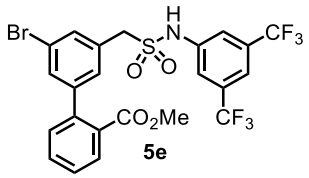
5c was obtained as white solid (43.9 mg, 82%); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.97 (d, *J* = 7.8 Hz, 1H), 7.84 (s, 1H), 7.61–7.55 (m, 2H), 7.54–7.44 (m, 3H), 7.31 (d, *J* = 7.6 Hz, 1H), 7.21 (s, 1H), 7.07 (d, *J* = 9.0 Hz, 1H), 6.66 (d, *J* = 8.4 Hz, 1H), 4.42 (s, 2H), 3.85 (s, 3H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 168.80, 162.40 (d, *J* = 249.0 Hz), 144.13 (d, *J* = 8.2 Hz), 141.10, 138.97, 132.82 (q, *J* = 33.7 Hz), 132.21, 130.71, 130.35, 129.57, 129.53, 128.25, 126.15 (d, *J* = 2.4 Hz), 122.75 (q, *J* = 272.9 Hz), 119.55 (q, *J* = 2.9 Hz), 118.09–117.90 (m), 116.41 (d, *J* = 22.2 Hz), 116.15 (d, *J* = 21.8 Hz), 58.09, 52.69; ^{19}F NMR (376 MHz, $CDCl_3$) δ -63.46, -112.35; HRMS (ESI-TOF) Calcd for $C_{23}H_{16}F_7NNaO_4S[M+Na]^+$: 558.0580; found: 558.0584.



5d

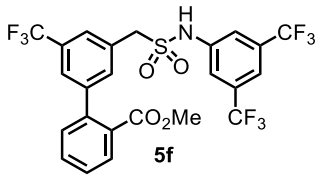
Methyl 3'-((*N*-(3,5-bis(trifluoromethyl)phenyl)sulfamoyl)methyl)-5'-chloro-[1,1'-biphenyl]-2-carboxylate (5d)

5d was obtained as white solid (45.8 mg, 83%); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.98 (d, *J* = 7.4 Hz, 1H), 7.84 (s, 1H), 7.62–7.56 (m, 2H), 7.54–7.46 (m, 3H), 7.35 (s, 1H), 7.34–7.30 (m, 2H), 6.90 (s, 1H), 4.40 (s, 2H), 3.86 (s, 3H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 168.76, 143.59, 141.02, 138.97, 134.61, 132.90 (q, *J* = 33.7 Hz), 132.27, 130.78, 130.40, 129.47, 129.30 (2C), 128.98, 128.54, 128.30, 122.76 (q, *J* = 273.0 Hz), 119.41 (q, *J* = 3.2 Hz), 118.16–117.97 (m), 57.93, 52.73; HRMS (ESI-TOF) Calcd for $C_{23}H_{16}ClF_6NNaO_4S[M+Na]^+$: 574.0285; found: 574.0286.



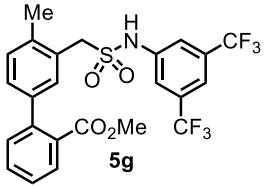
Methyl 3'-((*N*-(3,5-bis(trifluoromethyl)phenyl)sulfamoyl)methyl)-5'-bromo-[1,1'-biphenyl]-2-carboxylate (5e)

5e was obtained as white solid (54.8 mg, 92%); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.97 (d, *J* = 7.8 Hz, 1H), 7.81 (s, 1H), 7.63–7.55 (m, 2H), 7.52 (s, 2H), 7.51–7.46 (m, 2H), 7.37 (s, 1H), 7.31 (d, *J* = 7.8 Hz, 1H), 7.06 (s, 1H), 4.40 (s, 2H), 3.85 (s, 3H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 168.75, 143.73, 140.86, 138.96, 132.91 (q, *J* = 33.8 Hz), 132.25, 132.14, 131.85, 130.76, 130.42, 129.48, 129.04, 128.30, 122.76 (q, *J* = 273.0 Hz), 122.45, 119.32 (q, *J* = 3.1 Hz), 118.16–117.95 (m), 57.87, 52.72; HRMS (ESI-TOF) Calcd for $C_{23}H_{16}BrF_6NNaO_4S[M+Na]^+$: 617.9780; found: 617.9782.



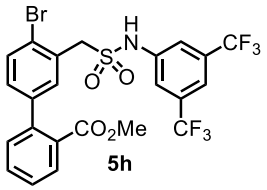
Methyl 3'-((*N*-(3,5-bis(trifluoromethyl)phenyl)sulfamoyl)methyl)-5'-(trifluoromethy)-[1,1'-biphenyl]-2-carboxylate (5f)

5f was obtained as white solid (50.3 mg, 86%); ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.01 (d, *J* = 7.8 Hz, 1H), 7.92 (s, 1H), 7.67 (s, 1H), 7.65–7.59 (m, 3H), 7.55–7.47 (m, 3H), 7.35 (d, *J* = 7.6 Hz, 1H), 7.15 (s, 1H), 4.50 (s, 2H), 3.85 (s, 3H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 168.69, 142.90, 140.92, 138.89, 133.67, 133.01 (q, *J* = 33.7 Hz), 132.44, 131.45 (q, *J* = 32.9 Hz), 130.93, 130.55, 129.41, 128.75, 128.51, 126.00 (q, *J* = 3.3 Hz), 125.70 (q, *J* = 3.1 Hz), 123.30 (q, *J* = 272.6 Hz), 122.71 (q, *J* = 272.9 Hz), 118.97 (q, *J* = 3.1 Hz), 118.13–117.92 (m), 57.89, 52.74; ^{19}F NMR (376 MHz, $CDCl_3$) δ -63.20, -63.53; HRMS (ESI-TOF) Calcd for $C_{24}H_{16}F_9NNaO_4S[M+Na]^+$: 608.0549; found: 608.0545.



Methyl 3'-((*N*-(3,5-bis(trifluoromethyl)phenyl)sulfamoyl)methyl)-4'-methy-[1,1'-biphenyl]-2-carboxylate (5g)

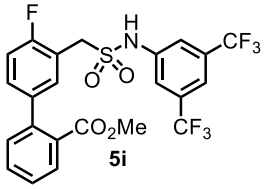
5g was obtained as white solid (42.5 mg, 80%); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.95 (d, *J* = 7.7 Hz, 1H), 7.85 (brs, 1H), 7.60–7.54 (m, 2H), 7.47–7.41 (m, 4H), 7.33 (d, *J* = 7.4 Hz, 1H), 7.27 (dd, *J* = 7.8, 1.5 Hz, 1H), 7.15 (d, *J* = 7.8 Hz, 1H), 4.49 (s, 2H), 3.87 (s, 3H), 1.90 (s, 3H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 169.43, 142.32, 139.36, 139.03, 136.62, 132.58 (q, *J* = 33.7 Hz), 132.11, 131.04, 130.63, 130.61, 130.58, 129.51, 128.85, 127.59, 126.29, 122.78 (q, *J* = 273.0 Hz), 119.88 (q, *J* = 3.3 Hz), 117.88–117.68 (m), 55.43, 52.70, 18.63; HRMS (ESI-TOF) Calcd for $C_{24}H_{19}F_6NNaO_4S[M+Na]^+$: 554.0831; found: 554.0833.



5h

Methyl 3'-((*N*-(3,5-bis(trifluoromethyl)phenyl)sulfamoyl)methyl)-4'-bromo-[1,1'-biphenyl]-2-carboxylate (5h)

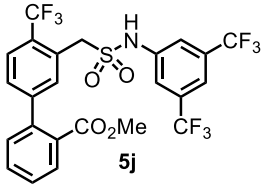
5h was obtained as white solid (37.0 mg, 62%);^{1}H NMR (400 MHz, $CDCl_3$) δ 8.01 (d, *J* = 8.0 Hz, 1H), 7.90 (brs, 1H), 7.70 (s, 1H), 7.64–7.58 (m, 2H), 7.52–7.46 (m, 2H), 7.44–7.36 (m, 3H), 7.25 (d, *J* = 7.7 Hz, 1H), 4.73 (s, 2H), 3.92 (s, 3H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 169.22, 141.47, 140.98, 138.52, 133.25, 132.67 (q, *J* = 33.6 Hz), 132.48, 131.71, 131.09, 130.48, 130.19, 129.20, 128.16, 127.54, 124.93, 122.86 (q, *J* = 272.9 Hz), 119.99 (q, *J* = 3.2 Hz), 118.26–118.07 (m), 57.81, 52.90; HRMS (ESI-TOF) Calcd for $C_{23}H_{16}BrF_6NNaO_4S[M+Na]^+$: 617.9780; found: 617.9780.



5i

Methyl 3'-((*N*-(3,5-bis(trifluoromethyl)phenyl)sulfamoyl)methyl)-4'-bromo-[1,1'-biphenyl]-2-carboxylate (5i)

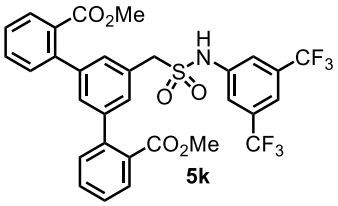
5i was obtained as white solid (41.2 mg, 77%); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.98 (dd, *J* = 7.8, 1.0 Hz, 1H), 7.74 (s, 1H), 7.63–7.52 (m, 3H), 7.51–7.44 (m, 3H), 7.39–7.31 (m, 2H), 6.98 (t, *J* = 9.0 Hz, 1H), 4.51 (s, 2H), 3.88 (s, 3H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 169.14, 160.10 (d, *J* = 249.8 Hz), 141.48, 138.62, 137.64 (d, *J* = 3.6 Hz), 132.66 (q, *J* = 33.5 Hz), 132.26, 131.86 (d, *J* = 1.5 Hz), 130.84, 130.72 (d, *J* = 8.5 Hz), 130.51, 129.53, 127.93, 122.80 (q, *J* = 272.9 Hz), 119.62 (q, *J* = 3.1 Hz), 118.18–117.97 (m), 115.64 (d, *J* = 22.5 Hz), 115.16 (d, *J* = 15.1 Hz), 52.74, 50.37 (d, *J* = 4.1 Hz); ^{19}F NMR (376 MHz, $CDCl_3$) δ -63.43, -120.78 HRMS (ESI-TOF) Calcd for $C_{23}H_{16}F_7NNaO_4S[M+Na]^+$: 558.0580; found: 558.0579.



5j

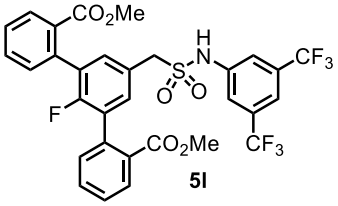
Methyl 3'-((*N*-(3,5-bis(trifluoromethyl)phenyl)sulfamoyl)methyl)-4'-(trifluoromethy)-[1,1'-biphenyl]-2-carboxylate (5j)

5j was obtained as white solid (43.3 mg, 74%); ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.07 (d, *J* = 7.9 Hz, 1H), 7.95 (s, 1H), 7.70–7.63 (m, 2H), 7.58 (s, 1H), 7.56–7.51 (m, 2H), 7.41 (d, *J* = 7.6 Hz, 1H), 7.36 (s, 2H), 4.66 (s, 2H), 3.93 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 169.27, 145.29, 141.25, 138.40, 132.71, 132.62 (q, *J* = 33.7 Hz), 131.98, 131.22, 130.80, 128.95, 128.60, 128.52, 128.01 (q, *J* = 30.3 Hz), 126.91 (q, *J* = 5.4 Hz), 126.15, 123.36 (q, *J* = 274.2 Hz), 122.79 (q, *J* = 272.9 Hz), 120.41 (q, *J* = 3.1 Hz), 118.46–118.23 (m), 54.86 (d, *J* = 2.6 Hz), 53.02; ^{19}F NMR (376 MHz, $CDCl_3$) δ -59.61, -63.52; HRMS (ESI-TOF) Calcd for $C_{24}H_{16}F_9NNaO_4S[M+Na]^+$: 608.0549; found: 608.0547.



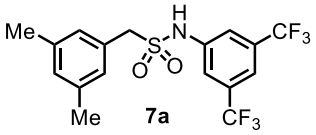
Dimethyl 5'-((*N*-(3,5-bis(trifluoromethyl)phenyl)sulfamoyl)methyl)-[1,1':3',1''-terphenyl]-2,2''-dicarboxylate (5k)

5k was obtained as white solid (58.6 mg, 90%);^{1}H NMR (500 MHz, $CDCl_3$) δ 7.90 (dd, *J* = 7.6, 0.7 Hz, 2H), 7.62 (s, 2H), 7.55–7.50 (m, 3H), 7.46–7.41 (m, 2H), 7.29 (s, 1H), 7.26 (d, *J* = 7.3 Hz, 2H), 7.19 (d, *J* = 1.2 Hz, 2H), 4.46 (s, 2H), 3.79 (s, 6H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 168.73, 141.93, 141.64, 139.50, 132.73 (q, *J* = 33.6 Hz), 131.75, 130.61, 130.31, 130.0, 129.31, 128.99, 127.77, 127.71, 122.79 (q, *J* = 273.0 H), 119.33 (q, *J* = 3.4 Hz), 117.66–117.44 (m), 58.12, 52.41; HRMS (ESI-TOF) Calcd for $C_{31}H_{23}F_6NNaO_6S[M+Na]^+$: 674.1042; found: 674.1043.



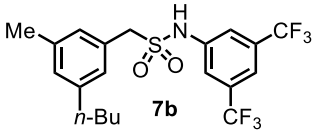
Dimethyl 5'-((*N*-(3,5-bis(trifluoromethyl)phenyl)sulfamoyl)methyl)-2'-fluoro-[1,1':3',1''-terphenyl]-2,2''-dicarboxylate (5l)

5l was obtained as white solid (62.9 mg, 94%); ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.67 (brs, 1H), 8.00 (d, *J* = 7.7 Hz, 2H), 7.69 (s, 2H), 7.59–7.52 (m, 3H), 7.51–7.44 (m, 2H), 7.28 (s, 1H), 7.26 (s, 1H), 7.16 (d, *J* = 6.4 Hz, 2H), 4.39 (s, 2H), 3.81 (s, 6H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 167.83, 156.32 (d, *J* = 248.3 Hz), 139.46, 135.69, 132.84 (q, *J* = 33.5 Hz), 132.12 (d, *J* = 1.6 Hz), 132.03, 131.29, 130.43, 130.24, 129.60 (d, *J* = 17.8 Hz), 128.38, 123.68, 122.76 (q, *J* = 266.8 Hz), 119.41 (q, *J* = 2.2 Hz), 117.71–117.59 (m), 57.26, 52.39; ^{19}F NMR (376 MHz, $CDCl_3$) δ -63.43, -119.23; HRMS (ESI-TOF) Calcd for $C_{31}H_{22}F_7NNaO_6S[M+Na]^+$: 692.0948; found: 692.0948.



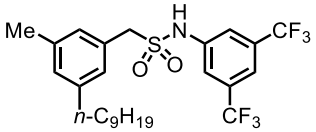
***N*-(3,5-Bis(trifluoromethyl)phenyl)-1-(3,5-dimethylphenyl)methanesulfonamide (7a)**

7a was obtained as white solid (26.7 mg, 65%); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.57 (s, 1H), 7.39 (s, 2H), 6.96 (s, 1H), 6.83 (s, 3H), 4.34 (s, 2H), 2.21 (s, 6H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 139.08, 138.94, 132.76 (q, *J* = 33.7 Hz), 131.10, 128.52, 127.05, 122.74 (q, *J* = 272.9 Hz), 118.94 (q, *J* = 3.2 Hz), 118.42–116.94 (m), 59.42, 20.86; HRMS (ESI-TOF) Calcd for $C_{17}H_{14}F_6NO_2S^-[M-H]^-$: 410.0655; found: 410.0656.



***N*-(3,5-Bis(trifluoromethyl)phenyl)-1-(3-butyl-5-methylphenyl)methanesulfonamide (7b)**

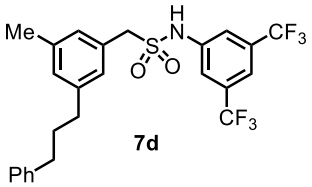
7b was obtained as white solid (27.2 mg, 60%); ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.56 (s, 1H), 7.37 (s, 2H), 7.08 (s, 1H), 6.96 (s, 1H), 6.86 (s, 1H), 6.81 (s, 1H), 4.34 (s, 2H), 2.46–2.42 (m, 2H), 2.22 (s, 3H), 1.47–1.40 (m, 2H), 1.32–1.24 (m, 2H), 0.87 (t, *J* = 7.4 Hz, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 144.08, 139.16, 138.93, 132.78 (q, *J* = 33.7 Hz), 130.43, 128.77, 127.89, 127.04, 122.77 (q, *J* = 273.0 Hz), 118.77 (q, *J* = 2.8 Hz), 117.80–117.60 (m), 59.50, 35.17, 33.40, 22.33, 20.93, 13.75; HRMS (ESI-TOF) Calcd for $C_{20}H_{20}F_6NO_2S^-$[M-H]$^-$: 452.1124; found: 452.1123.



7c

***N*-(3,5-Bis(trifluoromethyl)phenyl)-1-(3-methyl-5-nonylphenyl)methanesulfonamide (7c)**

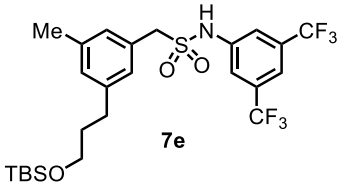
7c was obtained as white solid (31.4 mg, 60%); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.57 (s, 1H), 7.37 (s, 2H), 6.97 (s, 1H), 6.87 (s, 1H), 6.83 (s, 2H), 4.34 (s, 2H), 2.51–2.41 (m, 2H), 2.24 (s, 2H), 1.51–1.38 (m,3H), 1.36–1.22 (m, 12H), 0.88 (t, *J* = 6.9 Hz, 3H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 144.14, 139.06, 138.92, 132.78 (q, *J* = 33.6 Hz), 130.41, 128.77, 127.88, 127.11, 122.75 (q, *J* = 272.9 Hz), 118.92 (q, *J* = 3.1 Hz), 117.99–117.52 (m), 59.43, 35.51, 31.85, 31.37, 29.49, 29.37, 29.34, 29.28, 22.65, 20.97, 14.09; HRMS (ESI-TOF) Calcd for $C_{25}H_{30}F_6NO_2S^-$[M-H]$^-$: 522.1907; found: 522.1908.



7d

***N*-(3,5-Bis(trifluoromethyl)phenyl)-1-(3-methyl-5-(3-phenylpropyl)phenyl)methanesulfonamide (7d)**

7d was obtained as white solid (24.2 mg, 47%); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.55 (s, 1H), 7.36 (s, 2H), 7.31–7.23 (m, 2H), 7.20–7.08 (m, 3H), 6.96 (s, 2H), 6.84 (d, *J* = 8.6 Hz, 2H), 4.33 (s, 2H), 2.59 (t, *J* = 7.6 Hz, 2H), 2.53–2.45 (m, 2H), 2.22 (s, 3H), 1.88–1.75 (m, 2H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 143.47, 141.89, 139.07, 139.01, 132.78 (q, *J* = 33.8 Hz), 130.42, 128.93, 128.35, 128.32, 127.92, 127.13, 125.82, 122.75 (q, *J* = 272.9 Hz), 118.86 (q, *J* = 3.1 Hz), 117.88–117.69 (m), 59.44, 35.40, 34.91, 32.68, 20.93; HRMS (ESI-TOF) Calcd for $C_{25}H_{22}F_6NO_2S^-$[M-H]$^-$: 514.1281; found: 514.1282.

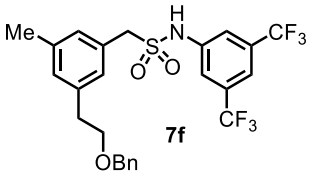


7e

***N*-(3,5-Bis(trifluoromethyl)phenyl)-1-(3-(3-((*tert*-butyldimethylsilyl)oxy)propyl)-5-methylphenyl)methanesulfonamide (7e)**

7e was obtained as white solid (41.0 mg, 72%); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.55 (s, 1H), 7.37 (s, 2H), 7.15 (s, 1H), 6.97 (s, 1H), 6.86 (s, 1H), 6.84 (s, 1H), 4.34 (s, 2H), 3.56 (t, *J* = 6.2 Hz, 2H), 2.60–2.40 (m, 2H), 2.21 (s, 3H), 1.72–1.62 (m, 2H), 0.89 (s, 9H), 0.03 (s, 6H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 143.49, 139.18, 138.95, 132.76 (q, *J* = 33.5 Hz), 130.52, 128.87, 127.96, 127.08, 122.76 (q, *J* = 273.0 Hz), 118.74 (q, *J* = 3.2 Hz), 117.78–117.57 (m),

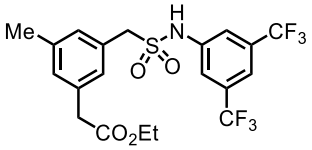
62.13, 59.50, 34.17, 31.65, 25.88, 20.90, 18.28, -5.39; HRMS (ESI-TOF) Calcd for $C_{25}H_{32}F_6NO_3SSi^-$[M-H]$^-$: 568.1782; found: 568.1784.



7f

1-(3-(2-(Benzyloxy)ethyl)-5-methylphenyl)-*N*-(3,5-bis(trifluoromethyl)phenyl)methanesulfonamide (7f)

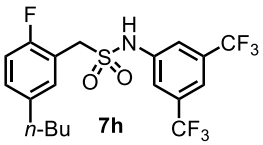
7f was obtained as white solid (23.9 mg, 45%); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.55 (s, 1H), 7.33 (s, 2H), 7.32–7.20 (m, 5H), 7.02 (s, 1H), 6.94–6.80 (m, 3H), 4.46 (s, 2H), 4.30 (s, 2H), 3.62 (t, *J* = 6.7 Hz, 2H), 2.78 (t, *J* = 6.6 Hz, 2H), 2.24 (s, 3H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 140.23, 139.07, 139.02, 138.16, 132.71 (q, *J* = 33.5 Hz), 130.76, 129.47, 128.45, 128.35, 127.76, 127.70, 127.40, 122.78 (q, *J* = 273.0 Hz), 118.97 (q, *J* = 3.1 Hz), 117.76–117.62 (m), 72.88, 70.66, 59.05, 35.75, 20.95; HRMS (ESI-TOF) Calcd for $C_{25}H_{22}F_6NO_3S^-$[M-H]$^-$: 530.1230; found: 530.1229.



7g

Ethyl 2-(3-((*N*-(3,5-bis(trifluoromethyl)phenyl)sulfamoyl)methyl)-5-methylphenyl)acetate (7g)

7g was obtained as white solid (21.7 mg, 45%); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.57 (s, 1H), 7.49 (s, 2H), 7.41 (s, 1H), 7.04 (s, 1H), 6.95 (d, *J* = 4.5 Hz, 2H), 4.33 (s, 2H), 4.14 (q, *J* = 7.2 Hz, 2H), 3.50 (s, 2H), 2.24 (s, 3H), 1.26 (t, *J* = 7.1 Hz, 3H). ^{13}C NMR (150 MHz, $CDCl_3$) δ 171.83, 139.31, 139.24, 134.87, 132.71 (q, *J* = 33.6 Hz), 131.12, 130.44, 128.83, 127.91, 122.82 (q, *J* = 273.0 Hz), 119.14 (q, *J* = 3.4 Hz), 117.78–117.63 (m), 61.21, 58.87, 40.52, 20.90, 14.06; HRMS (ESI-TOF) Calcd for $C_{20}H_{20}F_6NO_4S$[M+H]$^+$: 484.1012; found: 484.1010.

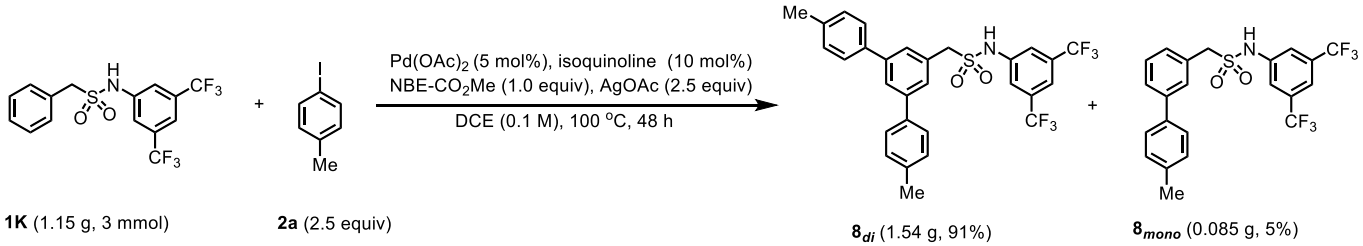


7h

***N*-(3,5-bis(trifluoromethyl)phenyl)-1-(5-butyl-2-fluorophenyl)methanesulfonamid (7h)**

7h was obtained as white solid (25.1 mg, 55%); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.55 (s, 1H), 7.43 (s, 2H), 7.15 (dd, *J* = 7.0, 2.0 Hz, 1H), 7.11–7.05 (m, 1H), 6.95 (s, 1H), 6.88–6.79 (m, 1H), 4.48 (s, 2H), 2.59–2.41 (m, 2H), 1.54–1.44 (m, 2H), 1.35–1.25 (m, 2H), 0.90 (t, *J* = 7.3 Hz, 3H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 159.26 (d, *J* = 246.7 Hz), 139.74 (d, *J* = 3.4 Hz), 138.76), 132.66 (q, *J* = 33.8 Hz), 132.19 (d, *J* = 1.9 Hz), 131.47 (d, *J* = 8.0 Hz), 122.74 (q, *J* = 273.0 Hz), 118.77 (q, *J* = 3.3 Hz), 118.03–117.66 (m), 115.40 (d, *J* = 21.5 Hz), 114.52 (d, *J* = 14.5 Hz), 52.81 (d, *J* = 2.6 Hz), 34.50, 33.42, 22.23, 13.77; ^{19}F NMR (376 MHz, $CDCl_3$) δ -63.37, -121.95; HRMS (ESI-TOF) Calcd for $C_{19}H_{17}F_7NO_2S^-$[M-H]$^-$: 456.0874; found: 456.0876.

2.5 Procedure for Gram-Scale Arylation of 1k.



Substrate **1k** (1.15 g, 3.0 mmol), $Pd(OAc)_2$ (33.6 mg, 0.15 mmol), and AgOAc (7.5 mmol, 1.25 g) were weighed in air and placed in a sealed tube (100 mL) with a magnetic stir bar. To the reaction mixture, isoquinoline (38.7 mg, 0.3 mmol), NBE-CO_2Me (456 mg, 3.0 mmol), aryl iodide **2a** (1.64 g, 7.5 mmol), and DCE (30 mL) were added. The reaction mixture was heated to 100 °C for 48 hours under vigorous stirring. Upon completion, the reaction mixture was cooled to room temperature, diluted with ethyl acetate, and filtered through a pad of celite. The filtrate was concentrated in vacuo, and the residue was purified by column chromatography (ethyl acetate/hexane = 1/4) to yield the $\mathbf{8}_{di}$ (1.54 g, 91%) and $\mathbf{8}_{mono}$ (85 mg, 5%).

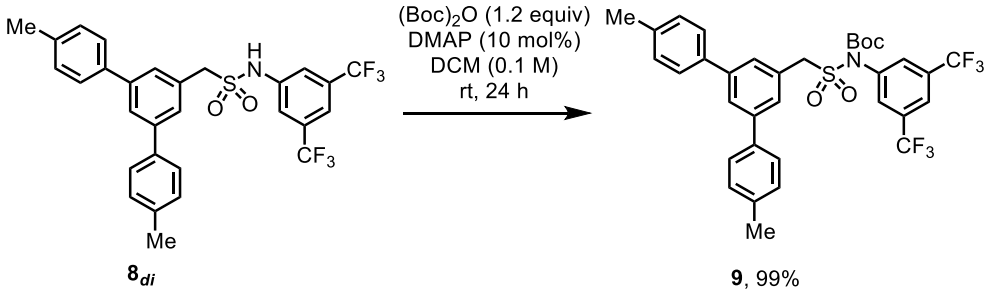
***N*-(3,5-Bis(trifluoromethyl)phenyl)-1-(4'-methyl-[1,1'-biphenyl]-3-yl)methanesulfonamide ($\mathbf{8}_{di}$)**

$\mathbf{8}_{di}$ was obtained as white solid; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.74 (s, 1H), 7.49 (s, 1H), 7.39 (s, 2H), 7.35 (d, *J* = 8.0 Hz, 4H), 7.32 (s, 2H), 7.19 (d, *J* = 8.0 Hz, 4H), 7.03 (s, 1H), 4.47 (s, 2H), 2.37 (s, 6H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 142.79, 138.95, 137.79, 136.84, 132.91 (q, *J* = 33.8 Hz), 129.58, 128.32, 127.78, 126.82, 126.65, 122.66 (q, *J* = 273.1 Hz), 118.31 (q, *J* = 3.0 Hz), 117.85–117.67 (m), 59.11, 21.05; HRMS (ESI-TOF) Calcd for $C_{29}H_{22}F_6NO_2S^-$[M-H]$^-$: 562.1281; found: 562.1280.

***N*-(3,5-Bis(trifluoromethyl)phenyl)-1-(4'-methyl-[1,1'-biphenyl]-3-yl)methanesulfonamide ($\mathbf{8}_{mono}$)**

$\mathbf{8}_{mono}$ was obtained as white solid; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.58–7.52 (m, 2H), 7.42 (s, 1H), 7.40–7.34 (m, 3H), 7.31 (d, *J* = 8.0 Hz, 2H), 7.22–7.14 (m, 3H), 6.99 (brs, 1H), 4.45 (s, 2H), 2.37 (s, 3H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 142.29, 138.87, 137.74, 136.73, 132.87 (q, *J* = 33.8 Hz), 129.60, 129.50, 129.25, 129.22, 128.03, 127.88, 126.73, 122.69 (q, *J* = 273.1 Hz), 118.71 (q, *J* = 3.2 Hz), 117.96–117.73 (m), 59.35, 21.04; HRMS (ESI-TOF) Calcd for $C_{22}H_{16}F_6NO_2S^-$[M-H]$^-$: 472.0811; found: 472.0812.

2.6 Procedure for Synthesis of 9



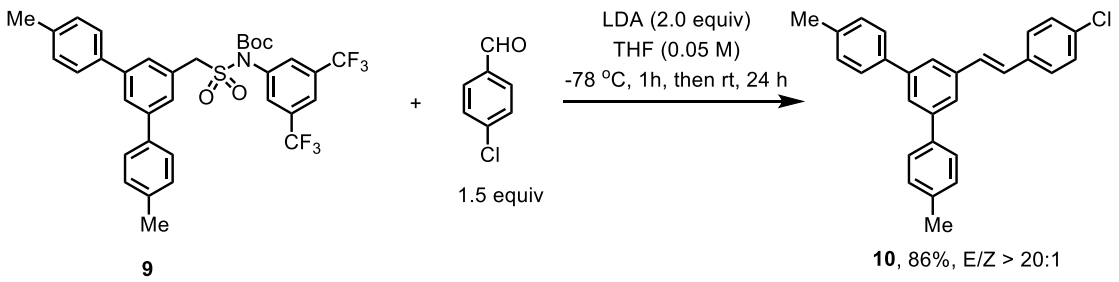
$\mathbf{8}_{di}$ $\mathbf{9}$, 99%

$\mathbf{8}_{di}$ (563.6 mg, 1.0 mmol) was added to a solution of $(Boc)_2O$ (262.2 mg, 1.2 mmol) and DMAP (12.2 mg, 0.1 mmol) in dry dichloromethane (10 mL). The solution was stirred for 24 h at room temperature. After the reaction finished, the organic layer was washed with saturated aqueous sodium bicarbonate (10.0 mL), dried over sodium sulfate, filtered and concentrated. The residue was purified by column chromatography (ethyl acetate/hexane = 1/5) to yield the desired product **9** (663.5 mg, 99%) as white solid.

***tert*-Butyl (3,5-bis(trifluoromethyl)phenyl)(((4,4''-dimethyl-[1,1':3',1''-terphenyl]-5'-yl)methyl)sulfonyl)-carbamate (9)**

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.91 (t, *J* = 1.5 Hz, 1H), 7.66 (s, 1H), 7.57 (d, *J* = 1.6 Hz, 2H), 7.47 (d, *J* = 8.1 Hz, 4H), 7.24 (d, *J* = 7.8 Hz, 4H), 6.80 (s, 2H), 5.01 (s, 2H), 2.39 (s, 6H), 1.35 (s, 9H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 150.50, 142.99, 137.86, 137.23, 136.94, 132.04 (q, *J* = 34.1 Hz), 129.86 (q, *J* = 2.7 Hz), 129.59, 128.81, 127.95, 127.21, 126.97, 122.49–122.33 (m), 122.44 (q, *J* = 273.1 Hz), 86.08, 59.39, 27.72, 21.11; HRMS (ESI-TOF) Calcd for $C_{34}H_{30}F_6NO_4S^-$[M-H]$^-$: 662.1805; found: 662.1809.

2.7 Procedure for Synthesis of 10

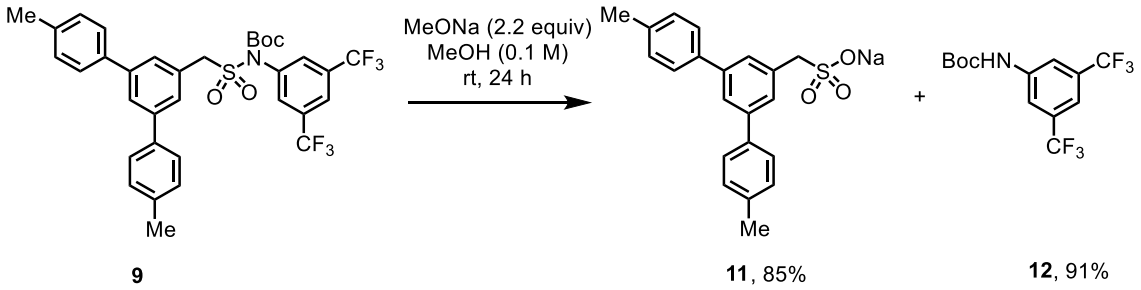


To a dried flask equipped with a magnetic stir bar was added LDA solution (0.3 mL, 2.0 M in THF), and dry THF (5.0 mL) under N_2. A solution 4-chlorobenzaldehyde (56.2mg. 0.4 mmol) and **9** (199.1 mg, 0.3 mmol) in THF (2.0 mL) was added slowly to the LDA/THF solution around 1 hour at -78 °C. The reaction mixture was stirred overnight while warming to room temperature. After the reaction mixture was quenched on saturated NH_4Cl solution and extracted with ethylacetate (3 × 10 mL). The combined organic layers were dried over anhydrous Na_2SO_4, filtered, and concentrated under vacuum. The resulting mixture was purified by column chromatography using ethyl acetate/hexane (1/20) as the eluent to yield the desired product **10** (101.9 mg, 86%) as white solid.

(*E*)-5'-(4-chlorostyryl)-4,4''-dimethyl-1,1':3',1''-terphenyl (10)

White solid, ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.67 (s, 1H), 7.64 (s, 2H), 7.56 (d, *J* = 8.0 Hz, 4H), 7.45 (d, *J* = 8.5 Hz, 2H), 7.32 (d, *J* = 8.4 Hz, 2H), 7.28 (d, *J* = 7.9 Hz, 4H), 7.19 (d, *J* = 16.4 Hz, 1H), 7.14 (d, *J* = 16.4 Hz, 1H), 2.41 (s, 6H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 142.13, 138.11, 137.80, 137.35, 135.75, 133.24, 129.53, 129.25, 128.85, 127.84, 127.70, 127.09, 125.46, 123.92, 21.13.

2.8 Procedure for Synthesis of 11



9 **11**, 85% **12**, 91%

9 (199.1 mg, 0.3 mmol) was added to a solution of MeONa (35.6 mg, 0.66 mmol) in dry MeOH (3 mL). The solution was stirred for 24 h at room temperature. After the reaction finished, the reaction mixture was quenched with H_2O (10 mL) and extracted with ethylacetate (3×10 mL). The aqueous portion was concentrated under reduced pressure to afford a white solid. The resulting solid was washed with cold MeOH (0.2 mL) and ethyl acetate (5 mL). After washing, sodium sulfonate **11** was obtained (95.5 mg, 85%) as white solid. The combined organic portion was dried over anhydrous Na_2SO_4. The crude mixture was concentrated under reduced pressure and purified by column chromatography using ethyl acetate/hexane (1/10) as the eluent to yield the desired product **12** (89.8 mg, 91%) as white solid.

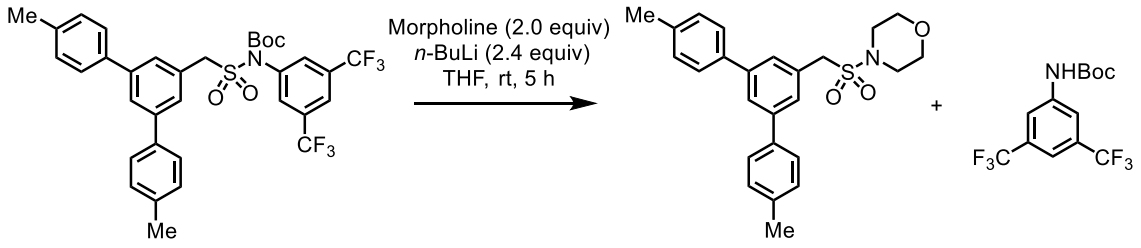
Sodium (4,4''-dimethyl-[1,1':3',1''-terphenyl]-5'-yl)methanesulfonate (11)

^{1}H NMR (400 MHz, CD_3OD) δ 7.69 (t, *J* = 1.6 Hz, 1H), 7.63 (d, *J* = 1.5 Hz, 2H), 7.58 (d, *J* = 8.1 Hz, 4H), 7.26 (d, *J* = 7.9 Hz, 4H), 4.18 (s, 2H), 2.38 (s, 6H); ^{13}C NMR (150 MHz, CD_3OD) δ 142.84, 139.55, 138.24, 135.49, 130.4, 128.93, 128.06, 125.30, 58.56, 21.14; HRMS (ESI-TOF) Calcd for $C_{21}H_{20}NaO_3S[M+H]^+$: 375.1025; found: 375.1027.

***tert*-Butyl (3,5-bis(trifluoromethyl)phenyl)carbamate (12)**

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.86 (s, 2H), 7.52 (s, 1H), 6.78 (s, 1H), 1.54 (s, 9H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 152.08, 139.88, 132.32 (q, *J* = 33.4 Hz), 123.13 (q, *J* = 272.8 Hz), 117.96, 117.09–114.66 (m), 81.94, 28.18.

2.9 Procedure for Synthesis of 13



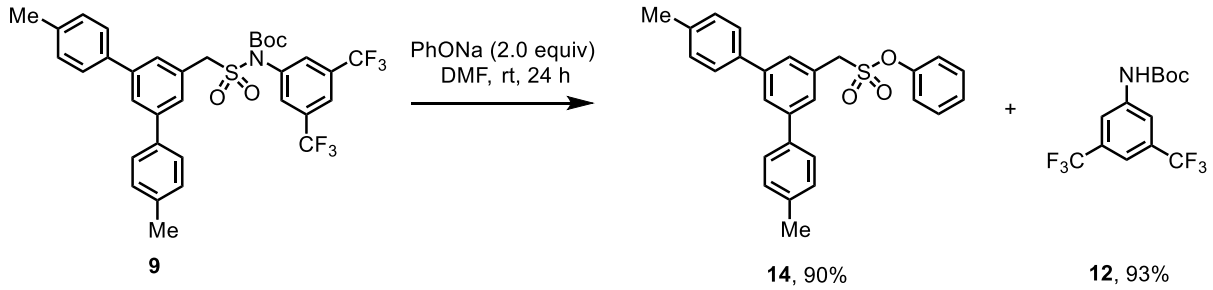
9 **13**, 91% **12**, 97%

To a solution of morpholine (9.0 μL, 0.1 mmol) in THF (0.3 mL) under N_2 was added n-BuLi (0.45 mL, 2.7 M) at room temperature. After 10 mins, a solution of **9** (33.2 mg, 0.05 mmol) in THF (0.7 mL) was added, and then the mixture was stirred for 5 hours. Then the mixture was concentrated in vacuum, and the crude products were purified by the PTLC using EA/Hexane (1/2) as eluent to afford sulfonamide **13** as a light yellow solid (19.3 mg, 91%). The Boc-protected 3,5-bis(trifluoromethyl)aniline **12** was isolated as a white solid (16.0 mg, 97%).

4-(((4,4''-Dimethyl-[1,1':3',1''-terphenyl]-5'-yl)methyl)sulfonyl)morpholine (13)

white solid, ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.78 (t, *J* = 1.7 Hz, 1H), 7.57 (d, *J* = 1.7 Hz, 2H), 7.54 (d, *J* = 8.0 Hz, 4H), 7.28 (d, *J* = 7.8 Hz, 4H), 4.33 (s, 2H), 3.62 (t, *J* = 4.6 Hz, 4H), 3.18 (t, *J* = 4.6 Hz, 4H), 2.41 (s, 6H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 142.26, 137.69, 137.34, 129.62, 129.37, 127.79, 127.03, 126.12, 66.70, 56.72, 46.26, 21.13; HRMS (ESI-TOF) Calcd for $C_{25}H_{28}NO_3S[M+H]^+$: 422.1784; found: 422.1786.

2.10 Procedure for Synthesis of 14



A solution of **9** (33.2 mg, 0.05 mmol), and PhONa (11.6 mg, 0.1 mmol) in DMF (1.0 mL) was stirred at room temperature for 24 hours. The mixture was diluted by EA (2 mL) and pass through a pad of Celite to remove the insoluble salt. After concertation under vacuum, the crude products were purified by the PTLC using DCM/Hexane (1/1) as eluent to afford sulfonate ester **14** as a white solid (19.6 mg, 90%). The Boc-protected 3,5-bis(trifluoromethyl)aniline **12** was isolated as a white solid (15.6 mg, 93%).

Phenyl (4,4''-dimethyl-[1,1':3',1''-terphenyl]-5'-yl)methanesulfonate (14)

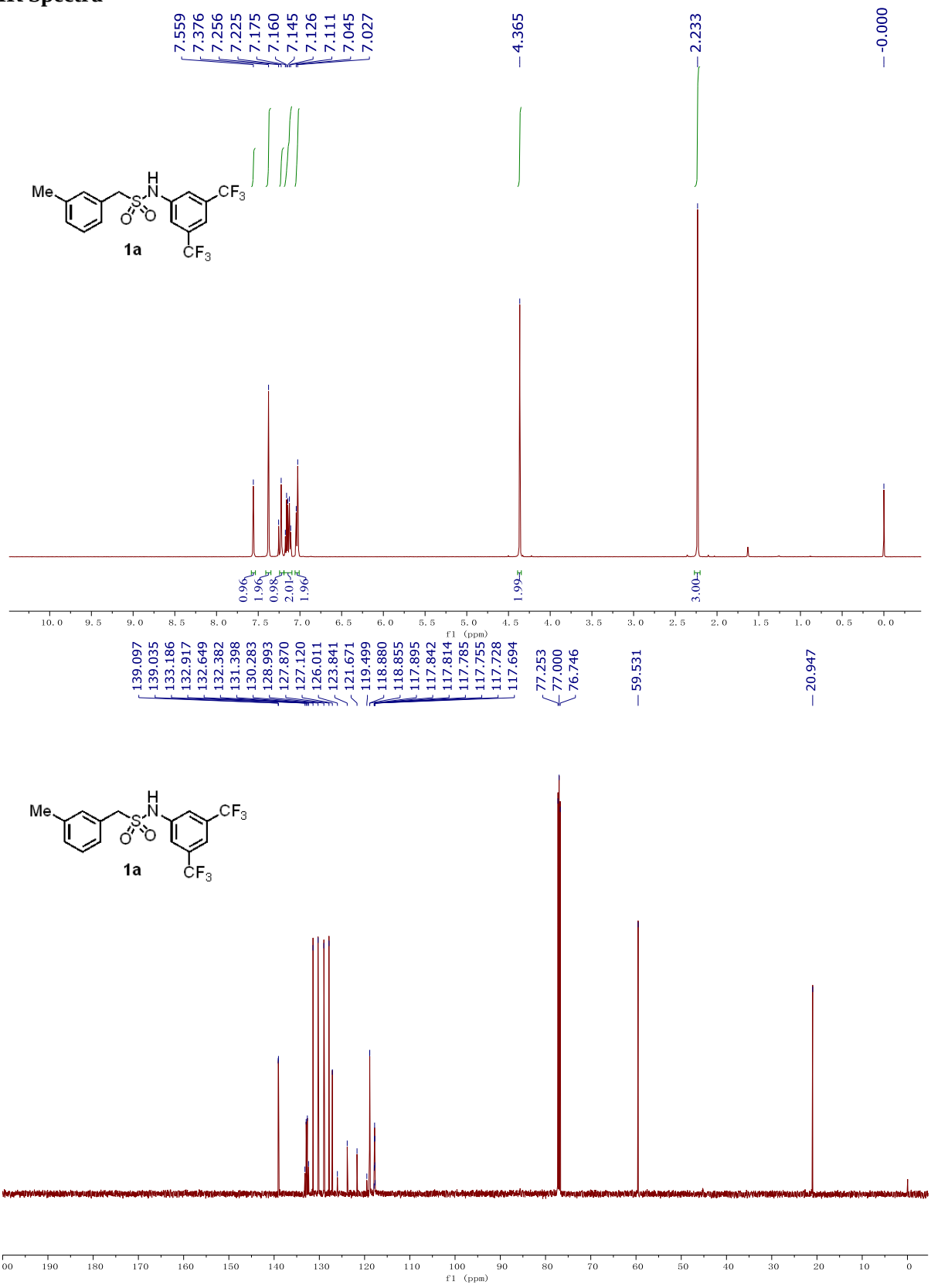
White solid, ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.80 (t, *J* = 1.7 Hz, 1H), 7.60 (s, 2H), 7.52 (d, *J* = 7.8 Hz, 4H), 7.36 (t, *J* = 7.8 Hz, 2H), 7.30–7.25 (m, 5H), 7.18 (d, *J* = 7.9 Hz, 2H), 4.62 (s, 2H), 2.40 (s, 6H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 149.31, 142.46, 137.65, 137.37, 129.90, 129.59, 128.02, 127.99, 127.15, 127.09, 126.59, 121.98, 56.88, 21.13; HRMS (ESI-TOF) Calcd for $C_{27}H_{25}O_3S[M+H]^+$: 429.1519; found: 429.1523.

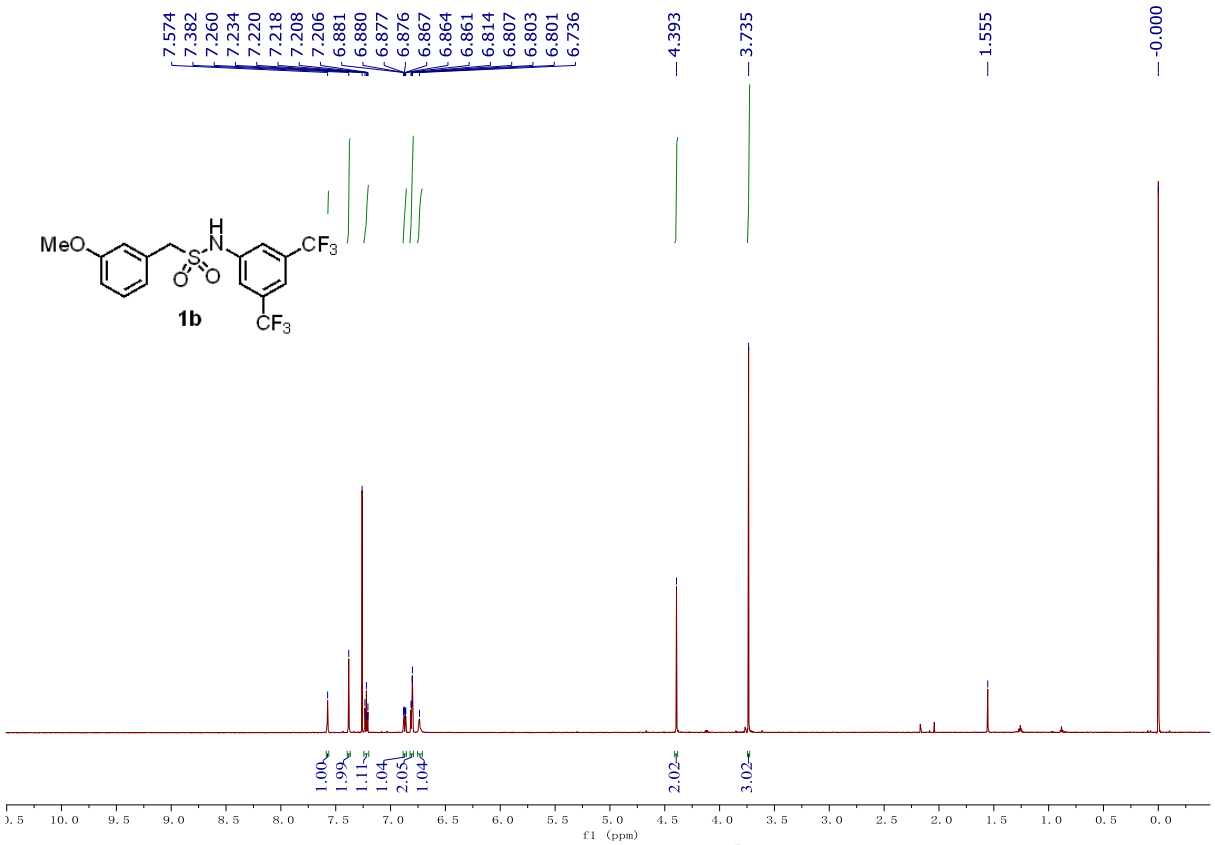
3. References

1. P. Wang, G.-C. Li, P. Jain, M. E. Farmer, J. He, P.-X. Shen, J.-Q. Yu, *J. Am. Chem. Soc.* **2016**, *138*, 14092.

2. H.-X. Dai, A. F. Stepan, M. S. Plummer, Y.-H. Zhang, J.-Q. Yu, *J. Am. Chem. Soc.* **2011**, *133*, 7222.

4. NMR Spectra

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6.801
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3.735
1.555
-0.000
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CF3
1b
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1.99
1.11
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2.05
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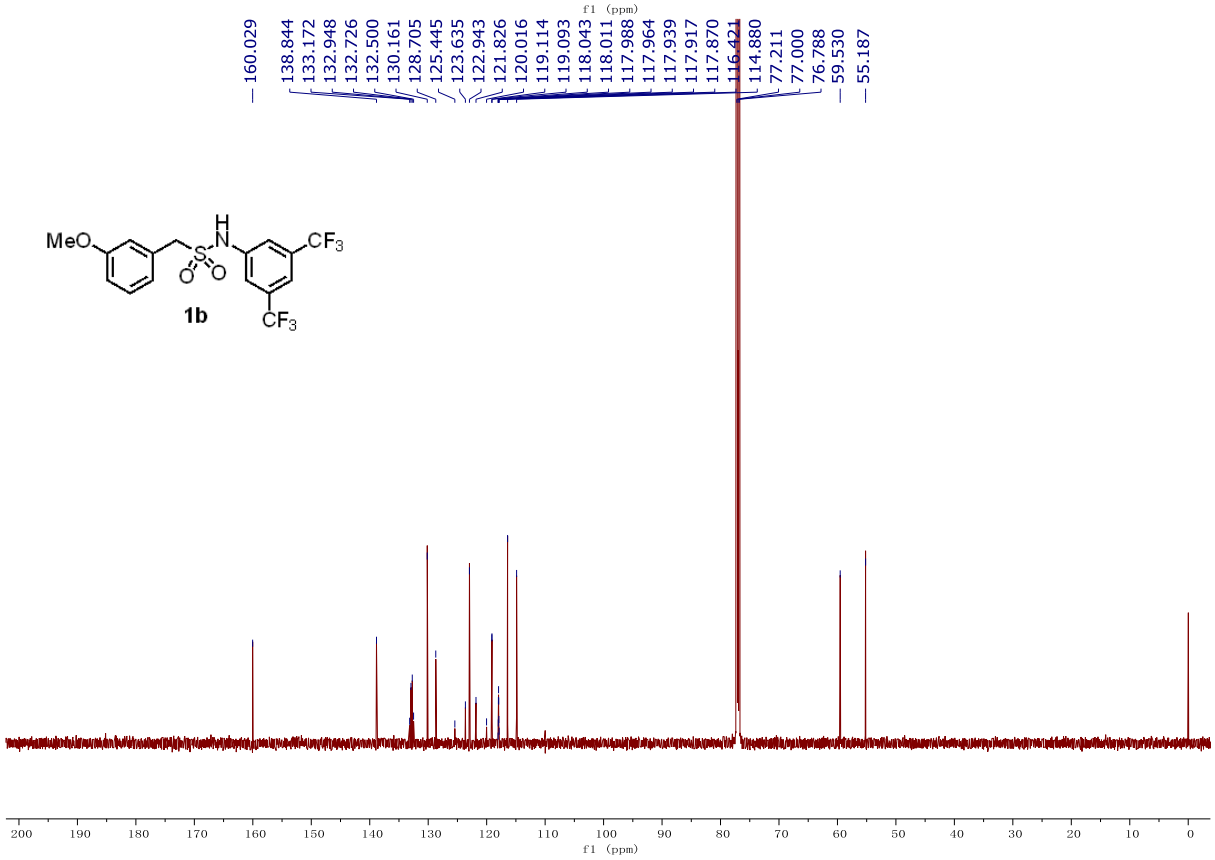
2.02
3.02
f1 (ppm)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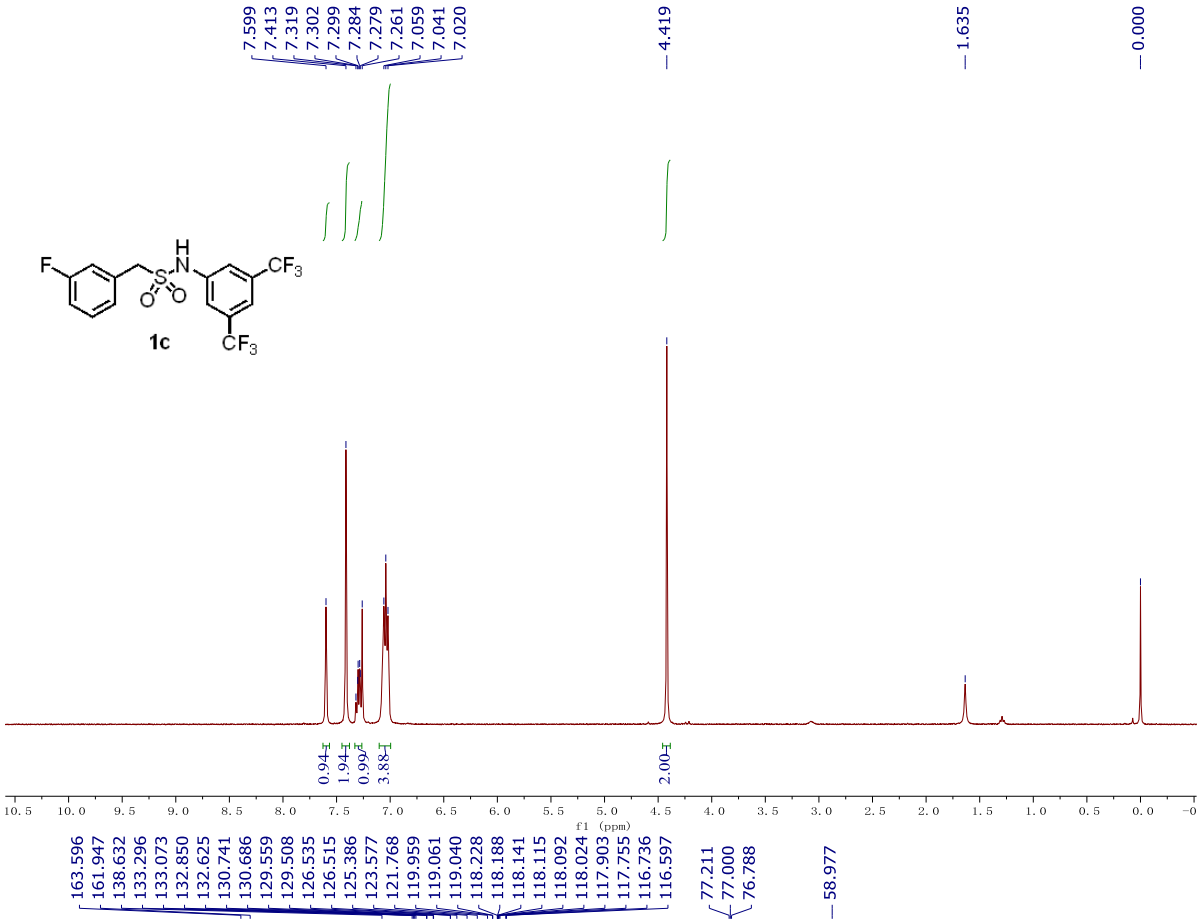
f1 (ppm)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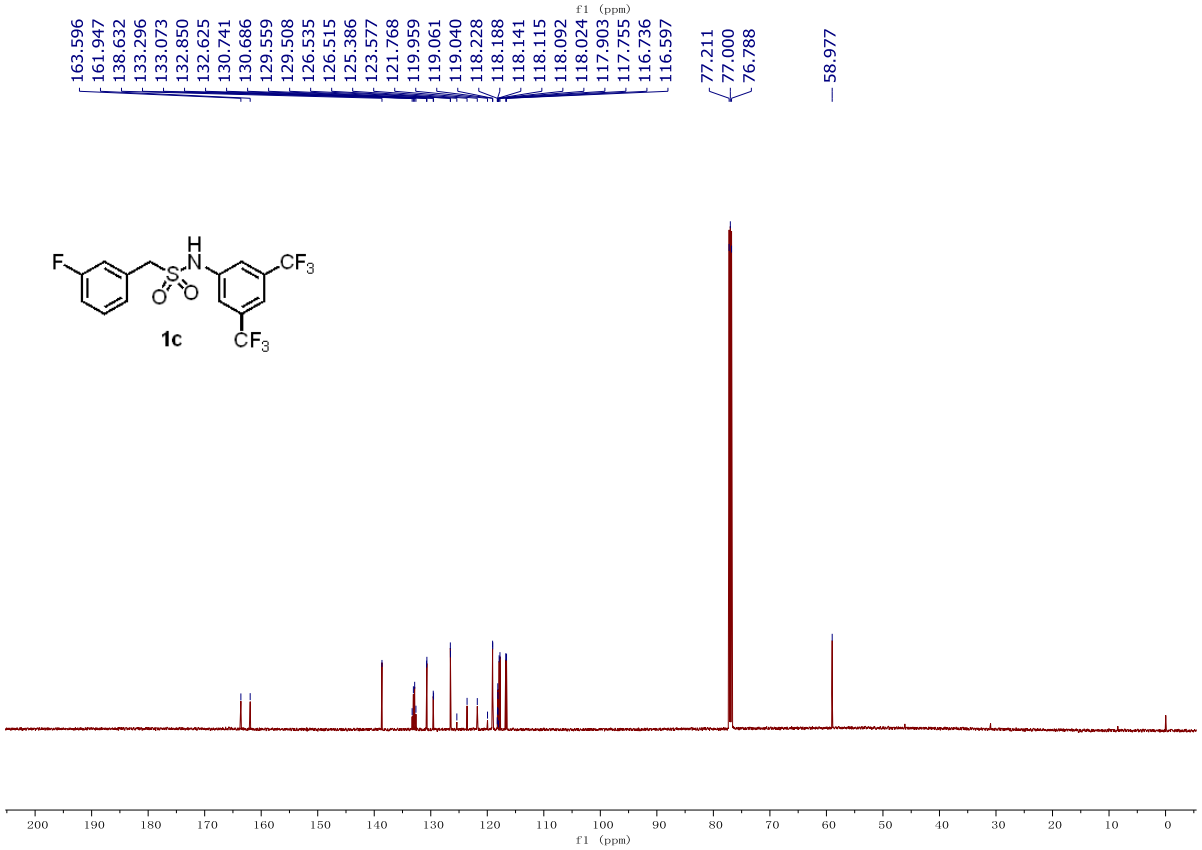
N
S
O
O
CF3
CF3
1c
0.94
1.94
0.99
3.88
2.00
f1 (ppm)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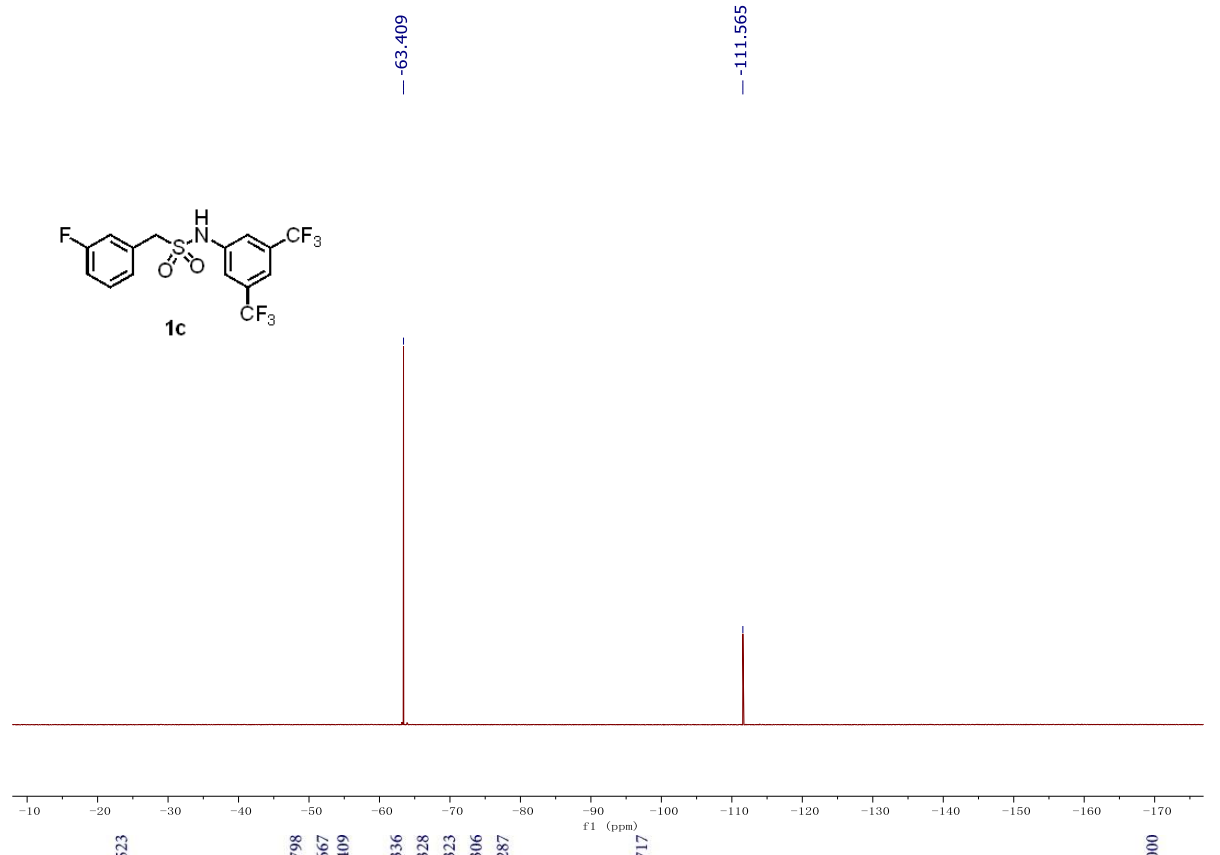
133.296
133.073
132.850
132.625
130.741
130.686
129.559
129.508
126.535
126.515
125.386
123.577
121.768
119.959
119.061
119.040
118.228
118.188
118.141
118.115
118.092
118.024
117.903
117.755
116.736
116.597
77.211
77.000
76.788
58.977
F
H
N
S
O
O
CF3
CF3
1c
f1 (ppm)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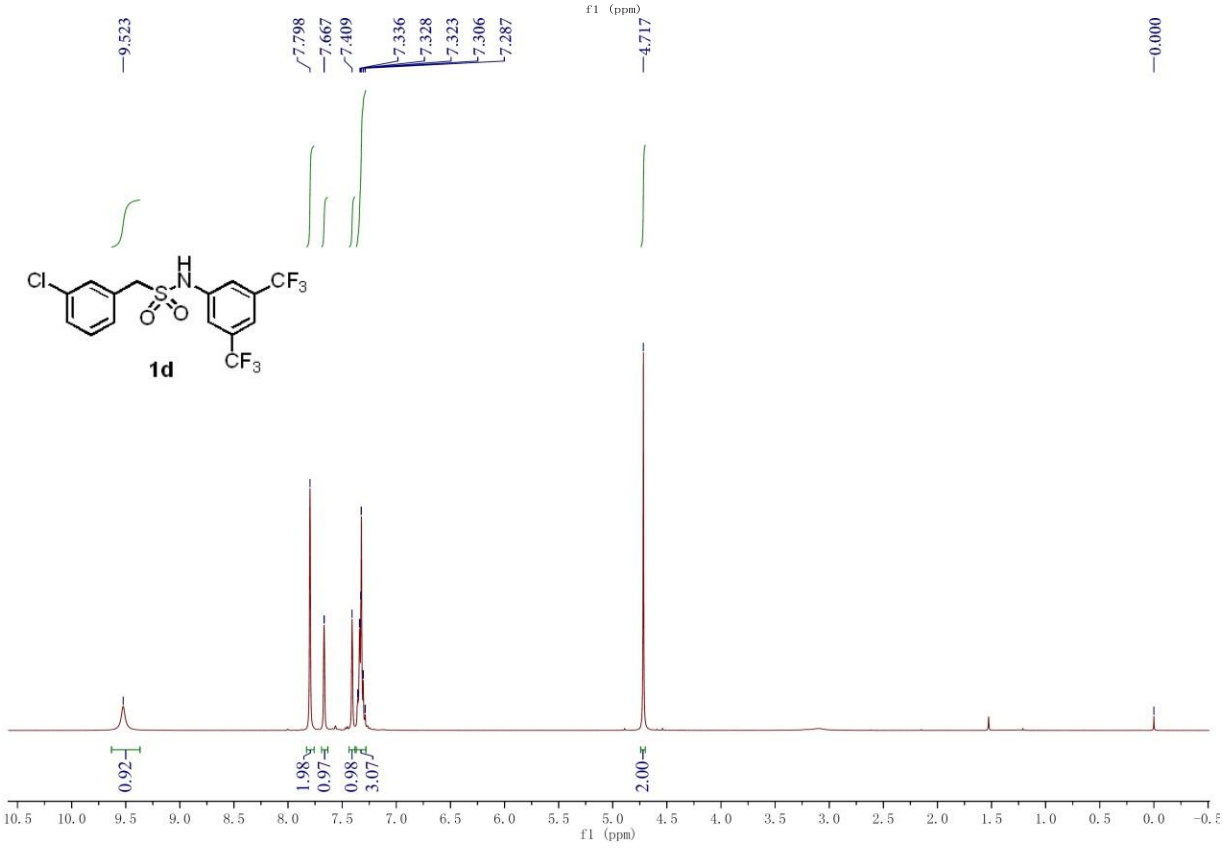
-111.565
F
H
N
S
O
O
CF3
CF3
1c
f1 (ppm)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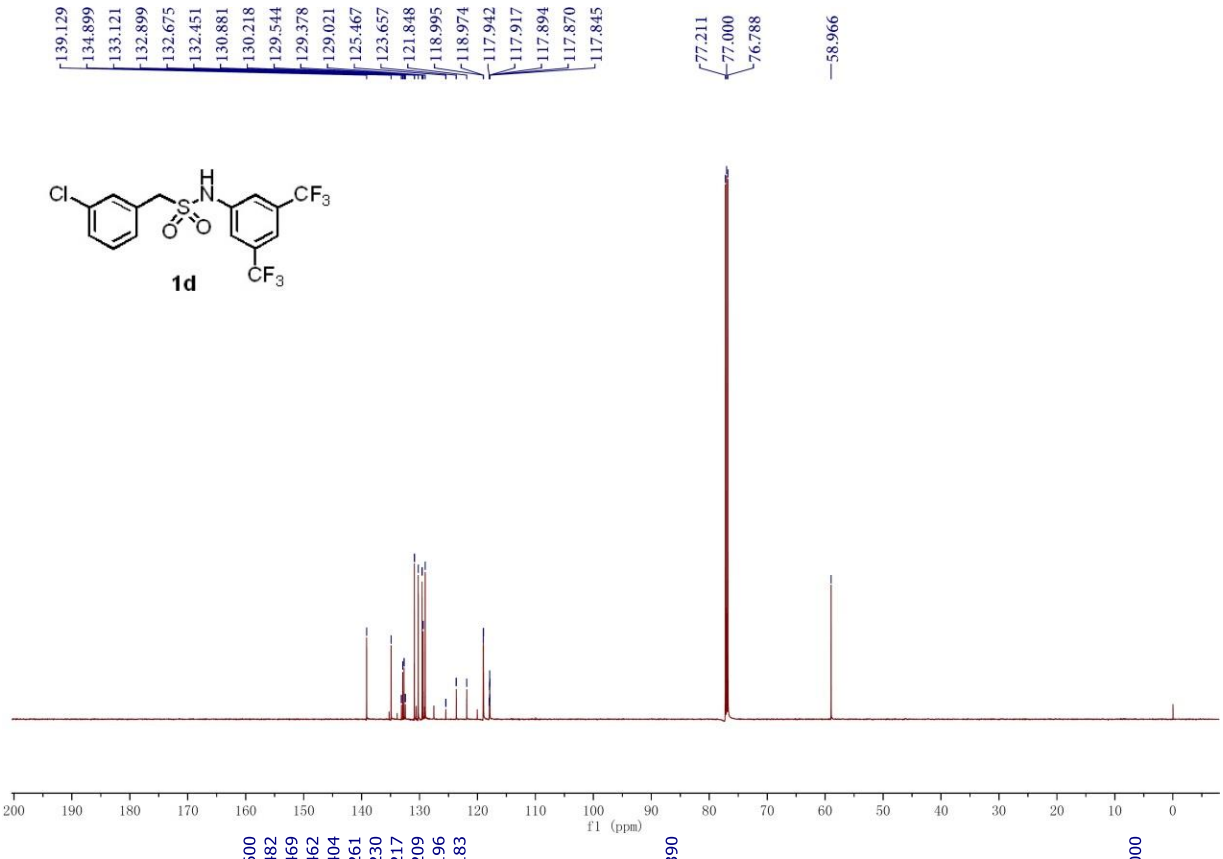
7.798
7.667
7.409
7.336
7.328
7.323
7.306
7.287
4.717
0.000
Cl
H
N
S
O
O
CF3
CF3
1d
0.92
1.98
0.97
0.98
3.07
2.00
f1 (ppm)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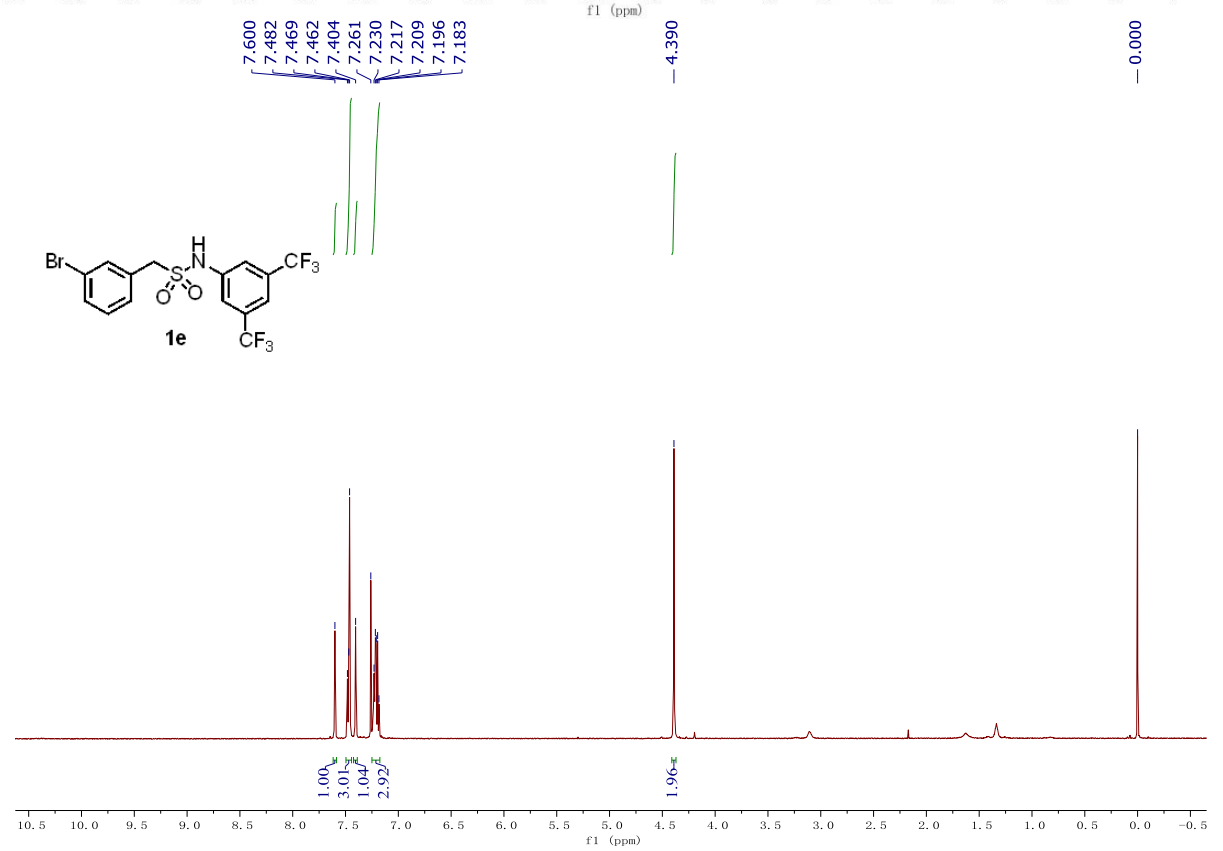
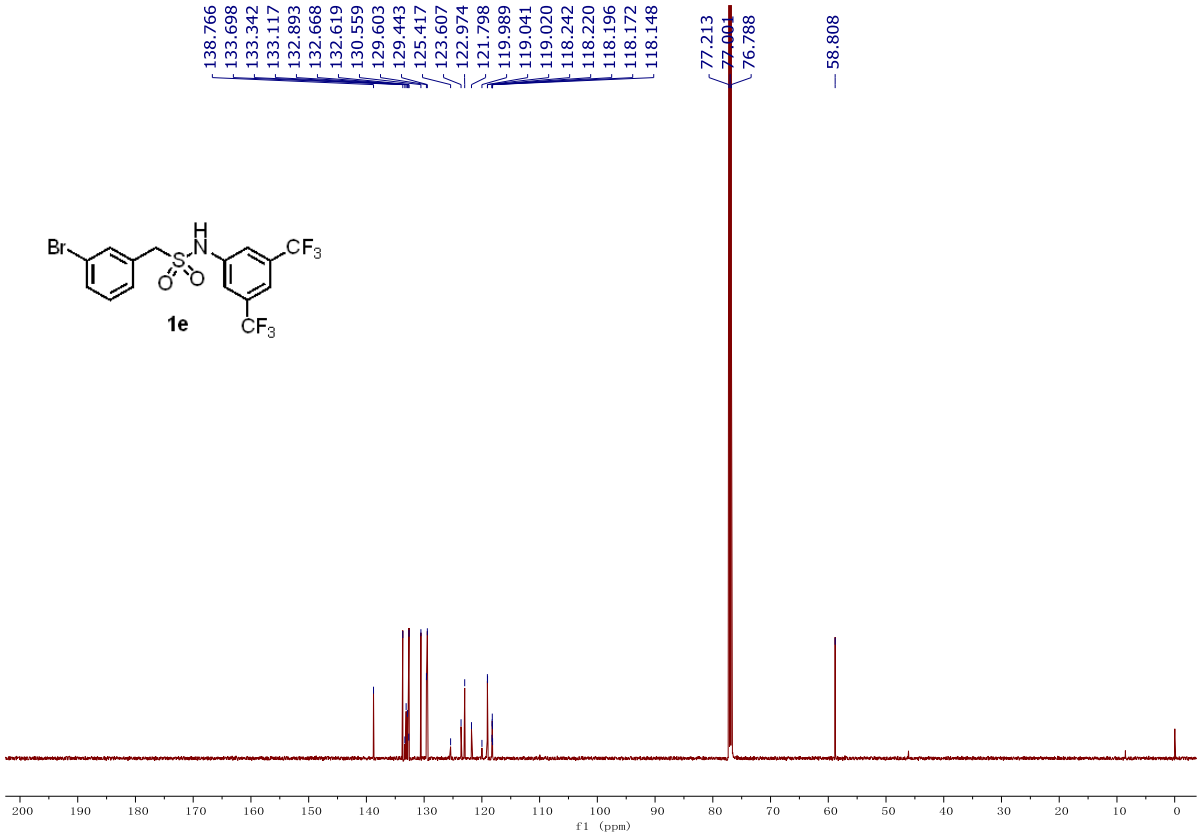
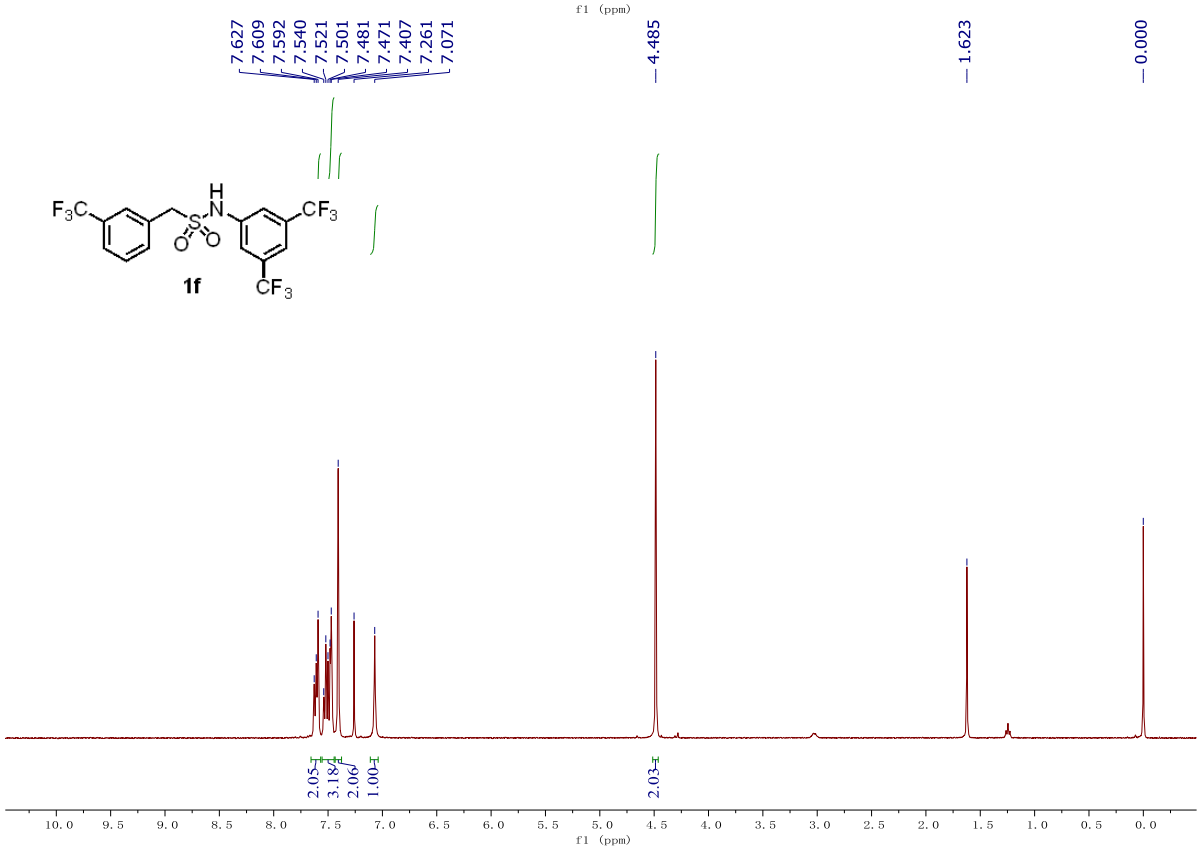
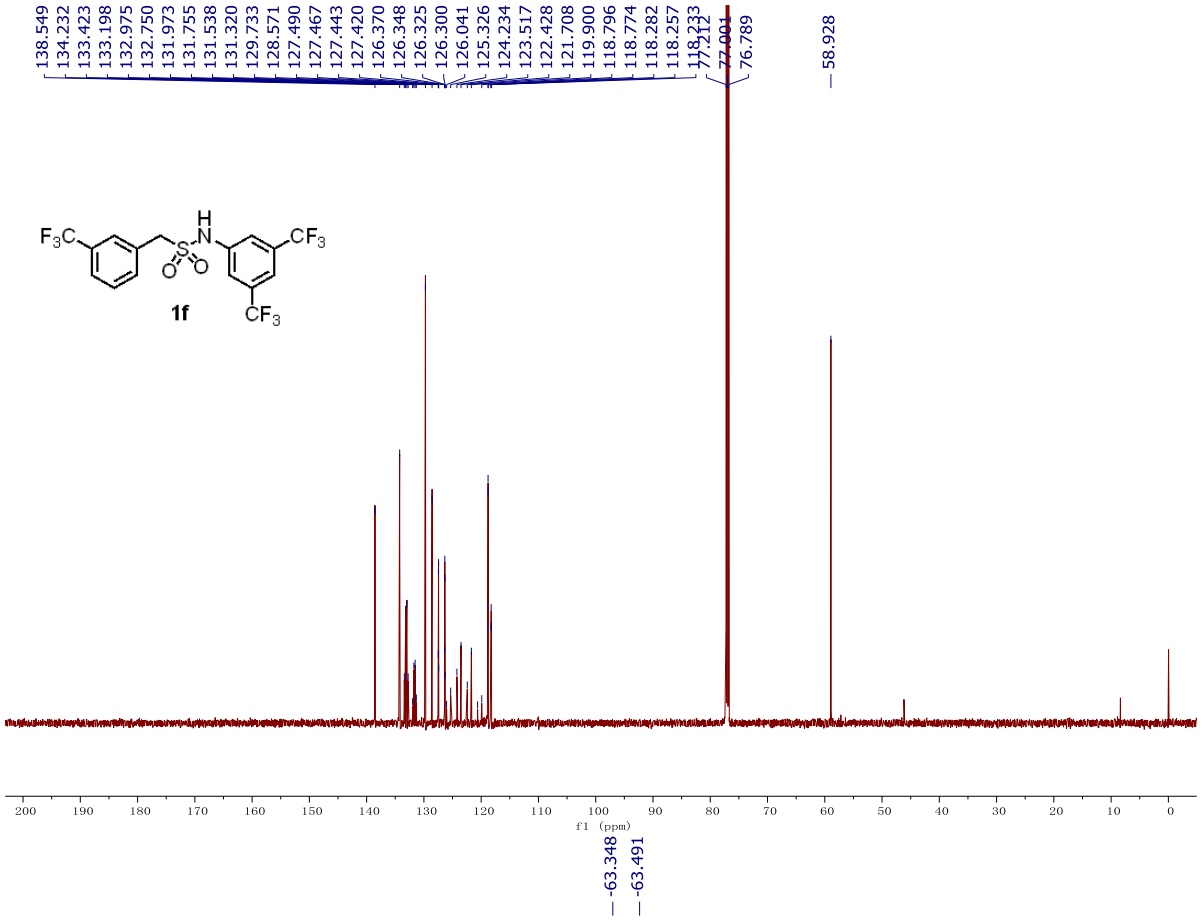
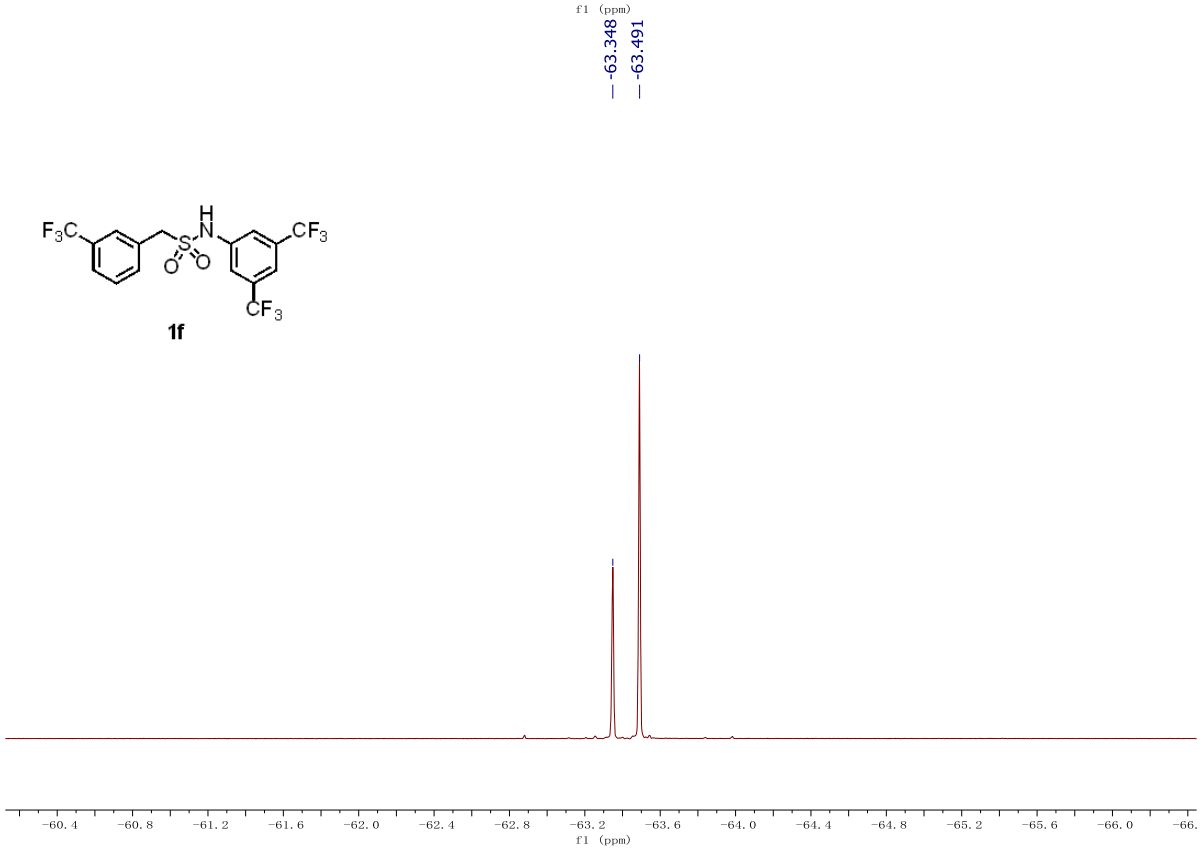
133.121
132.899
132.675
132.451
130.881
130.218
129.544
129.378
129.021
125.467
123.657
121.848
118.995
118.974
117.942
117.917
117.894
117.870
117.845
77.211
77.000
76.788
58.966
Cl
H
N
S
O
O
CF3
CF3
1d
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

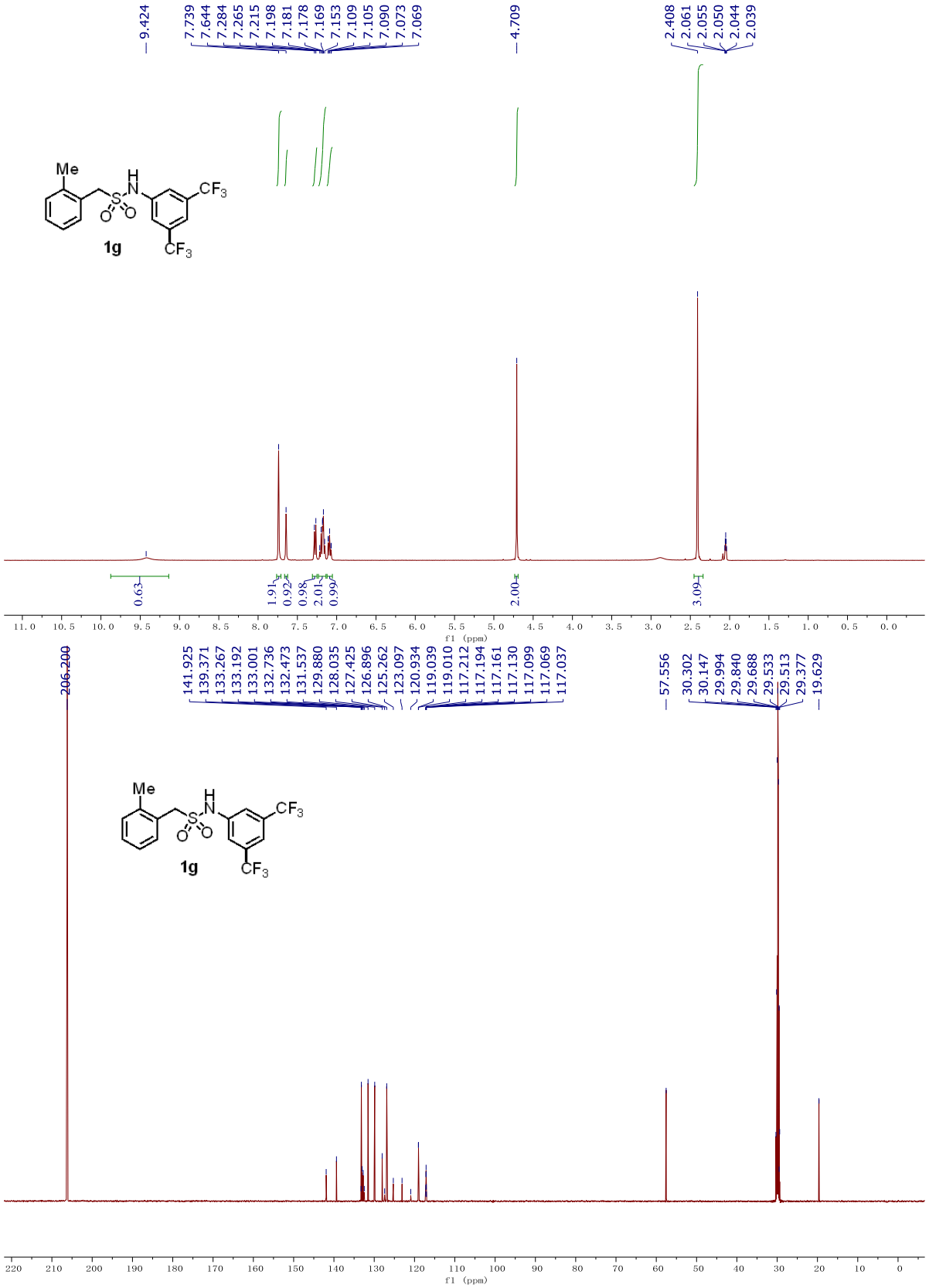

7.600
7.482
7.469
7.462
7.404
7.261
7.230
7.217
7.209
7.196
7.183
4.390
0.000
Br
H
N
S
O
O
CF3
CF3
1e
1.00
3.01
1.04
2.92
1.96
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)

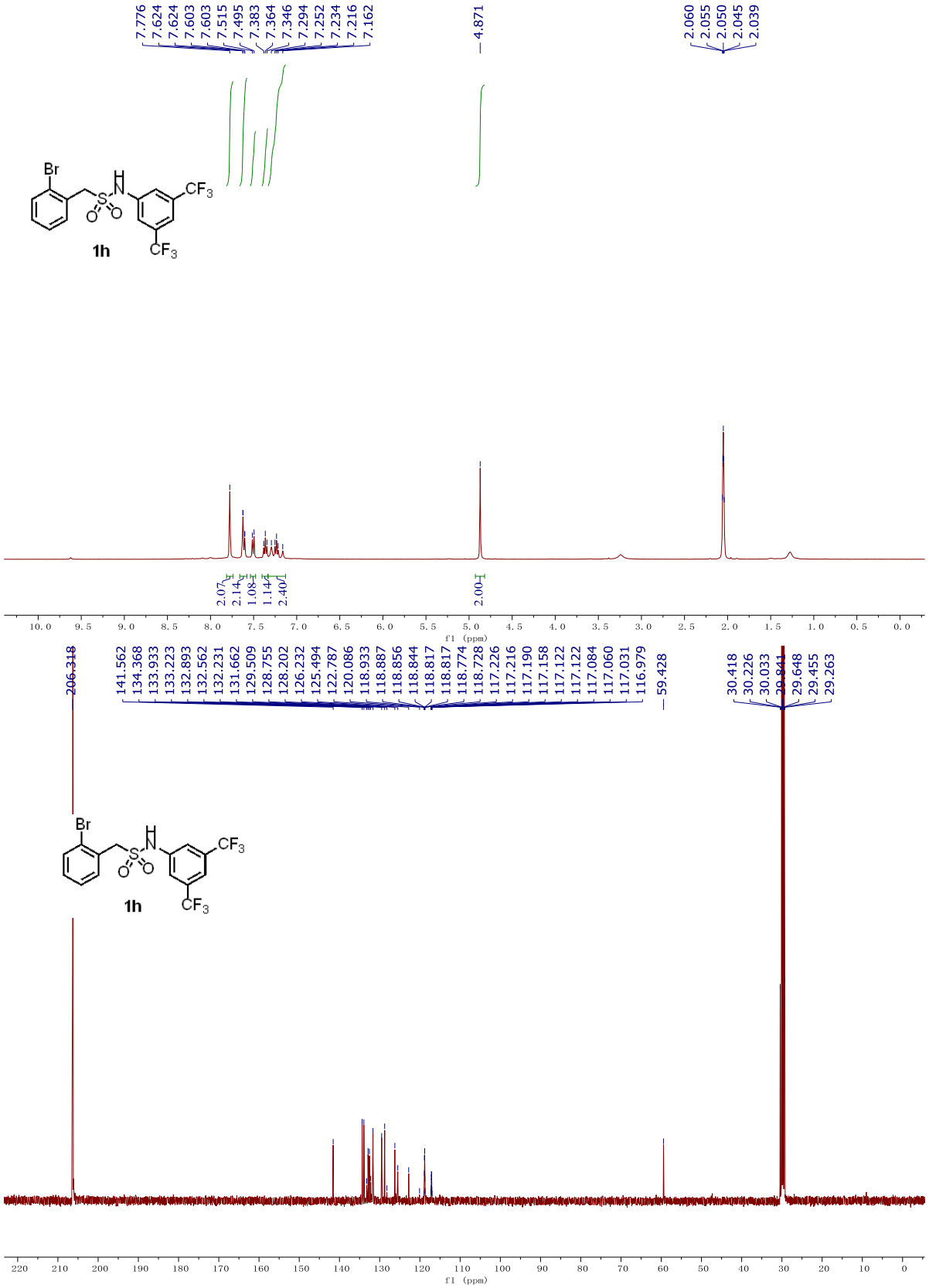

138.766
133.698
133.342
133.117
132.893
132.668
132.619
130.559
129.603
129.443
125.417
123.607
122.974
121.798
119.989
119.041
119.020
118.242
118.220
118.196
118.172
118.148
77.213
77.001
76.788
58.808
Br
CF3
CF3
1e
f1 (ppm)


7.627
7.609
7.592
7.540
7.521
7.501
7.481
7.471
7.407
7.261
7.071
4.485
1.623
0.000
F3C
CF3
CF3
1f
2.05
3.18
2.06
1.00
2.03
f1 (ppm)


138.549
134.232
133.423
133.198
132.975
132.750
131.973
131.755
131.538
131.320
129.733
128.571
127.490
127.467
127.443
127.420
126.370
126.348
126.325
126.300
126.041
125.326
124.234
123.517
122.428
121.708
119.900
118.796
118.774
118.282
118.257
118.233
77.212
77.001
76.789
58.928
F3C
CF3
CF3
1f
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)


-63.348
-63.491
F3C
CF3
CF3
1f
-60.4
-60.8
-61.2
-61.6
-62.0
-62.4
-62.8
-63.2
-63.6
-64.0
-64.4
-64.8
-65.2
-65.6
-66.0
-66.
f1 (ppm)


9.424
7.739
7.644
7.284
7.265
7.215
7.198
7.181
7.178
7.169
7.153
7.109
7.105
7.090
7.073
7.069
4.709
2.408
2.061
2.055
2.050
2.044
2.039
Me
H
N
S
O
O
CF3
CF3
1g
0.63
1.91
0.92
0.98
2.01
0.99
2.00
3.09
f1 (ppm)
206.200
141.925
139.371
133.267
133.192
133.001
132.736
132.473
131.537
129.880
128.035
127.425
126.896
125.262
123.097
120.934
119.039
119.010
117.212
117.194
117.161
117.130
117.099
117.069
117.037
57.556
30.302
30.147
29.994
29.840
29.688
29.533
29.513
29.377
19.629
Me
H
N
S
O
O
CF3
CF3
1g
f1 (ppm)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7.624
7.624
7.603
7.603
7.515
7.495
7.383
7.364
7.346
7.294
7.252
7.234
7.216
7.162
4.871
2.060
2.055
2.050
2.045
2.039
Br
CF3
CF3
1h
2.07
2.14
1.08
1.14
2.40
2.00
f1 (ppm)
206.318
141.562
134.368
133.933
133.223
132.893
132.562
132.231
131.662
129.509
128.755
128.202
126.232
125.494
122.787
120.086
118.933
118.887
118.856
118.844
118.817
118.817
118.774
118.728
117.226
117.216
117.190
117.158
117.122
117.122
117.084
117.060
117.031
116.979
59.428
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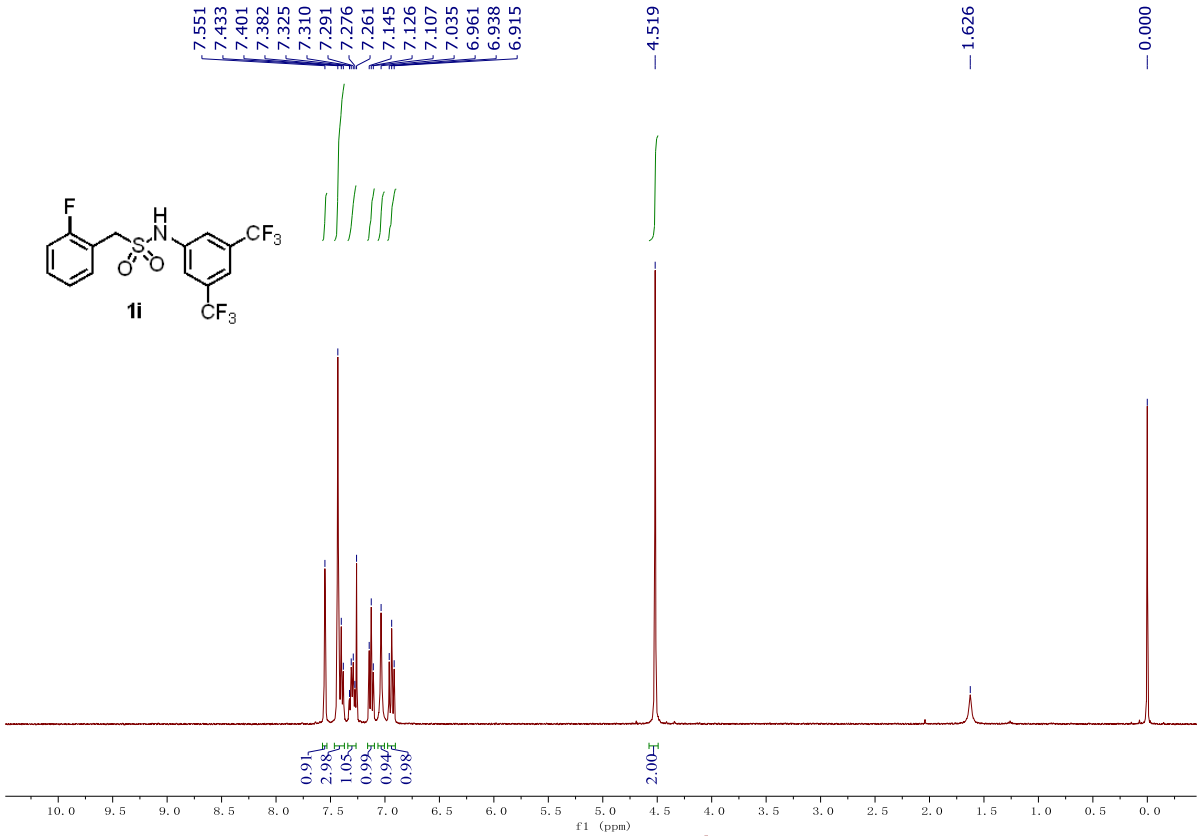
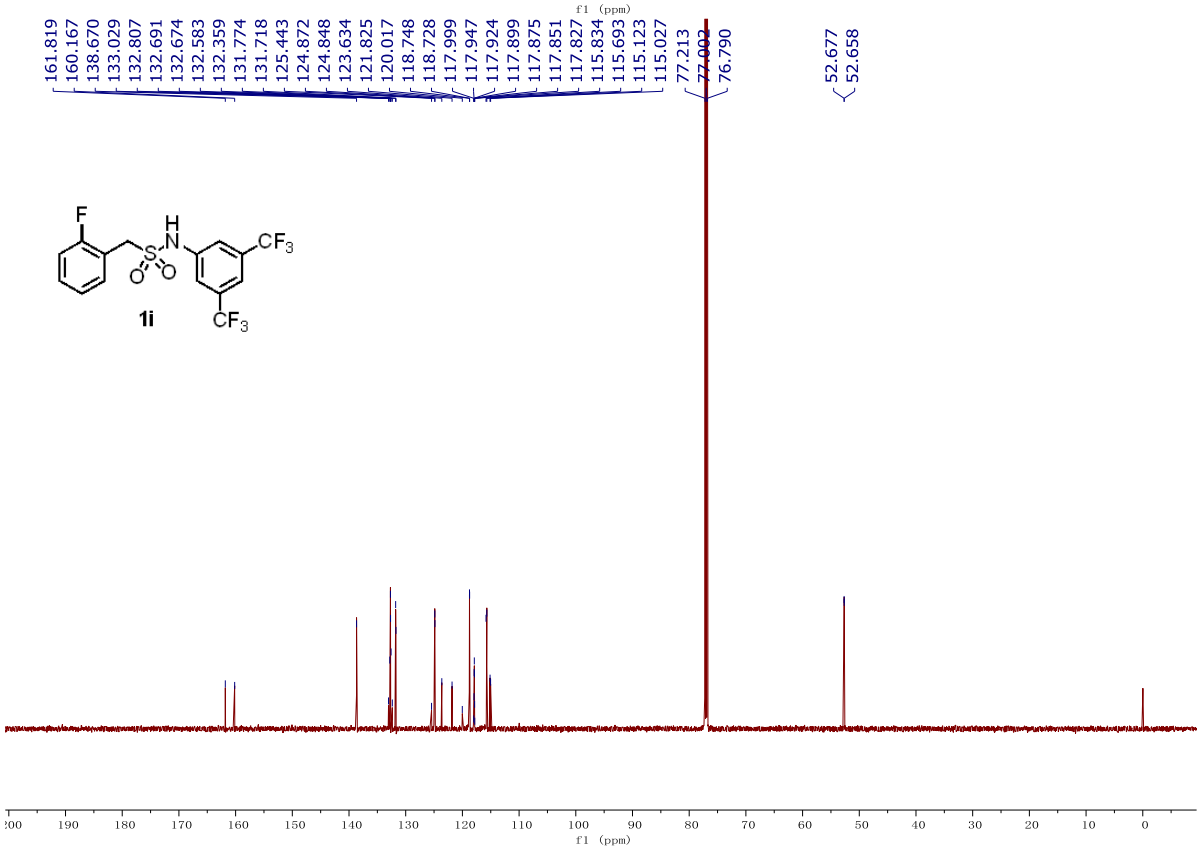
30.226
30.033
29.841
29.648
29.455
29.263
Br
CF3
CF3
1h
f1 (ppm)


7.551
7.433
7.401
7.382
7.325
7.310
7.291
7.276
7.261
7.145
7.126
7.107
7.035
6.961
6.938
6.915
4.519
1.626
0.000
F
H
N
S
O
O
CF3
CF3
1i
0.91
2.98
1.05
0.99
0.94
0.98
2.00
f1 (ppm)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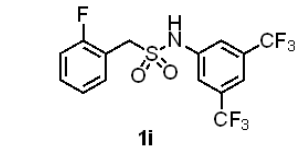
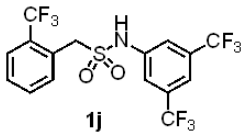
160.167
138.670
133.029
132.807
132.691
132.674
132.583
132.359
131.774
131.718
125.443
124.872
124.848
123.634
121.825
120.017
118.748
118.728
117.999
117.947
117.924
117.899
117.875
117.851
117.827
115.834
115.693
115.123
115.027
77.213
77.002
76.790
52.677
52.658
F
H
N
S
O
O
CF3
CF3
1i
f1 (ppm)



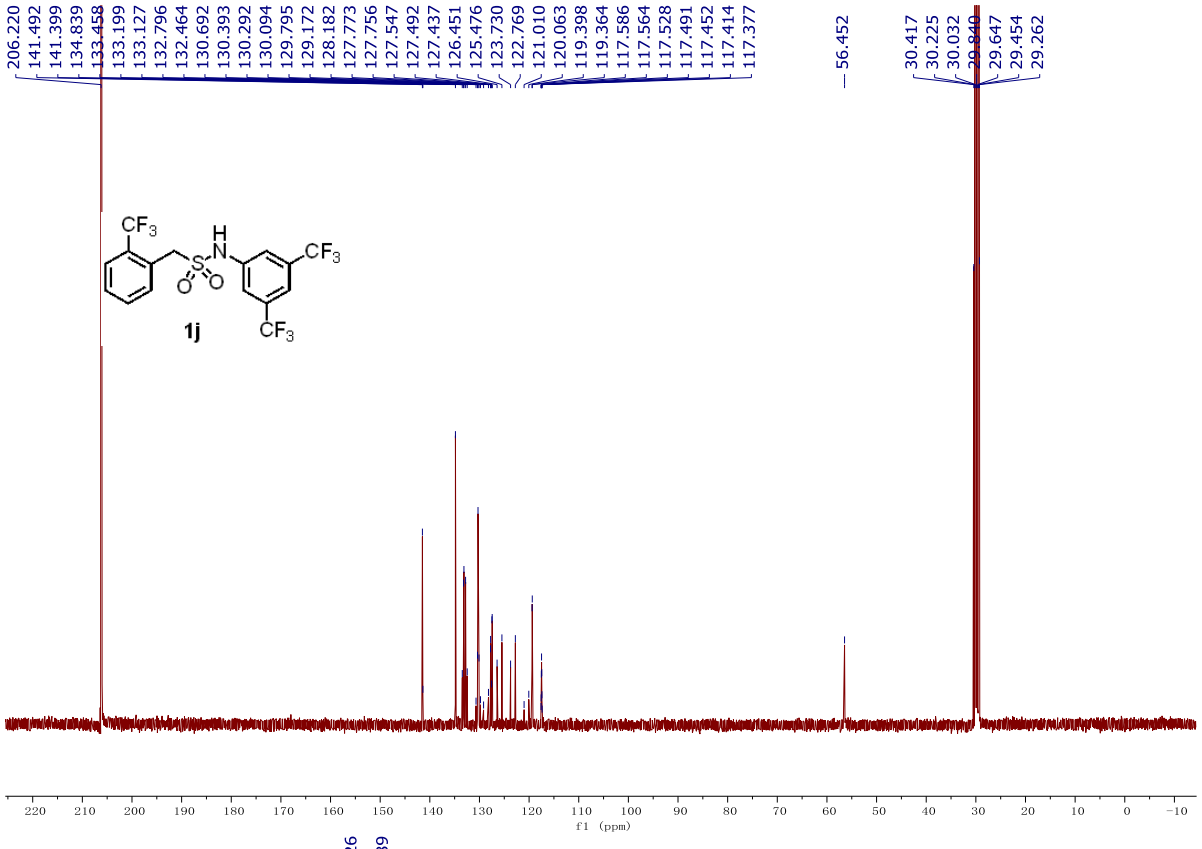
1i

-63.389
-116.949
f1 (ppm)



1j

9.639
7.807
7.786
7.730
7.711
7.684
7.656
7.637
7.584
7.565
7.546
4.877
2.061
2.056
2.050
2.045
2.039
0.85
2.84
2.91
1.01
2.01
f1 (ppm)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141.399
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132.796
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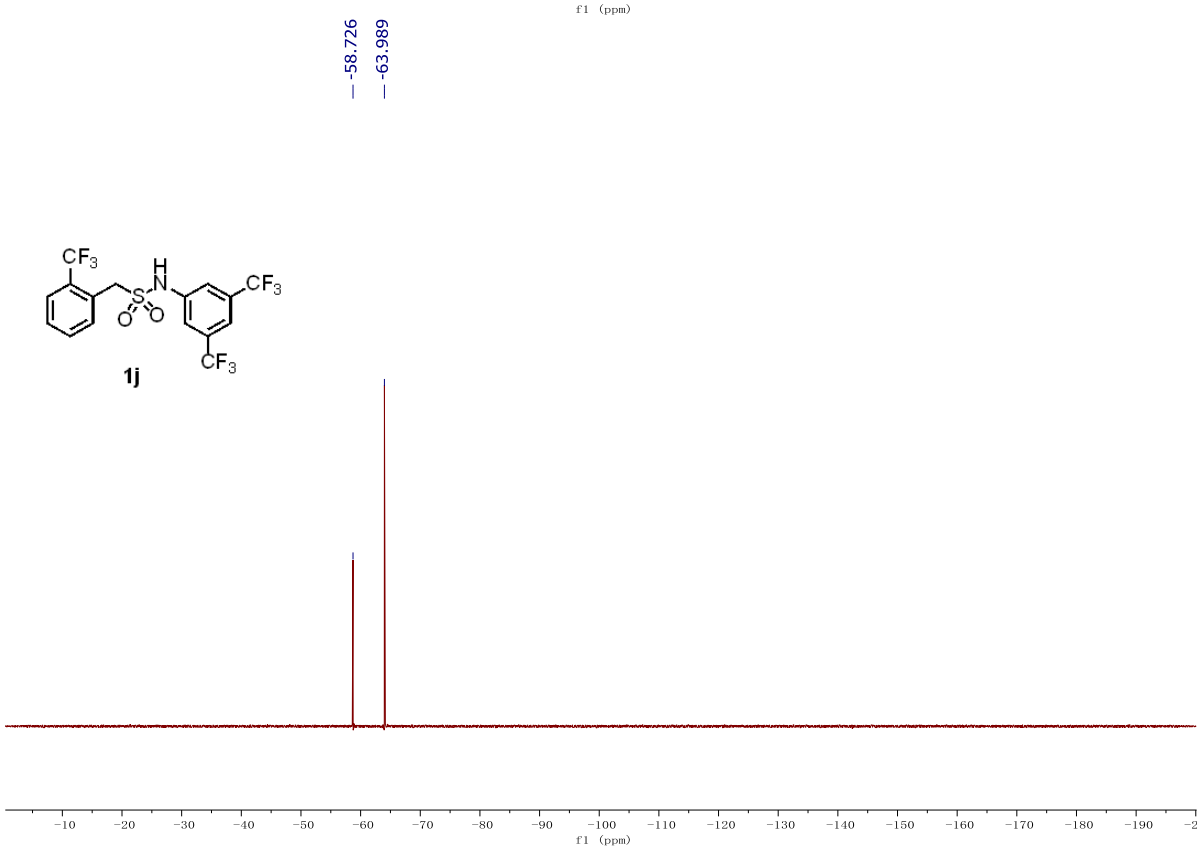
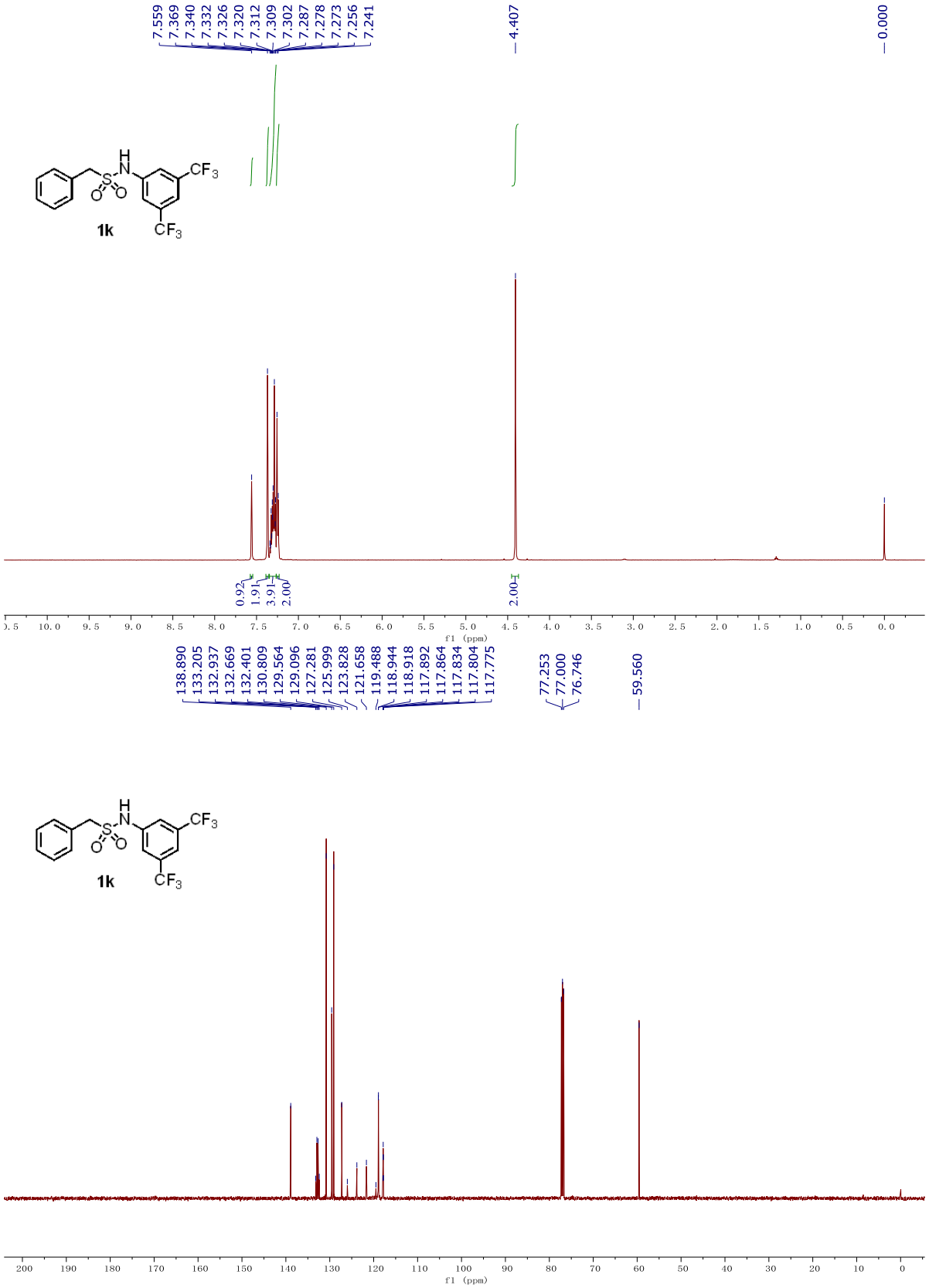
130.692
130.393
130.292
130.094
129.795
129.172
128.182
127.773
127.756
127.547
127.492
127.437
126.451
125.476
123.730
122.769
121.010
120.063
119.398
119.364
117.586
117.564
117.528
117.491
117.452
117.414
117.377
56.452
30.417
30.225
30.032
29.840
29.647
29.454
29.262
CF3
H
N
S
O
O
CF3
CF3
1j
220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)


-58.726
-63.989
CF3
H
N
S
O
O
CF3
CF3
1j
-10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -2
f1 (ppm)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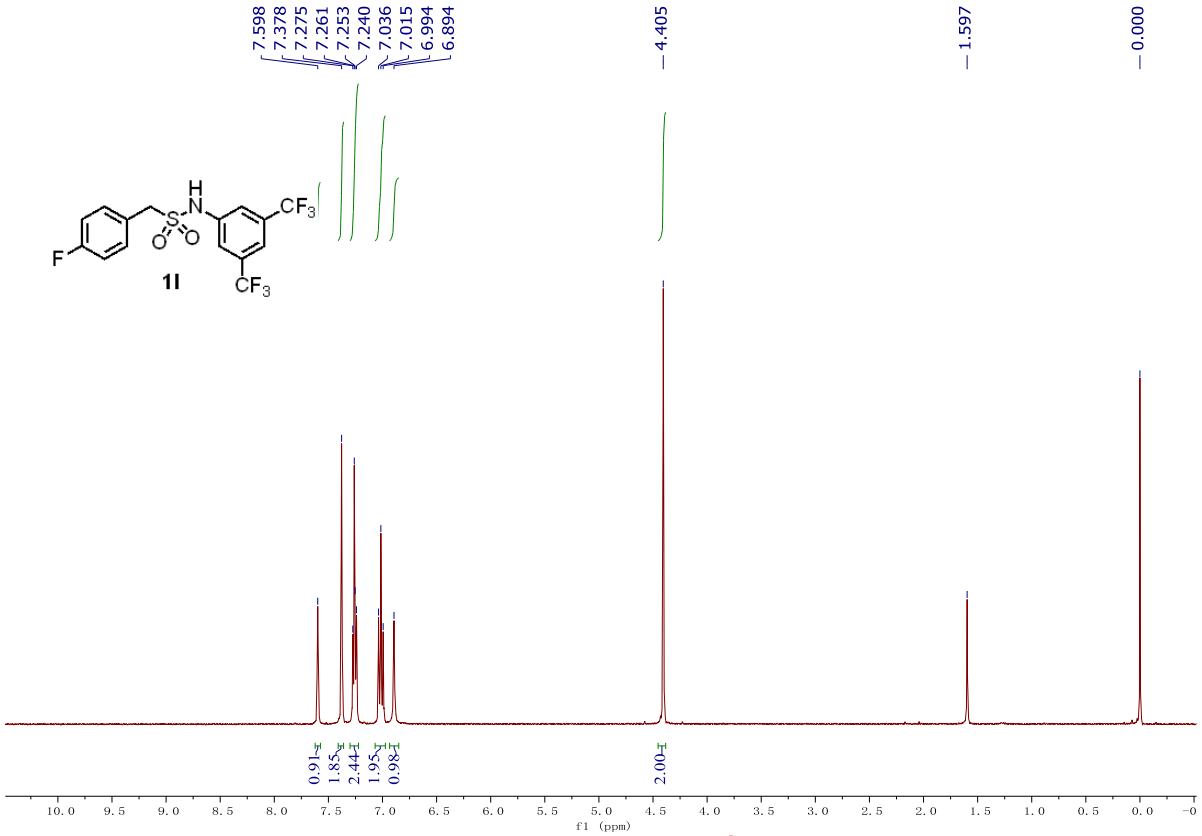
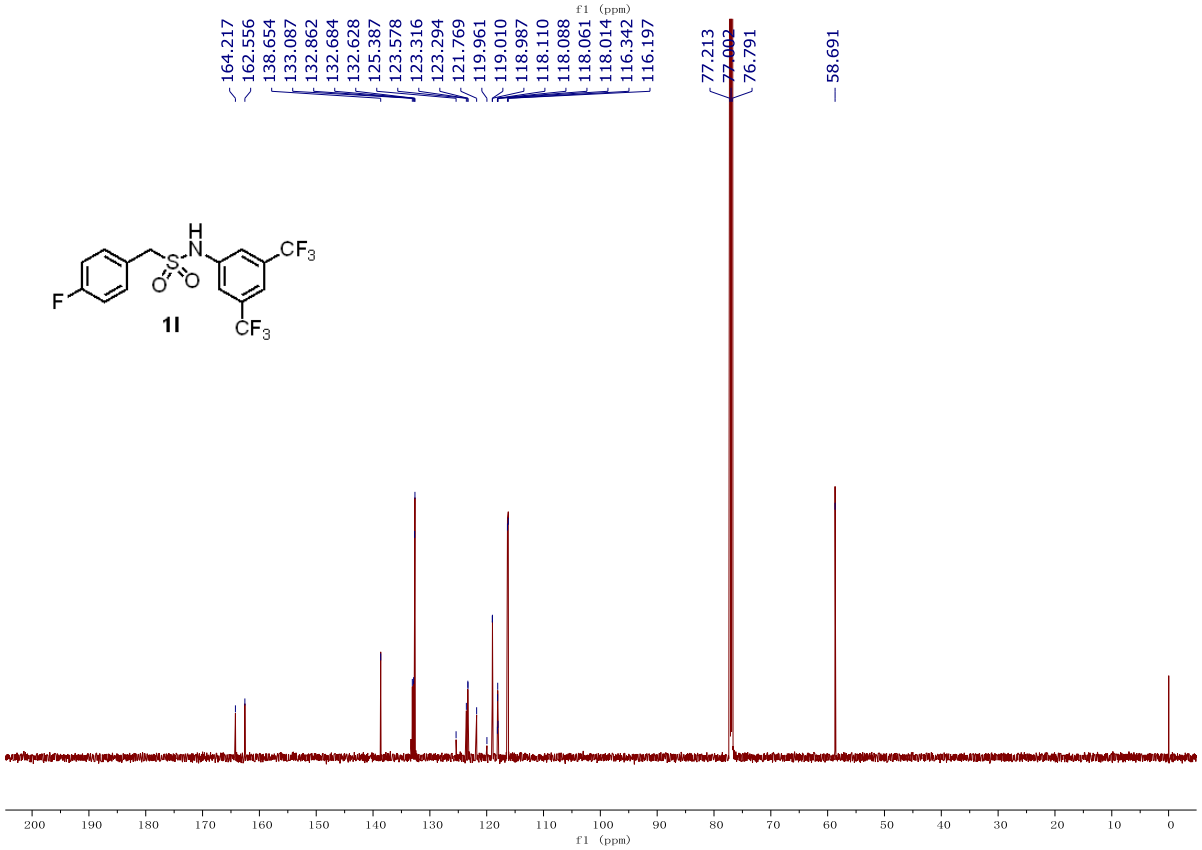
7.369
7.340
7.332
7.326
7.320
7.312
7.309
7.302
7.287
7.278
7.273
7.256
7.241
4.407
0.000
1k
CF3
CF3
0.92
1.91
3.91
2.00
2.00
f1 (ppm)
138.890
133.205
132.937
132.669
132.401
130.809
129.564
129.096
127.281
125.999
123.828
121.658
119.488
118.944
118.918
117.892
117.864
117.834
117.804
117.775
77.253
77.000
76.746
59.560
1k
CF3
CF3
f1 (ppm)


7.598
7.378
7.275
7.261
7.253
7.240
7.036
7.015
6.994
6.894
4.405
1.597
0.000
1l
0.91
1.85
2.44
1.95
0.98
2.00
f1 (ppm)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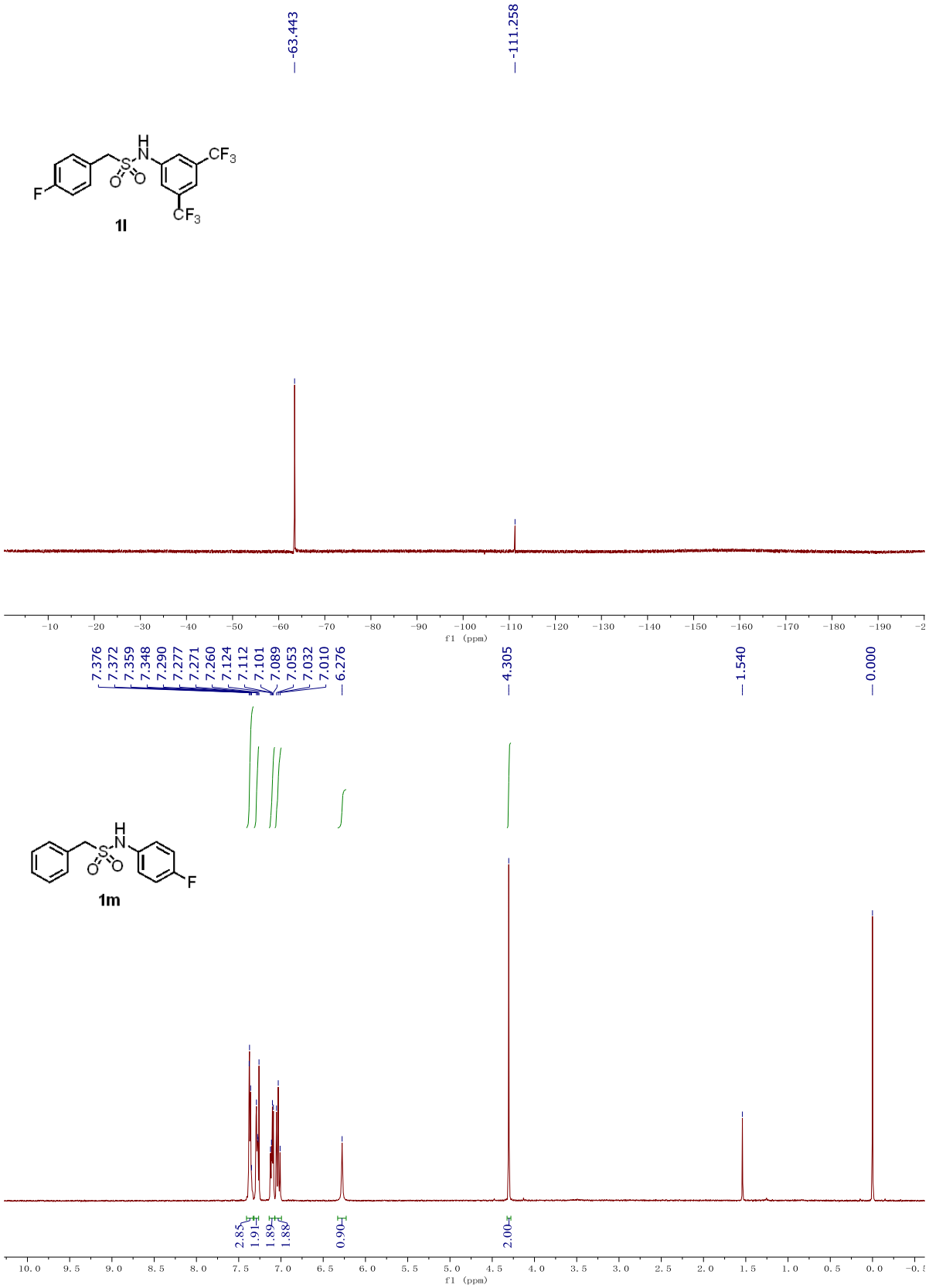
132.862
132.684
132.628
125.387
123.578
123.316
123.294
121.769
119.961
119.010
118.987
118.110
118.088
118.061
118.014
116.342
116.197
77.213
77.002
76.791
58.691
1l
f1 (ppm)


-63.443
-111.258
1l
f1 (ppm)
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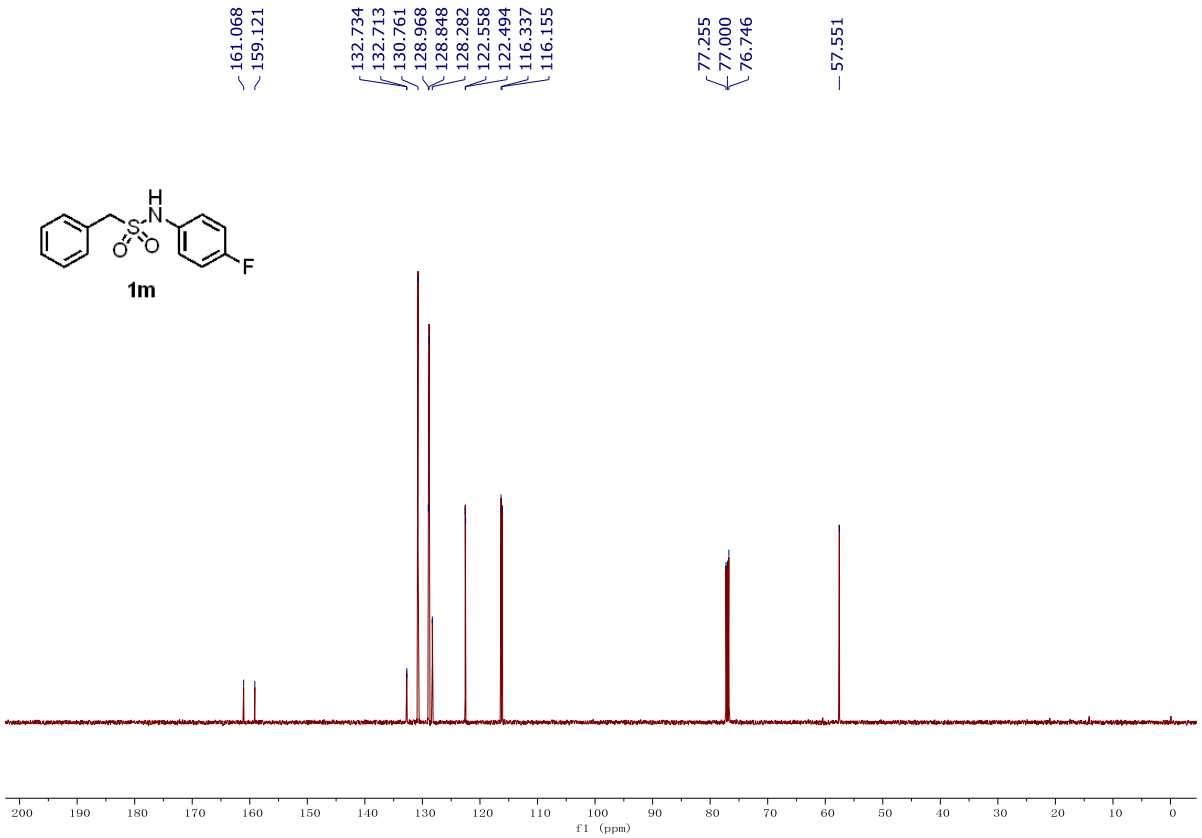
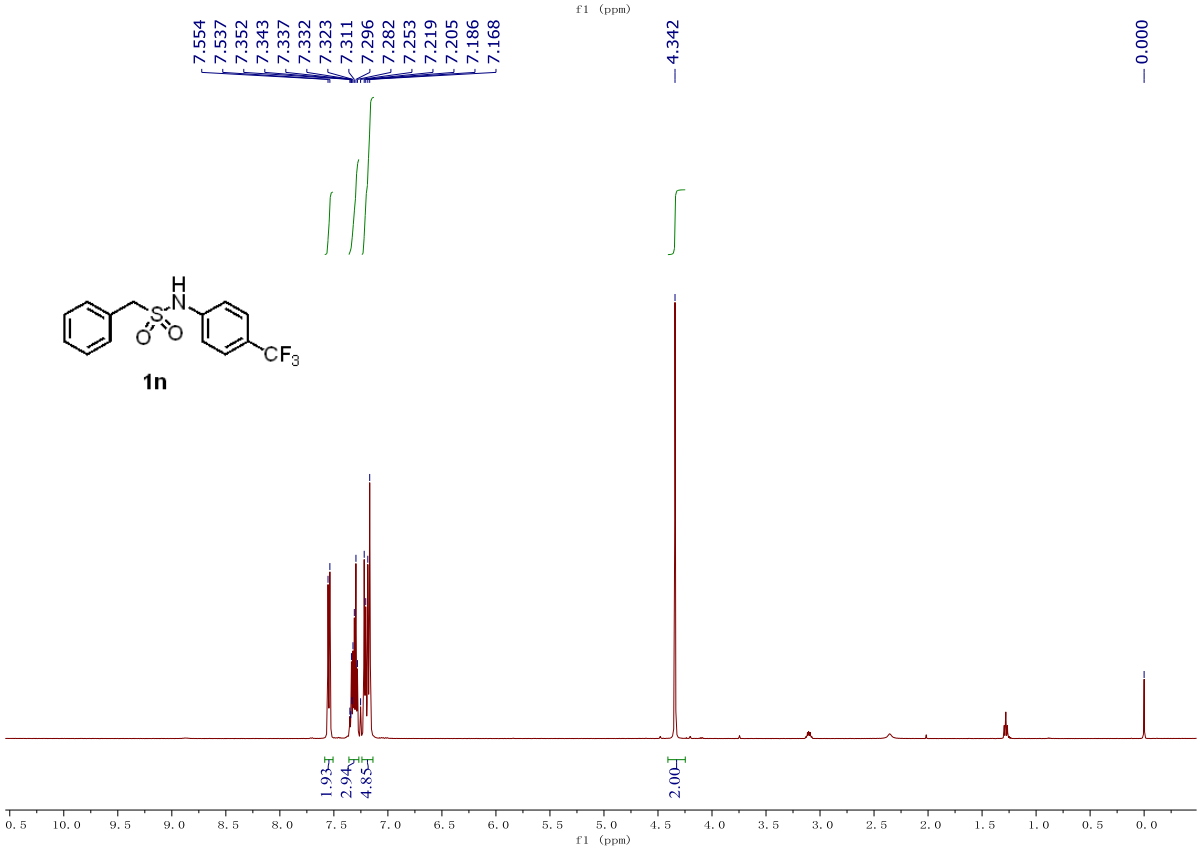
7.372
7.359
7.348
7.290
7.277
7.271
7.260
7.124
7.112
7.101
7.089
7.053
7.032
7.010
6.276
4.305
1.540
0.000
1m
2.85
1.91
1.89
1.88
0.90
2.00
f1 (ppm)


161.068
159.121
132.734
132.713
130.761
128.968
128.848
128.282
122.558
122.494
116.337
116.155
77.255
77.000
76.746
57.551
1m
f1 (ppm)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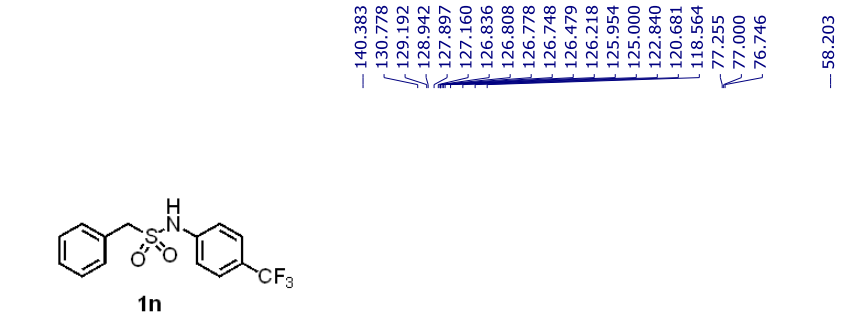
7.343
7.337
7.332
7.323
7.311
7.296
7.282
7.253
7.219
7.205
7.186
7.168
4.342
0.000
1n
1.93
2.94
4.85
2.00
f1 (ppm)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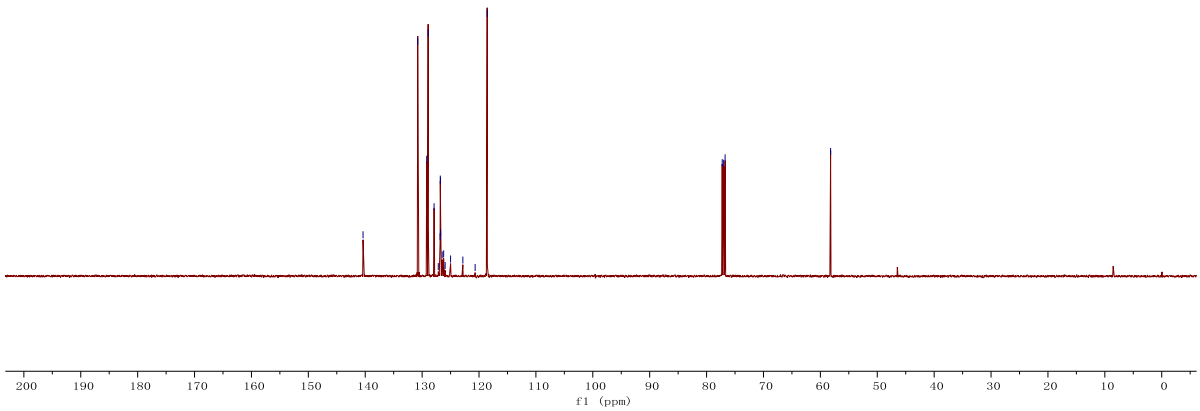
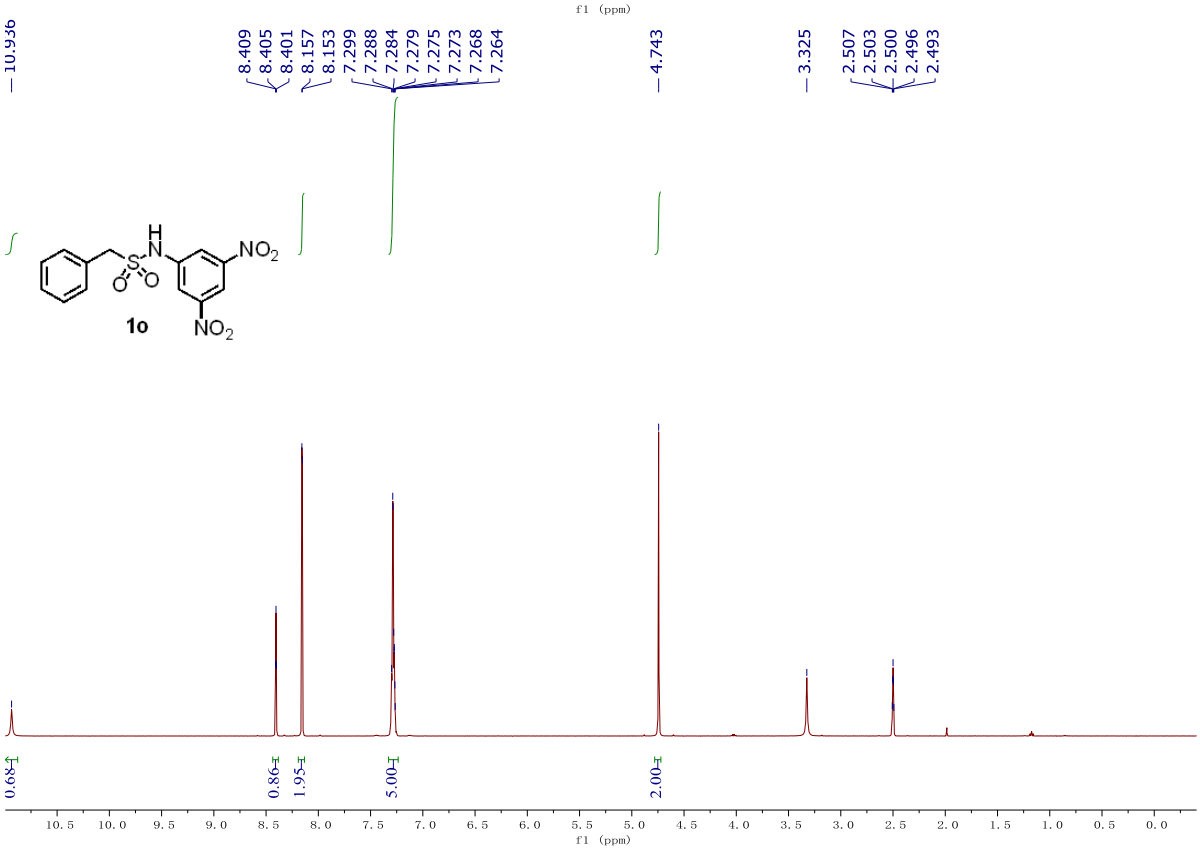
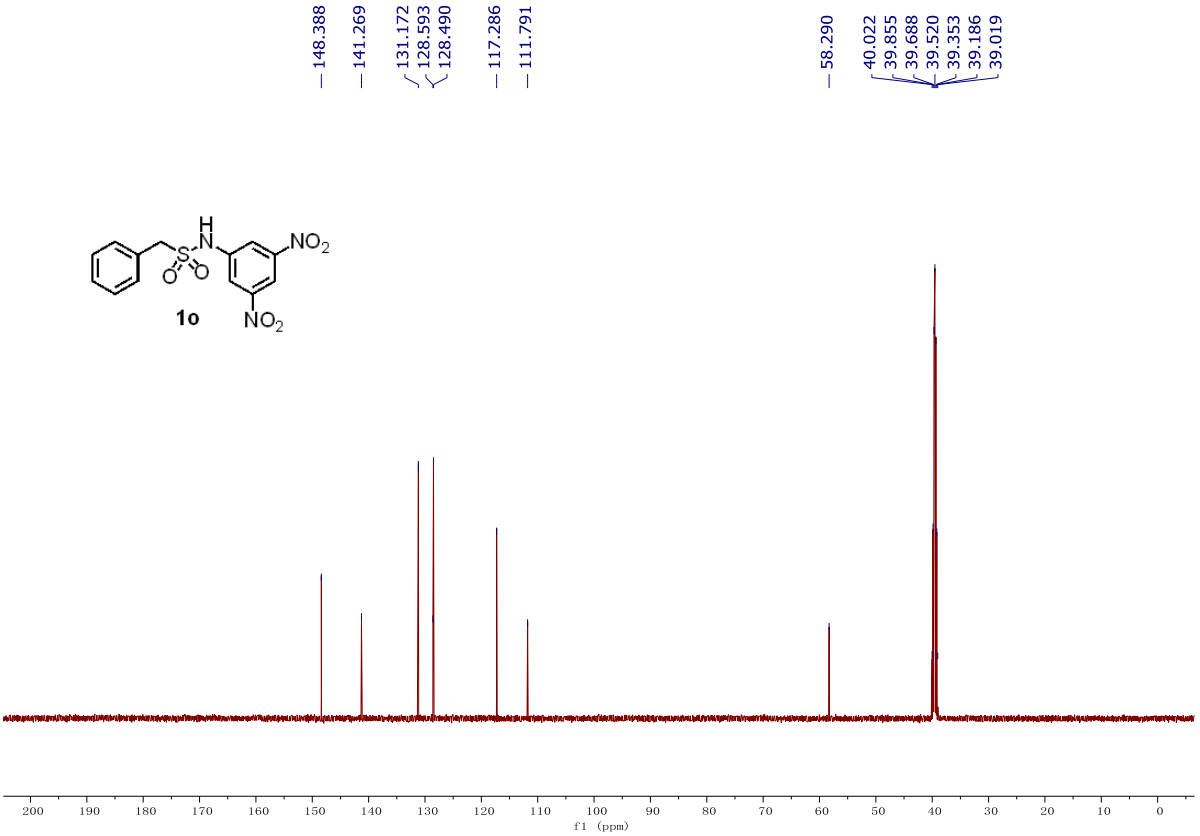
130.778
129.192
128.942
127.897
127.160
126.836
126.808
126.778
126.748
126.479
126.218
125.954
125.000
122.840
120.681
118.564
77.255
77.000
76.746
58.203
CF3

1n


200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)


10.936
8.409
8.405
8.401
8.157
8.153
7.299
7.288
7.284
7.279
7.275
7.273
7.268
7.264
4.743
3.325
2.507
2.503
2.500
2.496
2.493
NO2
NO2
0.68
0.86
1.95
5.00
2.00
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

1o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128.593
128.490
117.286
111.791
58.290
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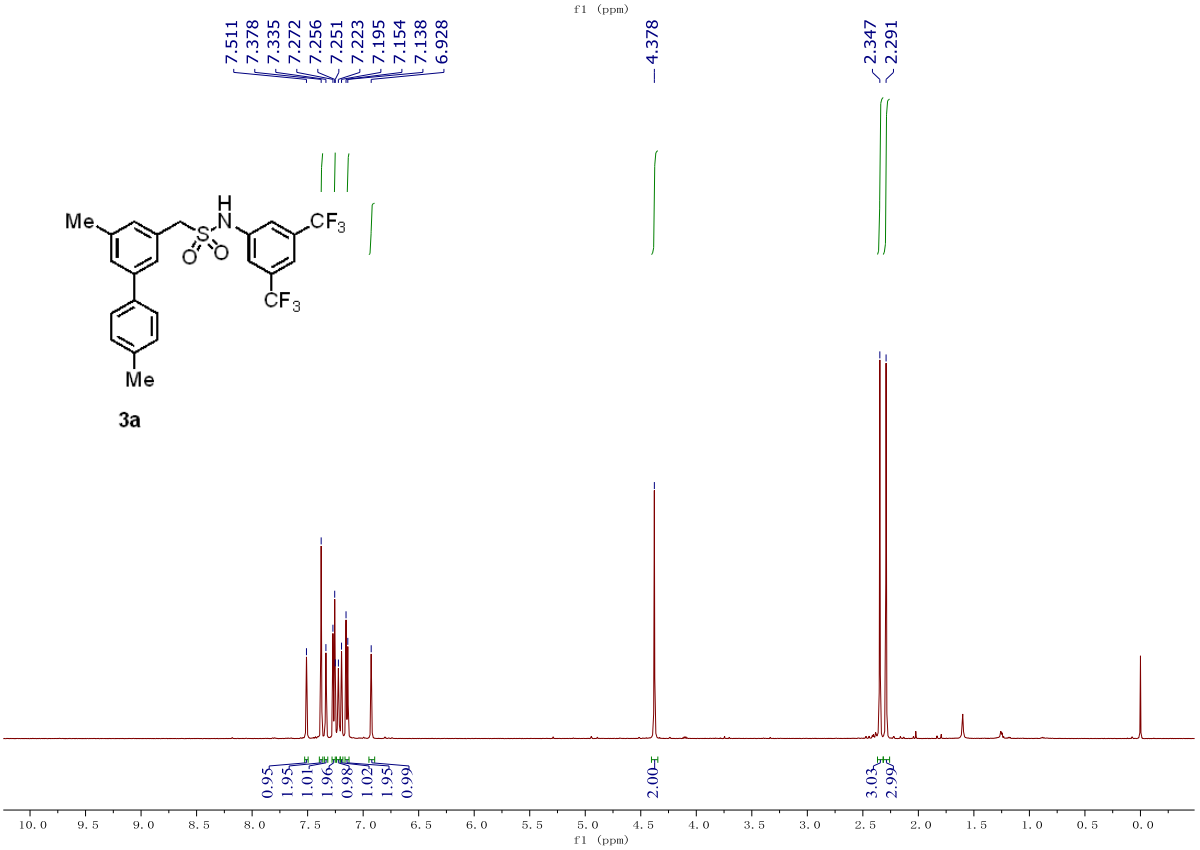
39.688
39.520
39.353
39.186
39.019
NO2
NO2
1o
f1 (ppm)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7.251
7.223
7.195
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7.138
6.928
4.378
2.347
2.291
Me
CF3
CF3
Me
3a
0.95
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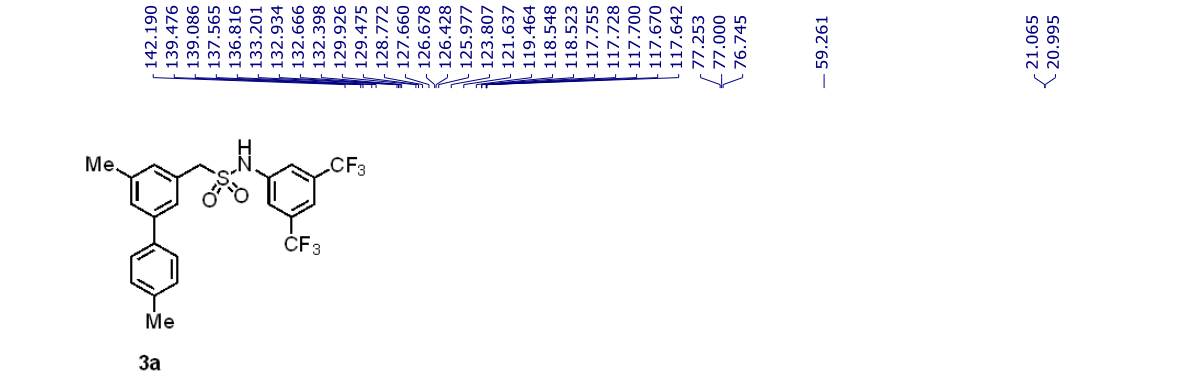
1.96
0.98
1.02
1.95
0.99
2.00
3.03
2.99
f1 (ppm)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133.201
132.934
132.666
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129.475
128.772
127.660
126.678
126.428
125.977
123.807
121.637
119.464
118.548
118.523
117.755
117.728
117.700
117.670
117.642
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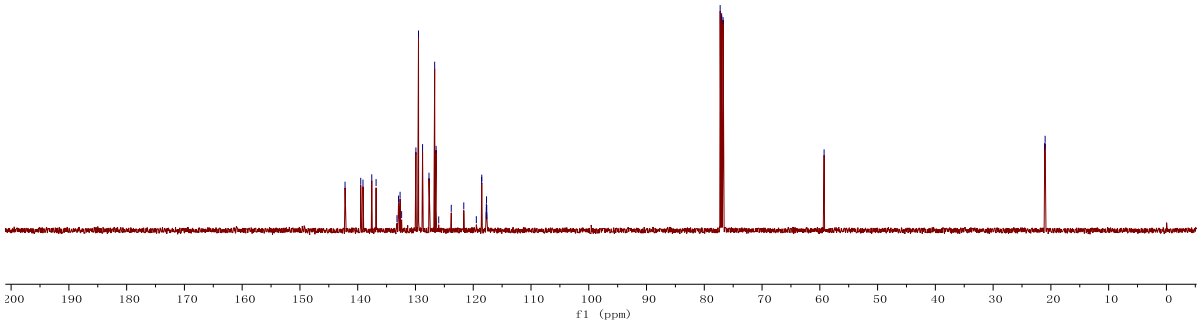
76.745
59.261
21.065
20.995
Me
H
N
S
O
O
CF3
CF3
Me

3a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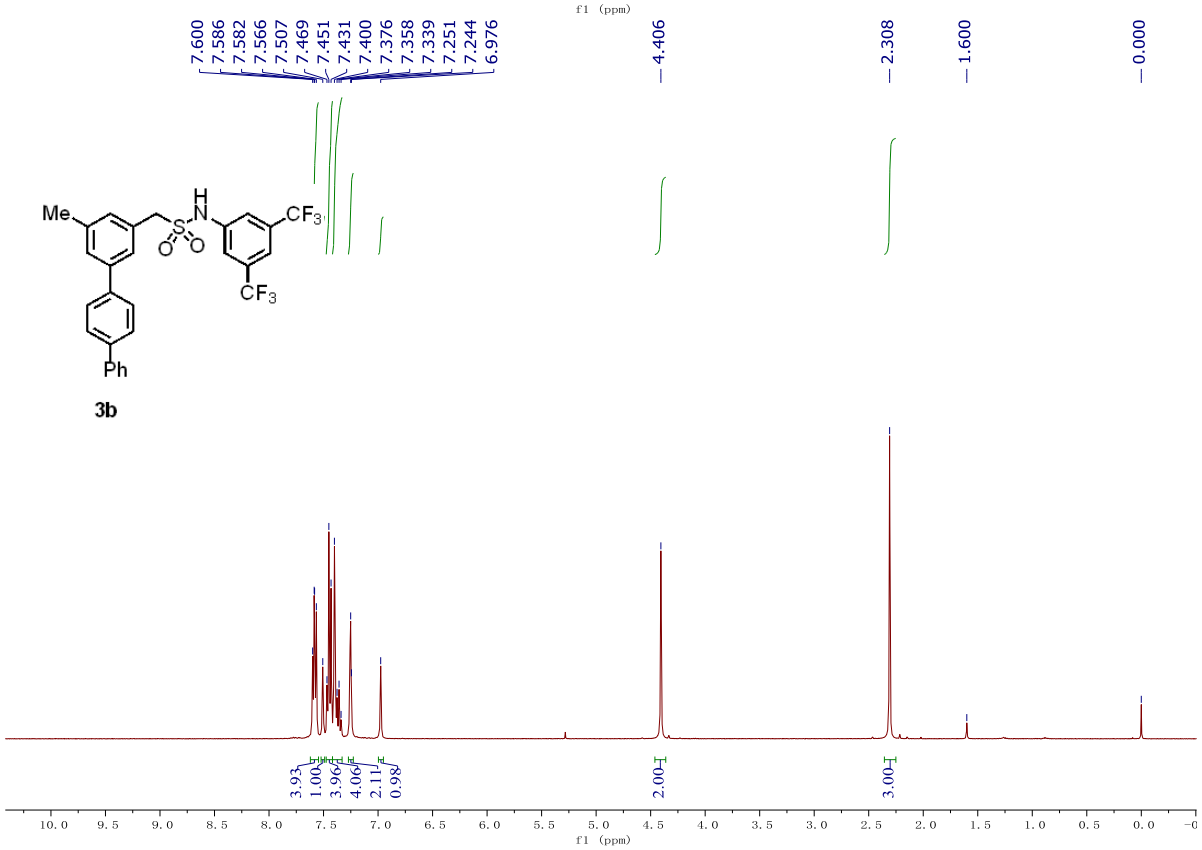
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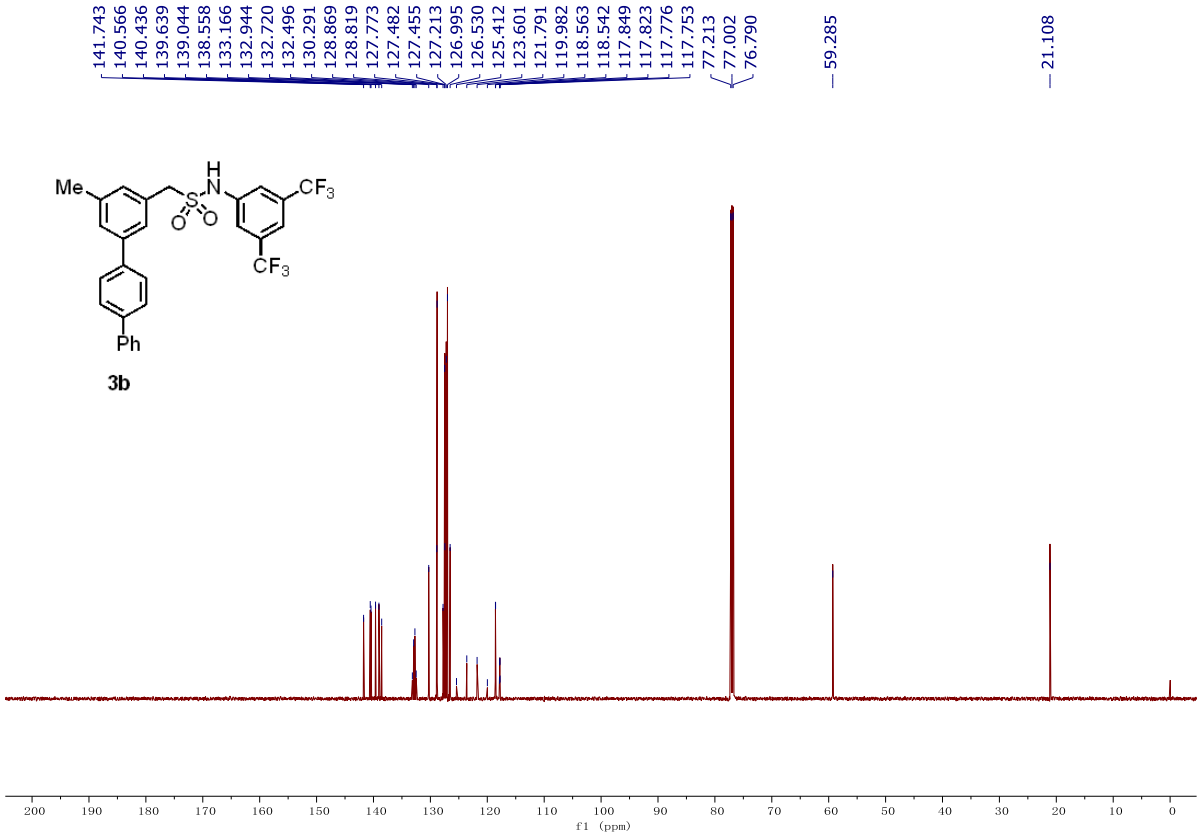
7.431
7.400
7.376
7.358
7.339
7.251
7.244
6.976
4.406
2.308
1.600
0.000
Me
H
N
S
O
O
CF3
CF3
Ph
3.93
1.00
3.96
4.06
2.11
0.98
2.00
3.00
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)

3b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139.639
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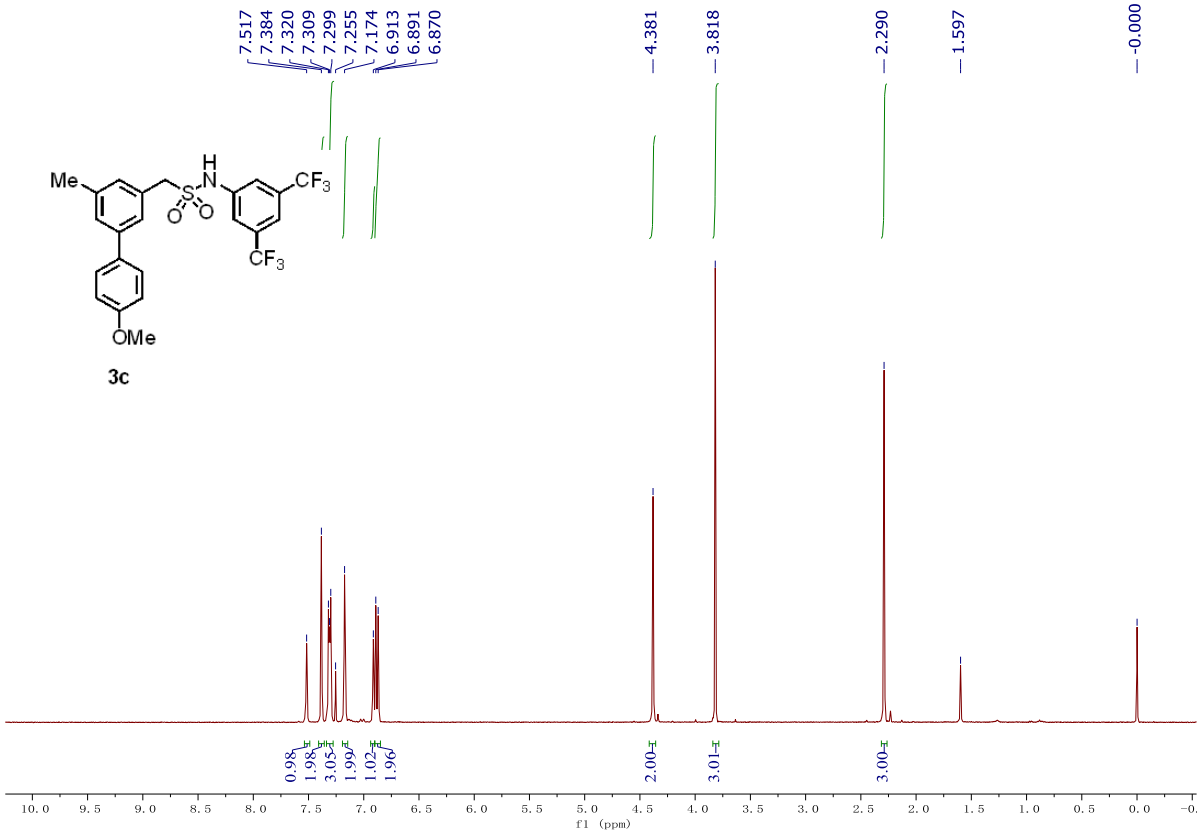
133.166
132.944
132.720
132.496
130.291
128.869
128.819
127.773
127.482
127.455
127.213
126.995
126.530
125.412
123.601
121.791
119.982
118.563
118.542
117.849
117.823
117.776
117.753
77.213
77.002
76.790
59.285
21.108
Me
H
N
S
O
O
CF3
CF3
Ph
3b
f1 (ppm)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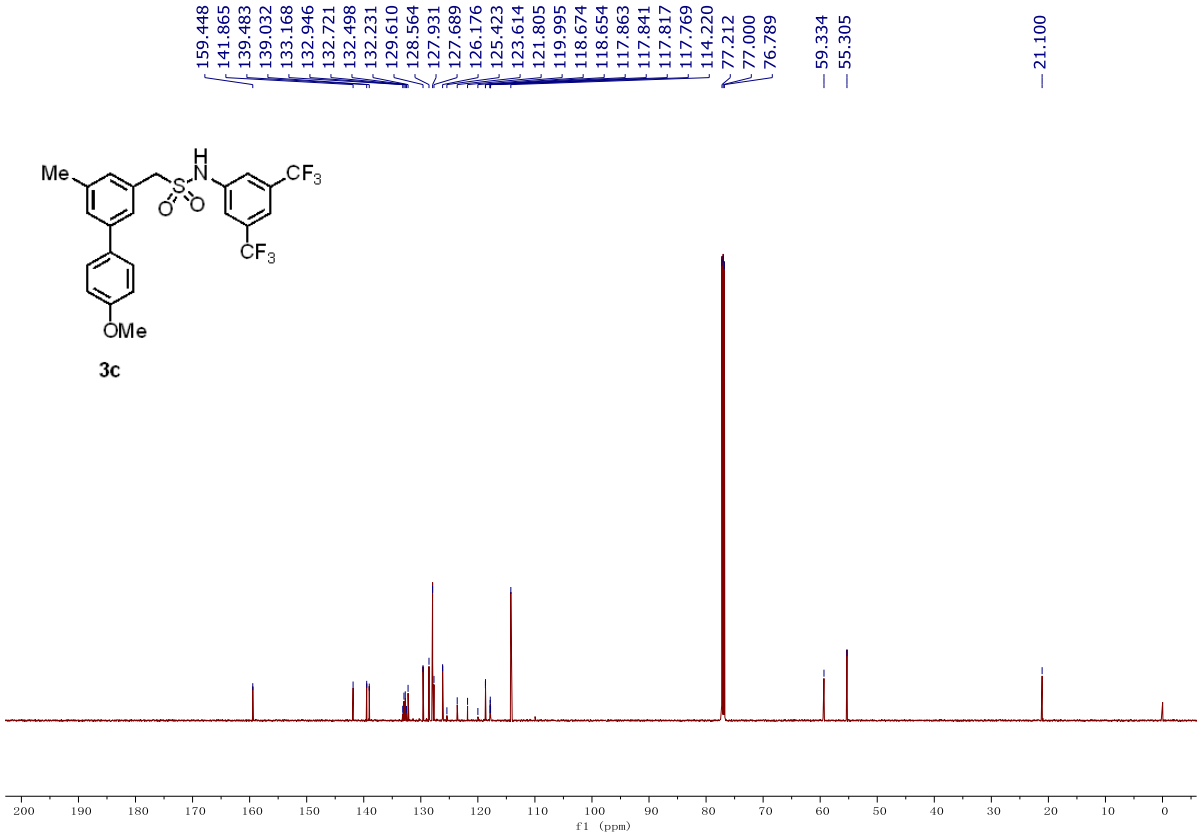
7.384
7.320
7.309
7.299
7.255
7.174
6.913
6.891
6.870
4.381
3.818
2.290
1.597
-0.000
Me
H
N
S
O
O
CF3
CF3
OMe
3c
0.98
1.98
3.05
1.99
1.02
1.96
2.00
3.01
3.00
f1 (ppm)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139.483
139.032
133.168
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132.231
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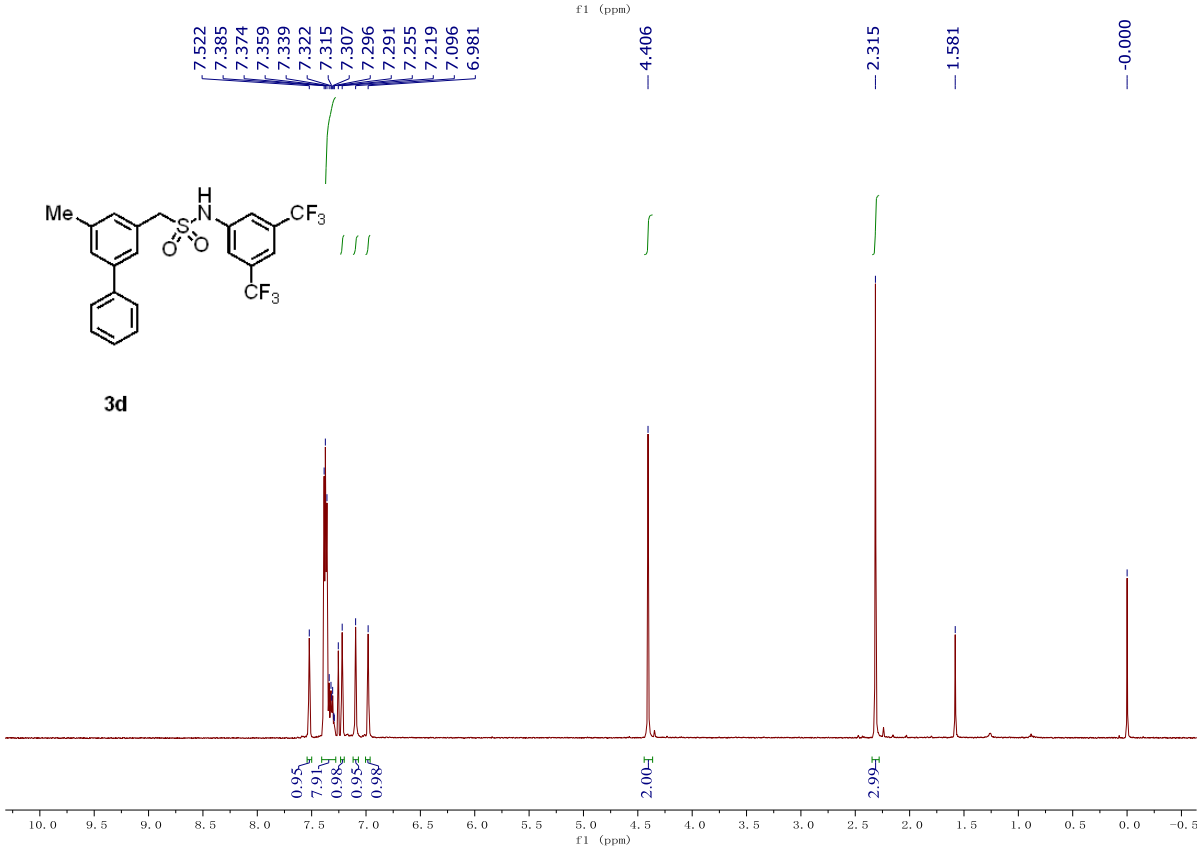
127.931
127.689
126.176
125.423
123.614
121.805
119.995
118.674
118.654
117.863
117.841
117.817
117.769
114.220
77.212
77.000
76.789
59.334
55.305
21.100
Me
H
N
S
O
O
CF3
CF3
OMe
3c
f1 (ppm)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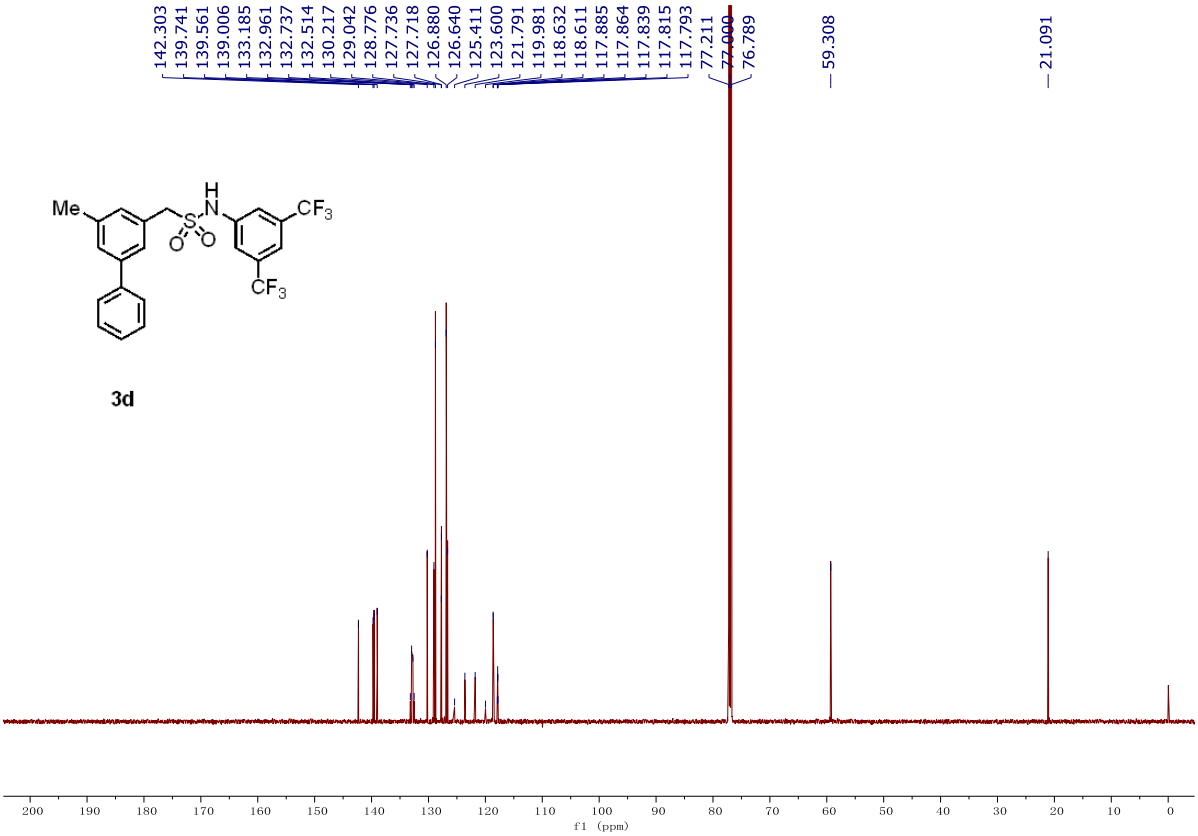
7.385
7.374
7.359
7.339
7.322
7.315
7.307
7.296
7.291
7.255
7.219
7.096
6.981
4.406
2.315
1.581
-0.000
Me
H
N
S
O
O
CF3
CF3
3d
0.95
7.91
0.98
0.95
0.98
2.00
2.99
f1 (ppm)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139.561
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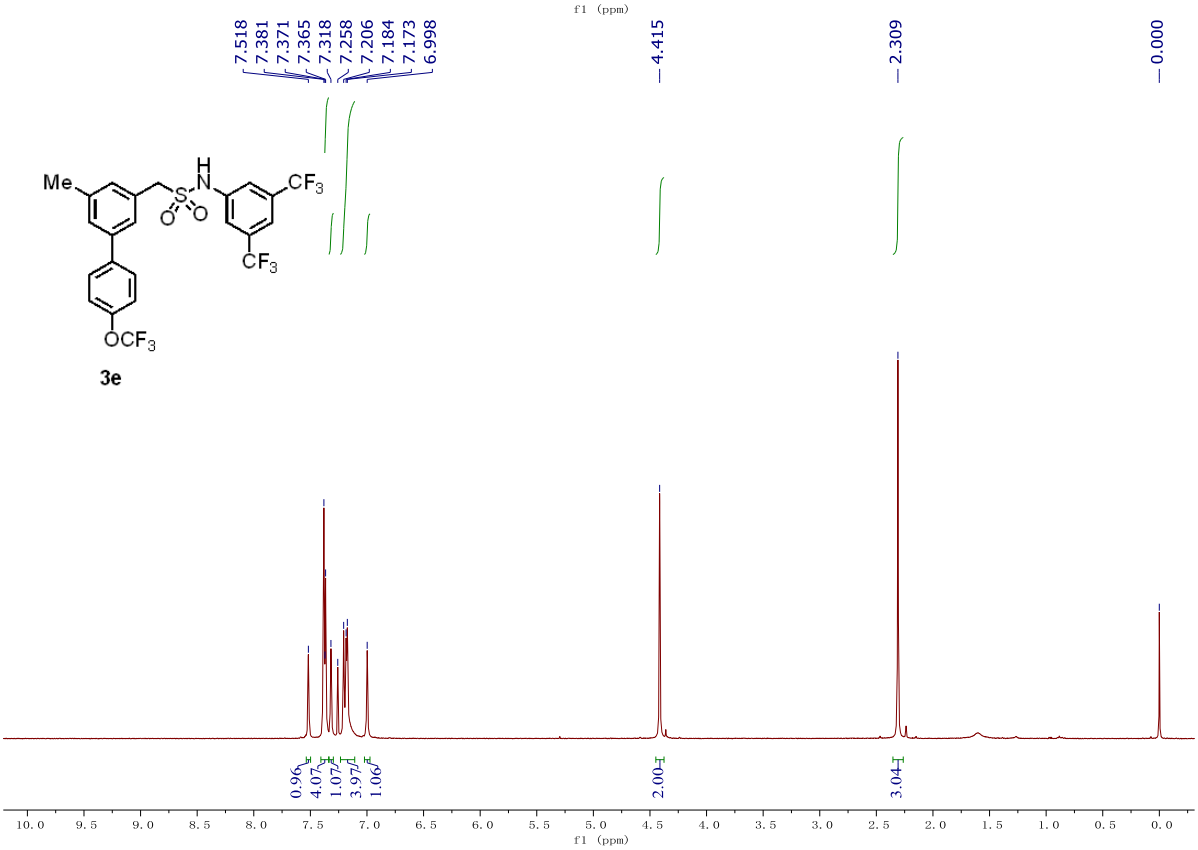
132.961
132.737
132.514
130.217
129.042
128.776
127.736
127.718
126.880
126.640
125.411
123.600
121.791
119.981
118.632
118.611
117.885
117.864
117.839
117.815
117.793
77.211
77.000
76.789
59.308
21.091
Me
CF3
CF3
3d
f1 (ppm)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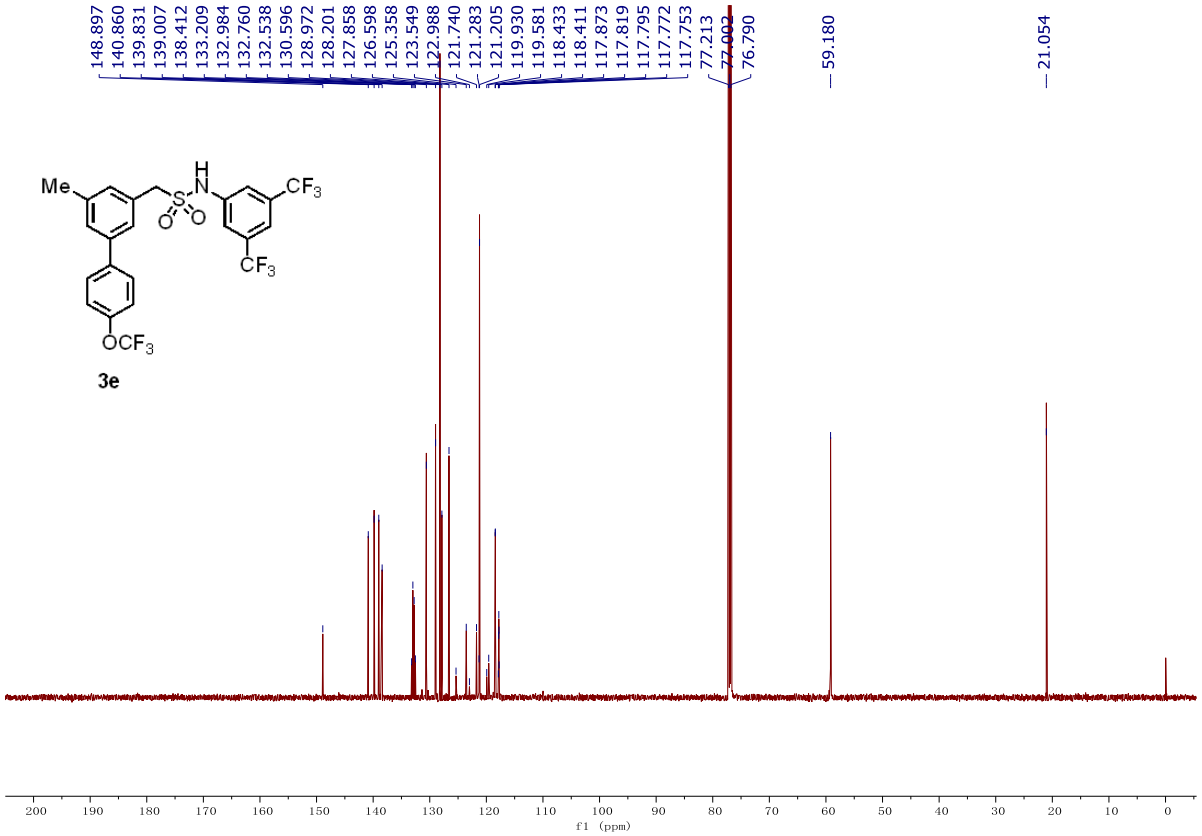
7.381
7.371
7.365
7.318
7.258
7.206
7.184
7.173
6.998
4.415
2.309
0.000
Me
CF3
CF3
OCF3
3e
0.96
4.07
1.07
3.97
1.06
2.00
3.04
f1 (ppm)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132.760
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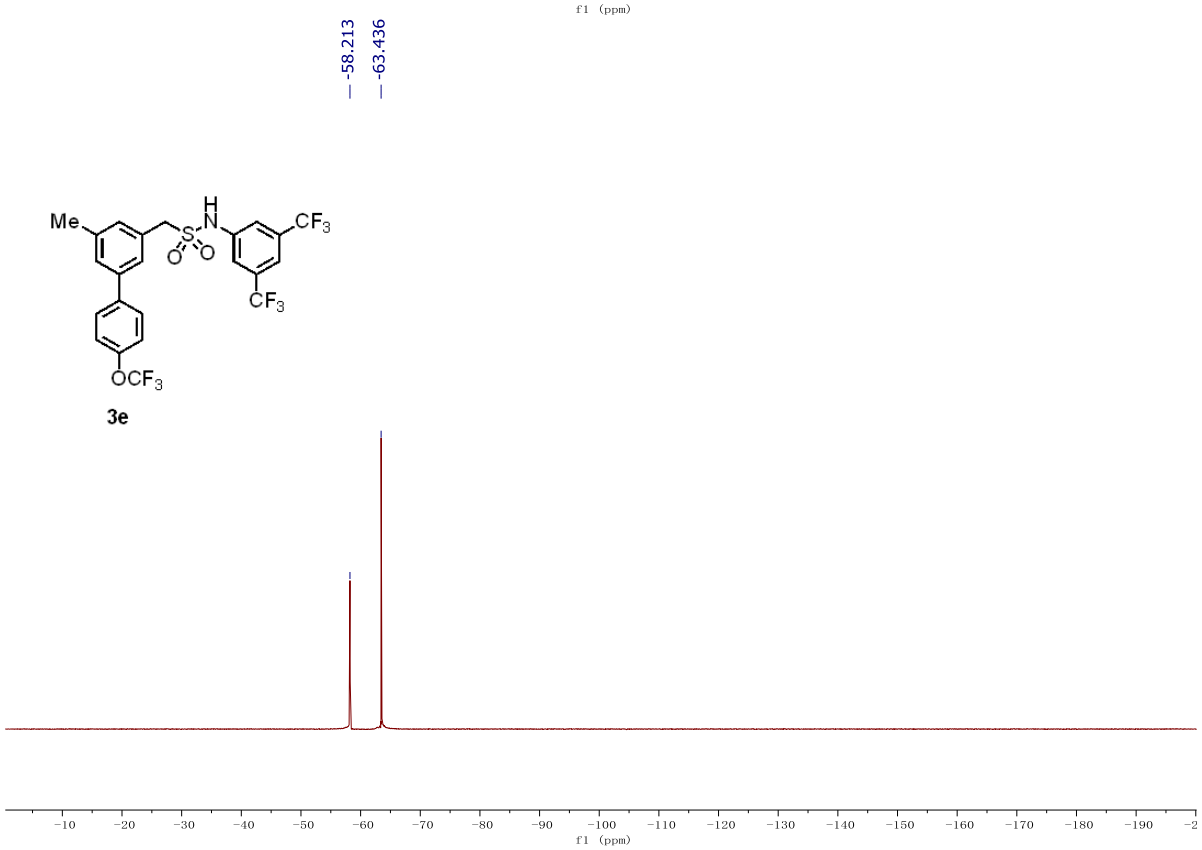
128.201
127.858
126.598
125.358
123.549
122.988
121.740
121.283
121.205
119.930
119.581
118.433
118.411
117.873
117.819
117.795
117.772
117.753
77.213
77.002
76.790
59.180
21.054
Me
CF3
CF3
OCF3
3e
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)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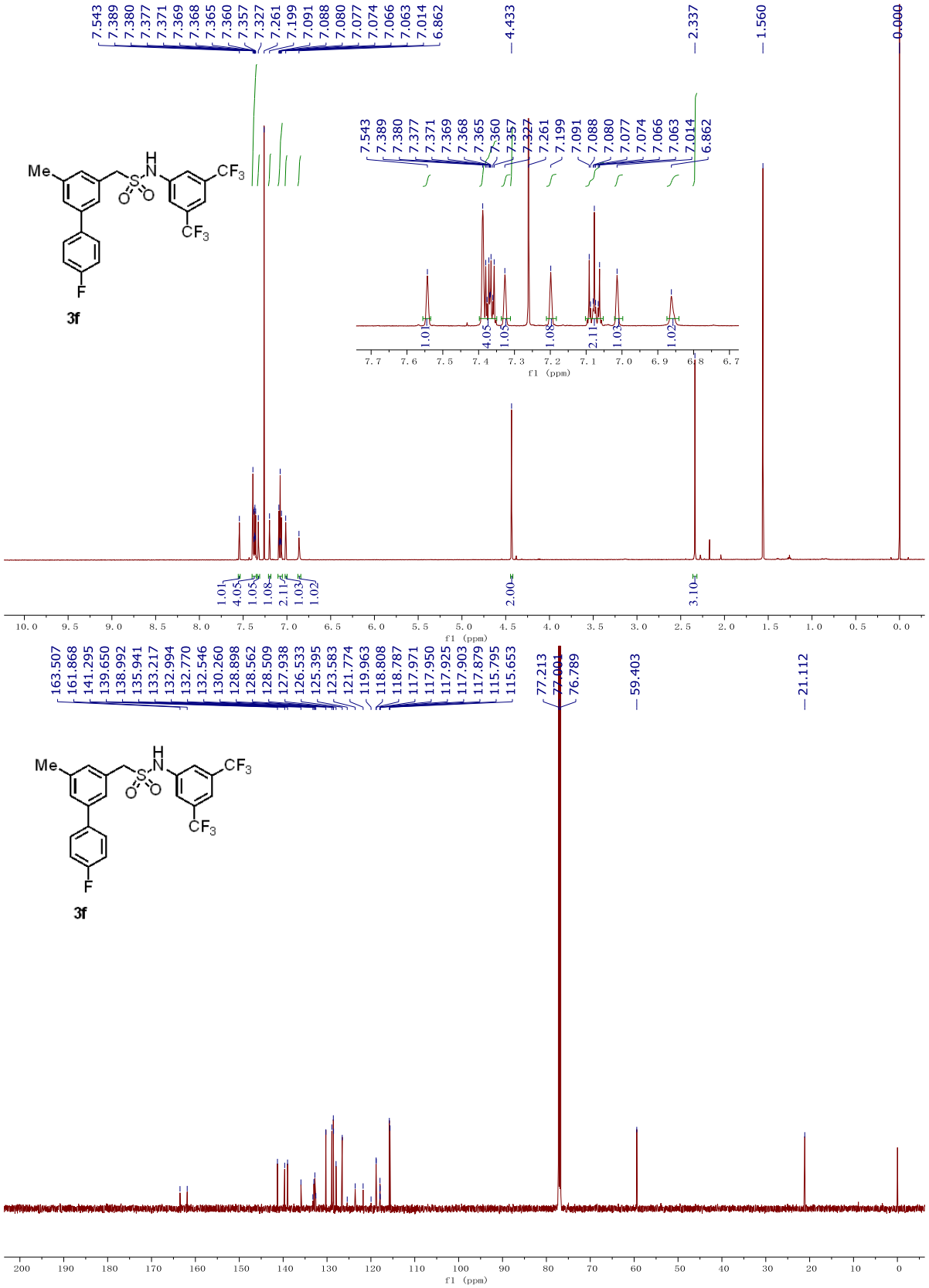
-63.436
Me
CF3
CF3
OCF3
3e
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
-160
-170
-180
-190
-2
f1 (ppm)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7.377
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7.369
7.368
7.365
7.360
7.357
7.327
7.261
7.199
7.091
7.088
7.080
7.077
7.074
7.066
7.063
7.014
6.862
4.433
2.337
1.560
0.000
Me
CF3
CF3
F
3f
1.01
4.05
1.05
1.08
2.11
1.03
1.02
2.00
3.10
f1 (ppm)
163.507
161.868
141.295
139.650
138.992
135.941
133.217
132.994
132.770
132.546
130.260
128.898
128.562
128.509
127.938
126.533
125.395
123.583
121.774
119.963
118.808
118.787
117.971
117.950
117.925
117.903
117.879
115.795
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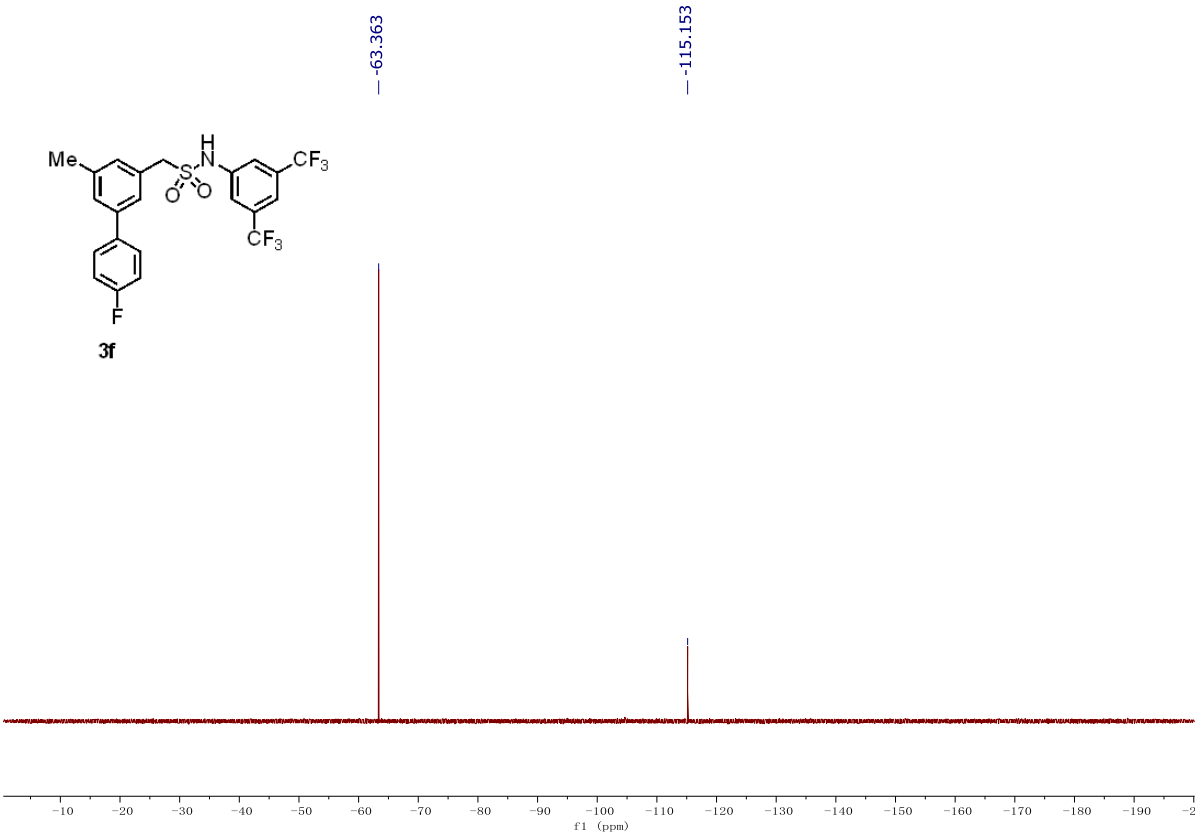
77.213
77.001
76.789
59.403
21.112
Me
CF3
CF3
F
3f
f1 (ppm)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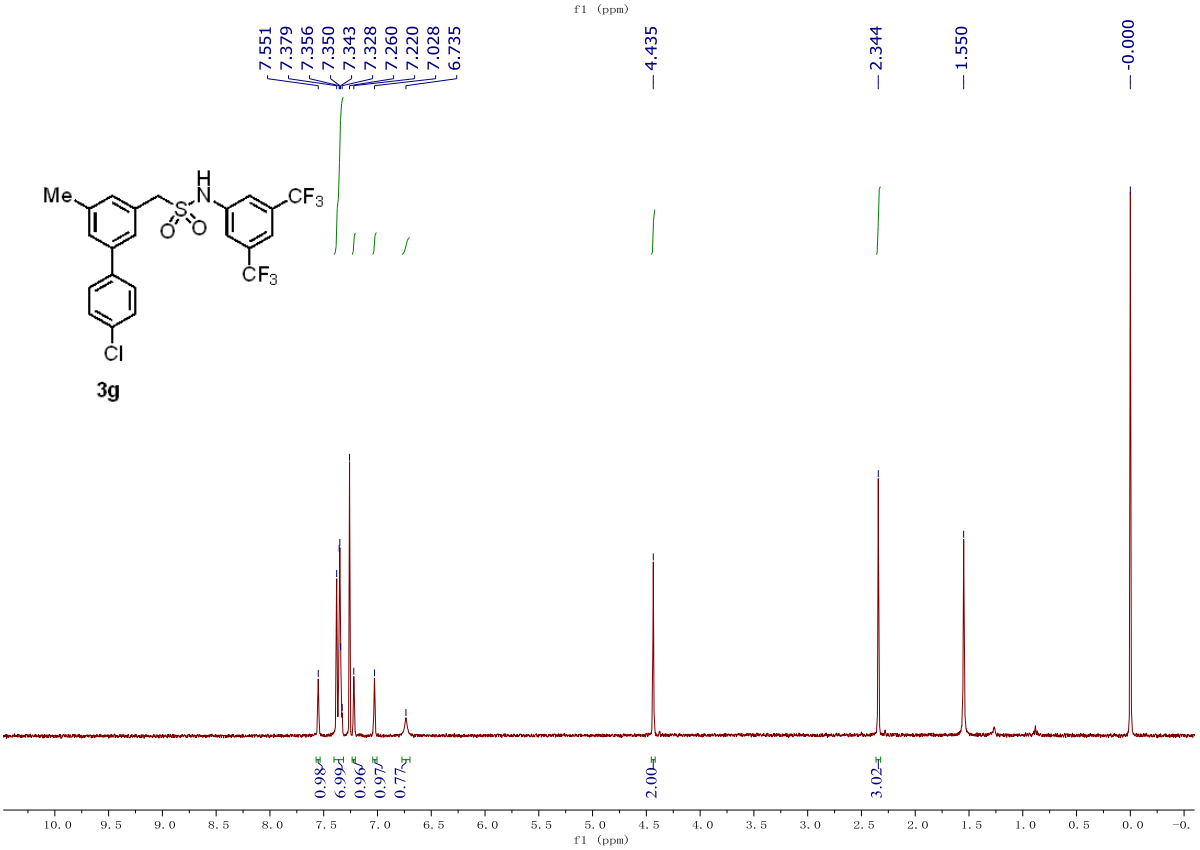
-115.153
Me
CF3
CF3
F
3f
f1 (ppm)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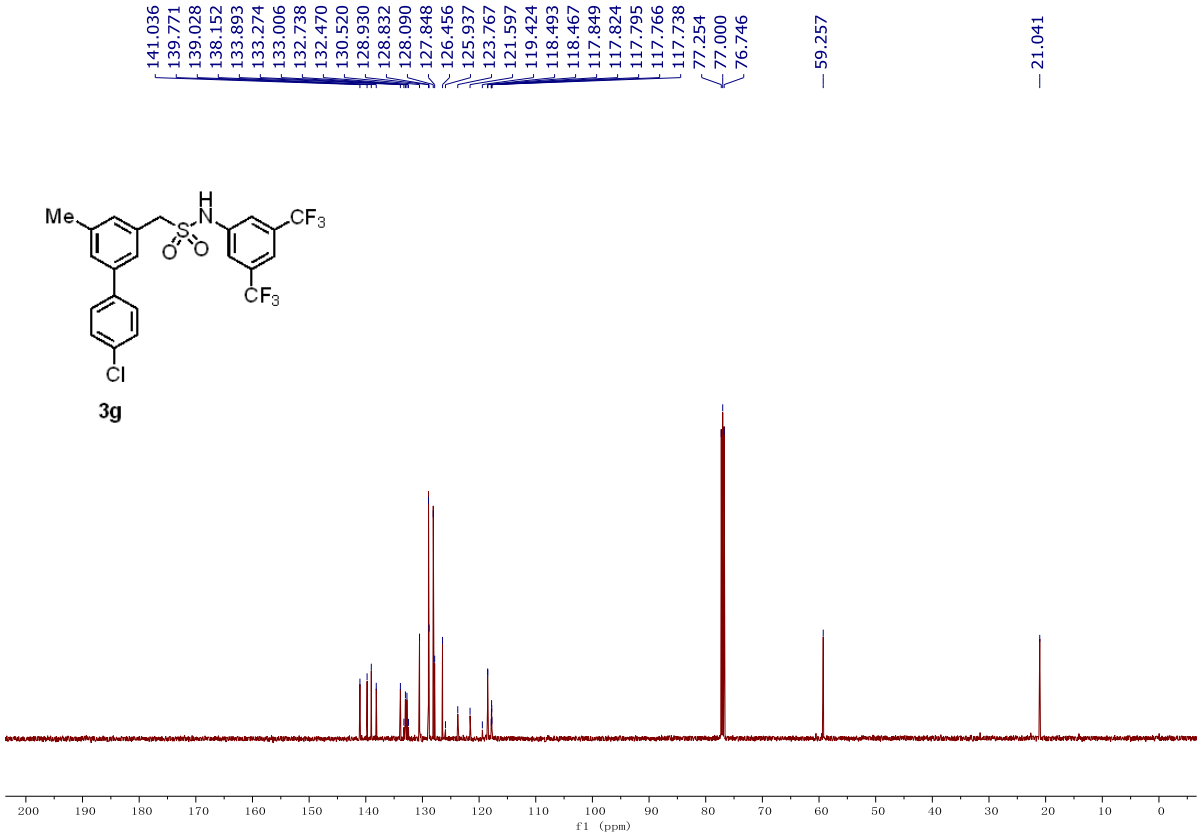
7.350
7.343
7.328
7.260
7.220
7.028
6.735
4.435
2.344
1.550
-0.000
Me
CF3
CF3
Cl
3g
0.98
6.99
0.96
0.97
0.77
2.00
3.02
f1 (ppm)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132.470
130.520
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128.832
128.090
127.848
126.456
125.937
123.767
121.597
119.424
118.493
118.467
117.849
117.824
117.795
117.766
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77.000
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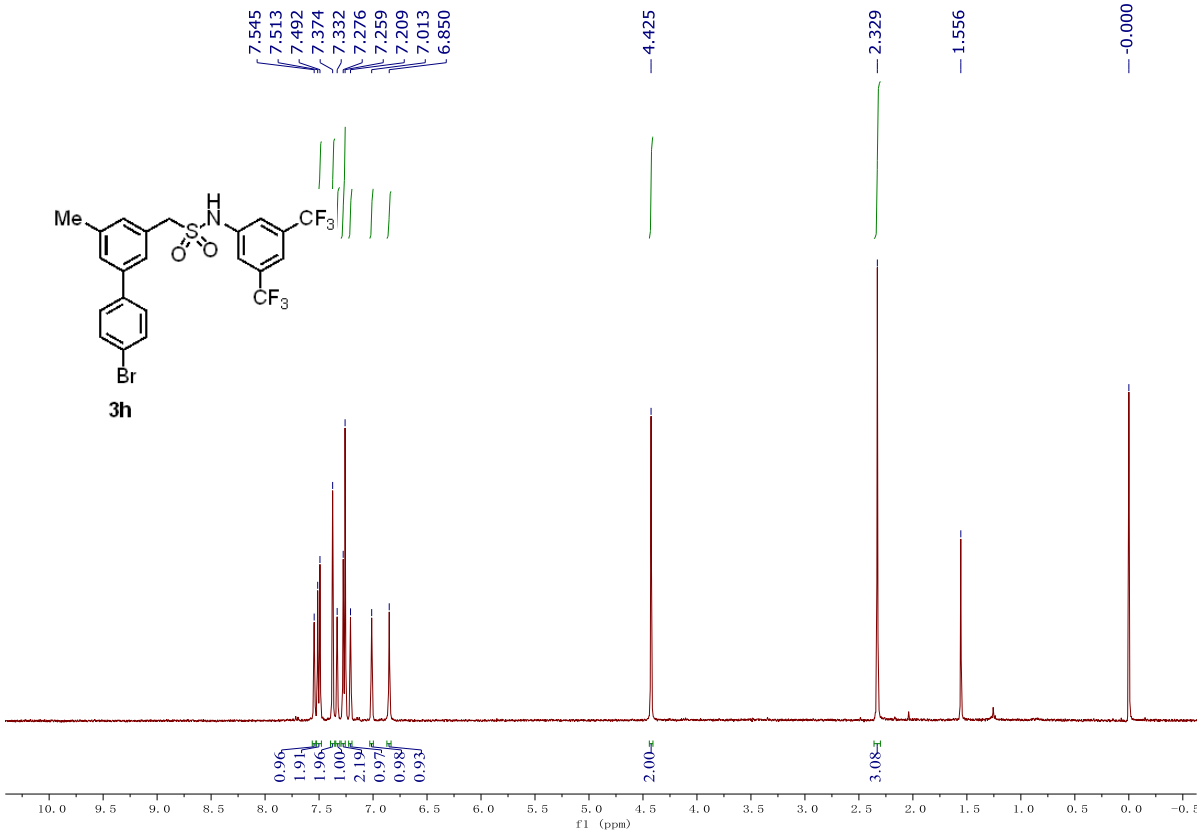
21.041
Me
CF3
CF3
Cl
3g
f1 (ppm)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7.259
7.209
7.013
6.850
4.425
2.329
1.556
-0.000
Me
CF3
CF3
Br
3h
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1.96
1.00
2.19
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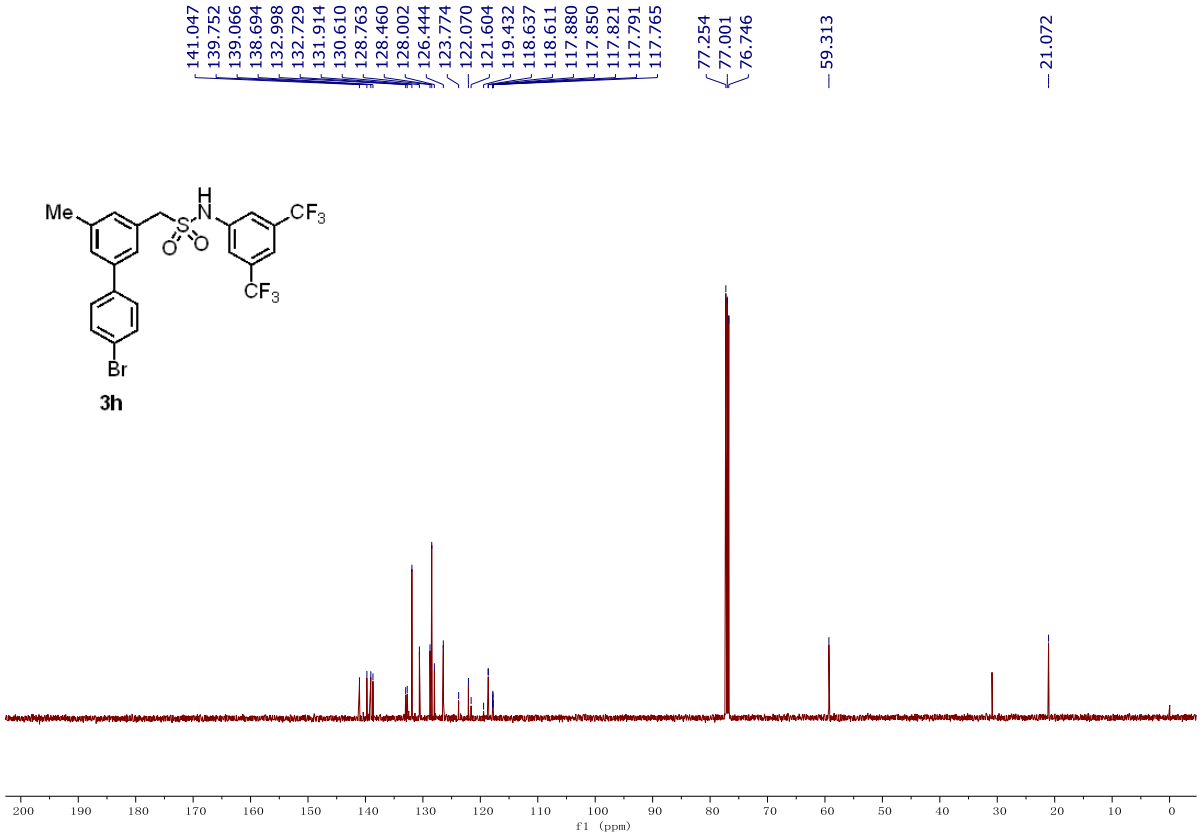
0.98
0.93
2.00
3.08
f1 (ppm)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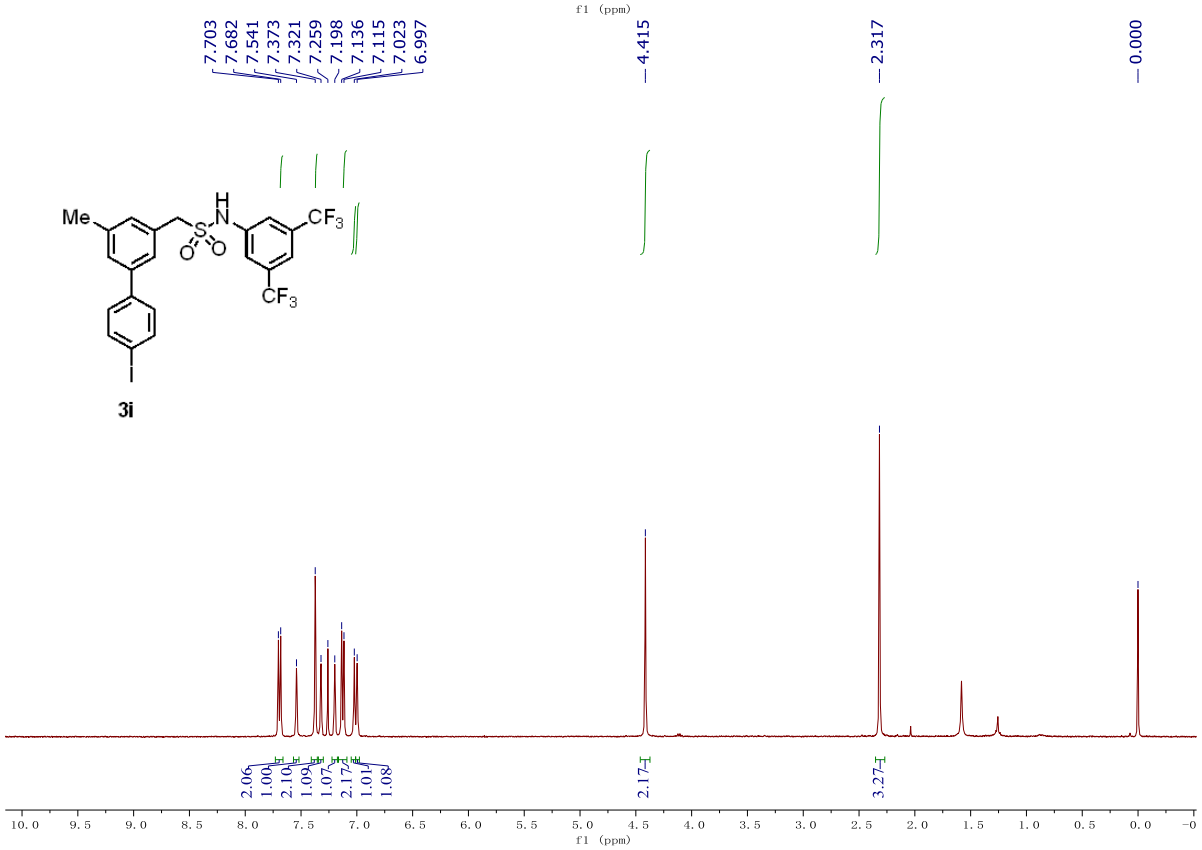
128.002
126.444
123.774
122.070
121.604
119.432
118.637
118.611
117.880
117.850
117.821
117.791
117.765
77.254
77.001
76.746
59.313
21.072
Me
H
N
S
O
O
CF3
CF3
Br
3h
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)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7.198
7.136
7.115
7.023
6.997
4.415
2.317
0.000
Me
H
N
S
O
O
CF3
CF3
3i
2.06
1.00
2.10
1.09
1.07
2.17
1.01
1.08
2.17
3.27
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
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3.0
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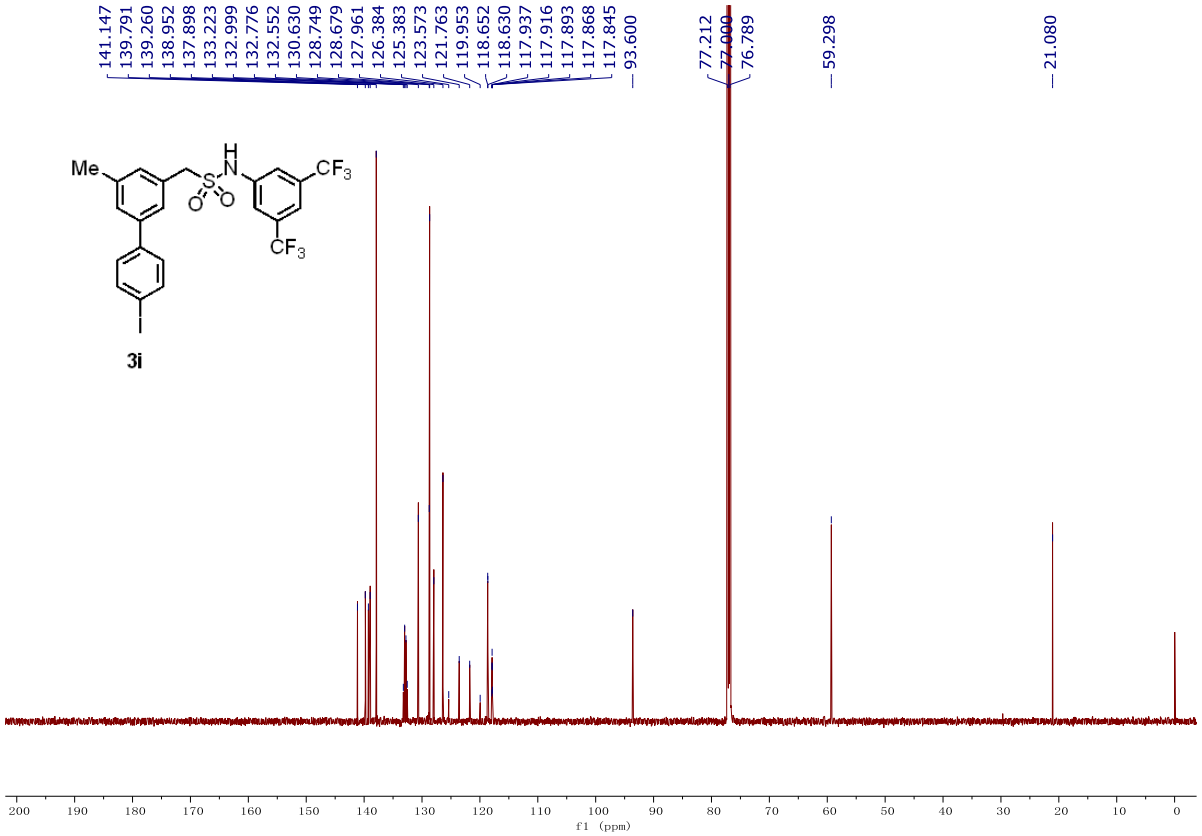
2.0
1.5
1.0
0.5
0.0
−0
f1 (ppm)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128.679
127.961
126.384
125.383
123.573
121.763
119.953
118.652
118.630
117.937
117.916
117.893
117.868
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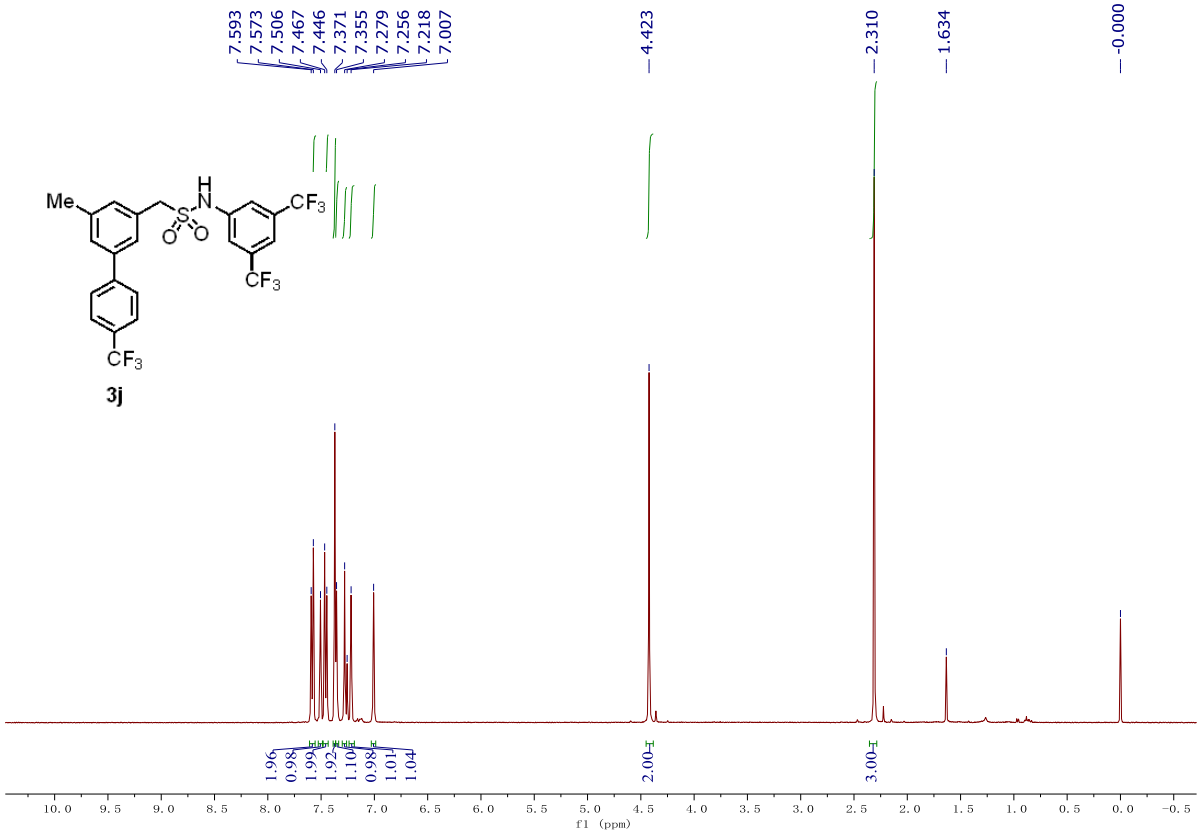
77.212
77.000
76.789
59.298
21.080
Me
CF3
CF3
3i
f1 (ppm)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7.467
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7.371
7.355
7.279
7.256
7.218
7.007
4.423
2.310
1.634
-0.000
Me
CF3
CF3
CF3
3j
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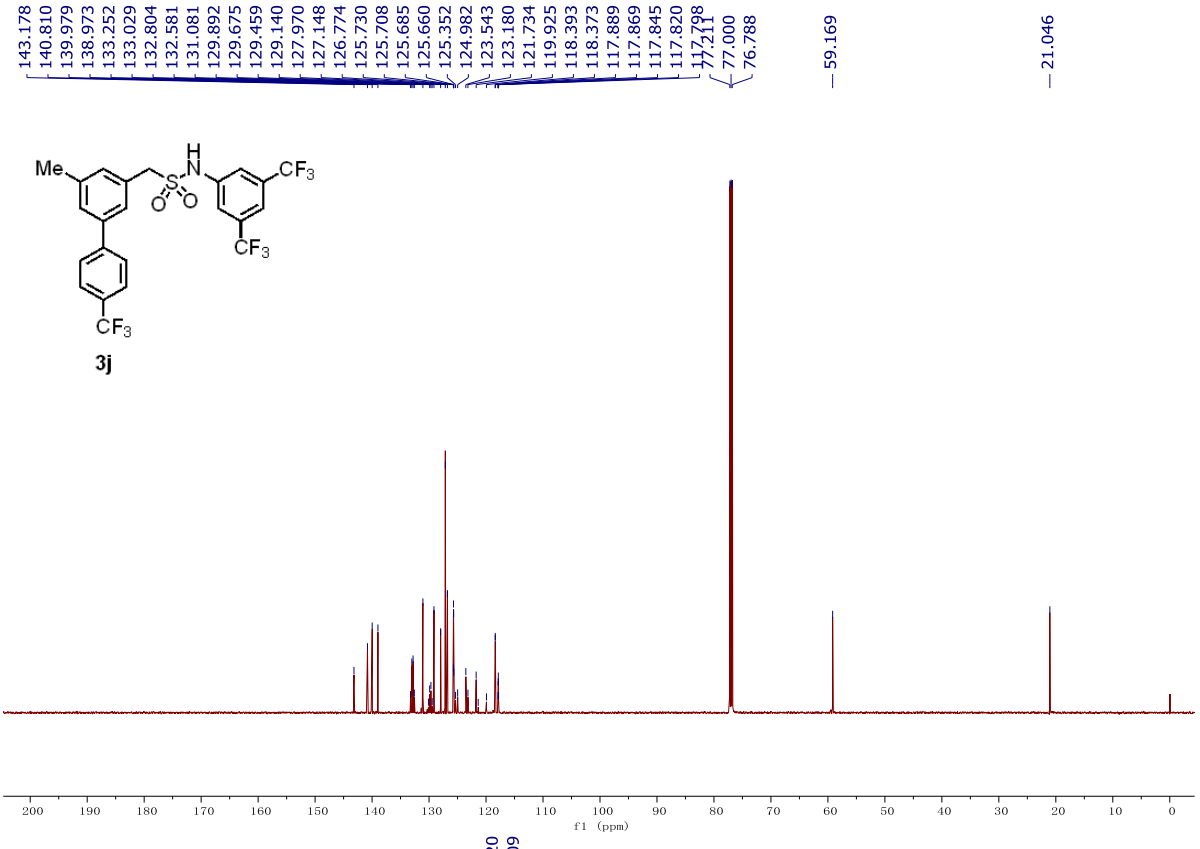
0.98
1.99
1.92
1.10
0.98
1.01
1.04
2.00
3.00
f1 (ppm)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131.081
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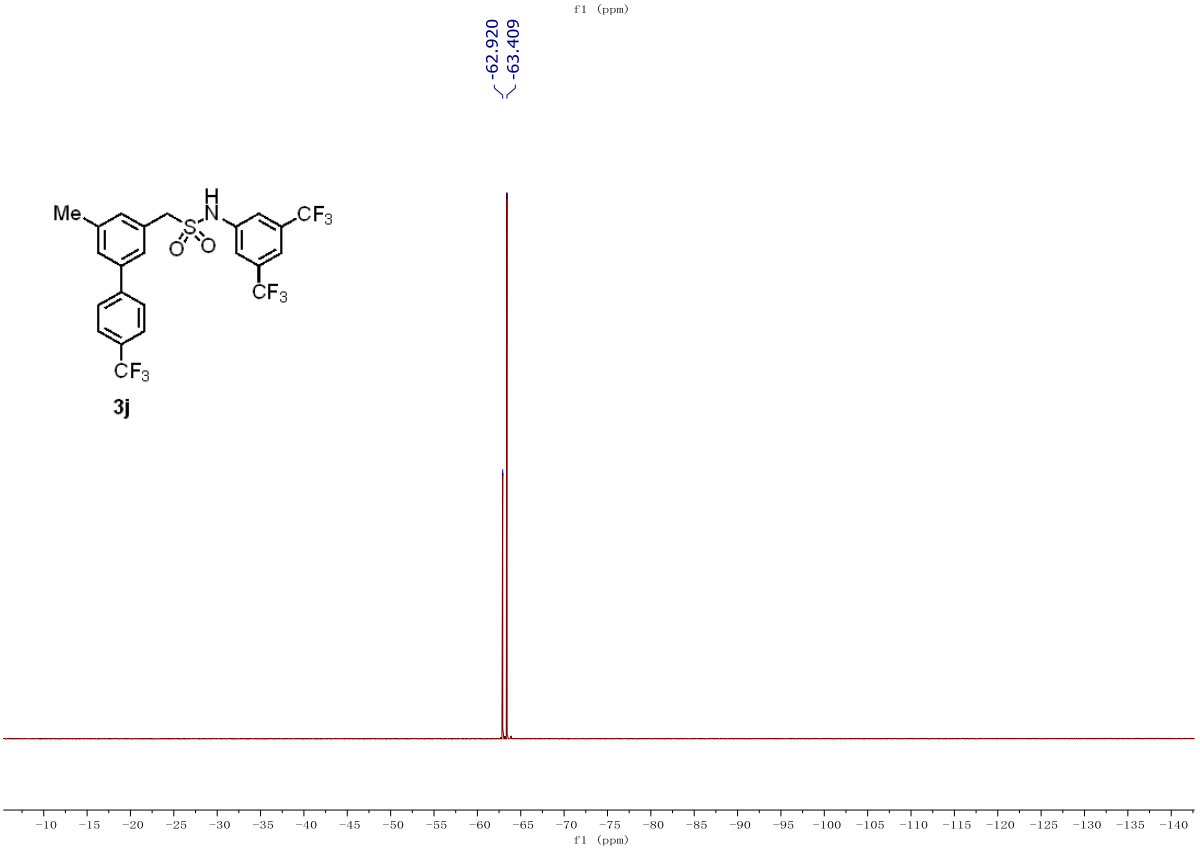
129.140
127.970
127.148
126.774
125.730
125.708
125.685
125.660
125.352
124.982
123.543
123.180
121.734
119.925
118.393
118.373
117.889
117.869
117.845
117.820
117.798
77.211
77.000
76.788
59.169
21.046
Me
H
N
S
O
O
CF3
CF3
CF3
3j
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)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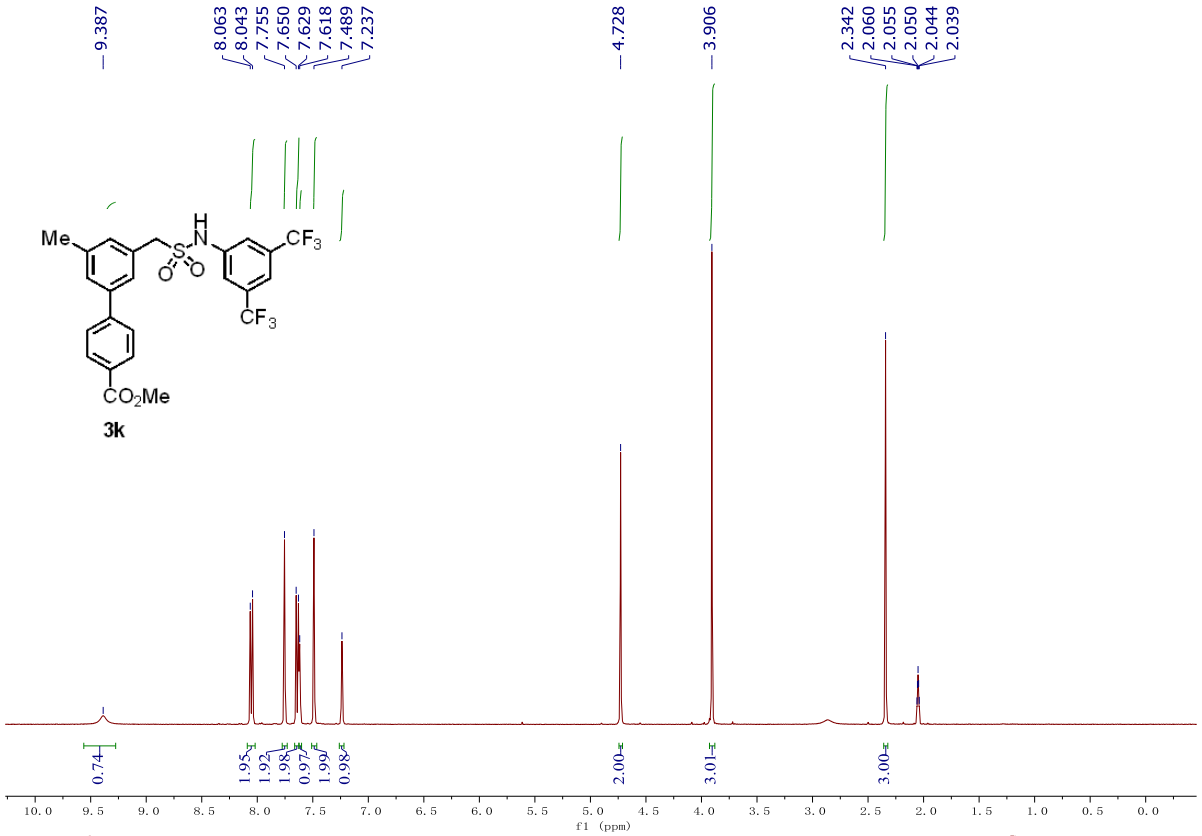
-63.409
Me
H
N
S
O
O
CF3
CF3
CF3
3j
-10
-15
-20
-25
-30
-35
-40
-45
-50
-55
-60
-65
-70
-75
-80
-85
-90
-95
-100
-105
-110
-115
-120
-125
-130
-135
-140
f1 (ppm)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7.618
7.489
7.237
4.728
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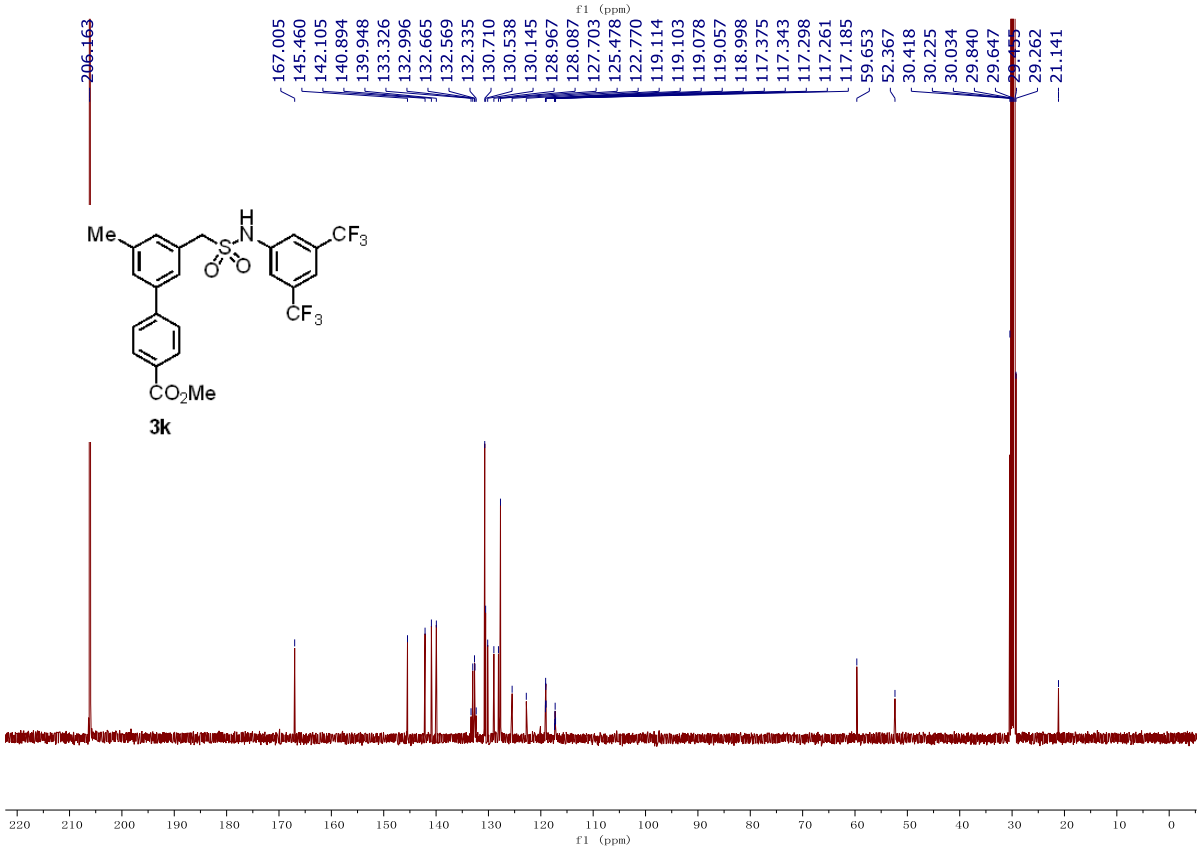
2.342
2.060
2.055
2.050
2.044
2.039
Me
H
N
S
O
O
CF3
CF3
CO2Me
3k
0.74
1.95
1.92
1.98
0.97
1.99
0.98
2.00
3.01
3.00
f1 (ppm)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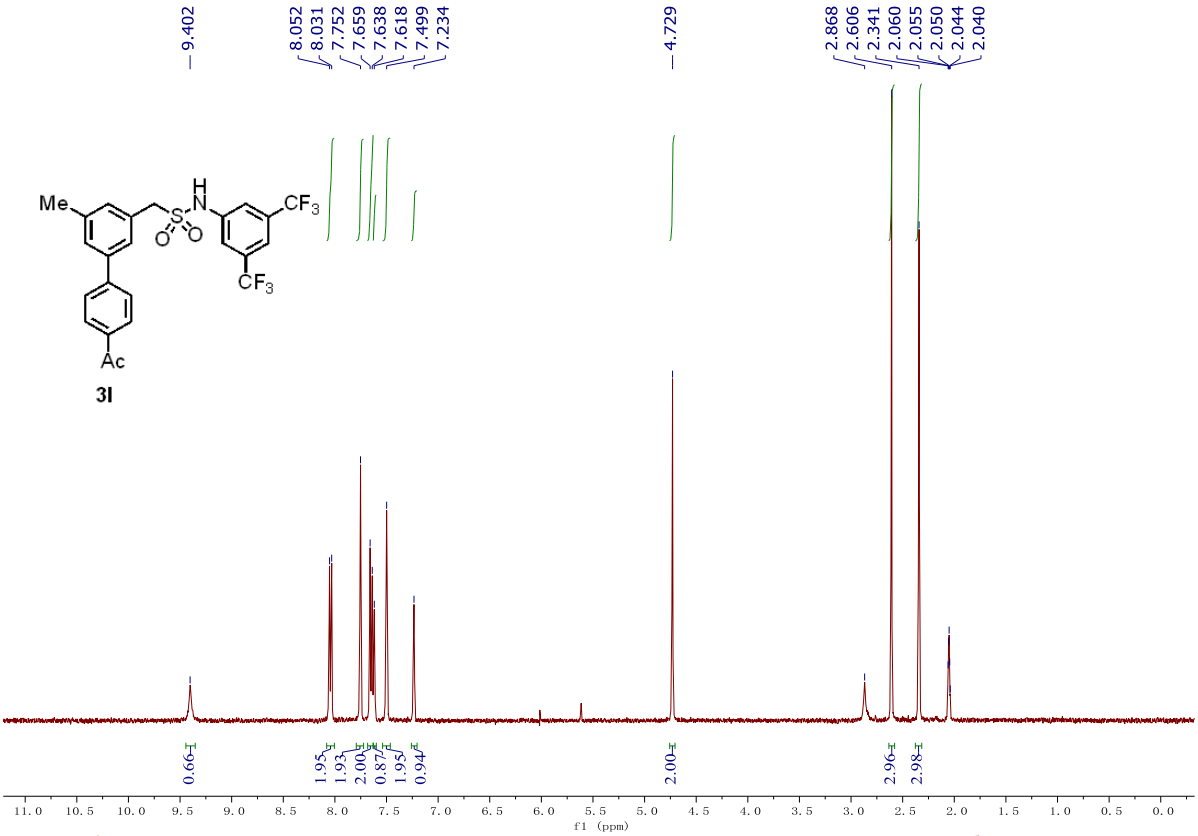
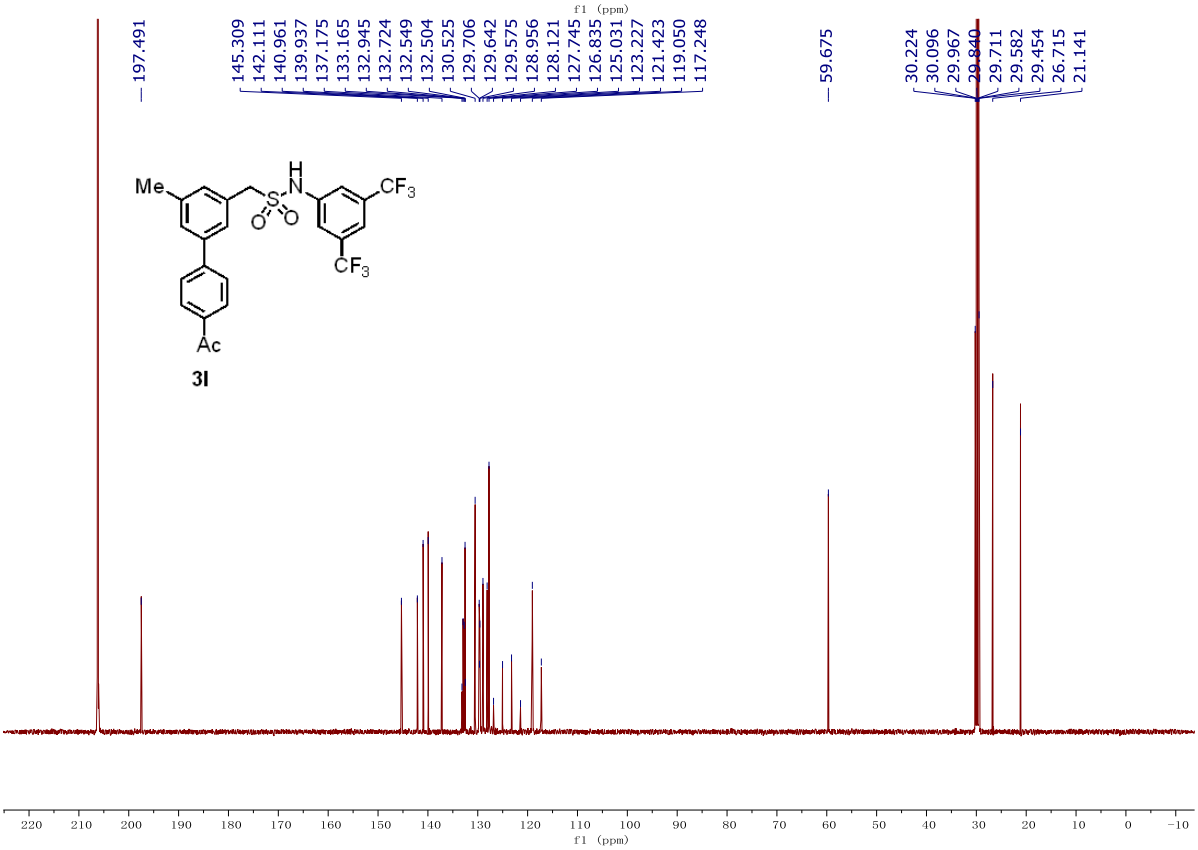
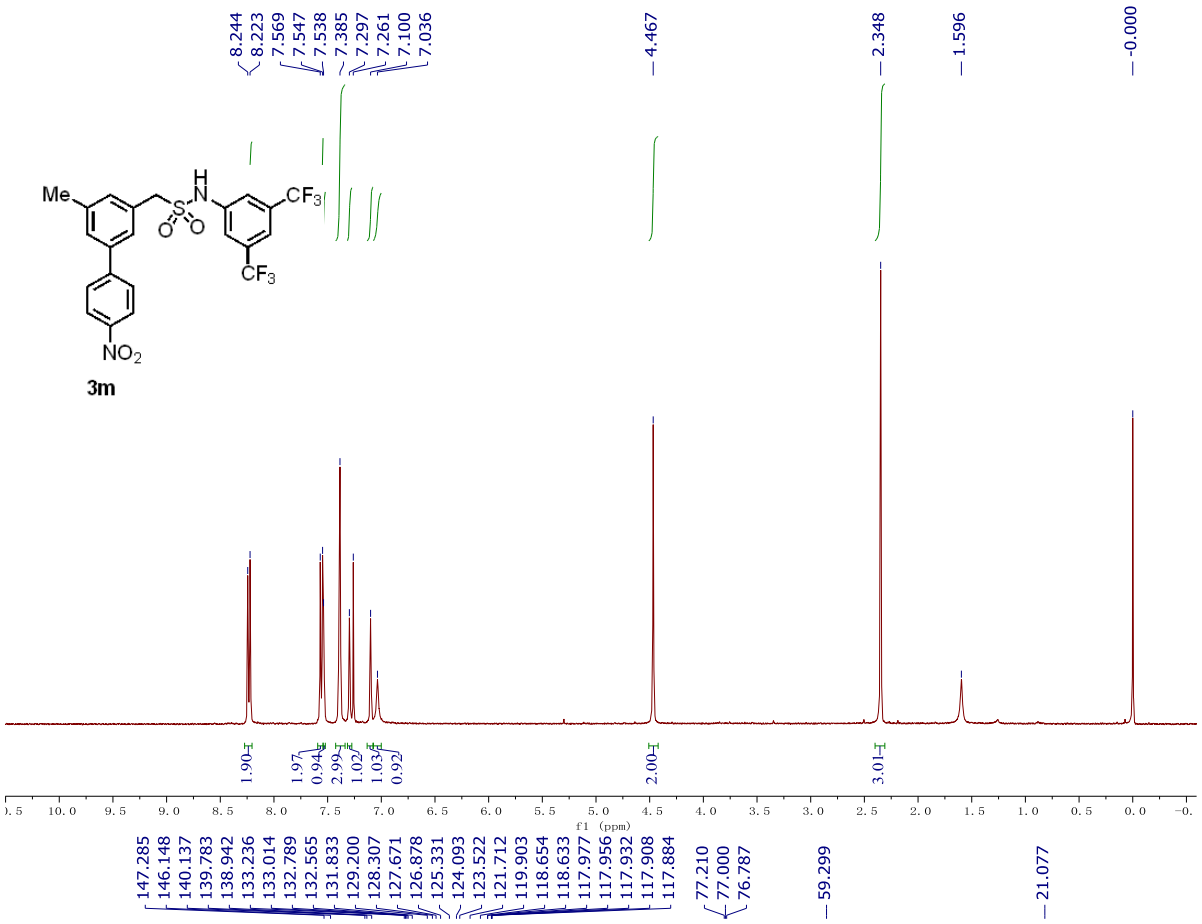
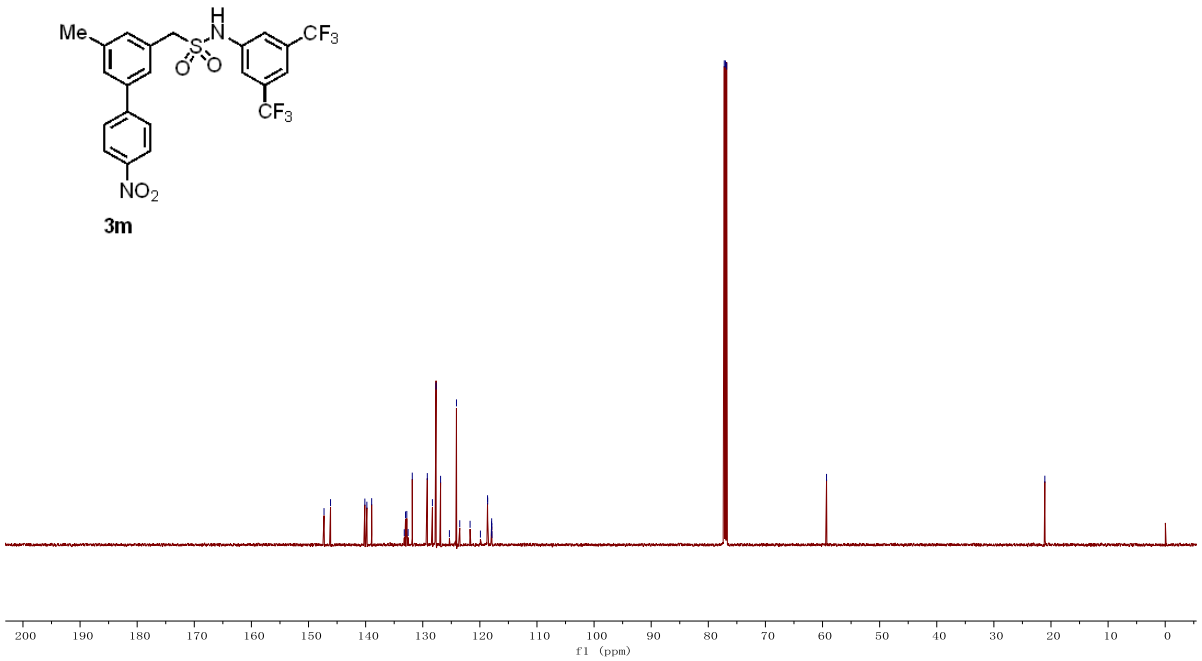
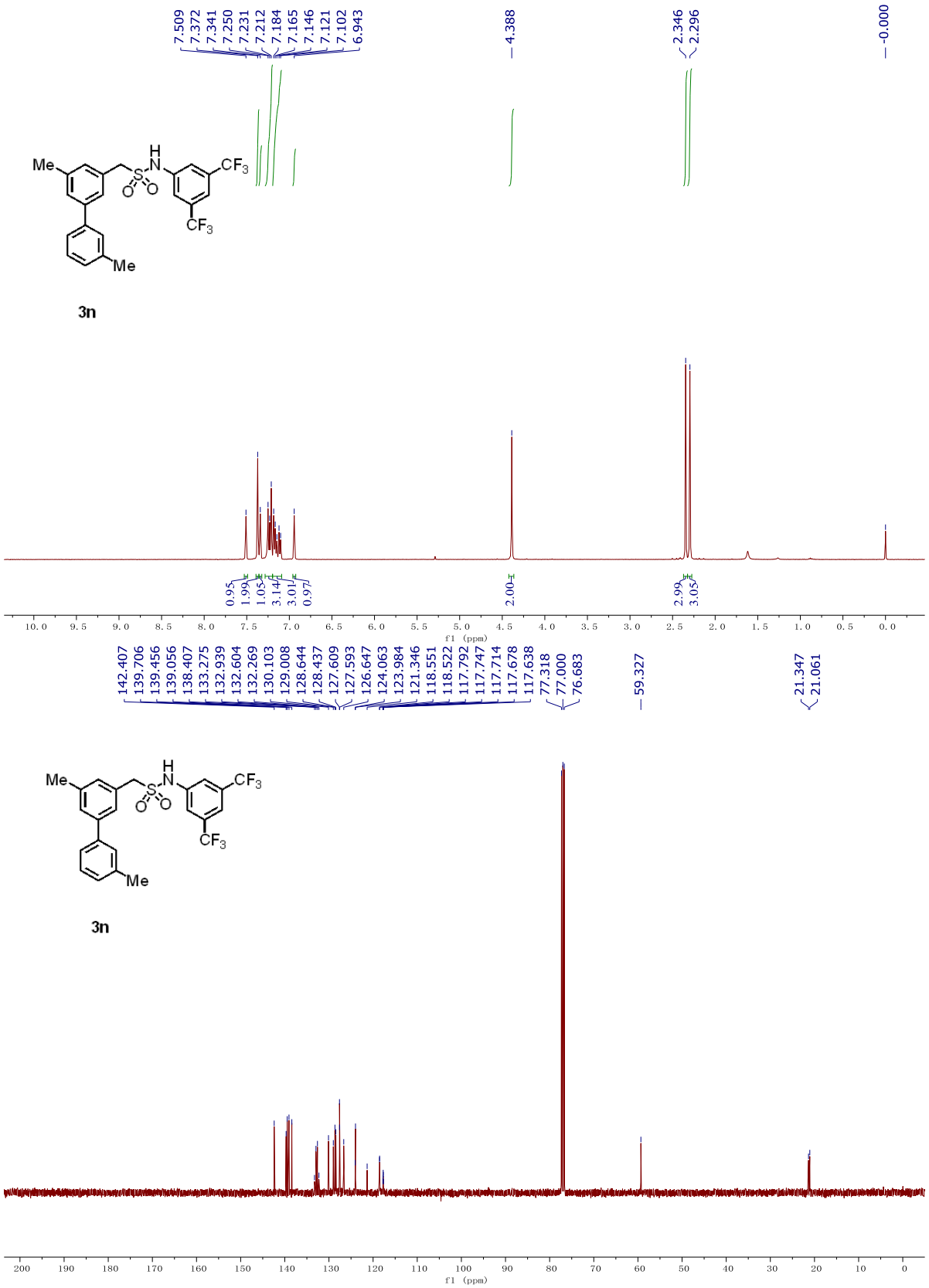
130.538
130.145
128.967
128.087
127.703
125.478
122.770
119.114
119.103
119.078
119.057
118.998
117.375
117.343
117.298
117.261
117.185
59.653
52.367
30.418
30.225
30.034
29.840
29.647
29.455
29.262
21.141
Me
H
N
S
O
O
CF3
CF3
CO2Me
3k
f1 (ppm)

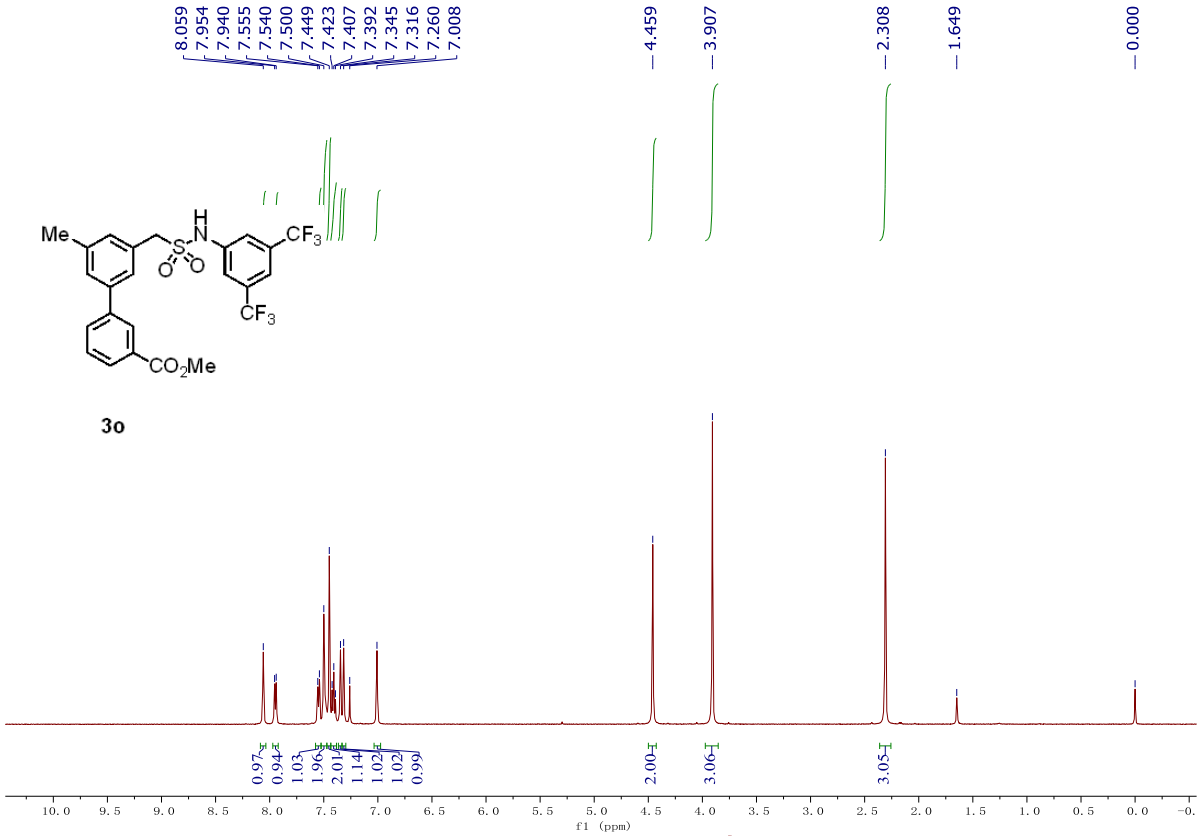

9.402
8.052
8.031
7.752
7.659
7.638
7.618
7.499
7.234
4.729
2.868
2.606
2.341
2.060
2.055
2.050
2.044
2.040
Me
CF3
CF3
Ac
3l
0.66
1.95
1.93
2.00
0.87
1.95
0.94
2.00
2.96
2.98
f1 (ppm)

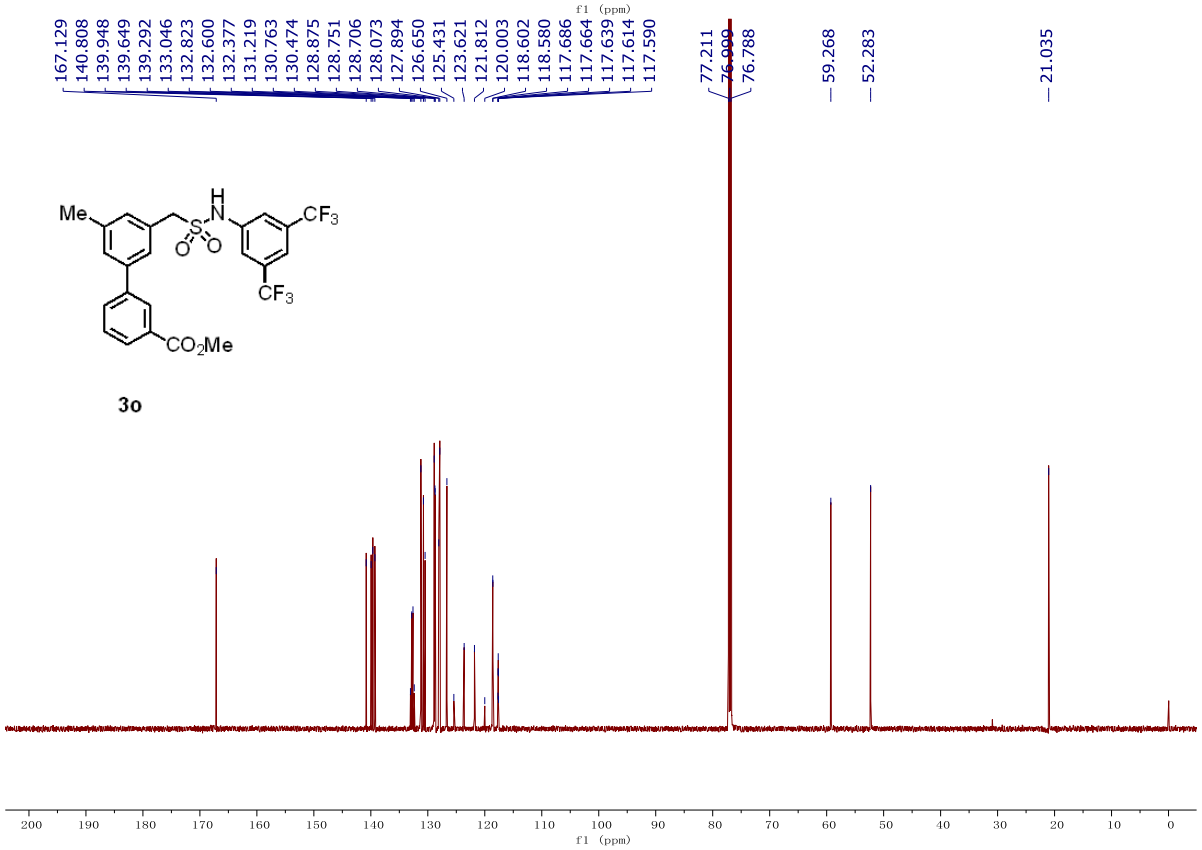

197.491
145.309
142.111
140.961
139.937
137.175
133.165
132.945
132.724
132.549
132.504
130.525
129.706
129.642
129.575
128.956
128.121
127.745
126.835
125.031
123.227
121.423
119.050
117.248
59.675
30.224
30.096
29.967
29.840
29.711
29.582
29.454
26.715
21.141
Me
CF3
CF3
Ac
3l
f1 (ppm)

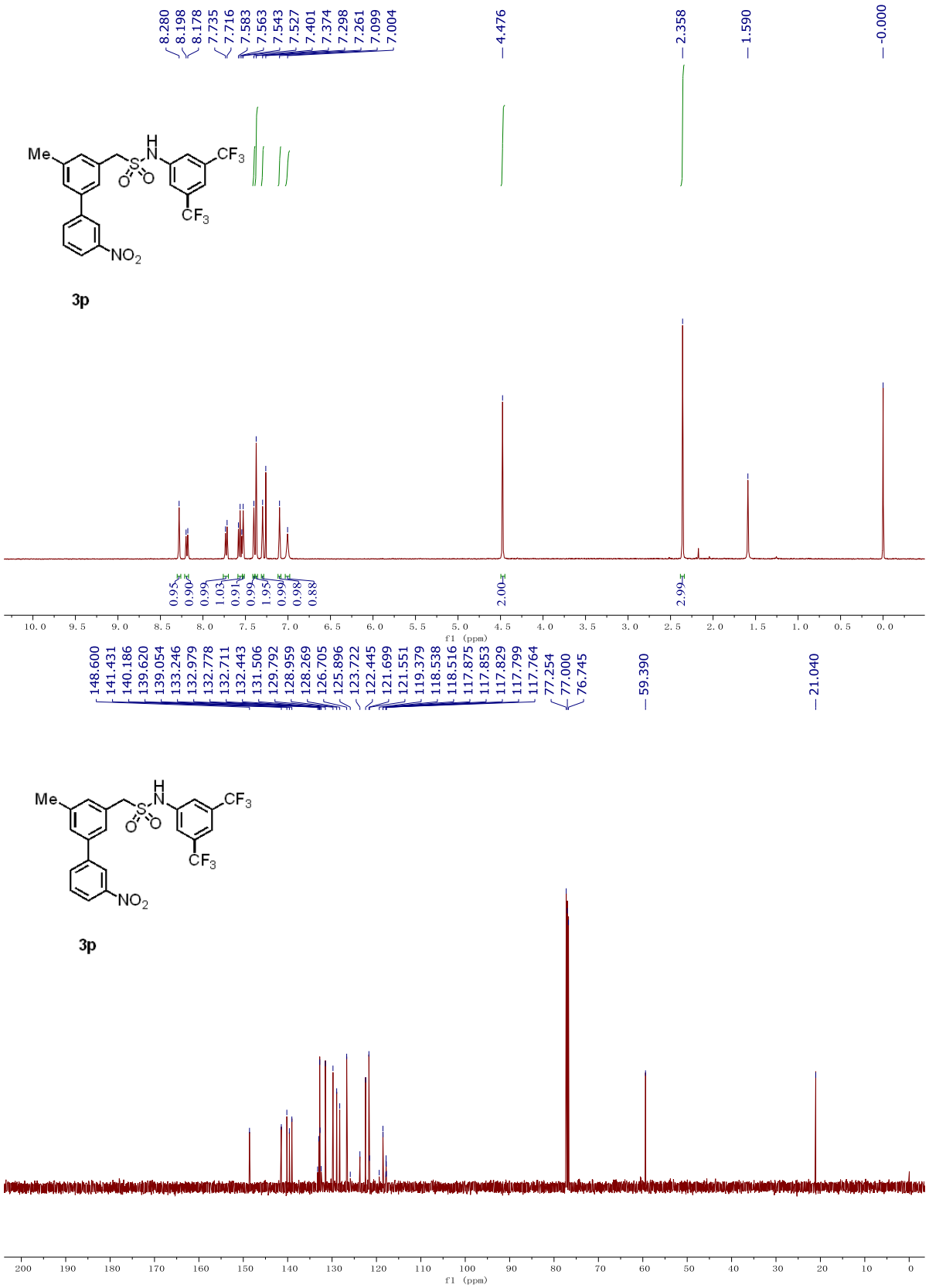

8.244
8.223
7.569
7.547
7.538
7.385
7.297
7.261
7.100
7.036
4.467
2.348
1.596
-0.000
Me
S
O
O
H
N
CF3
CF3
NO2
3m
1.90
1.97
0.94
2.99
1.02
1.03
0.92
2.00
3.01
f1 (ppm)
147.285
146.148
140.137
139.783
138.942
133.236
133.014
132.789
132.565
131.833
129.200
128.307
127.671
126.878
125.331
124.093
123.522
121.712
119.903
118.654
118.633
117.977
117.956
117.932
117.908
117.884
77.210
77.000
76.787
59.299
21.077

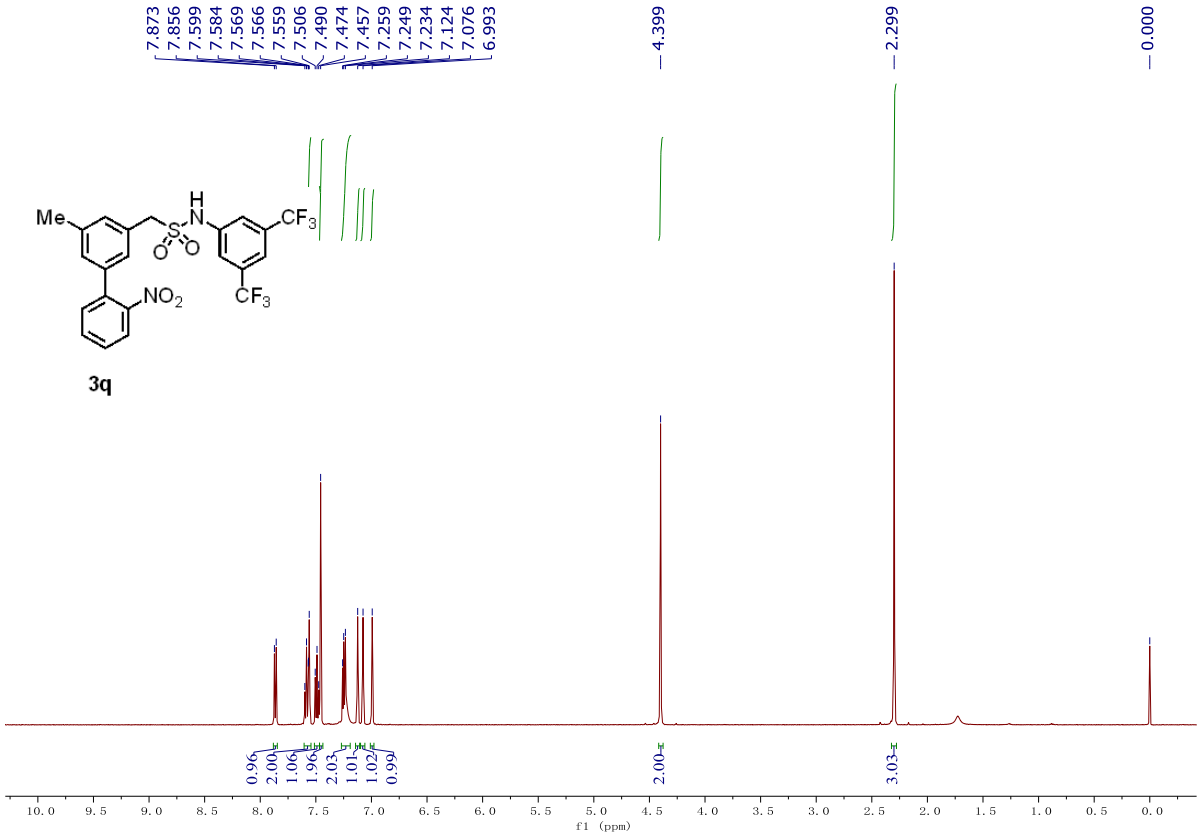

Me
S
O
O
H
N
CF3
CF3
NO2
3m
f1 (ppm)


7.509
7.372
7.341
7.250
7.231
7.212
7.184
7.165
7.146
7.121
7.102
6.943
4.388
2.346
2.296
-0.000
Me
H
N
S
O
O
CF3
CF3
Me
3n
0.95
1.99
1.05
3.14
3.01
0.97
2.00
2.99
3.05
f1 (ppm)
142.407
139.706
139.456
139.056
138.407
133.275
132.939
132.604
132.269
130.103
129.008
128.644
128.437
127.609
127.593
126.647
124.063
123.984
121.346
118.551
118.522
117.792
117.747
117.714
117.678
117.638
77.318
77.000
76.683
59.327
21.347
21.061
Me
H
N
S
O
O
CF3
CF3
Me
3n
f1 (ppm)

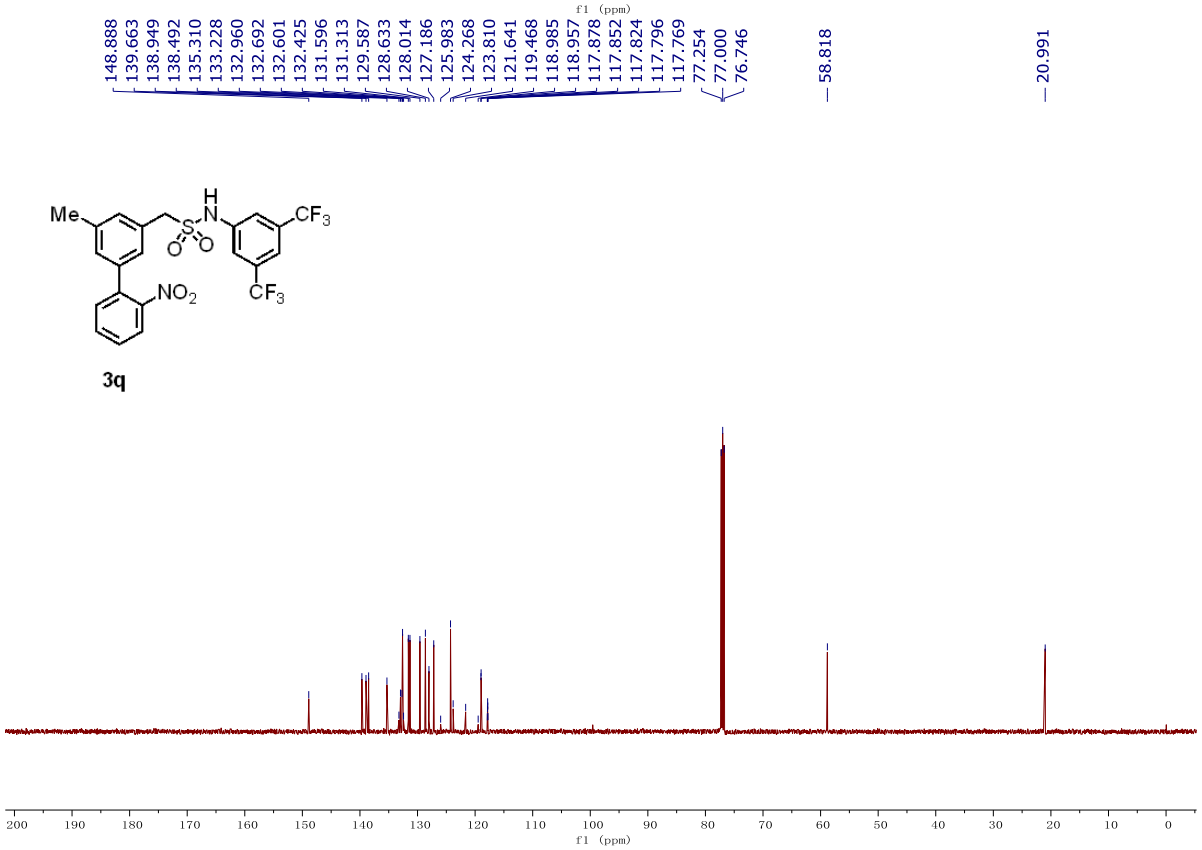

8.059
7.954
7.940
7.555
7.540
7.500
7.449
7.423
7.407
7.392
7.345
7.316
7.260
7.008
4.459
3.907
2.308
1.649
0.000
Me
CF3
CF3
CO2Me
3o
0.97
0.94
1.03
1.96
2.01
1.14
1.02
1.02
0.99
2.00
3.06
3.05
f1 (ppm)


167.129
140.808
139.948
139.649
139.292
133.046
132.823
132.600
132.377
131.219
130.763
130.474
128.875
128.751
128.706
128.073
127.894
126.650
125.431
123.621
121.812
120.003
118.602
118.580
117.686
117.664
117.639
117.614
117.590
77.211
76.999
76.788
59.268
52.283
21.035
Me
CF3
CF3
CO2Me
3o
f1 (ppm)

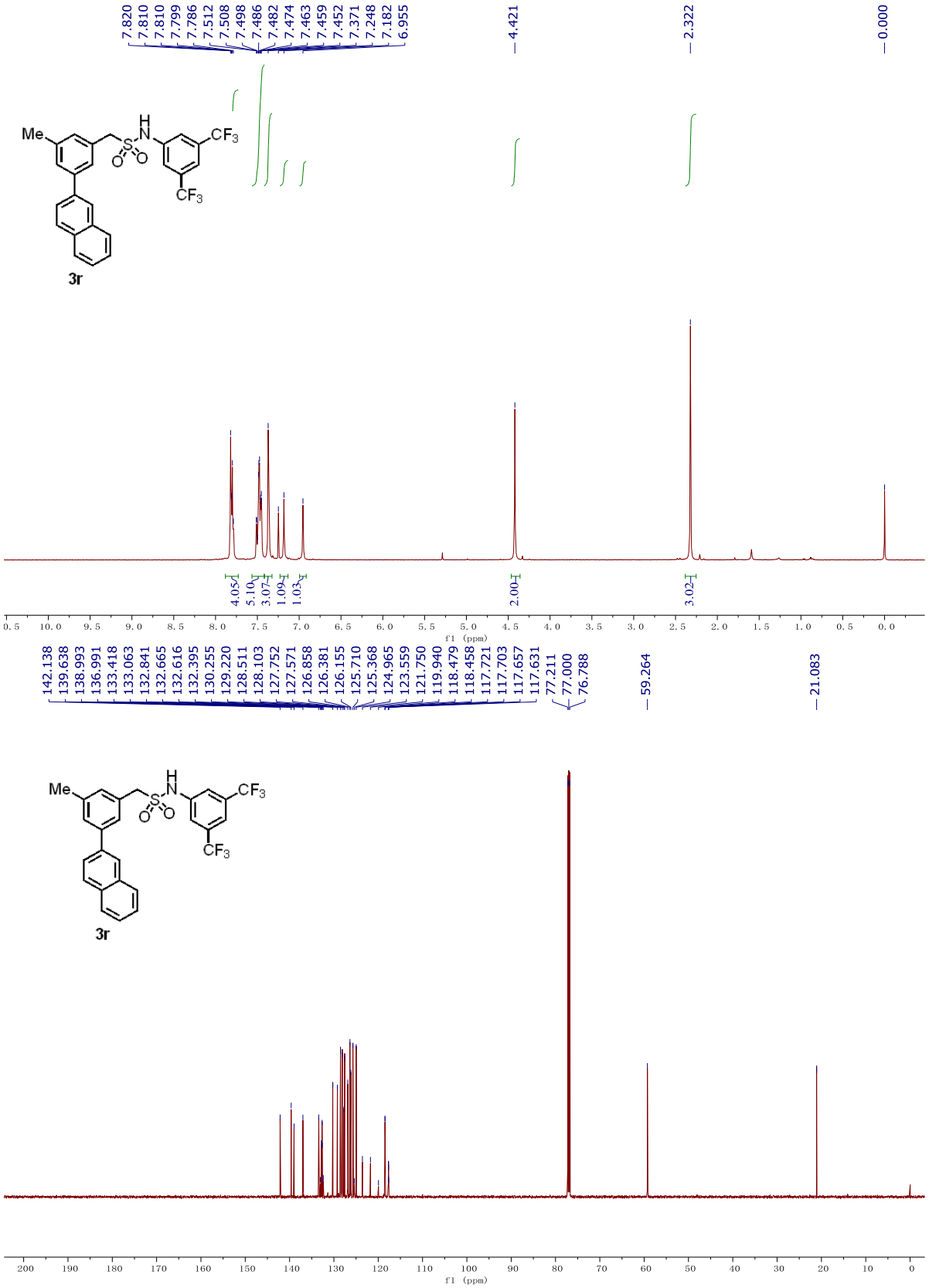

8.280
8.198
8.178
7.735
7.716
7.583
7.563
7.543
7.527
7.401
7.374
7.298
7.261
7.099
7.004
4.476
2.358
1.590
-0.000
Me
CF3
CF3
NO2
3p
0.95
0.90
0.99
1.03
0.91
0.99
1.95
0.99
0.98
0.88
2.00
2.99
f1 (ppm)
148.600
141.431
140.186
139.620
139.054
133.246
132.979
132.778
132.711
132.443
131.506
129.792
128.959
128.269
126.705
125.896
123.722
122.445
121.699
121.551
119.379
118.538
118.516
117.875
117.853
117.829
117.799
117.764
77.254
77.000
76.745
59.390
21.040
Me
CF3
CF3
NO2
3p
f1 (ppm)

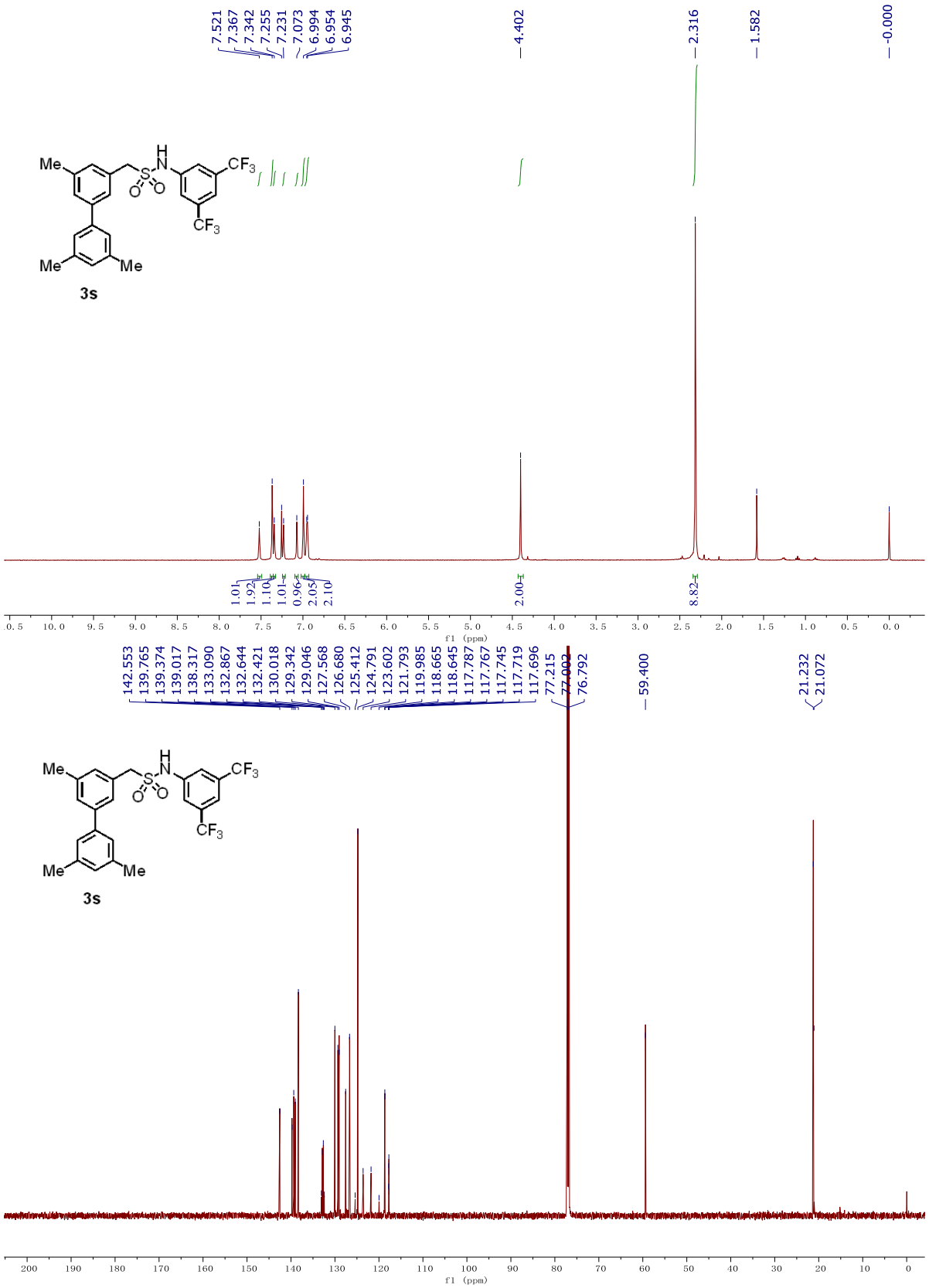

7.873
7.856
7.599
7.584
7.569
7.566
7.559
7.506
7.490
7.474
7.457
7.259
7.249
7.234
7.124
7.076
6.993
4.399
2.299
0.000
Me
H
N
S
O
O
CF3
CF3
NO2
0.96
2.00
1.06
1.96
2.03
1.01
1.02
0.99
2.00
3.03
f1 (ppm)

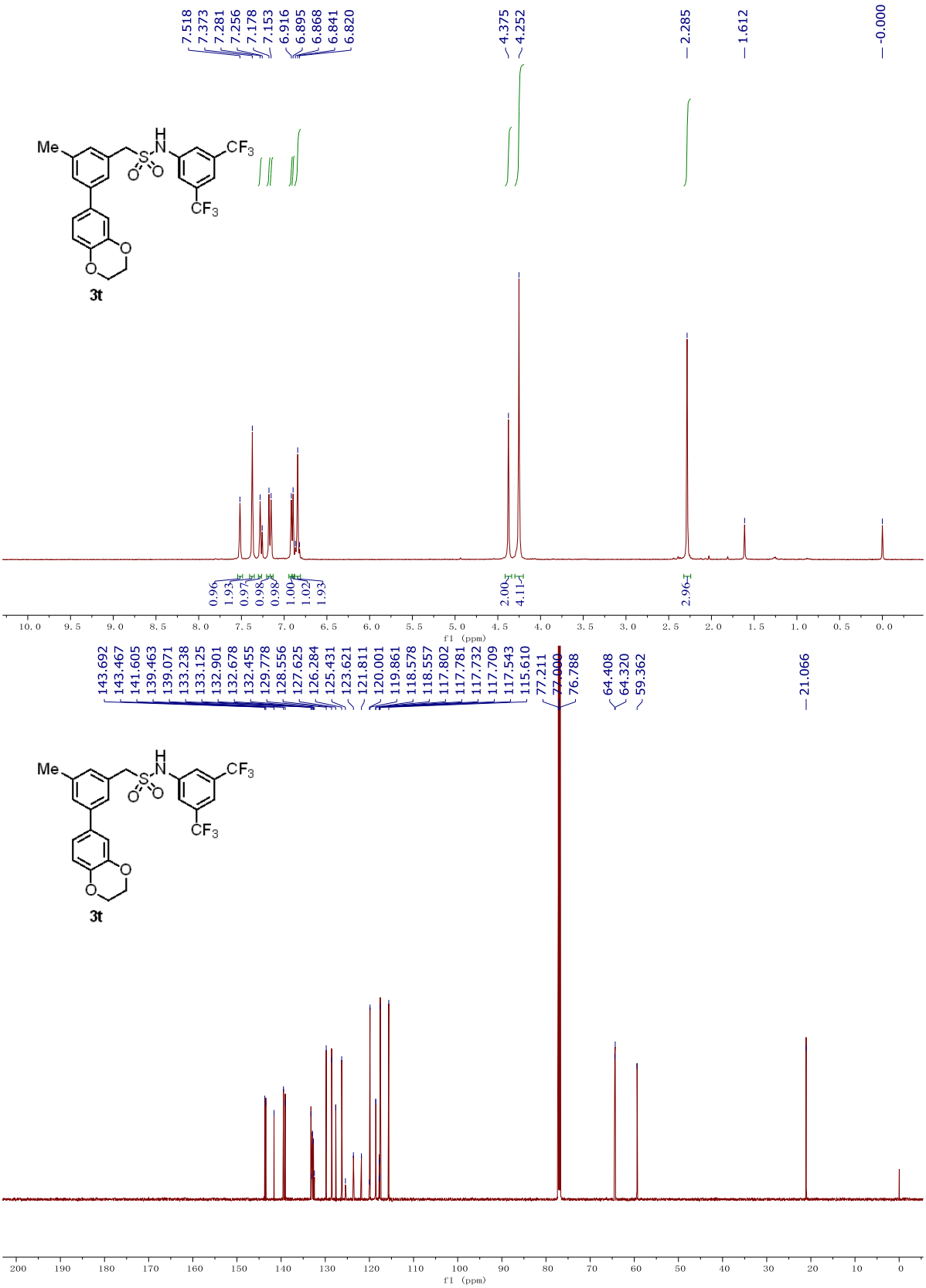
3q

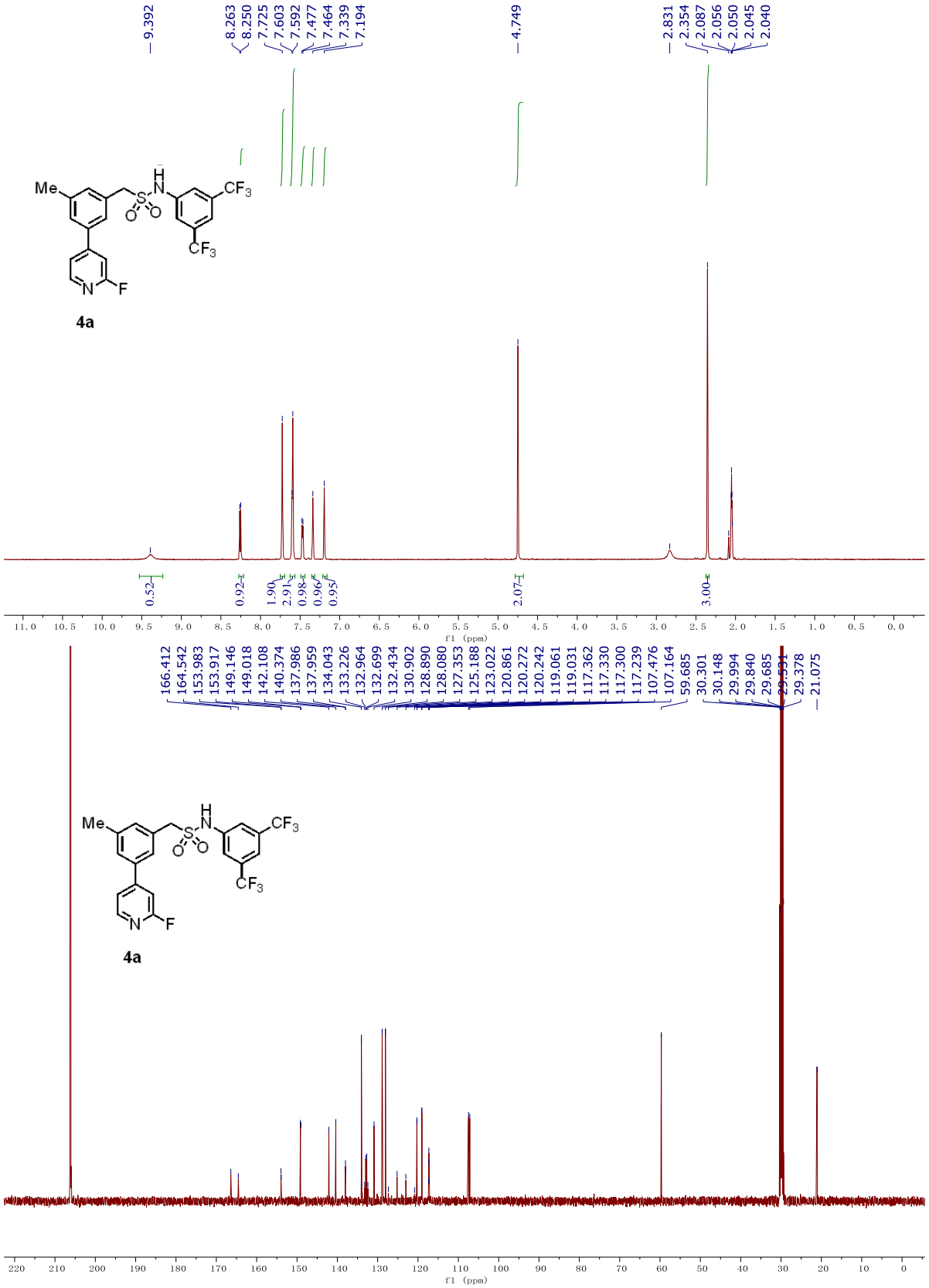

148.888
139.663
138.949
138.492
135.310
133.228
132.960
132.692
132.601
132.425
131.596
131.313
129.587
128.633
128.014
127.186
125.983
124.268
123.810
121.641
119.468
118.985
118.957
117.878
117.852
117.824
117.796
117.769
77.254
77.000
76.746
58.818
20.991
Me
H
N
S
O
O
CF3
CF3
NO2
f1 (ppm)

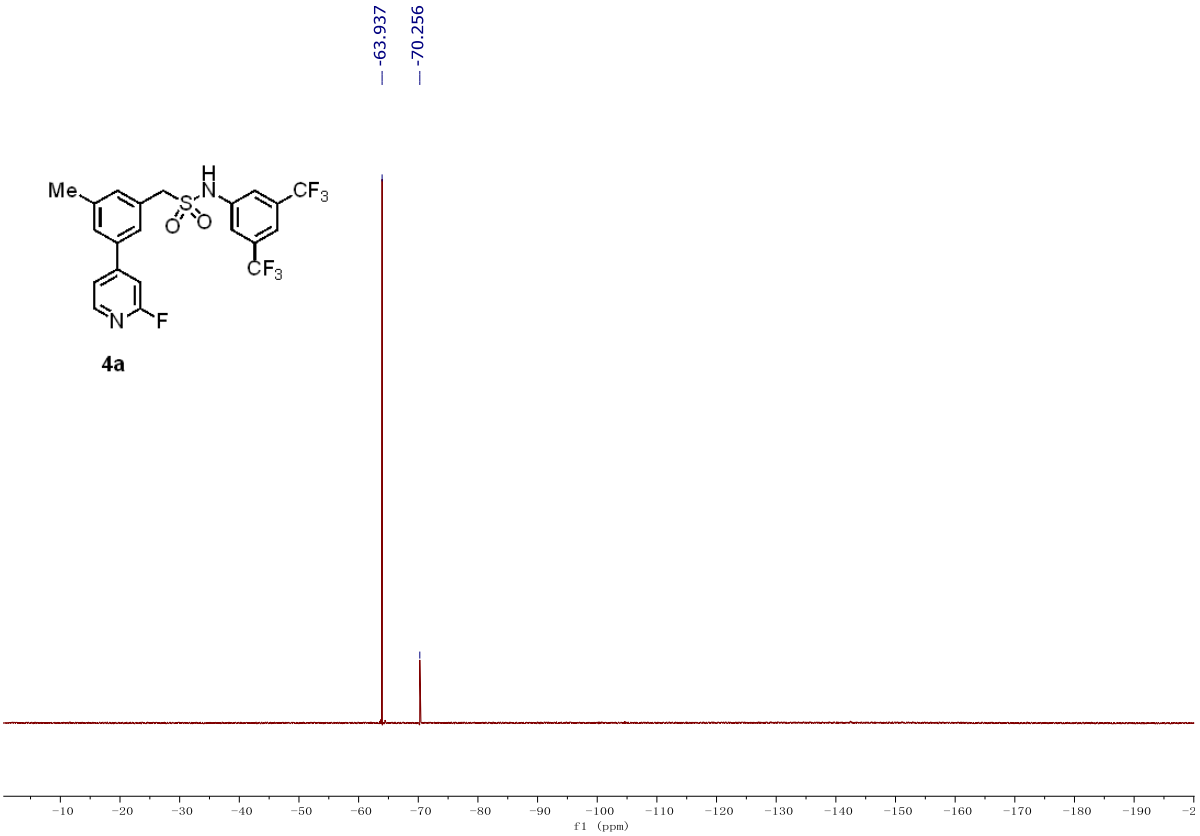
3q


7.820
7.810
7.810
7.799
7.786
7.512
7.508
7.498
7.486
7.482
7.474
7.463
7.459
7.452
7.371
7.248
7.182
6.955
4.421
2.322
0.000
Me
H
N
S
O
O
CF3
CF3
3r
4.05
5.10
3.07
1.09
1.03
2.00
3.02
f1 (ppm)
142.138
139.638
138.993
136.991
133.418
133.063
132.841
132.665
132.616
132.395
130.255
129.220
128.511
128.103
127.752
127.571
126.858
126.381
126.155
125.710
125.368
124.965
123.559
121.750
119.940
118.479
118.458
117.721
117.703
117.657
117.631
77.211
77.000
76.788
59.264
21.083
Me
H
N
S
O
O
CF3
CF3
3r
f1 (ppm)

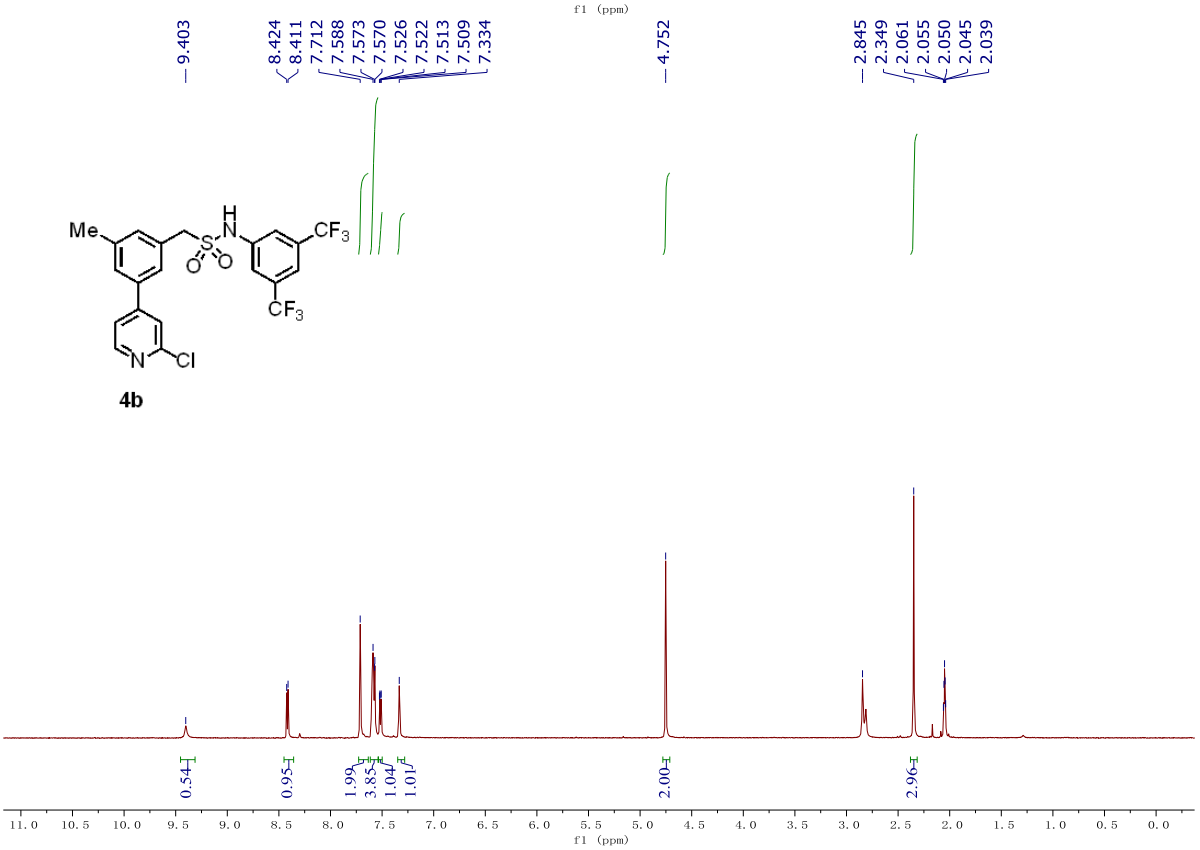

7.521
7.367
7.342
7.255
7.231
7.073
6.994
6.954
6.945
4.402
2.316
1.582
-0.000
Me
CF3
CF3
Me
Me
3s
1.01
1.92
1.10
1.01
0.96
2.05
2.10
2.00
8.82
f1 (ppm)
142.553
139.765
139.374
139.017
138.317
133.090
132.867
132.644
132.421
130.018
129.342
129.046
127.568
126.680
125.412
124.791
123.602
121.793
119.985
118.665
118.645
117.787
117.767
117.745
117.719
117.696
77.215
77.002
76.792
59.400
21.232
21.072
Me
CF3
CF3
Me
Me
3s
f1 (ppm)


7.518
7.373
7.281
7.256
7.178
7.153
6.916
6.895
6.868
6.841
6.820
4.375
4.252
2.285
1.612
-0.000
Me
CF3
CF3
O
O
O
H
N
S
O
O
3t
0.96
1.93
0.97
0.98
0.98
1.00
1.02
1.93
2.00
4.11
2.96
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)
143.692
143.467
141.605
139.463
139.071
133.238
133.125
132.901
132.678
132.455
129.778
128.556
127.625
126.284
125.431
123.621
121.811
120.001
119.861
118.578
118.557
117.802
117.781
117.732
117.709
117.543
115.610
77.211
77.000
76.788
64.408
64.320
59.362
21.066
Me
CF3
CF3
O
O
O
H
N
S
O
O
3t
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

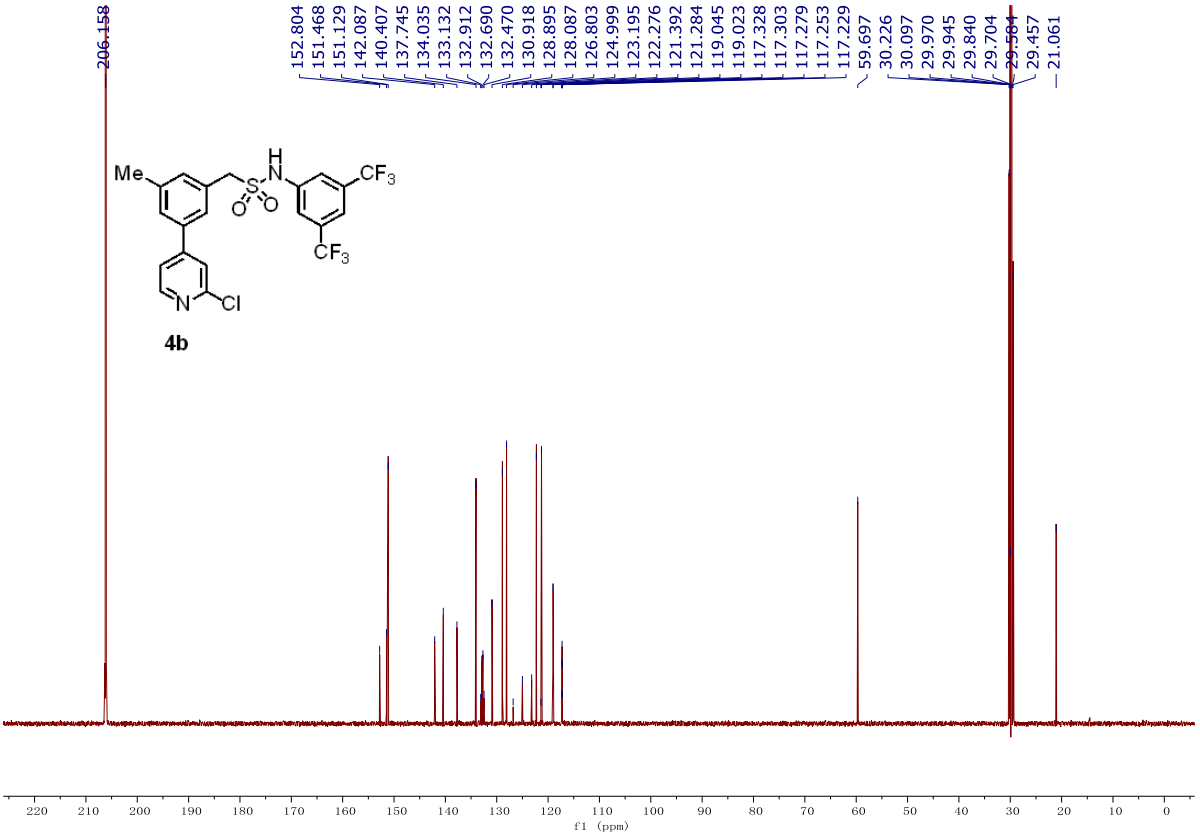

9.392
8.263
8.250
7.725
7.603
7.592
7.477
7.464
7.339
7.194
4.749
2.831
2.354
2.087
2.056
2.050
2.045
2.040
Me
CF3
CF3
F
4a
0.52
0.92
1.90
2.91
0.98
0.96
0.95
2.07
3.00
f1 (ppm)
166.412
164.542
153.983
153.917
149.146
149.018
142.108
140.374
137.986
137.959
134.043
133.226
132.964
132.699
132.434
130.902
128.890
128.080
127.353
125.188
123.022
120.861
120.272
120.242
119.061
119.031
117.362
117.330
117.300
117.239
107.476
107.164
59.685
30.301
30.148
29.994
29.840
29.685
29.531
29.378
21.075
Me
CF3
CF3
F
4a
f1 (ppm)

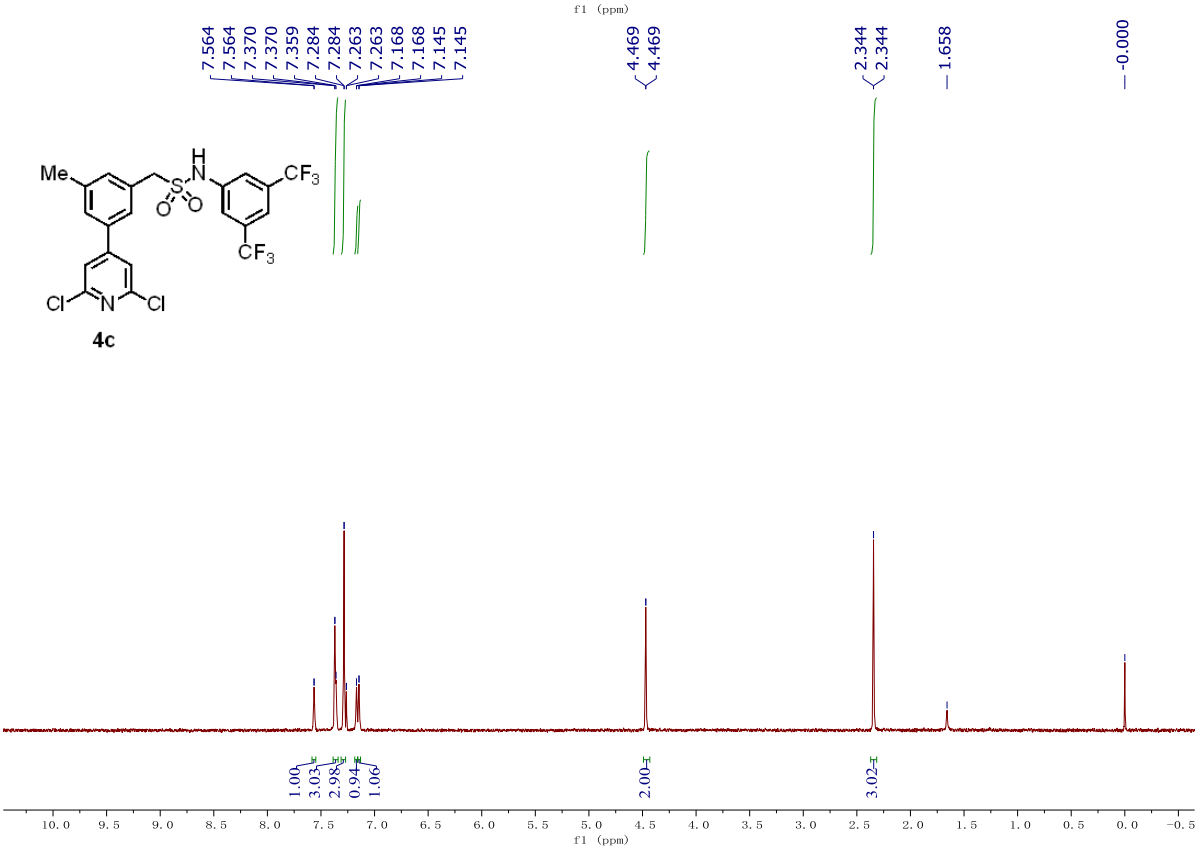

-63.937
-70.256
Me
CF3
CF3
N
F
f1 (ppm)

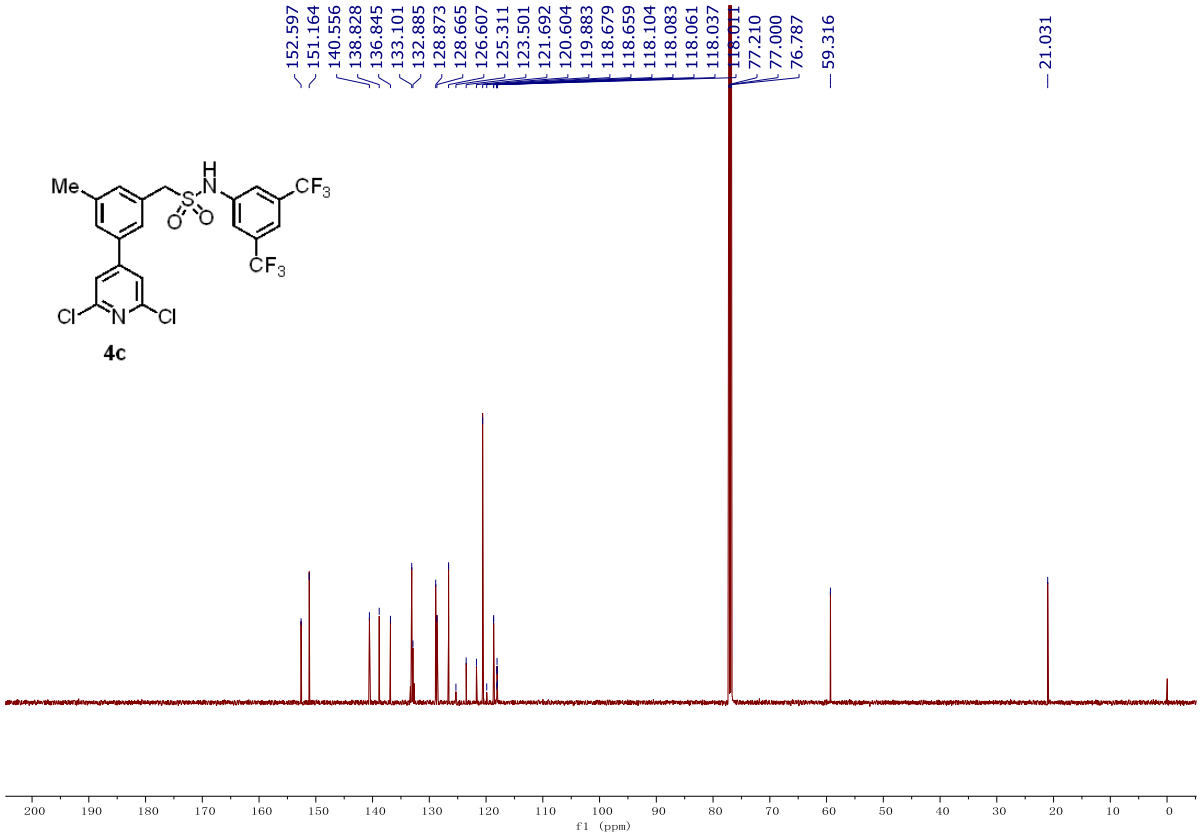
4a

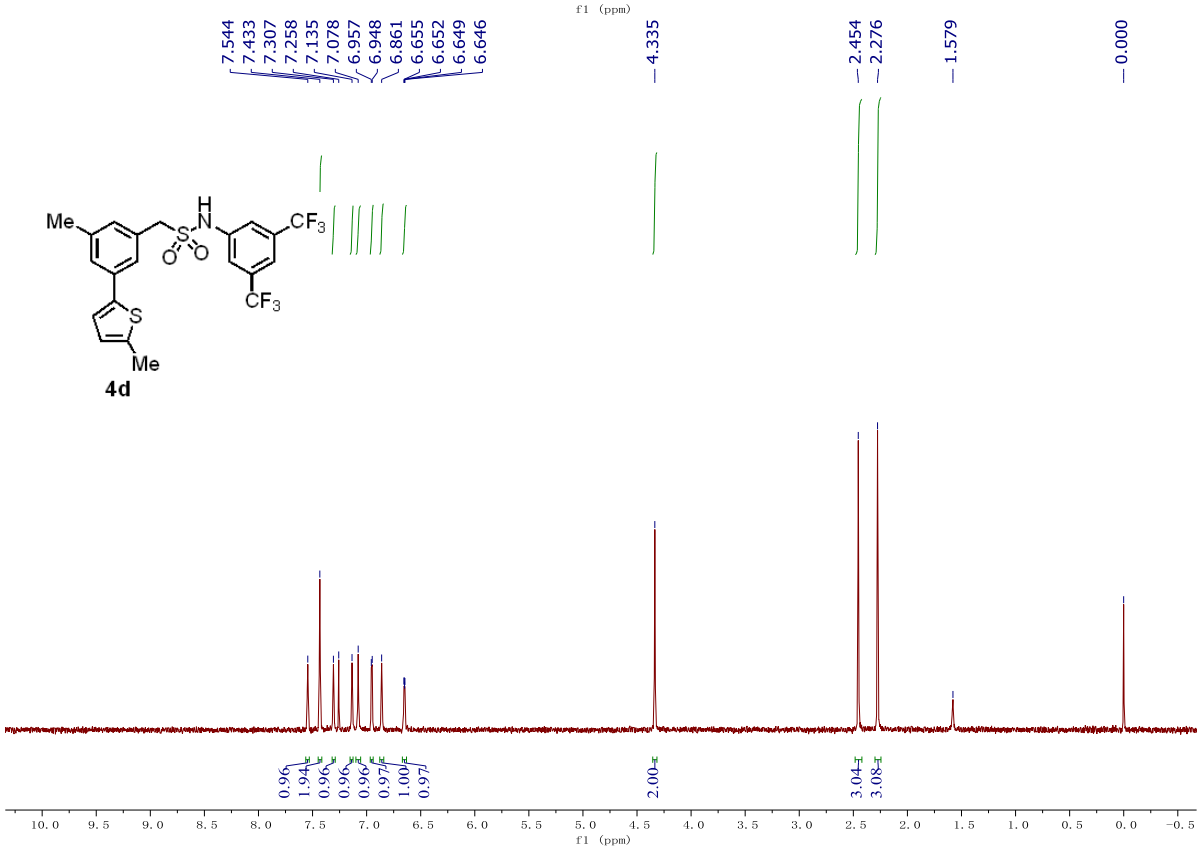

9.403
8.424
8.411
7.712
7.588
7.573
7.570
7.526
7.522
7.513
7.509
7.334
4.752
2.845
2.349
2.061
2.055
2.050
2.045
2.039
Me
CF3
CF3
N
Cl
0.54
0.95
1.99
3.85
1.04
1.01
2.00
2.96
f1 (ppm)

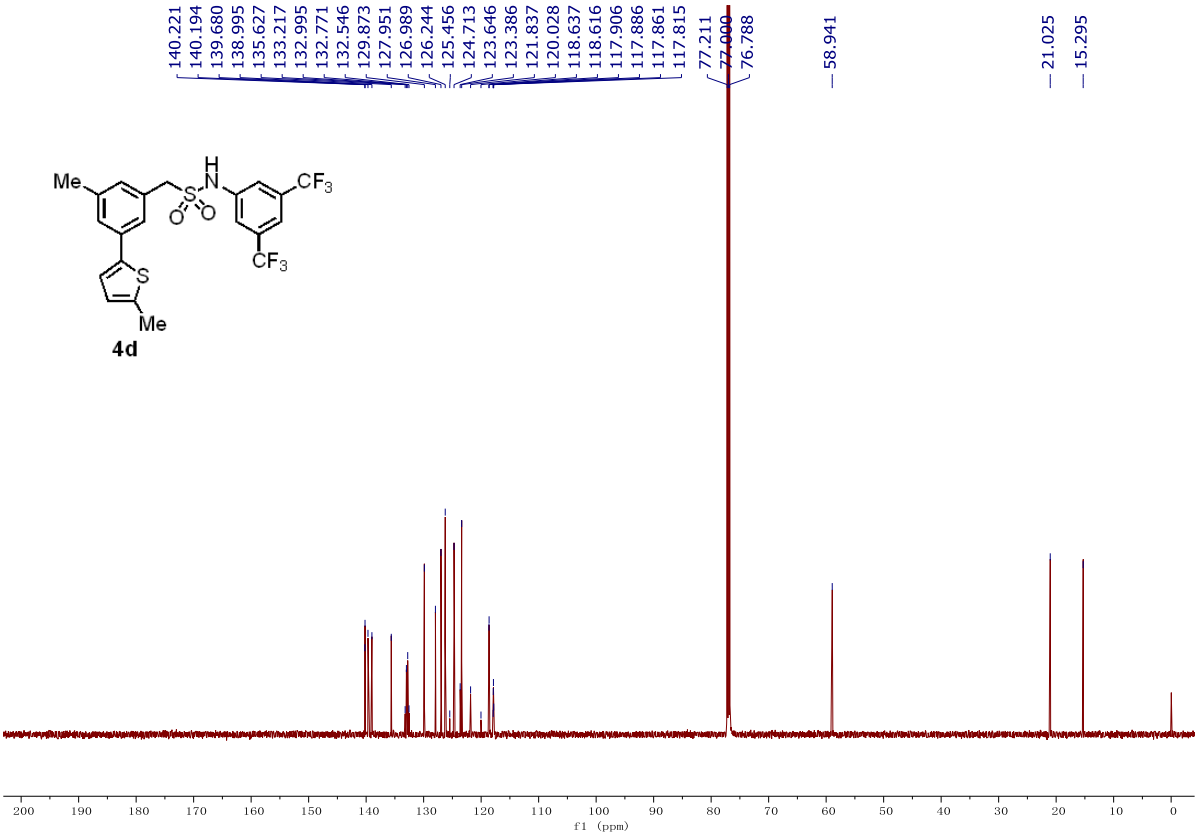
4b

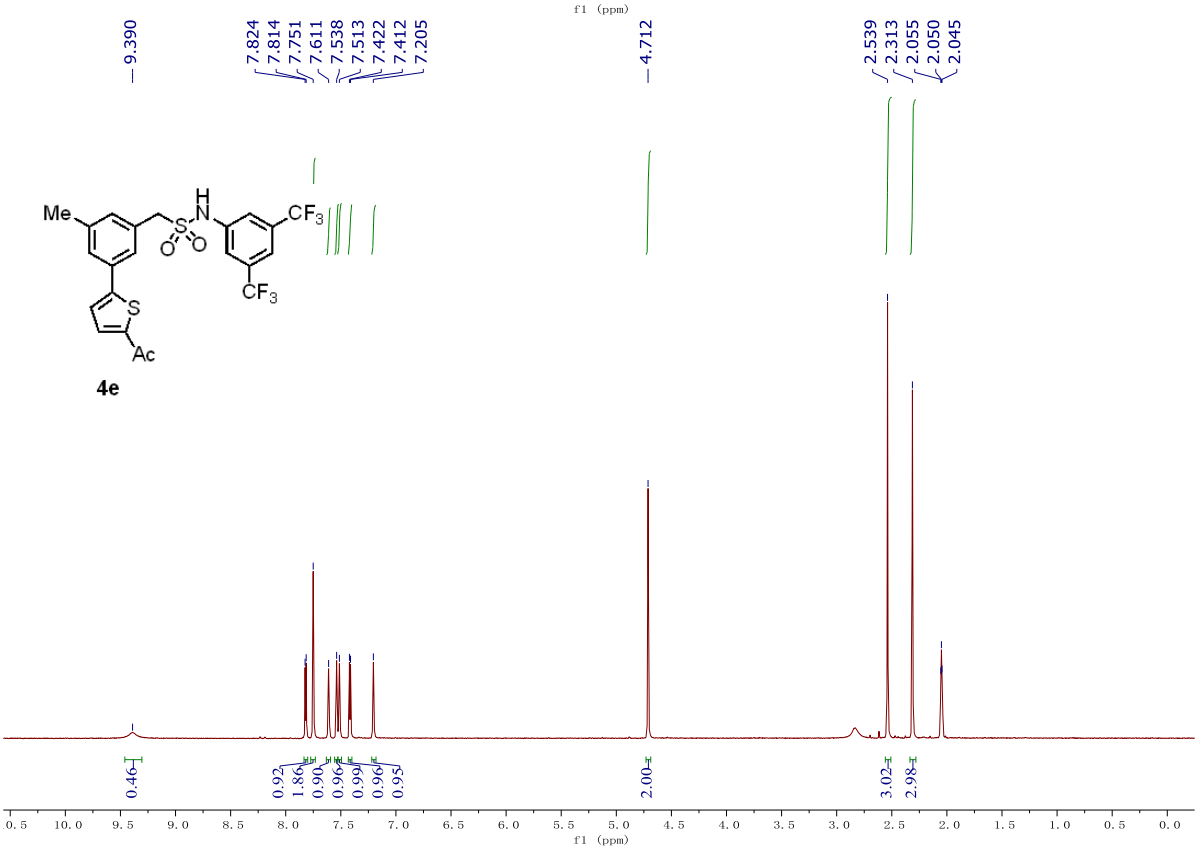

206.158
152.804
151.468
151.129
142.087
140.407
137.745
134.035
133.132
132.912
132.690
132.470
130.918
128.895
128.087
126.803
124.999
123.195
122.276
121.392
121.284
119.045
119.023
117.328
117.303
117.279
117.253
117.229
59.697
30.226
30.097
29.970
29.945
29.840
29.704
29.564
29.457
21.061
Me
CF3
CF3
Cl
4b
f1 (ppm)

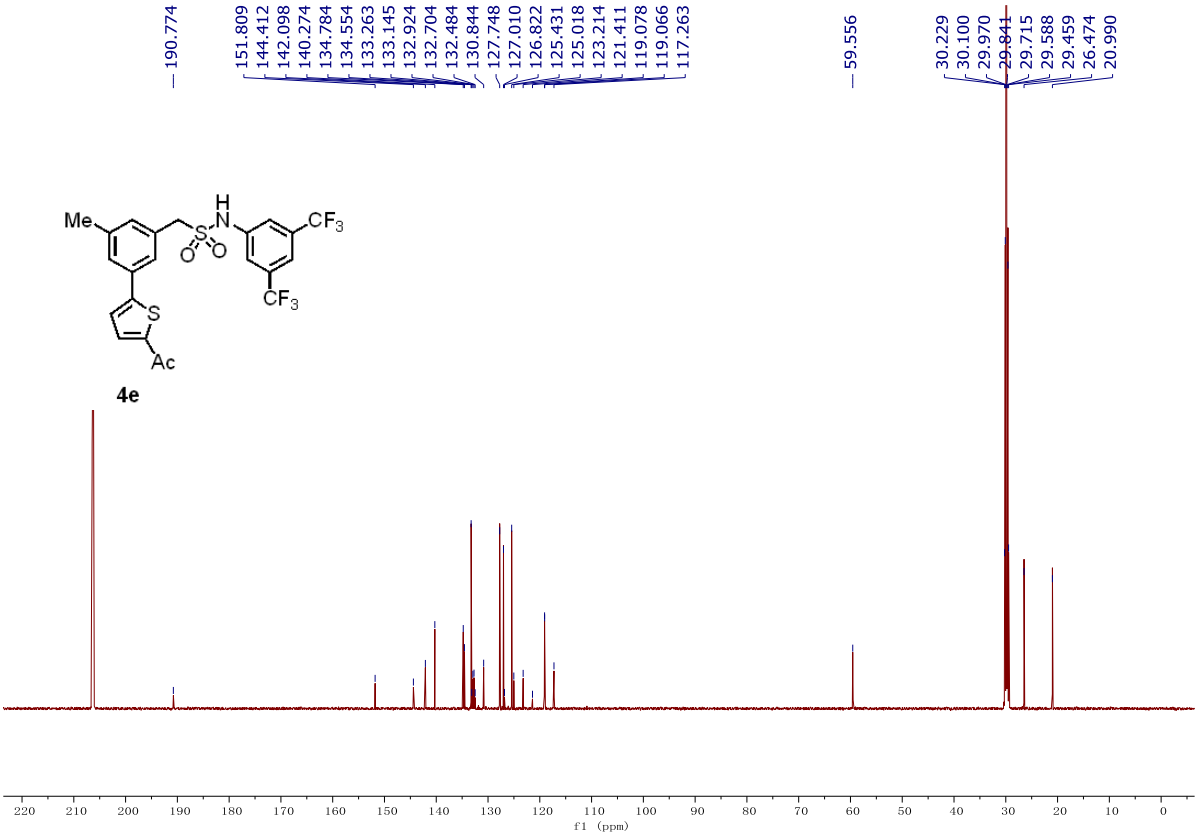

7.564
7.564
7.370
7.370
7.359
7.284
7.284
7.263
7.263
7.168
7.168
7.145
7.145
4.469
4.469
2.344
2.344
1.658
-0.000
Me
CF3
CF3
Cl
Cl
4c
1.00
3.03
2.98
0.94
1.06
2.00
3.02
f1 (ppm)


152.597
151.164
140.556
138.828
136.845
133.101
132.885
128.873
128.665
126.607
125.311
123.501
121.692
120.604
119.883
118.679
118.659
118.104
118.083
118.061
118.037
118.011
77.210
77.000
76.787
59.316
21.031
Me
CF3
CF3
Cl
N
Cl
4c
f1 (ppm)


7.544
7.433
7.307
7.258
7.135
7.078
6.957
6.948
6.861
6.655
6.652
6.649
6.646
4.335
2.454
2.276
1.579
0.000
Me
CF3
CF3
S
Me
4d
0.96
1.94
0.96
0.96
0.96
0.97
1.00
0.97
2.00
3.04
3.08
f1 (ppm)


140.221
140.194
139.680
138.995
135.627
133.217
132.995
132.771
132.546
129.873
127.951
126.989
126.244
125.456
124.713
123.646
123.386
121.837
120.028
118.637
118.616
117.906
117.886
117.861
117.815
77.211
77.000
76.788
58.941
21.025
15.295
Me
CF3
CF3
S
Me
4d
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)


9.390
7.824
7.814
7.751
7.611
7.538
7.513
7.422
7.412
7.205
4.712
2.539
2.313
2.055
2.050
2.045
Me
CF3
CF3
S
Ac
4e
0.46
0.92
1.86
0.90
0.96
0.99
0.96
0.95
2.00
3.02
2.98
0.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)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134.554
133.263
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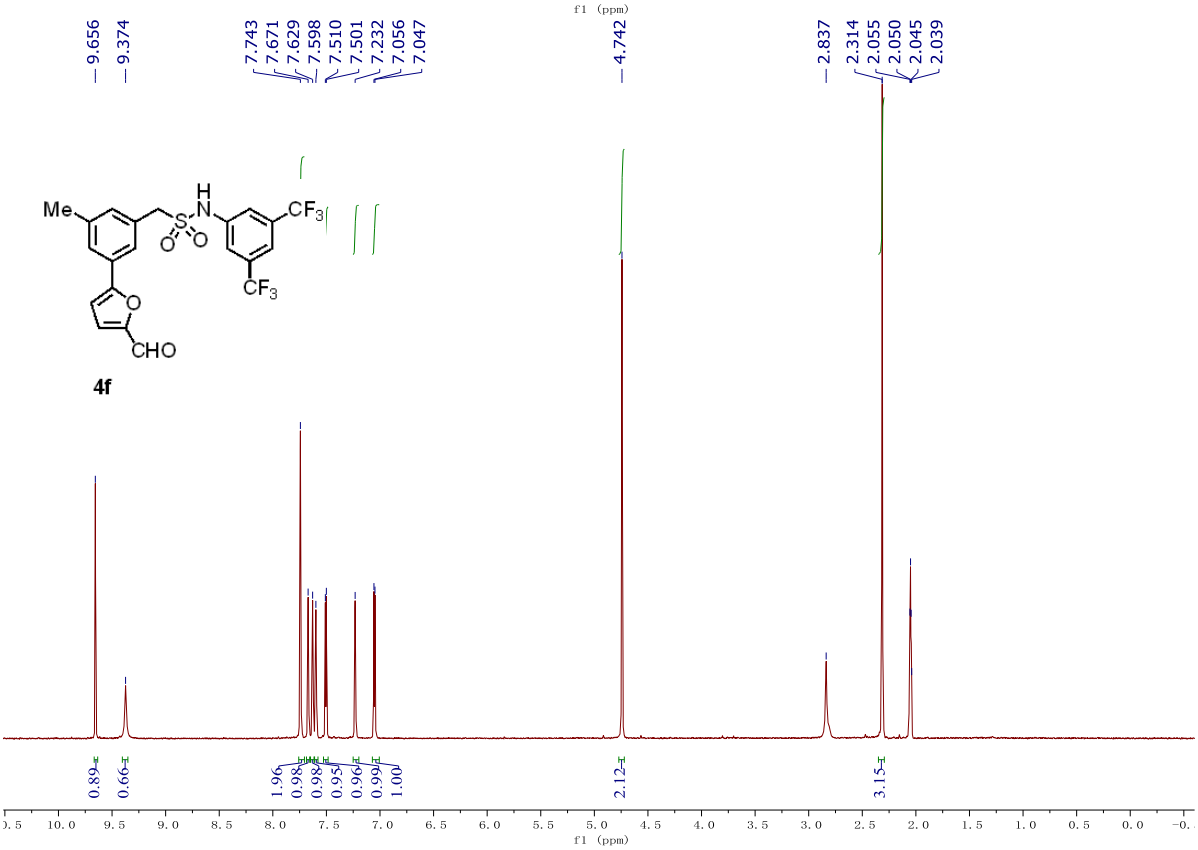
132.924
132.704
132.484
130.844
127.748
127.010
126.822
125.431
125.018
123.214
121.411
119.078
119.066
117.263
59.556
30.229
30.100
29.970
29.841
29.715
29.588
29.459
26.474
20.990
Me
H
N
S
O
O
CF3
CF3
S
Ac
4e
f1 (ppm)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7.671
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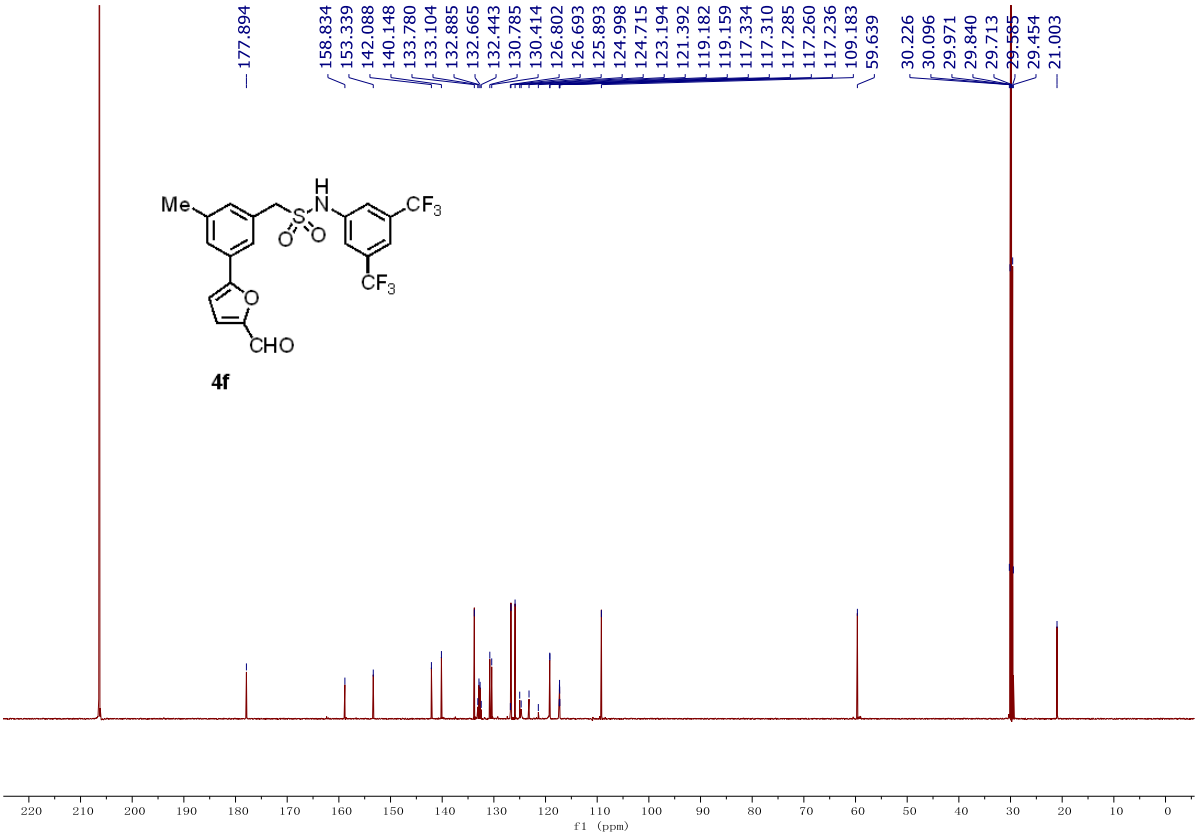
7.510
7.501
7.232
7.056
7.047
4.742
2.837
2.314
2.055
2.050
2.045
2.039
Me
H
N
S
O
O
CF3
CF3
O
CHO
4f
0.89
0.66
1.96
0.98
0.98
0.95
0.96
0.99
1.00
2.12
3.15
f1 (ppm)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132.885
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132.443
130.785
130.414
126.802
126.693
125.893
124.998
124.715
123.194
121.392
119.182
119.159
117.334
117.310
117.285
117.260
117.236
109.183
59.639
30.226
30.096
29.971
29.840
29.713
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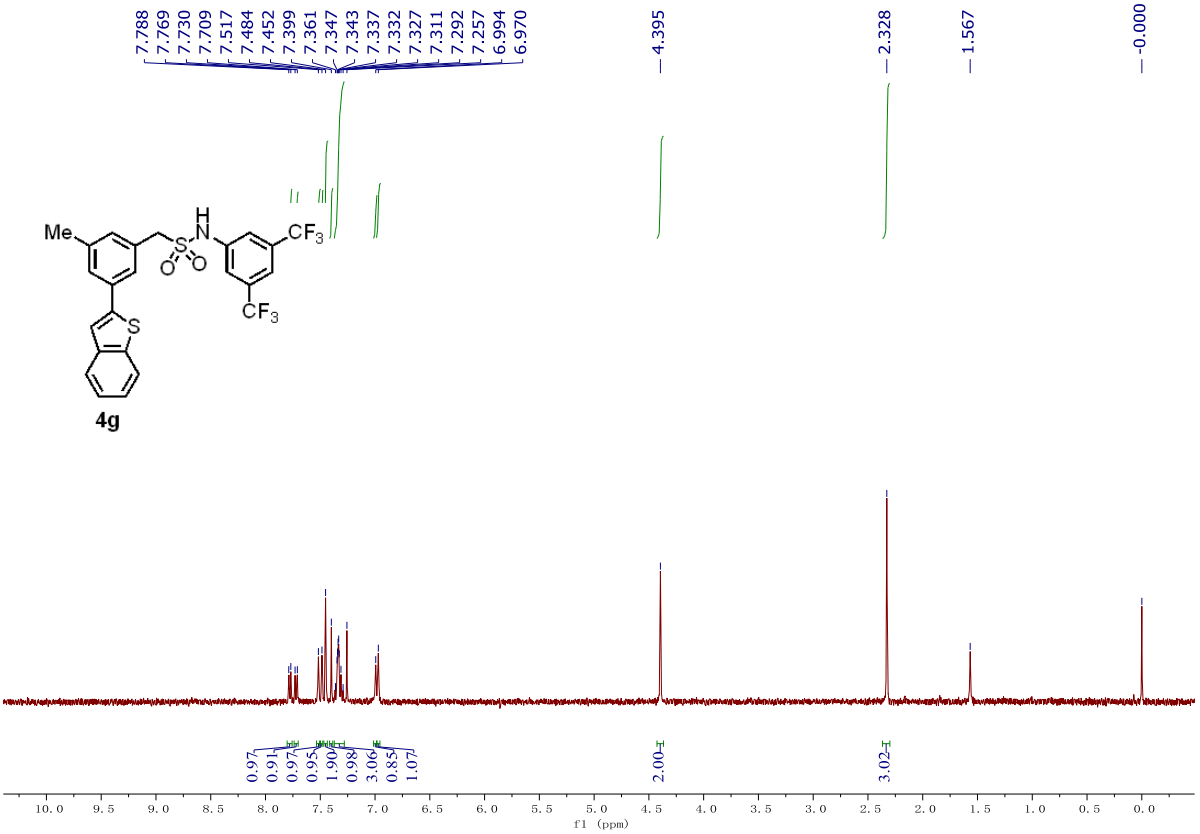
21.003
Me
H
N
S
O
O
CF3
CF3
O
CHO
4f
f1 (ppm)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7.452
7.399
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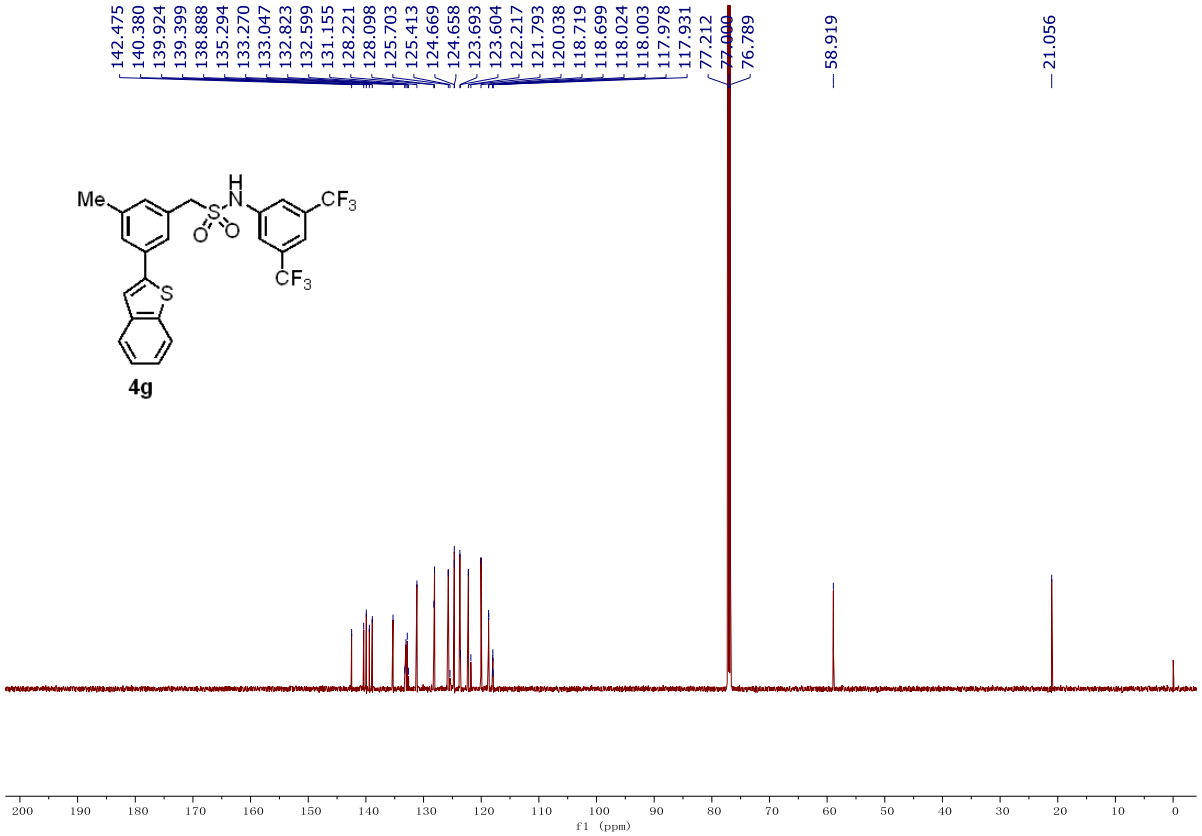
7.343
7.337
7.332
7.327
7.311
7.292
7.257
6.994
6.970
4.395
2.328
1.567
-0.000
Me
H
N
S
O
O
CF3
CF3
S
4g
0.97
0.91
0.97
0.95
1.90
0.98
3.06
0.85
1.07
2.00
3.02
f1 (ppm)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139.924
139.399
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135.294
133.270
133.047
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128.221
128.098
125.703
125.413
124.669
124.658
123.693
123.604
122.217
121.793
120.038
118.719
118.699
118.024
118.003
117.978
117.931
77.212
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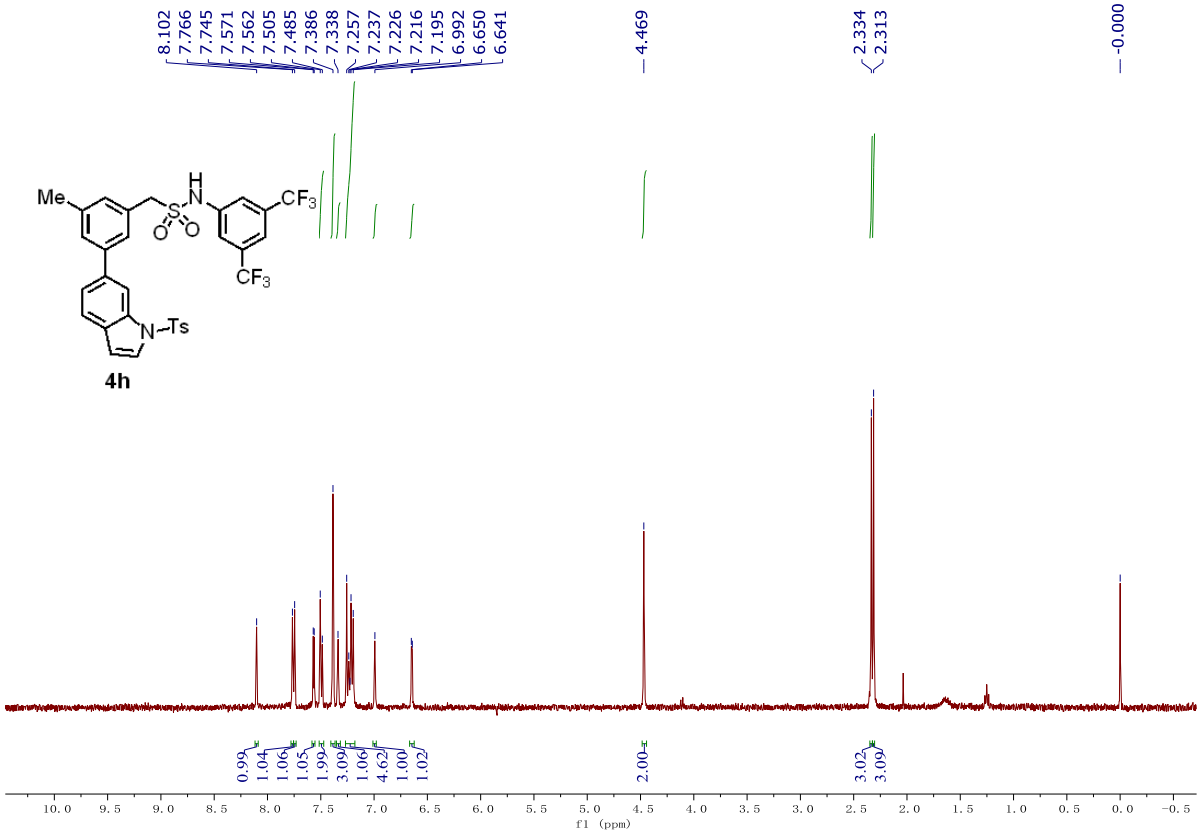
Me
CF3
CF3
S
N
H
O
O
4g
f1 (ppm)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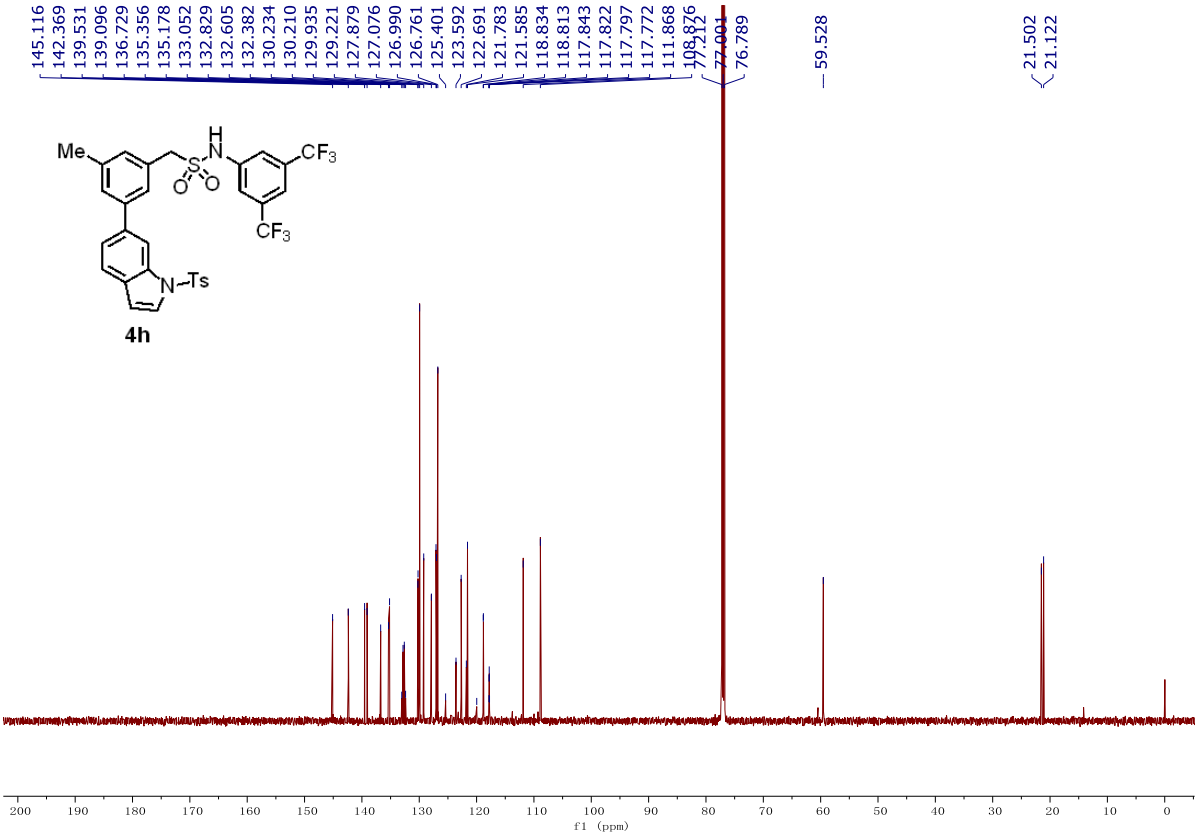
7.485
7.386
7.338
7.257
7.237
7.226
7.216
7.195
6.992
6.650
6.641
4.469
2.334
2.313
0.000
Me
CF3
CF3
N-Ts
4h
0.99
1.04
1.06
1.05
1.99
3.09
1.06
4.62
1.00
1.02
2.00
3.02
3.09
f1 (ppm)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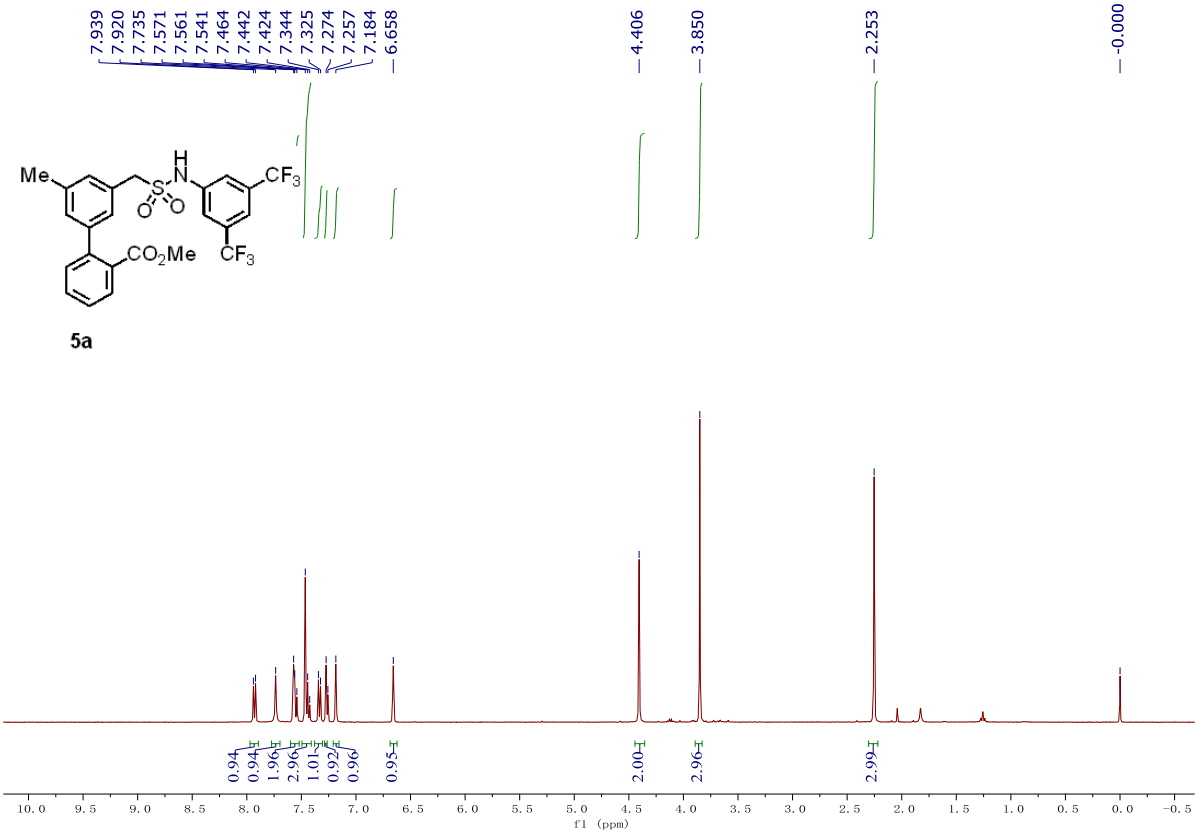
139.531
139.096
136.729
135.356
135.178
133.052
132.829
132.605
132.382
130.234
130.210
129.935
129.221
127.879
127.076
126.990
126.761
125.401
123.592
122.691
121.783
121.585
118.834
118.813
117.843
117.822
117.797
117.772
111.868
108.876
77.212
77.001
76.789
59.528
21.502
21.122
Me
CF3
CF3
N-Ts
4h
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)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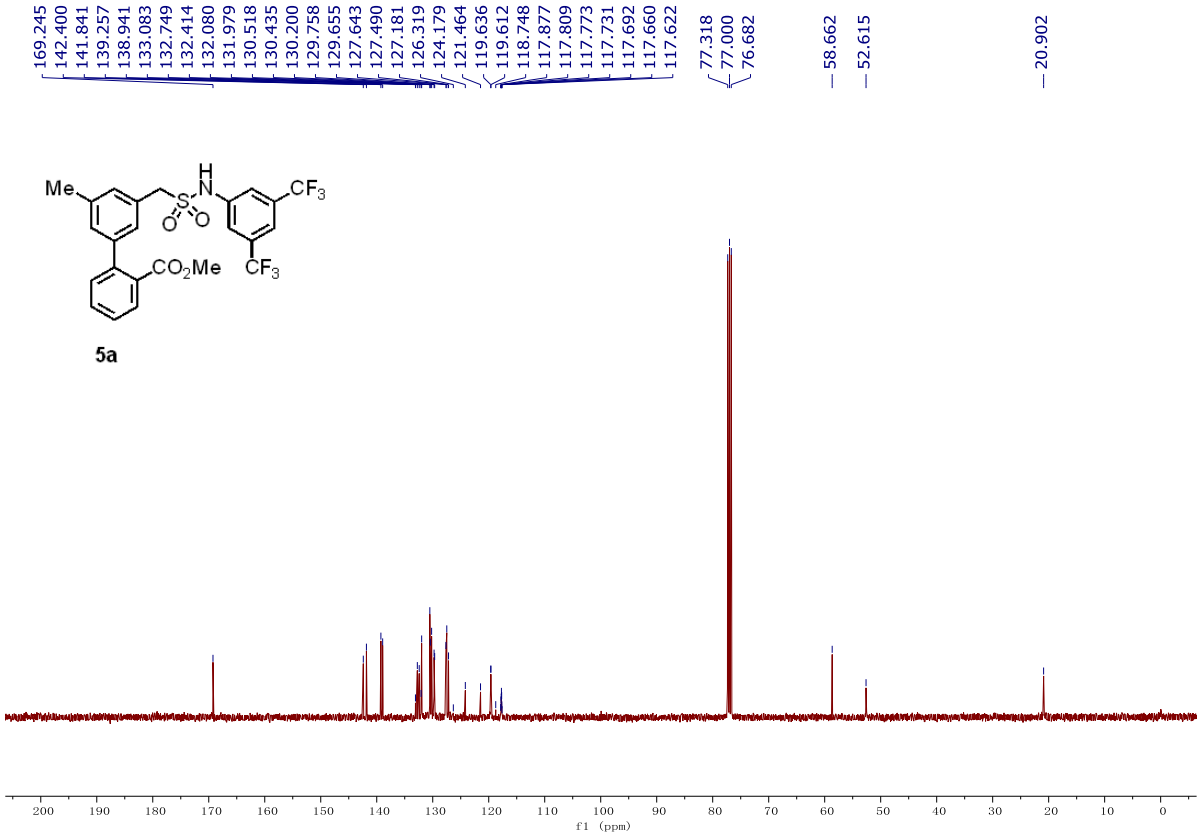
7.735
7.571
7.561
7.541
7.464
7.442
7.424
7.344
7.325
7.274
7.257
7.184
6.658
4.406
3.850
2.253
-0.000
Me
CF3
CF3
CO2Me
5a
0.94
0.94
1.96
2.96
1.01
0.92
0.96
0.95
2.00
2.96
2.99
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)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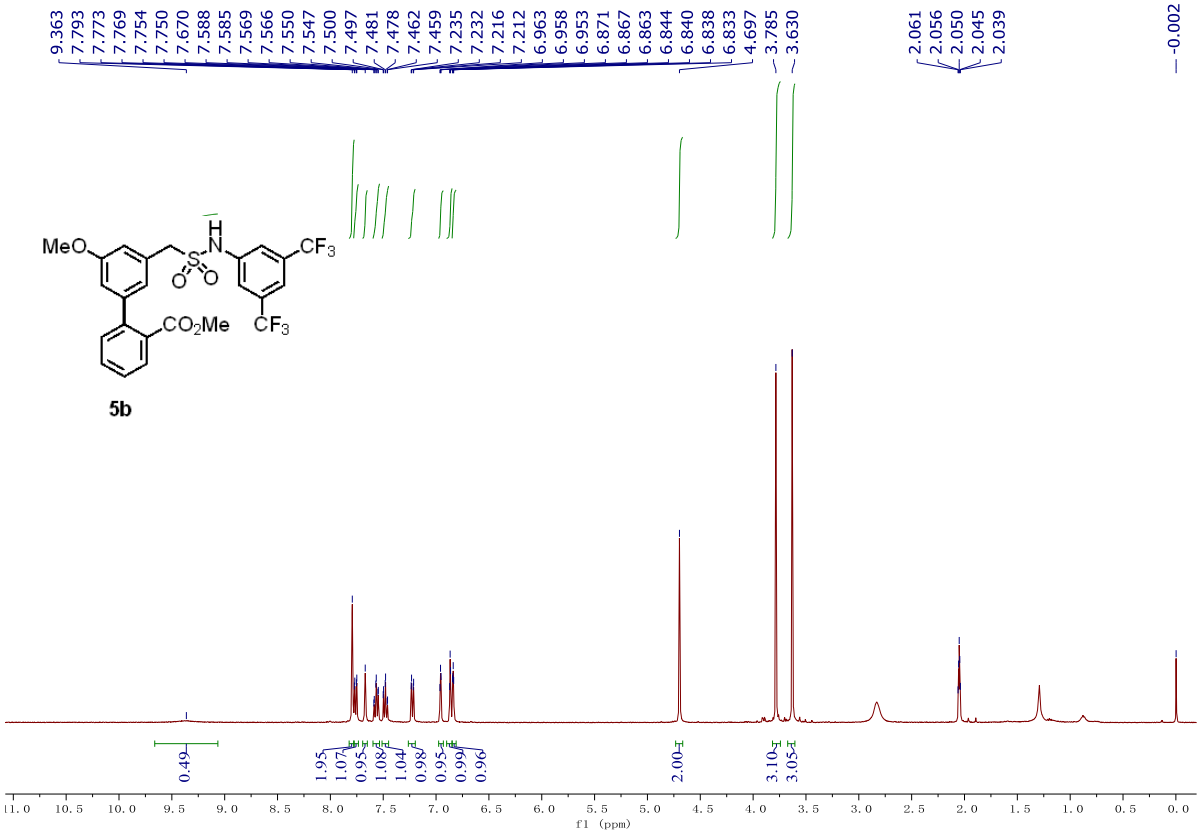
142.400
141.841
139.257
138.941
133.083
132.749
132.414
132.080
131.979
130.518
130.435
130.200
129.758
129.655
127.643
127.490
127.181
126.319
124.179
121.464
119.636
119.612
118.748
117.877
117.809
117.773
117.731
117.692
117.660
117.622
77.318
77.000
76.682
58.662
52.615
20.902
Me
CF3
CO2Me
CF3
H
N
S
O
O
5a
f1 (ppm)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7.773
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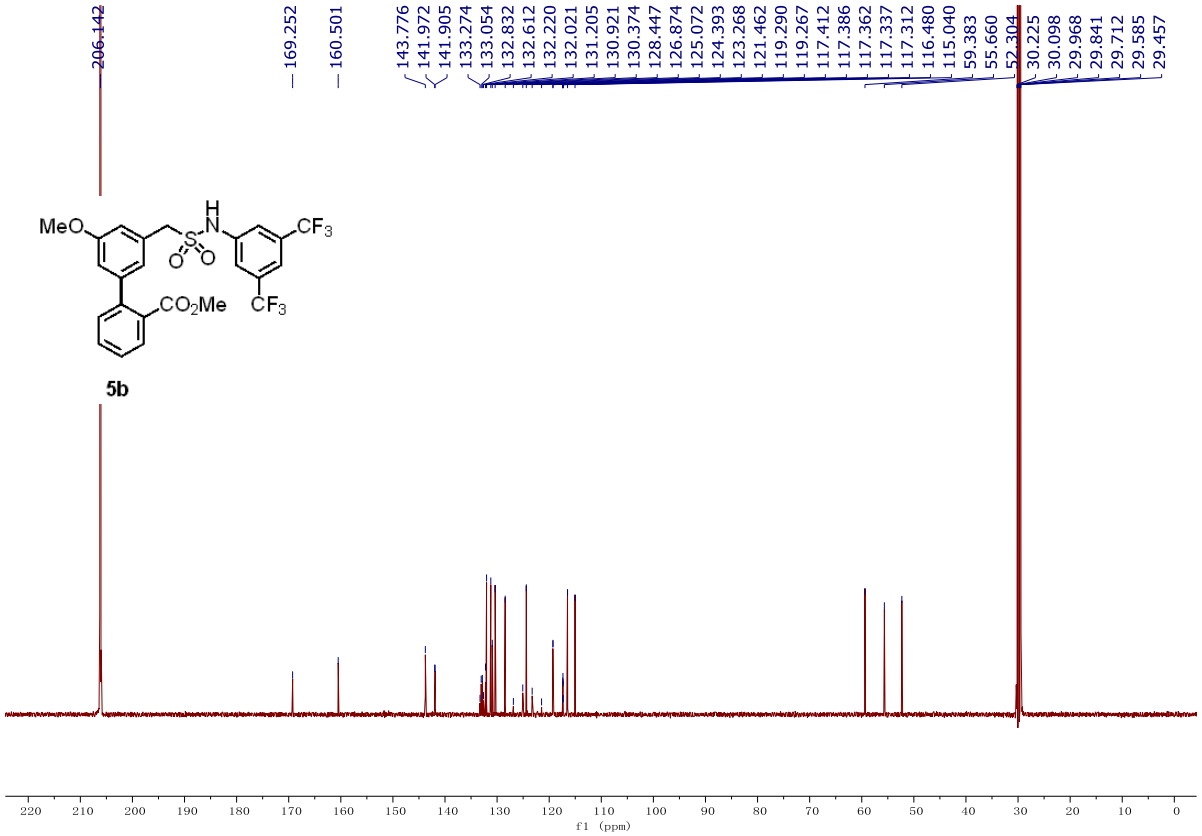
7.750
7.670
7.588
7.585
7.569
7.566
7.550
7.547
7.500
7.497
7.481
7.478
7.462
7.459
7.235
7.232
7.216
7.212
6.963
6.958
6.953
6.871
6.867
6.863
6.844
6.840
6.838
6.833
4.697
3.785
3.630
2.061
2.056
2.050
2.045
2.039
-0.002
MeO
CF3
CO2Me
CF3
H
N
S
O
O
5b
0.49
1.95
1.07
0.95
1.08
1.04
0.98
0.95
0.99
0.96
2.00
3.10
3.05
f1 (ppm)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169.252
160.501
143.776
141.972
141.905
133.274
133.054
132.832
132.612
132.220
132.021
131.205
130.921
130.374
128.447
126.874
125.072
124.393
123.268
121.462
119.290
119.267
117.412
117.386
117.362
117.337
117.312
116.480
115.040
59.383
55.660
52.304
30.225
30.098
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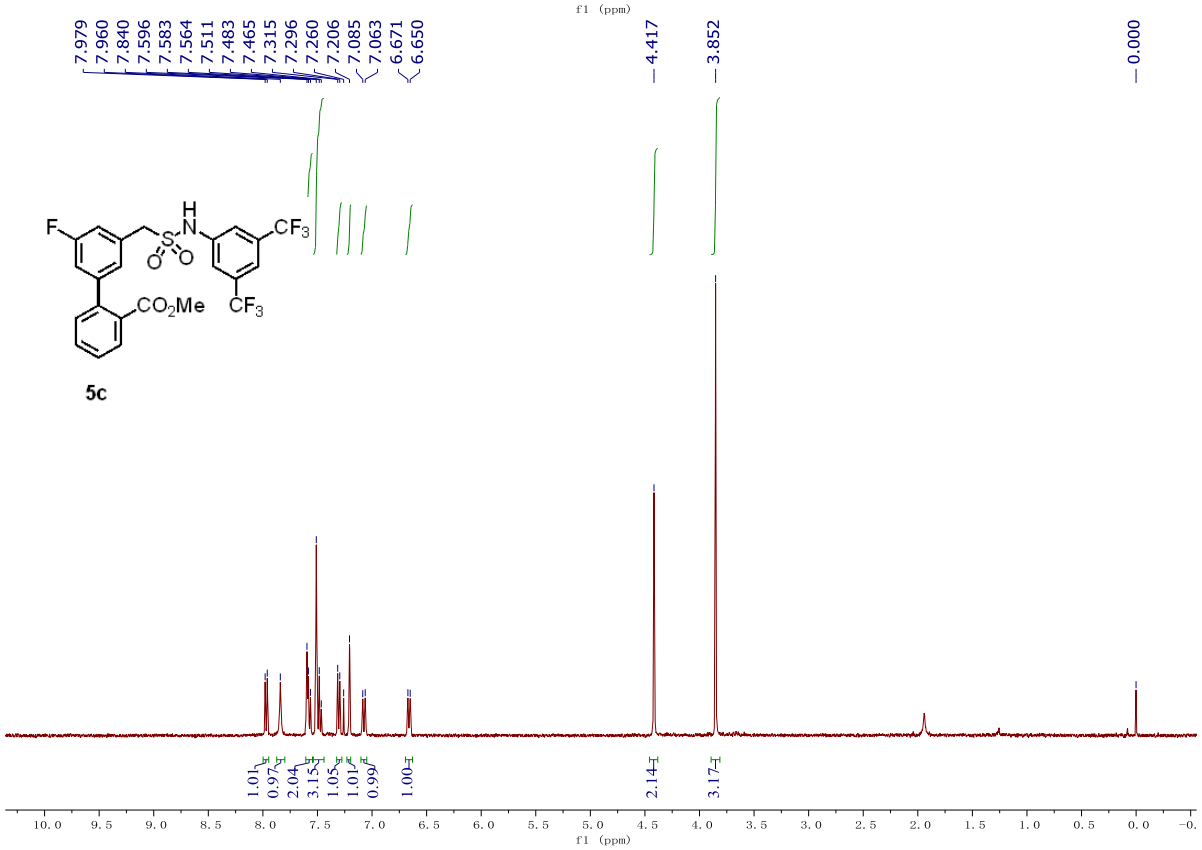
29.841
29.712
29.585
29.457
MeO
CF3
CO2Me
CF3
f1 (ppm)

5b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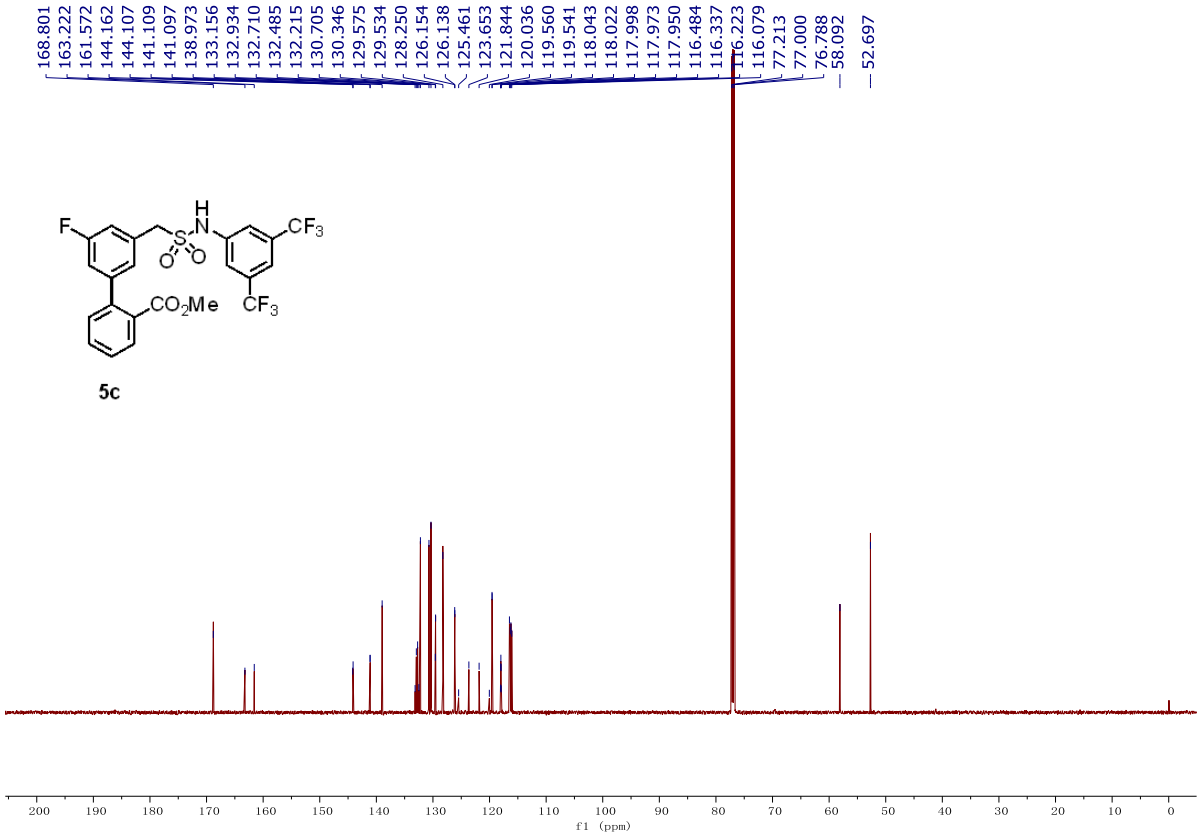
7.840
7.596
7.583
7.564
7.511
7.483
7.465
7.315
7.296
7.260
7.206
7.085
7.063
6.671
6.650
4.417
3.852
0.000
F
CF3
CO2Me
CF3
1.01
0.97
2.04
3.15
1.05
1.01
0.99
1.00
2.14
3.17
f1 (ppm)

5c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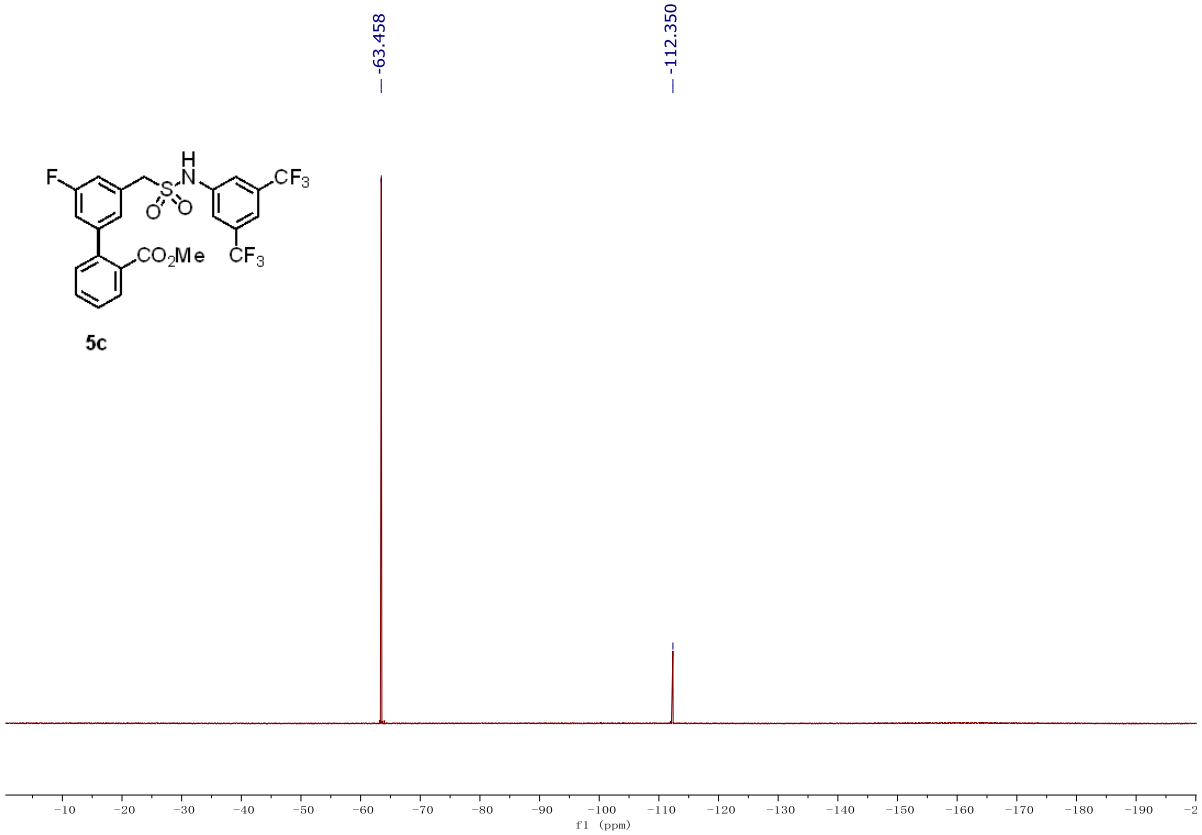
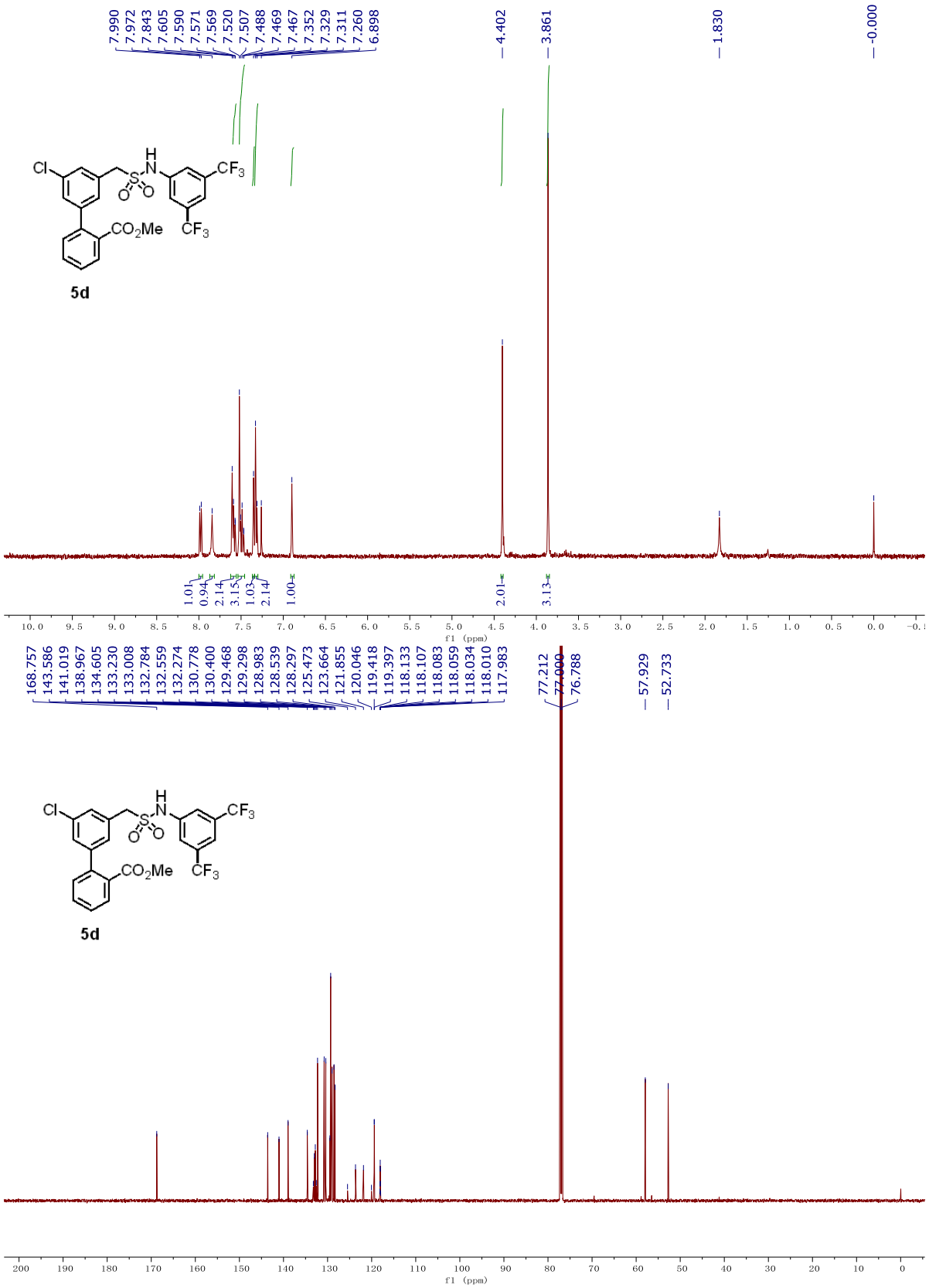
144.162
144.107
141.109
141.097
138.973
133.156
132.934
132.710
132.485
132.215
130.705
130.346
129.575
129.534
128.250
126.154
126.138
125.461
123.653
121.844
120.036
119.560
119.541
118.043
118.022
117.998
117.973
117.950
116.484
116.337
116.223
116.079
77.213
77.000
76.788
58.092
52.697
F
H
N
S
O
O
CF3
CO2Me
CF3
5c
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)


-63.458
-112.350
F
H
N
S
O
O
CF3
CO2Me
CF3
5c
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
-160
-170
-180
-190
-2
f1 (ppm)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7.520
7.507
7.488
7.469
7.467
7.352
7.329
7.311
7.260
6.898
4.402
3.861
1.830
-0.000
Cl
H
N
S
O
O
CF3
CO2Me
CF3
5d
1.01
0.94
2.14
3.15
1.03
2.14
1.00
2.01
3.13
f1 (ppm)
168.757
143.586
141.019
138.967
134.605
133.230
133.008
132.784
132.559
132.274
130.778
130.400
129.468
129.298
128.983
128.539
128.297
125.473
123.664
121.855
120.046
119.418
119.397
118.133
118.107
118.083
118.059
118.034
118.010
117.983
77.212
77.000
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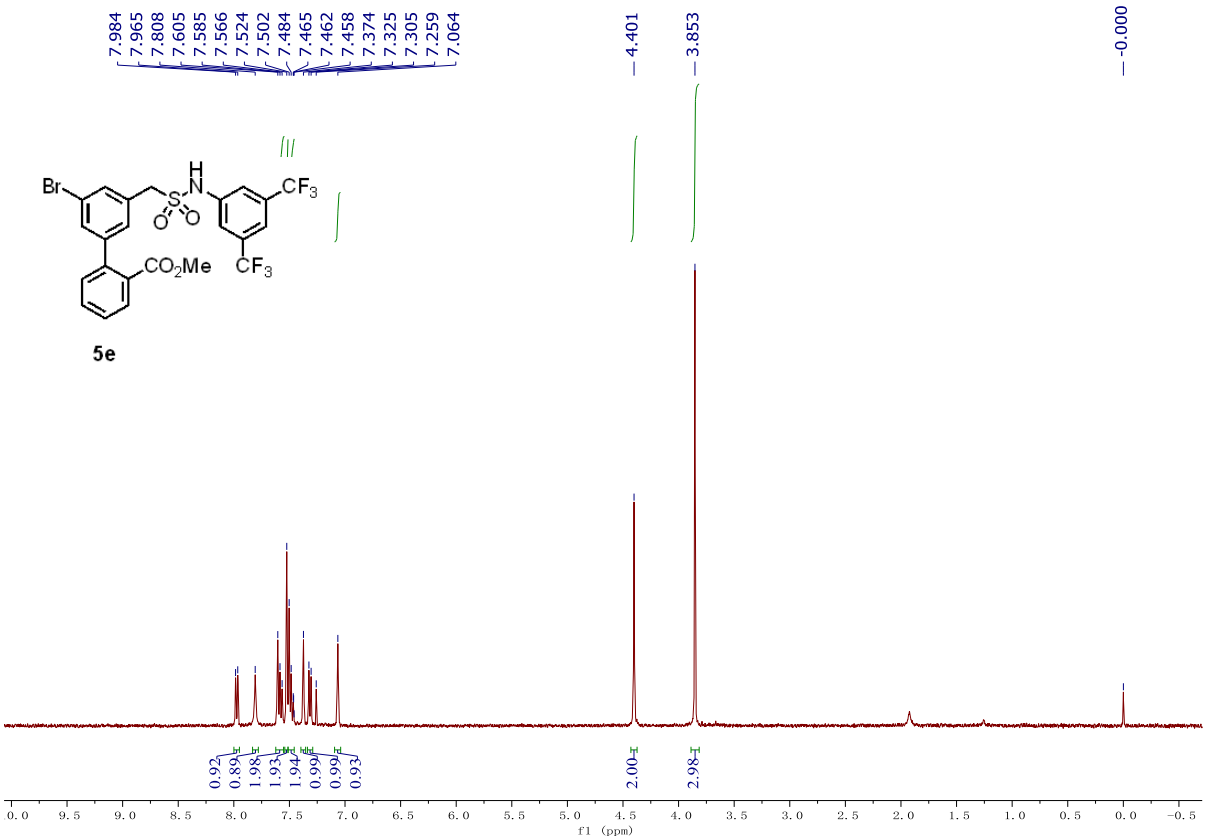
52.733
Cl
H
N
S
O
O
CF3
CO2Me
CF3
5d
f1 (ppm)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7.605
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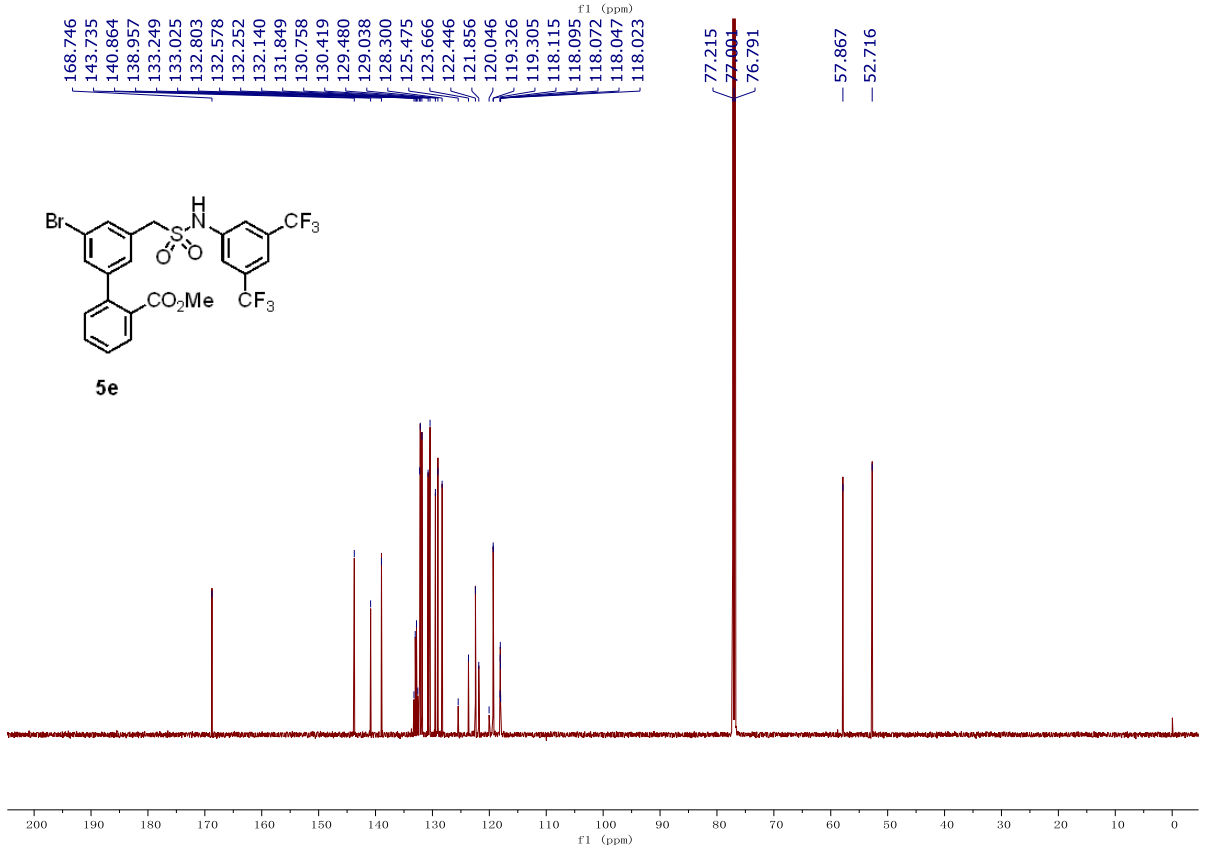
7.566
7.524
7.502
7.484
7.465
7.462
7.458
7.374
7.325
7.305
7.259
7.064
4.401
3.853
-0.000
Br
CF3
CO2Me
CF3
H
N
S
O
O
5e
0.92
0.89
1.98
1.93
1.94
0.99
0.99
0.93
2.00
2.98
f1 (ppm)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132.140
131.849
130.758
130.419
129.480
129.038
128.300
125.475
123.666
122.446
121.856
120.046
119.326
119.305
118.115
118.095
118.072
118.047
118.023
77.215
77.001
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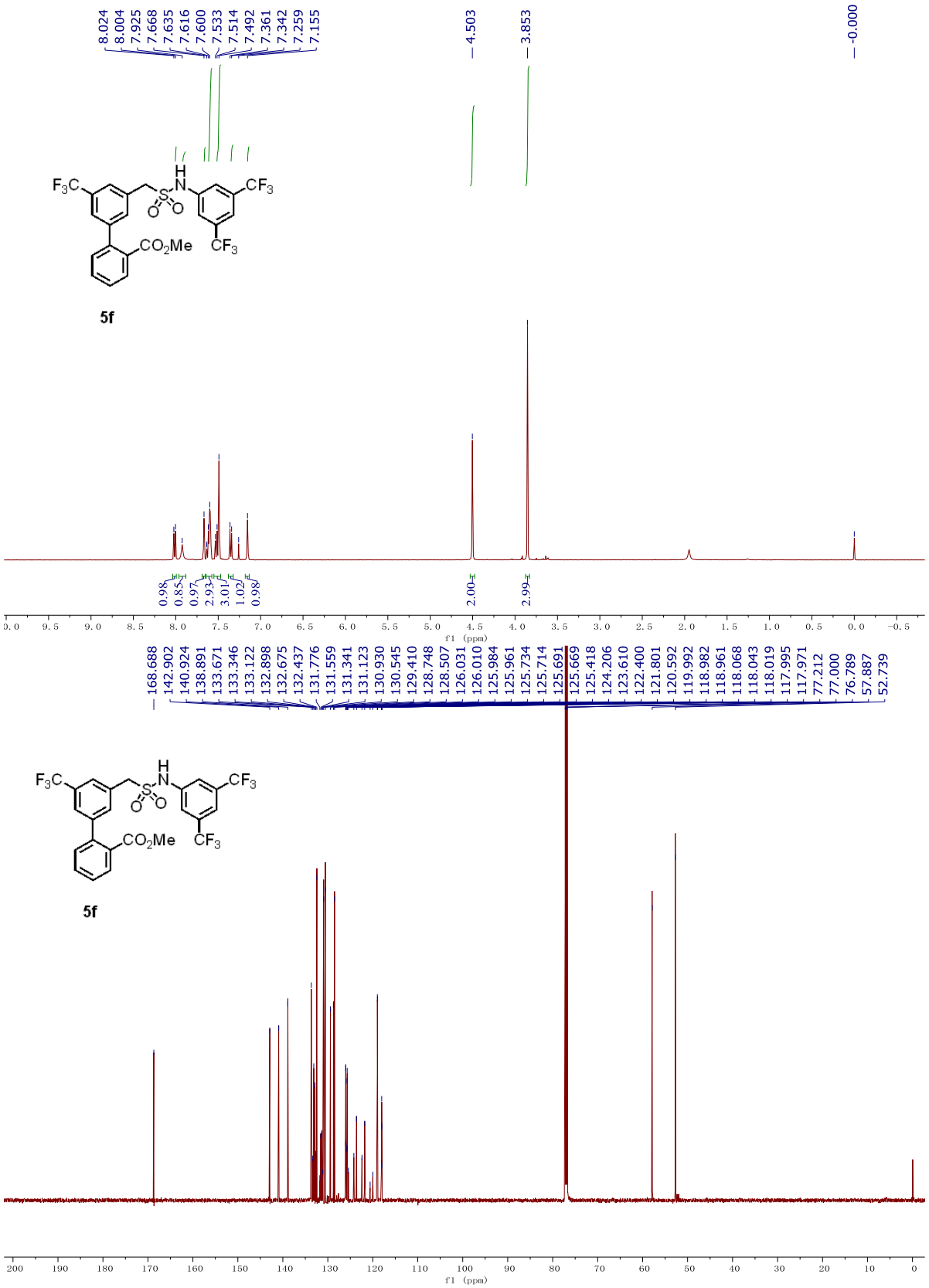
52.716
Br
CF3
CO2Me
CF3
H
N
S
O
O
5e
f1 (ppm)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7.616
7.600
7.533
7.514
7.492
7.361
7.342
7.259
7.155
4.503
3.853
-0.000
F3C
CF3
CO2Me
CF3
5f
0.98
0.85
0.97
2.93
3.01
1.02
0.98
2.00
2.99
f1 (ppm)
168.688
142.902
140.924
138.891
133.671
133.346
133.122
132.898
132.675
132.437
131.776
131.559
131.341
131.123
130.930
130.545
129.410
128.748
128.507
126.031
126.010
125.984
125.961
125.734
125.714
125.691
125.669
125.418
124.206
123.610
122.400
121.801
120.592
119.992
118.982
118.961
118.068
118.043
118.019
117.995
117.971
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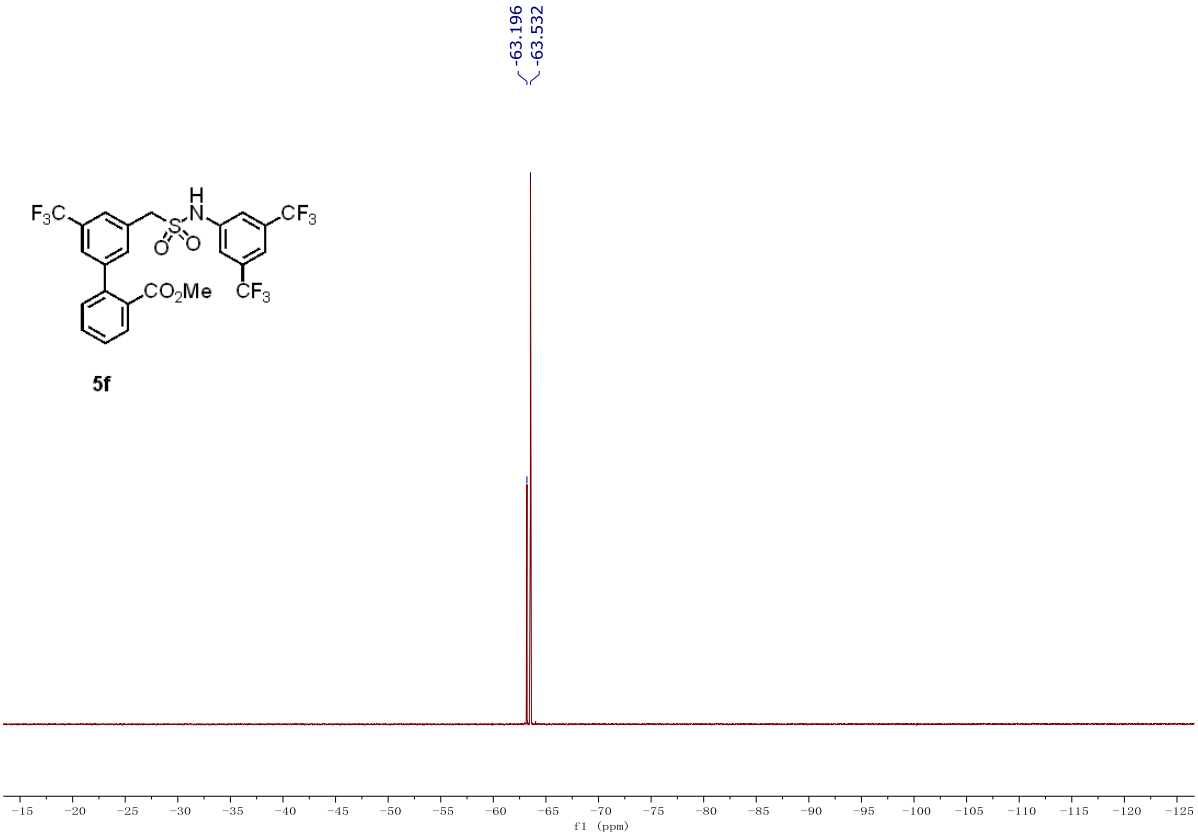
77.000
76.789
57.887
52.739
F3C
CF3
CO2Me
CF3
5f
f1 (ppm)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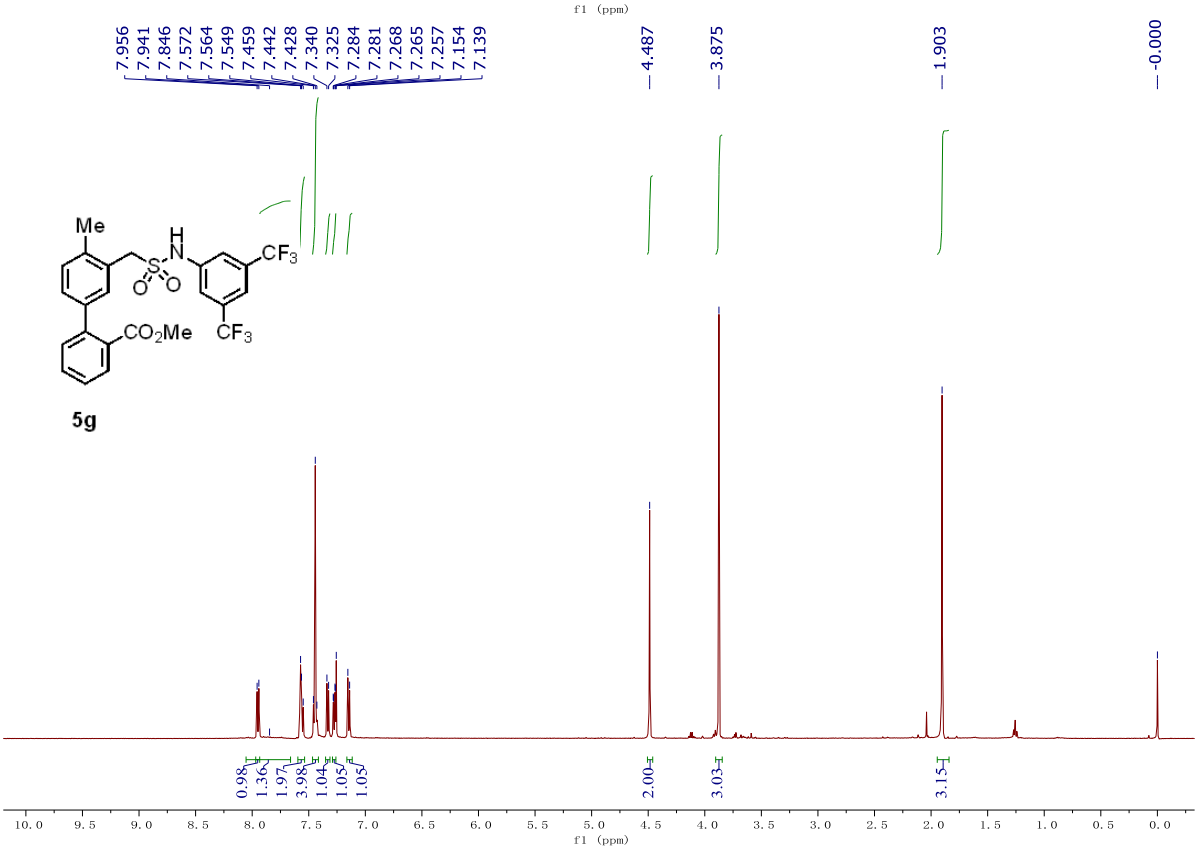
-63.532
F3C
CF3
CO2Me
CF3
H
N
S
O
O
f1 (ppm)

5f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7.572
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7.549
7.459
7.442
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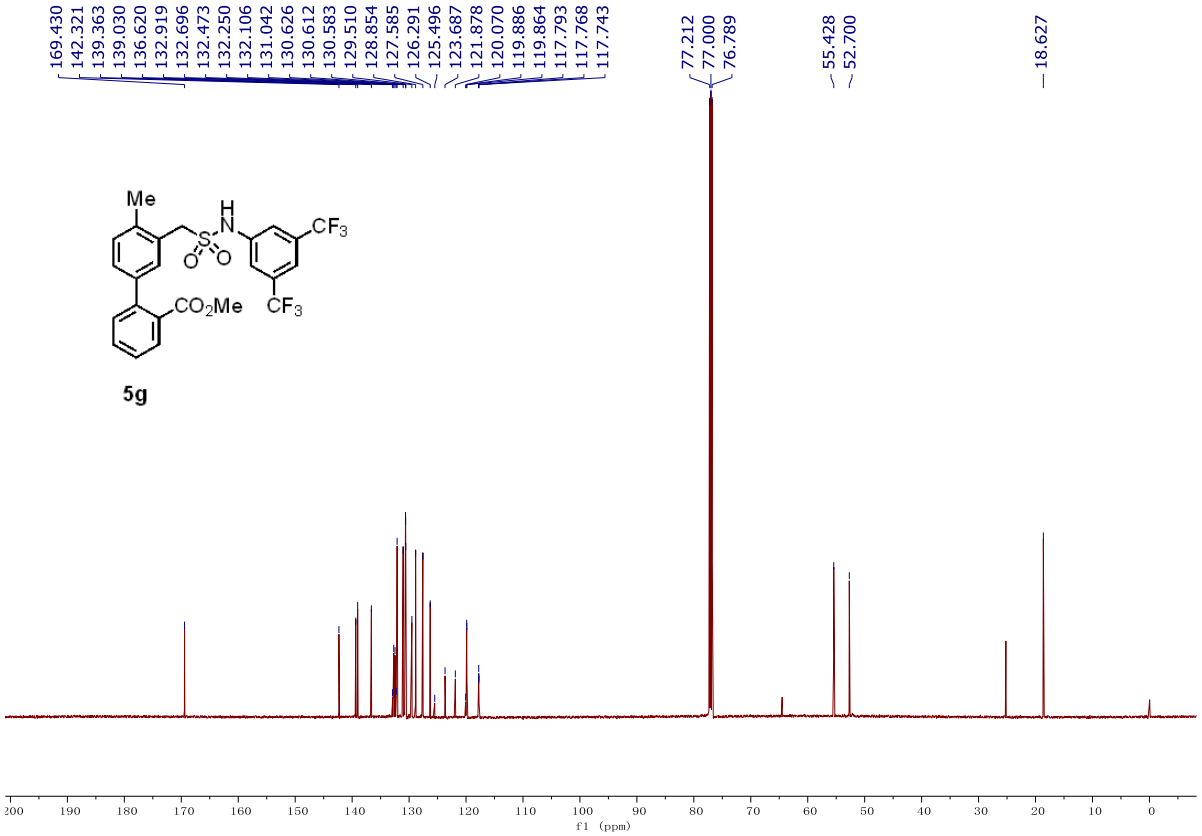
7.325
7.284
7.281
7.268
7.265
7.257
7.154
7.139
4.487
3.875
1.903
0.000
Me
CF3
CO2Me
CF3
H
N
S
O
O
0.98
1.36
1.97
3.98
1.04
1.05
1.05
2.00
3.03
3.15
f1 (ppm)

5g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139.363
139.030
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132.696
132.473
132.250
132.106
131.042
130.626
130.612
130.583
129.510
128.854
127.585
126.291
125.496
123.687
121.878
120.070
119.886
119.864
117.793
117.768
117.743
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76.789
55.428
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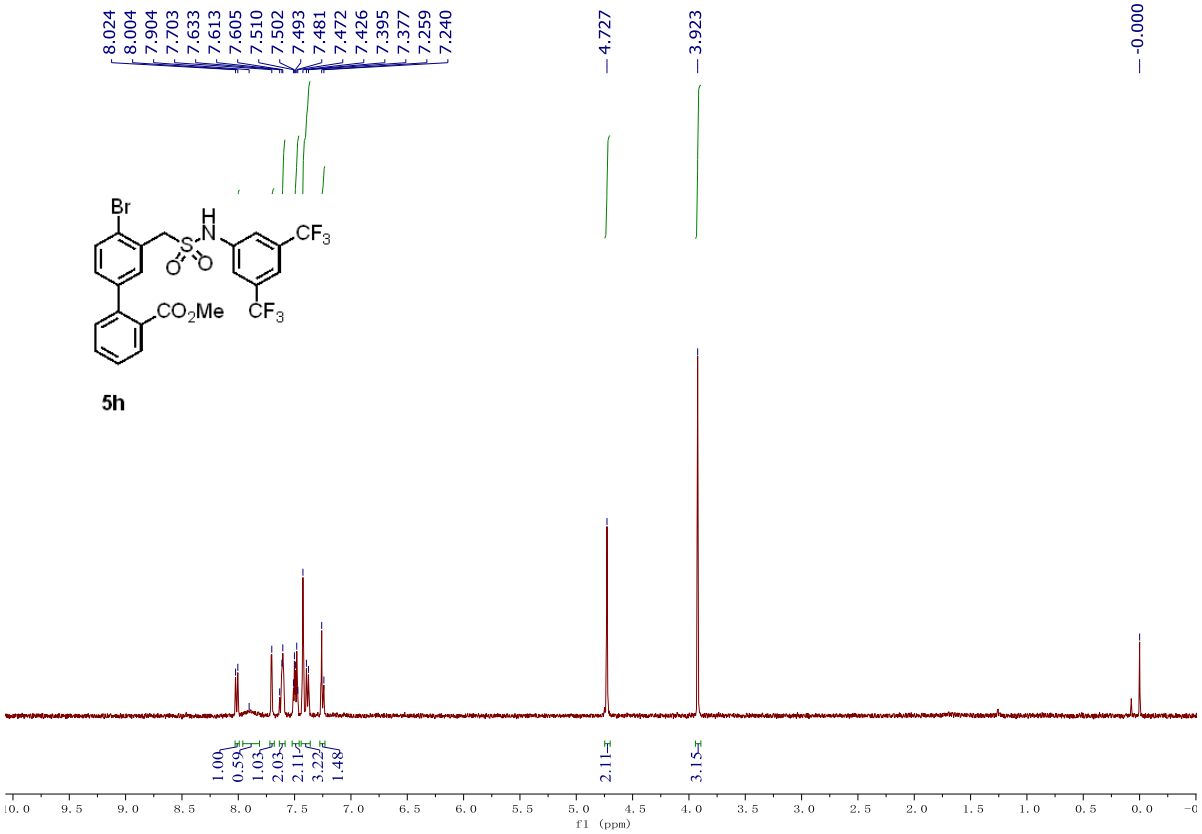
18.627
Me
CF3
CO2Me
CF3
5g
f1 (ppm)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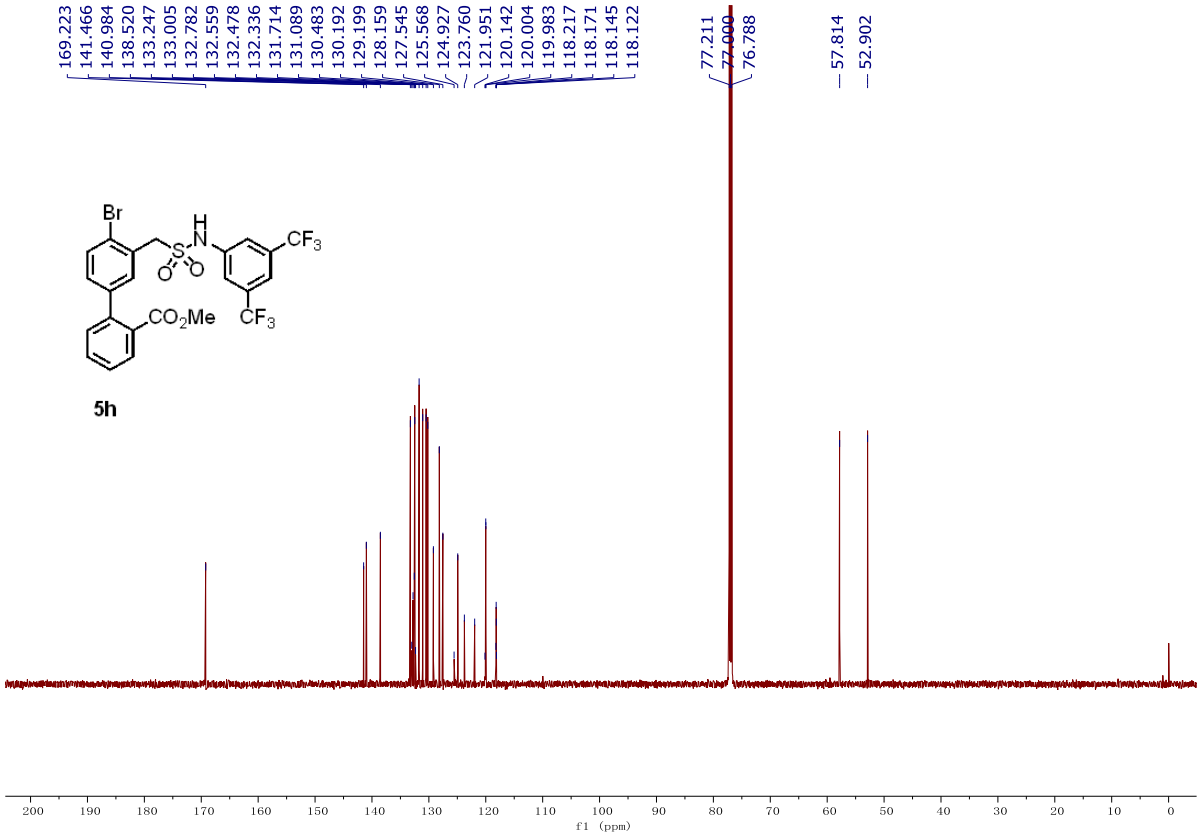
8.004
7.904
7.703
7.633
7.613
7.605
7.510
7.502
7.493
7.481
7.472
7.426
7.395
7.377
7.259
7.240
4.727
3.923
-0.000
Br
CF3
CO2Me
CF3
5h
1.00
0.59
1.03
2.03
2.11
3.22
1.48
2.11
3.15
f1 (ppm)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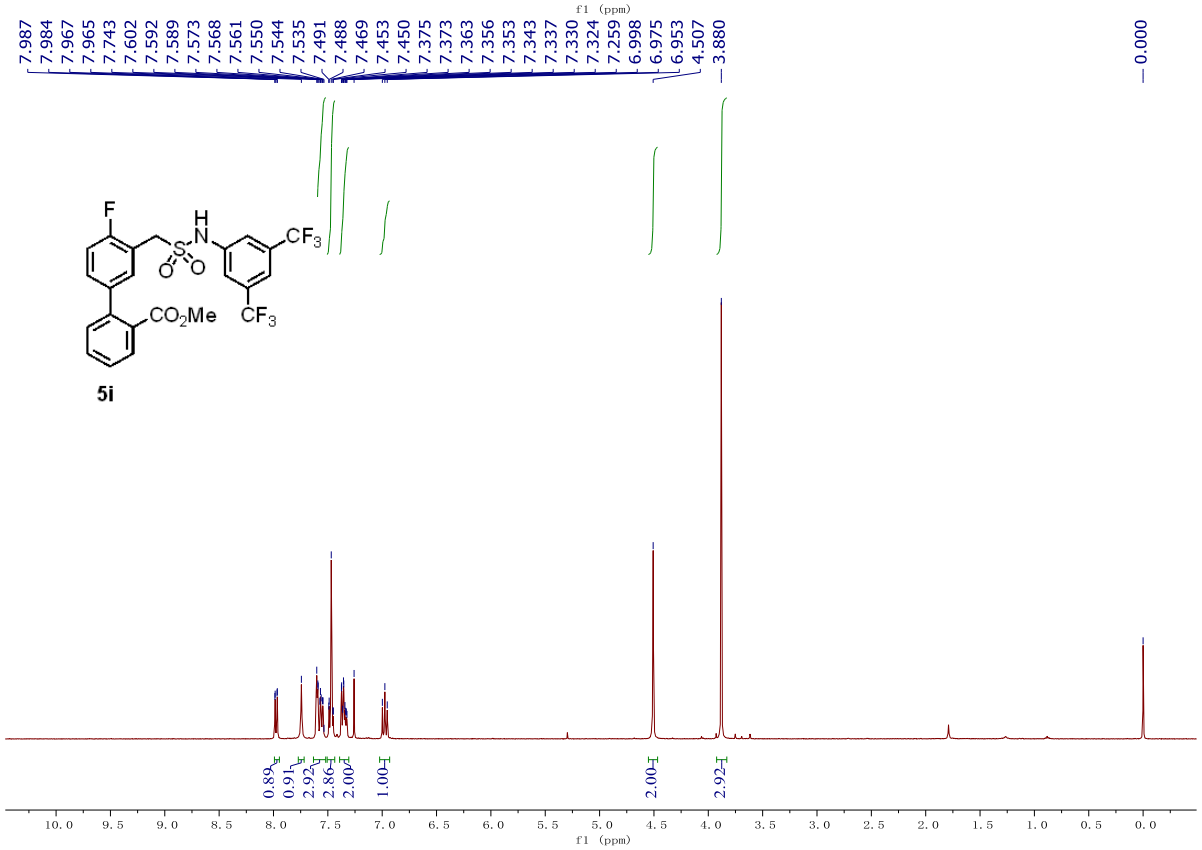
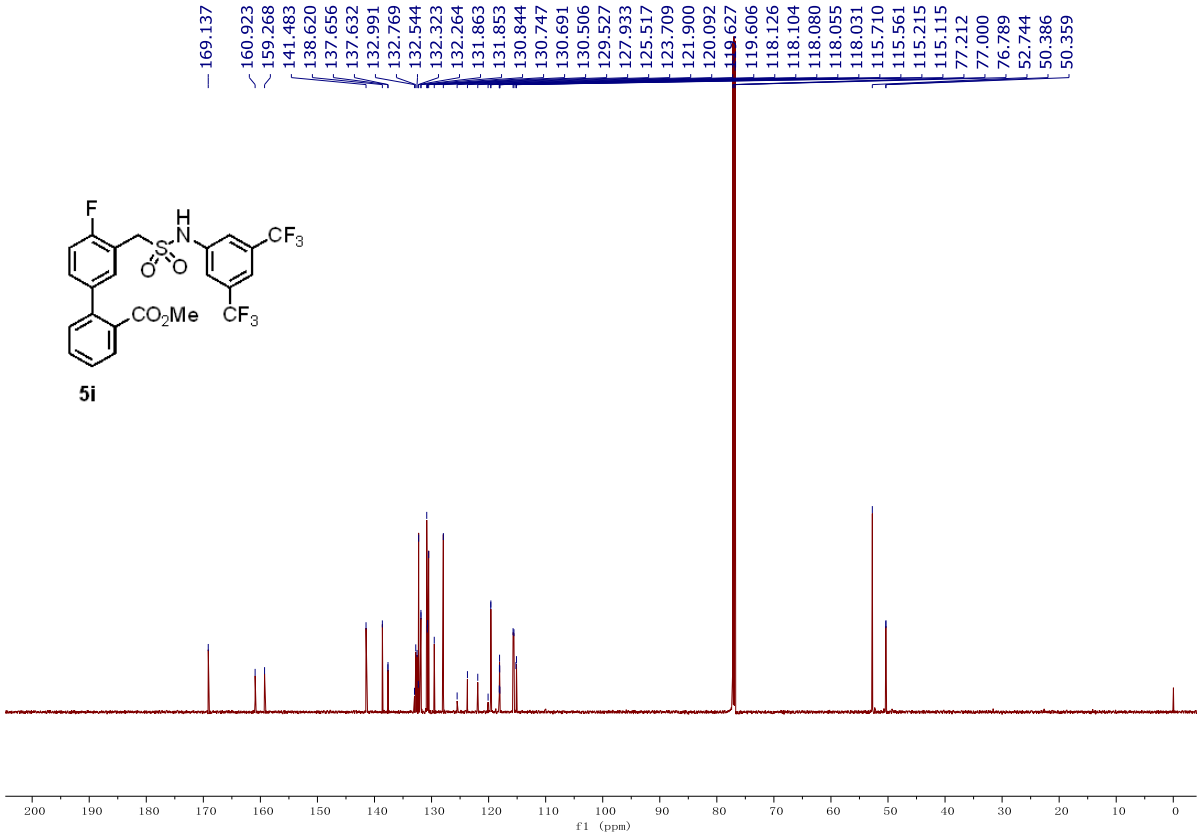
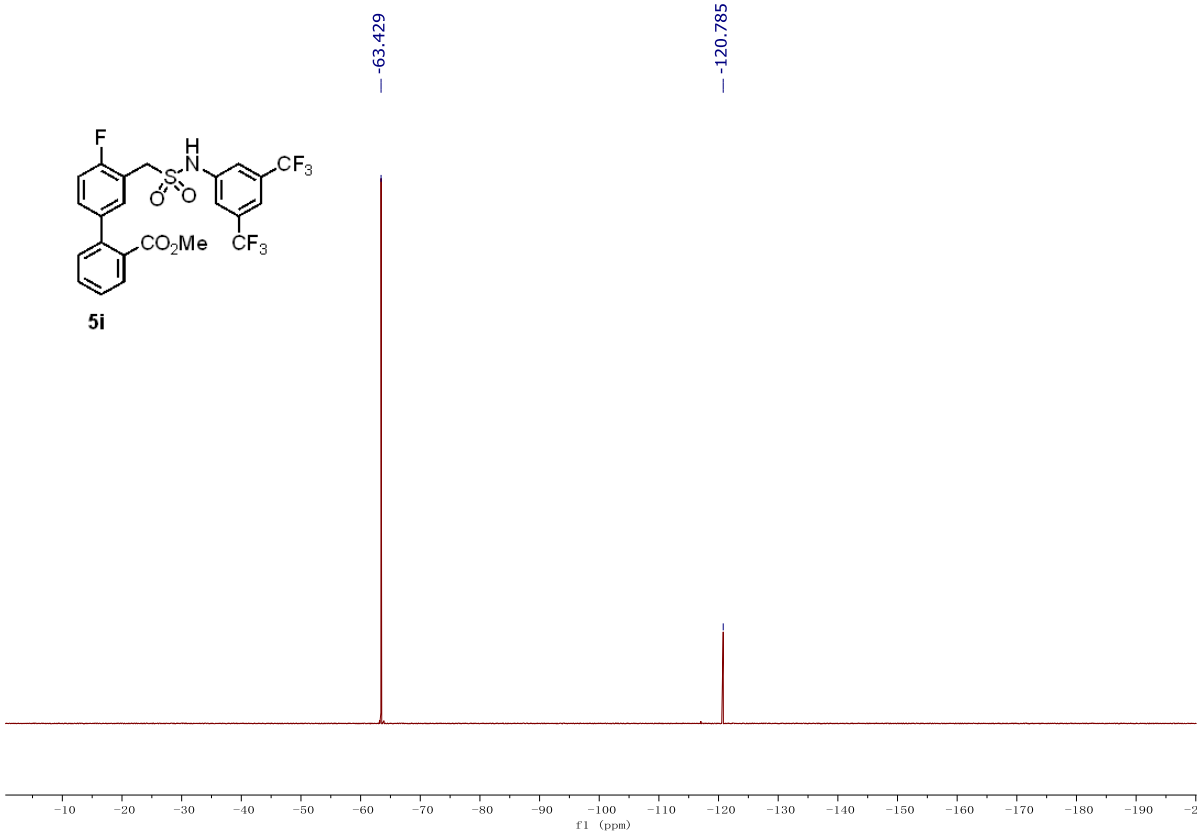
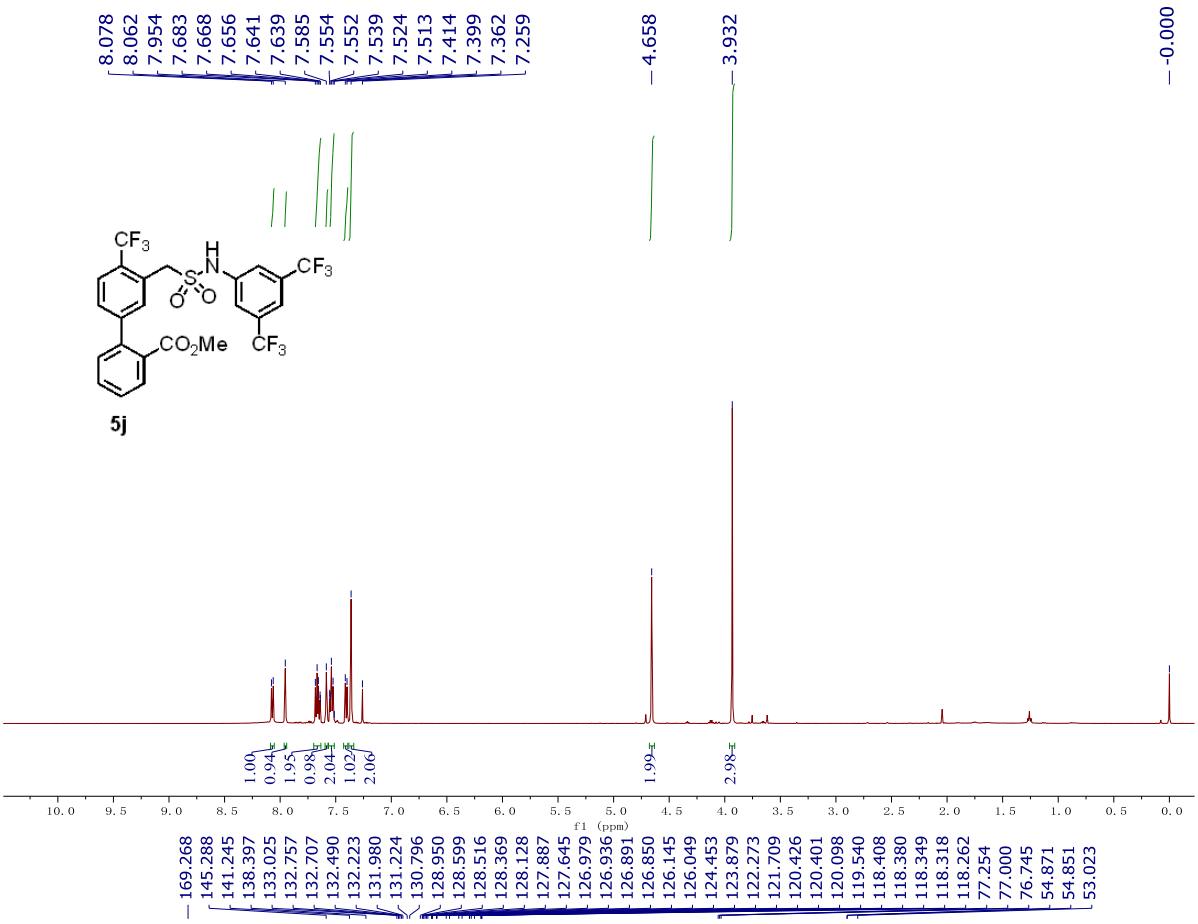
133.005
132.782
132.559
132.478
132.336
131.714
131.089
130.483
130.192
129.199
128.159
127.545
125.568
124.927
123.760
121.951
120.142
120.004
119.983
118.217
118.171
118.145
118.122
77.211
77.000
76.788
57.814
52.902
Br
H
N
S
O
O
CF3
CO2Me
CF3
5h
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

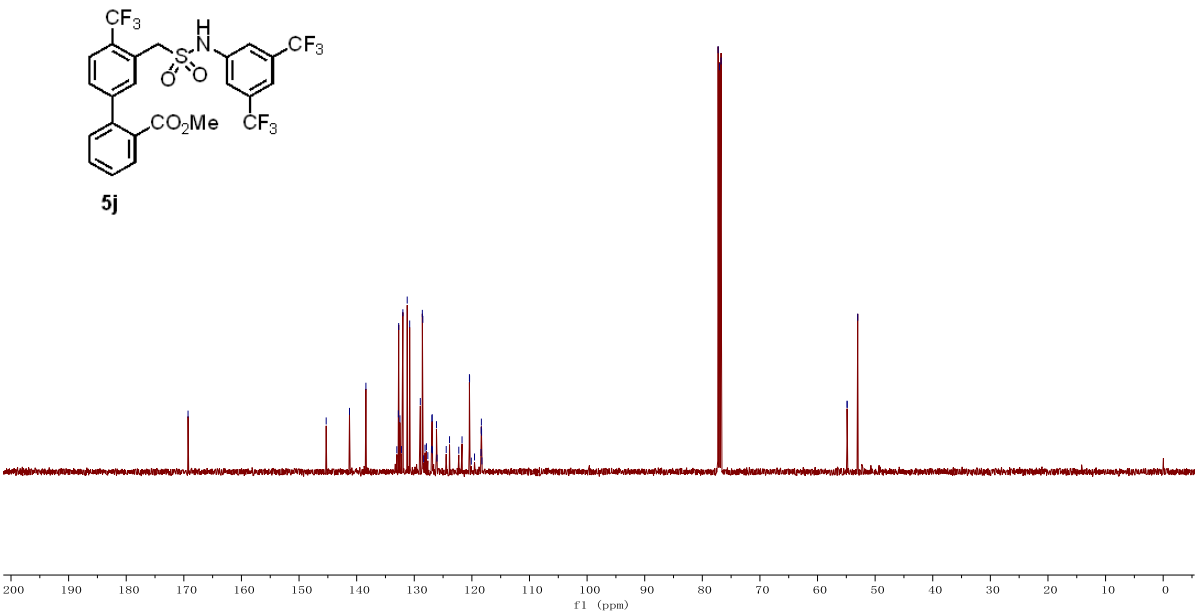

7.987
7.984
7.967
7.965
7.743
7.602
7.592
7.589
7.573
7.568
7.561
7.550
7.544
7.535
7.491
7.488
7.469
7.453
7.450
7.375
7.373
7.363
7.356
7.353
7.343
7.337
7.330
7.324
7.259
6.998
6.975
6.953
4.507
3.880
0.000
F
H
N
S
O
O
CF3
CO2Me
CF3
5i
0.89
0.91
2.92
2.86
2.00
1.00
2.00
2.92
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)


169.137
160.923
159.268
141.483
138.620
137.656
137.632
132.991
132.769
132.544
132.323
132.264
131.863
131.853
130.844
130.747
130.691
130.506
129.527
127.933
125.517
123.709
121.900
120.092
119.627
119.606
118.126
118.104
118.080
118.055
118.031
115.710
115.561
115.215
115.115
77.212
77.000
76.789
52.744
50.386
50.359
F
H
N
S
O
O
CF3
CO2Me
CF3
5i
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)


-63.429
-120.785
F
H
N
S
O
O
CF3
CO2Me
CF3
5i
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
-160
-170
-180
-190
-2
f1 (ppm)

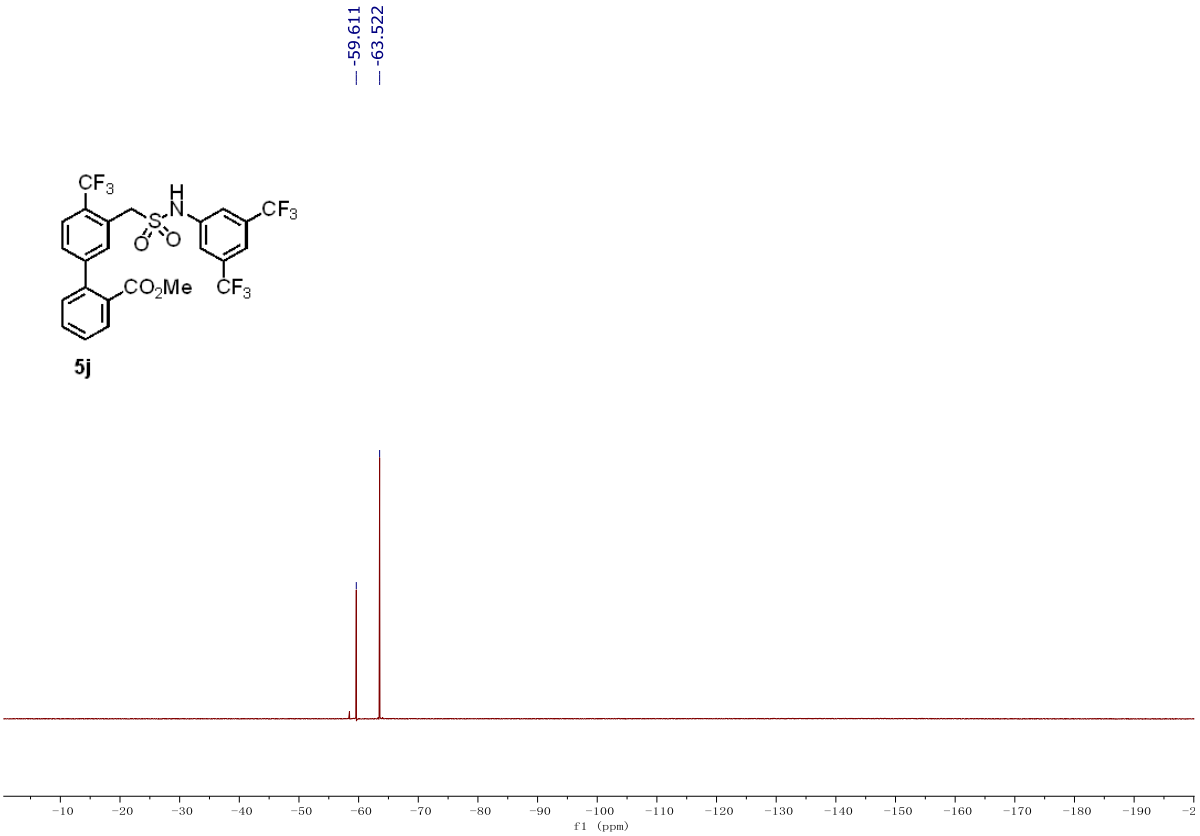

8.078
8.062
7.954
7.683
7.668
7.656
7.641
7.639
7.585
7.554
7.552
7.539
7.524
7.513
7.414
7.399
7.362
7.259
4.658
3.932
-0.000
CF3
H
N
S
O
O
CF3
CO2Me
CF3
1.00
0.94
1.95
0.98
2.04
1.02
2.06
1.99
2.98
f1 (ppm)

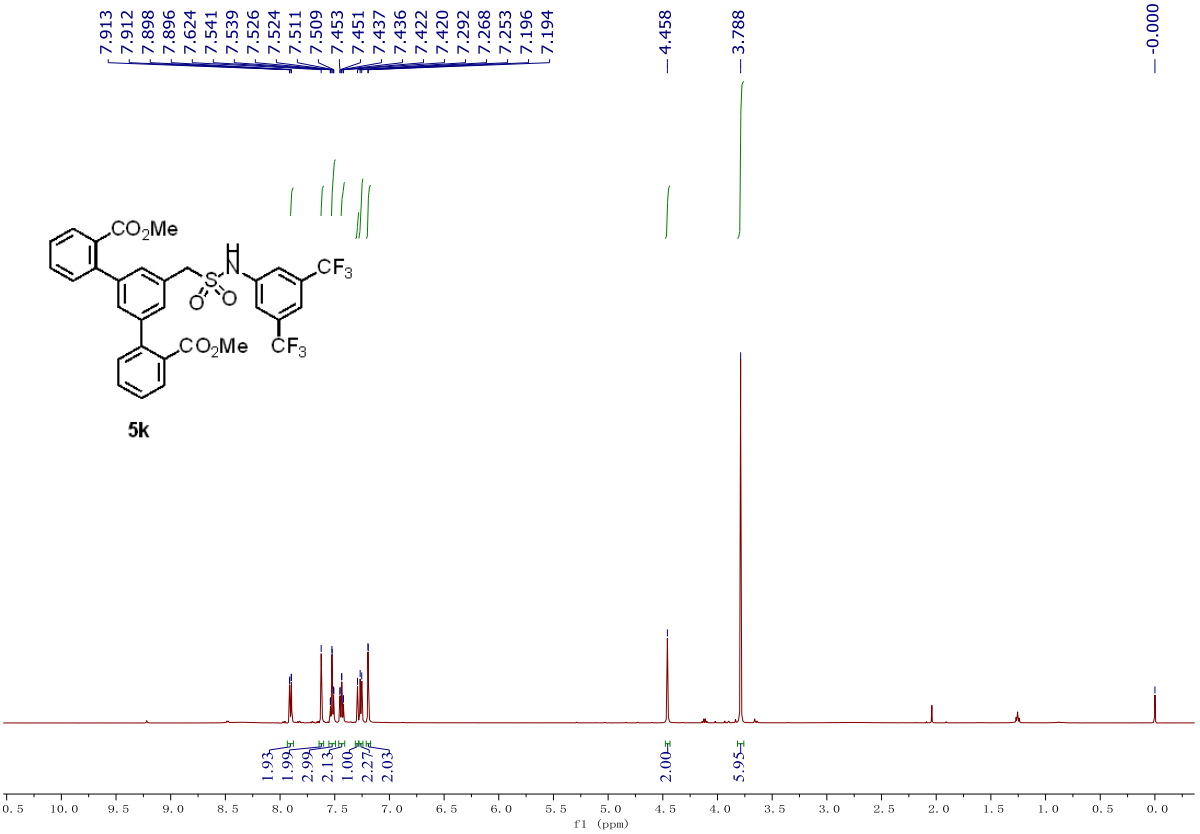
5j


169.268
145.288
141.245
138.397
133.025
132.757
132.707
132.490
132.223
131.980
131.224
130.796
128.950
128.599
128.516
128.369
128.128
127.887
127.645
126.979
126.936
126.891
126.850
126.145
126.049
124.453
123.879
122.273
121.709
120.426
120.401
120.098
119.540
118.408
118.380
118.349
118.318
118.262
77.254
77.000
76.745
54.871
54.851
53.023
f1 (ppm)

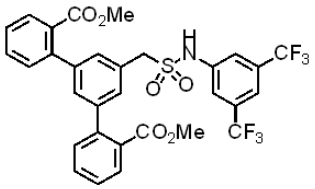
CF3
H
N
S
O
O
CF3
CO2Me
CF3

5j

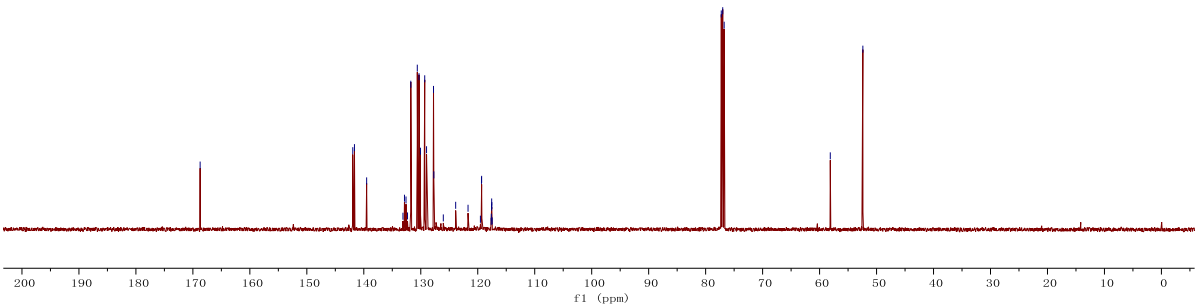

-59.611
-63.522
CF3
H
N
S
O
O
CF3
CO2Me
CF3
5j
-10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -2
f1 (ppm)


7.913
7.912
7.898
7.896
7.624
7.541
7.539
7.526
7.524
7.511
7.509
7.453
7.451
7.437
7.436
7.422
7.420
7.292
7.268
7.253
7.196
7.194
4.458
3.788
-0.000
CO2Me
H
N
S
O
O
CF3
CO2Me
CF3
5k
1.93
1.99
2.99
2.13
1.00
2.27
2.03
2.00
5.95
0.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)

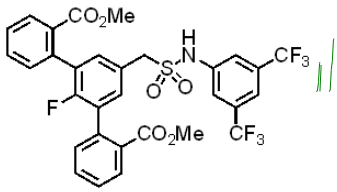

168.727
141.933
141.640
139.501
133.128
132.860
132.593
132.326
131.751
130.611
130.313
130.053
129.306
128.986
127.767
127.708
126.045
123.873
121.703
119.533
119.344
119.318
117.646
117.613
117.583
117.554
117.524
117.466
77.254
77.000
76.746
58.121
52.406


CO2Me
H
N
S
O
O
CF3
CO2Me
CF3

5k

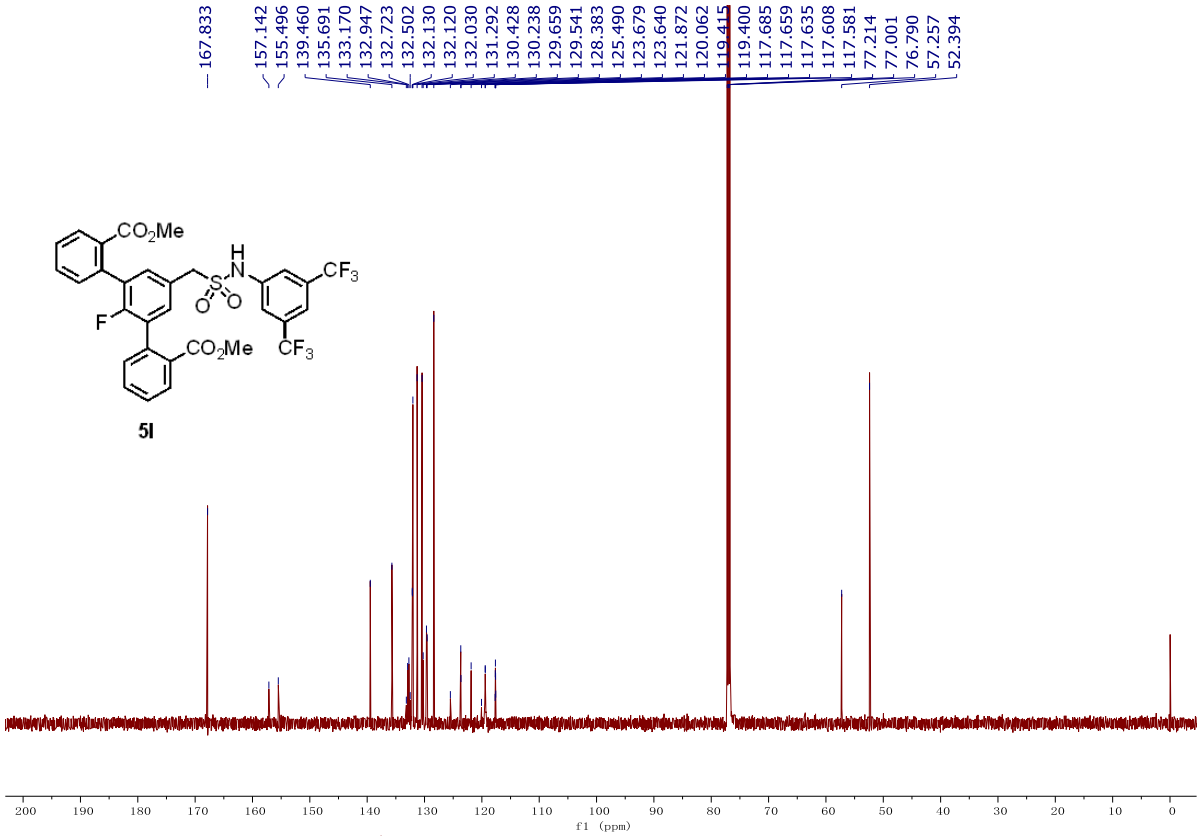

200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

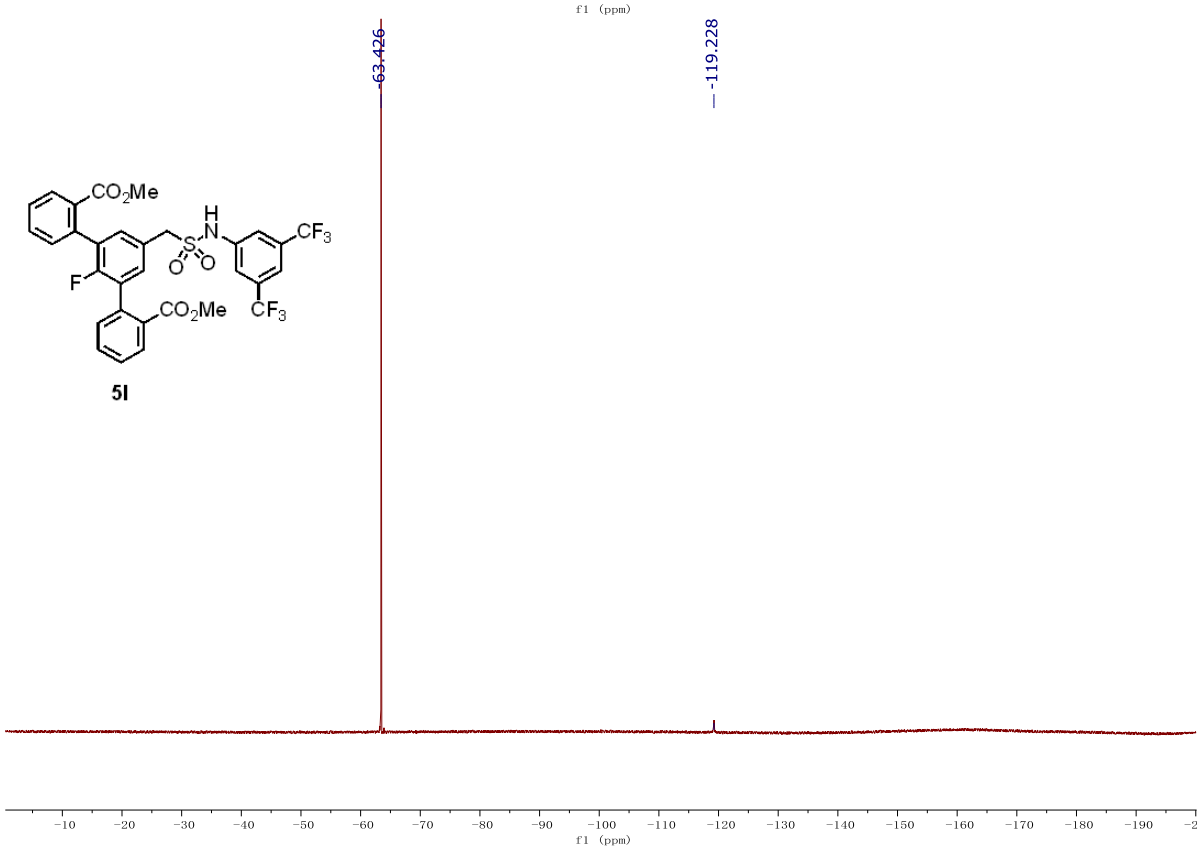

8.674
8.006
7.987
7.686
7.582
7.565
7.563
7.546
7.544
7.534
7.495
7.493
7.476
7.457
7.455
7.283
7.260
7.171
7.155
4.392
3.814
-0.000

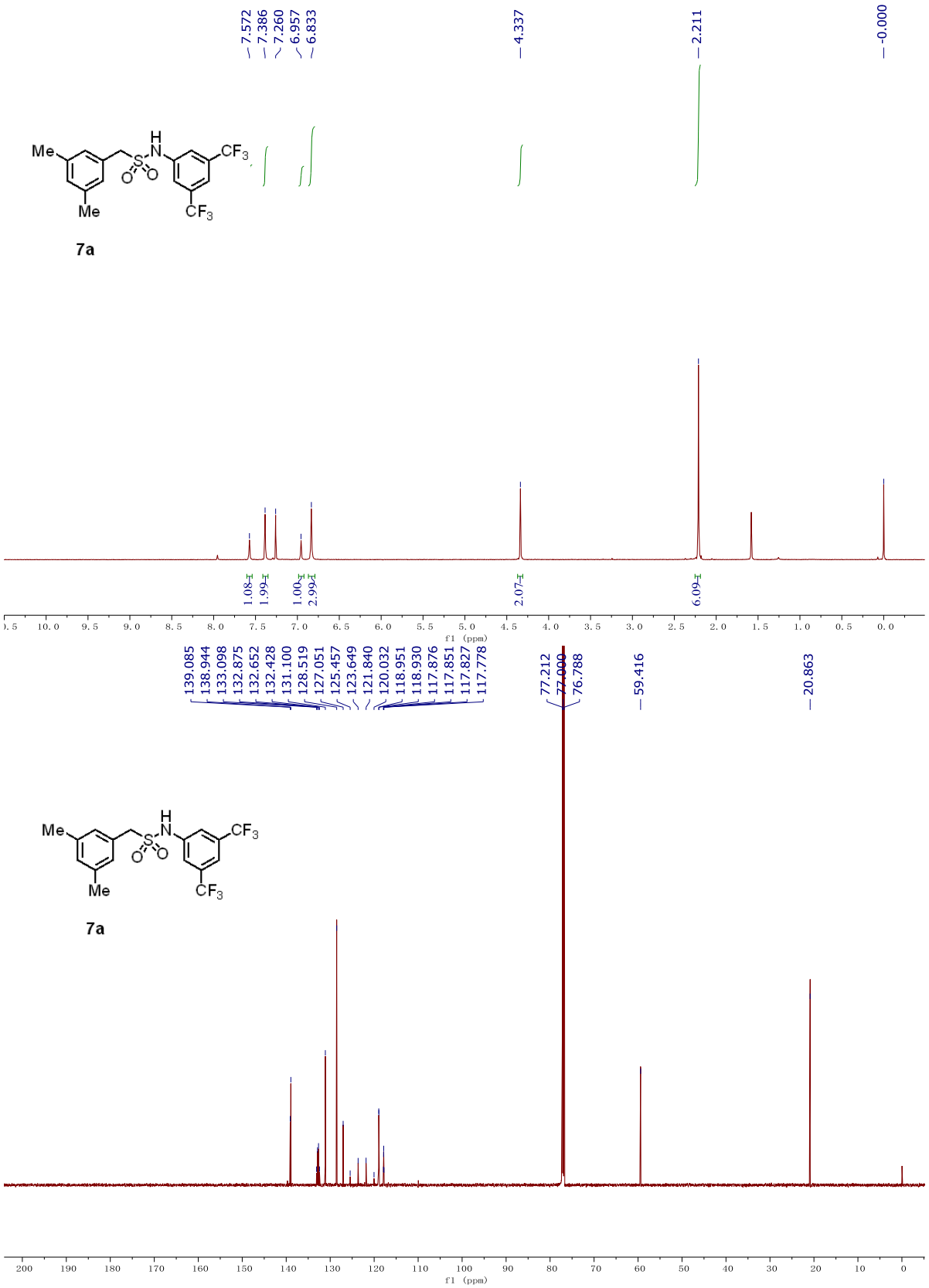

CO2Me
H
N
S
O
O
CF3
F
CO2Me
CF3

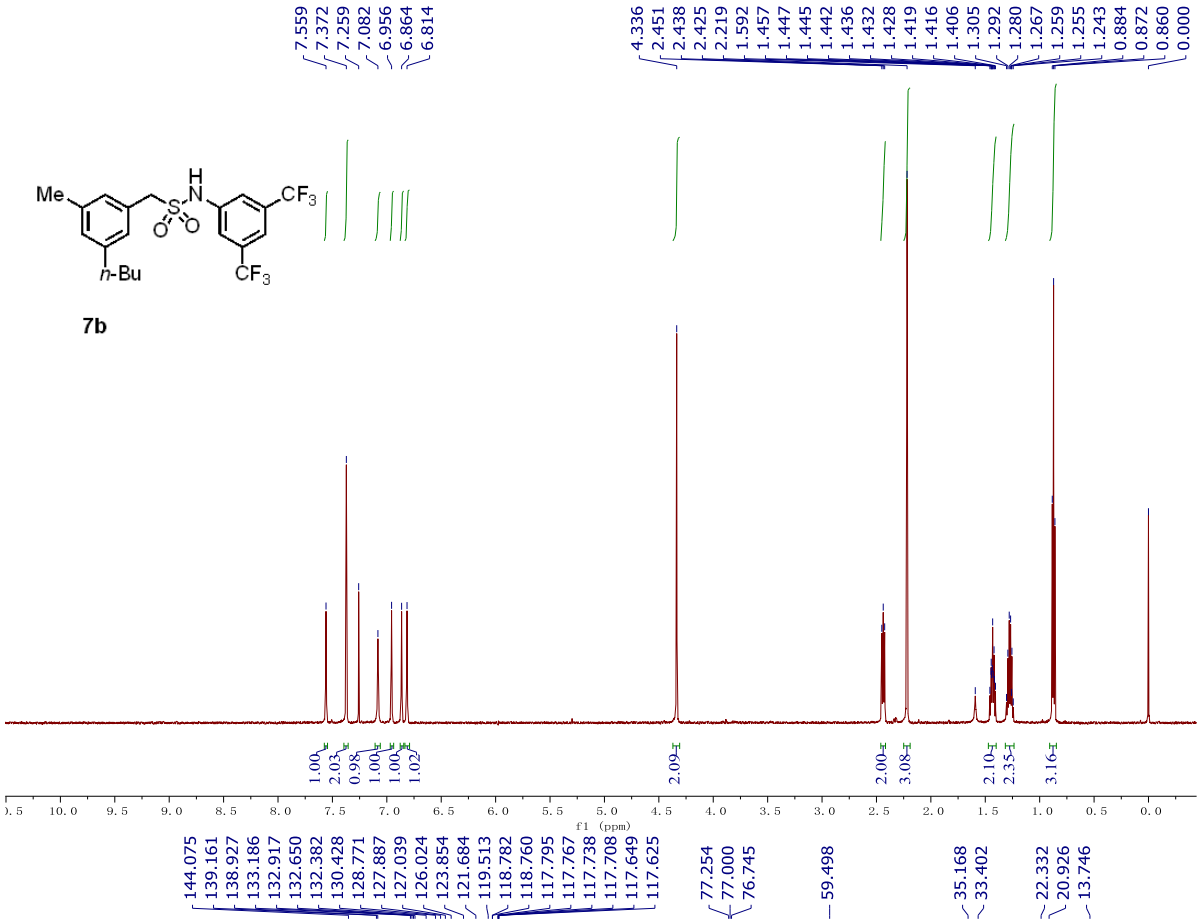
5l

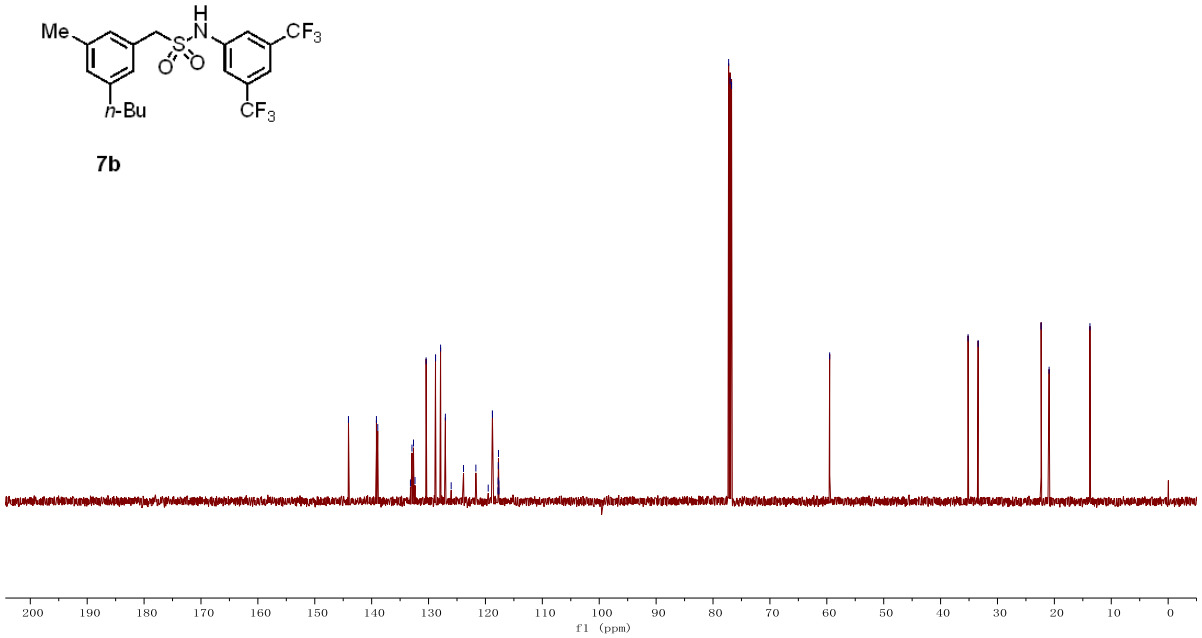
0.69
2.02
2.03
3.06
2.15
1.13
1.03
2.04
2.00
6.04
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

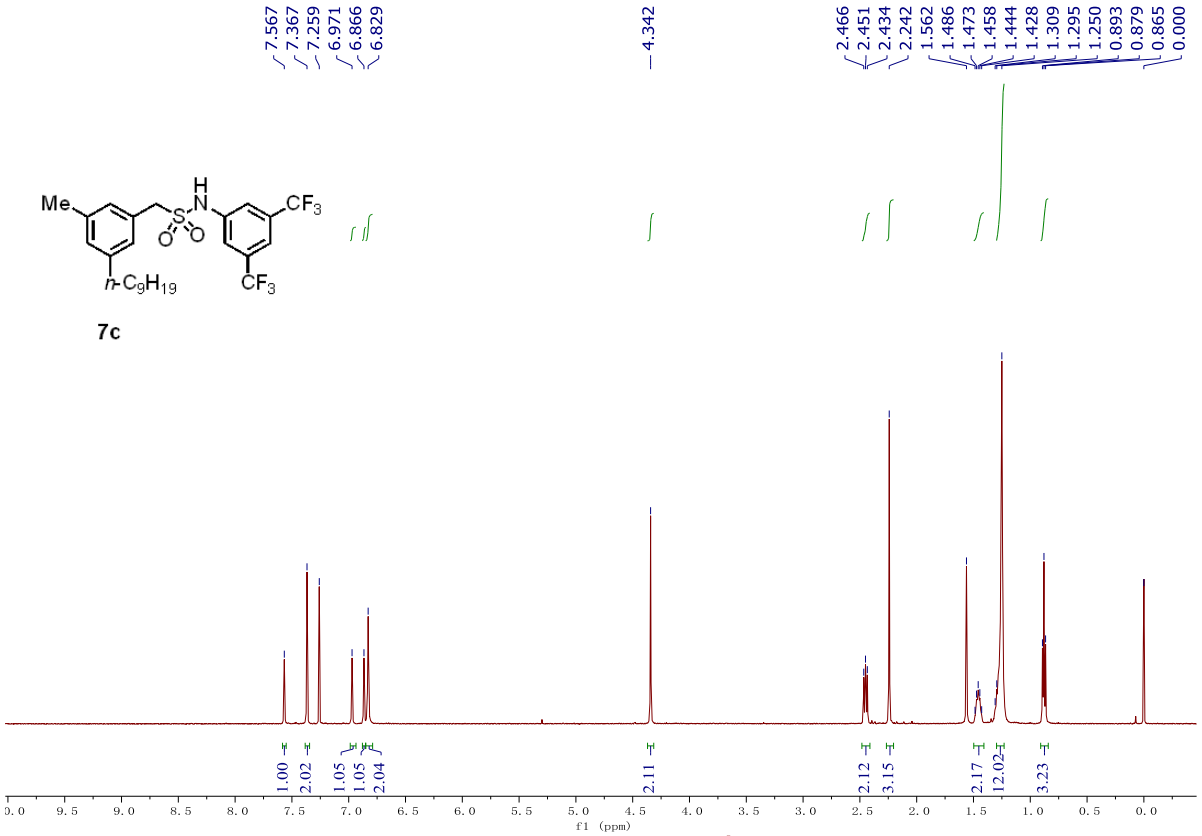

167.833
157.142
155.496
139.460
135.691
133.170
132.947
132.723
132.502
132.130
132.120
132.030
131.292
130.428
130.238
129.659
129.541
128.383
125.490
123.679
123.640
121.872
120.062
119.415
119.400
117.685
117.659
117.635
117.608
117.581
77.214
77.001
76.790
57.257
52.394
CO2Me
H
N
S
O
O
CF3
F
CO2Me
CF3
5l
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

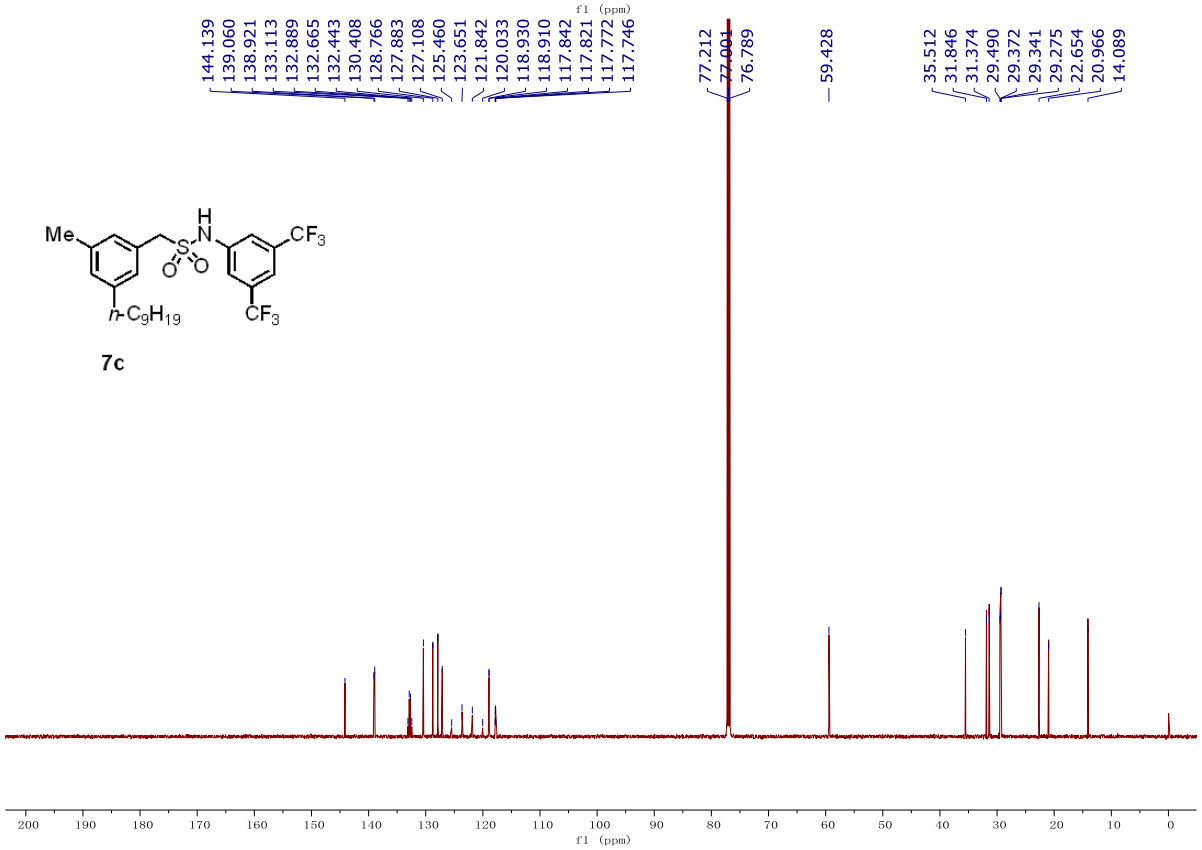

-63.426
-119.228
CO2Me
H
N
S
O
O
CF3
F
CO2Me
CF3
5l
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
-160
-170
-180
-190
-2
f1 (ppm)

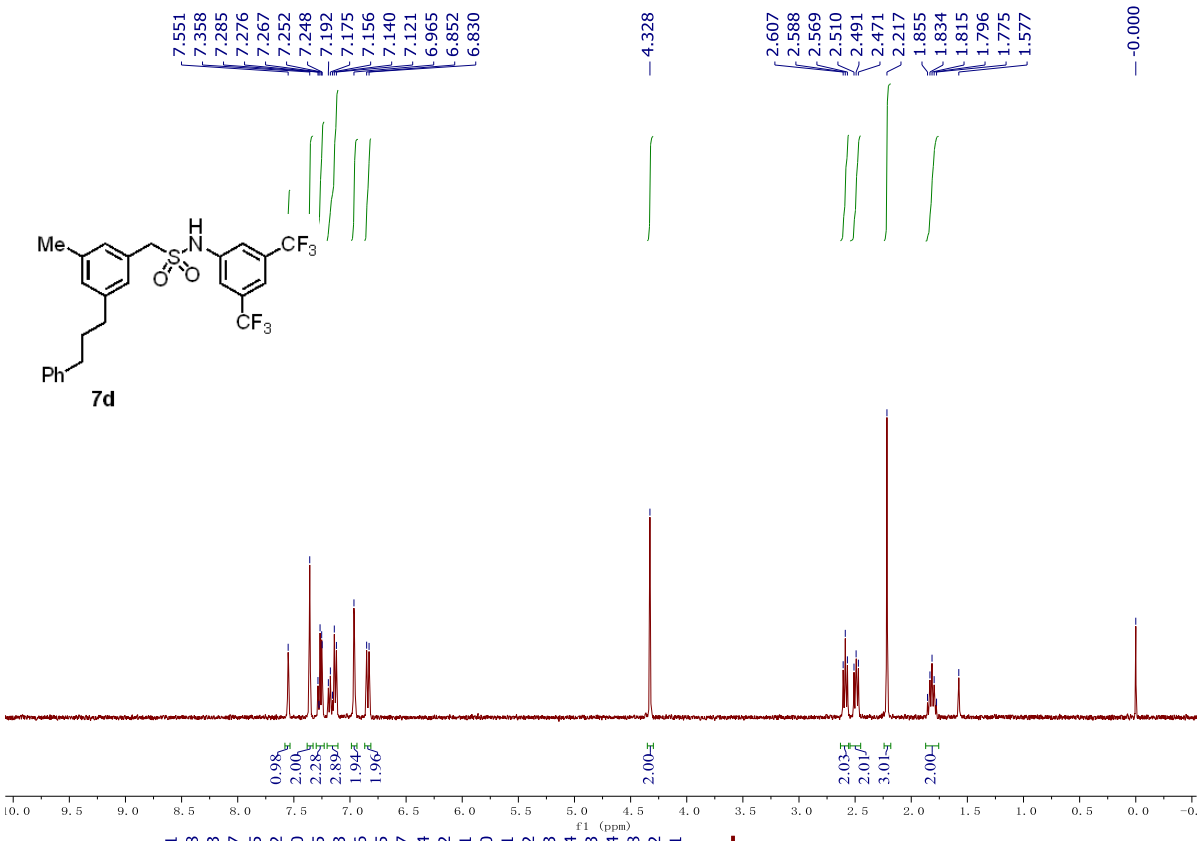

7.572
7.386
7.260
6.957
6.833
4.337
2.211
-0.000
Me
Me
CF3
CF3
H
N
S
O
O
7a
1.08
1.99
1.00
2.99
2.07
6.09
f1 (ppm)
139.085
138.944
133.098
132.875
132.652
132.428
131.100
128.519
127.051
125.457
123.649
121.840
120.032
118.951
118.930
117.876
117.851
117.827
117.778
77.212
77.000
76.788
59.416
20.863
f1 (ppm)

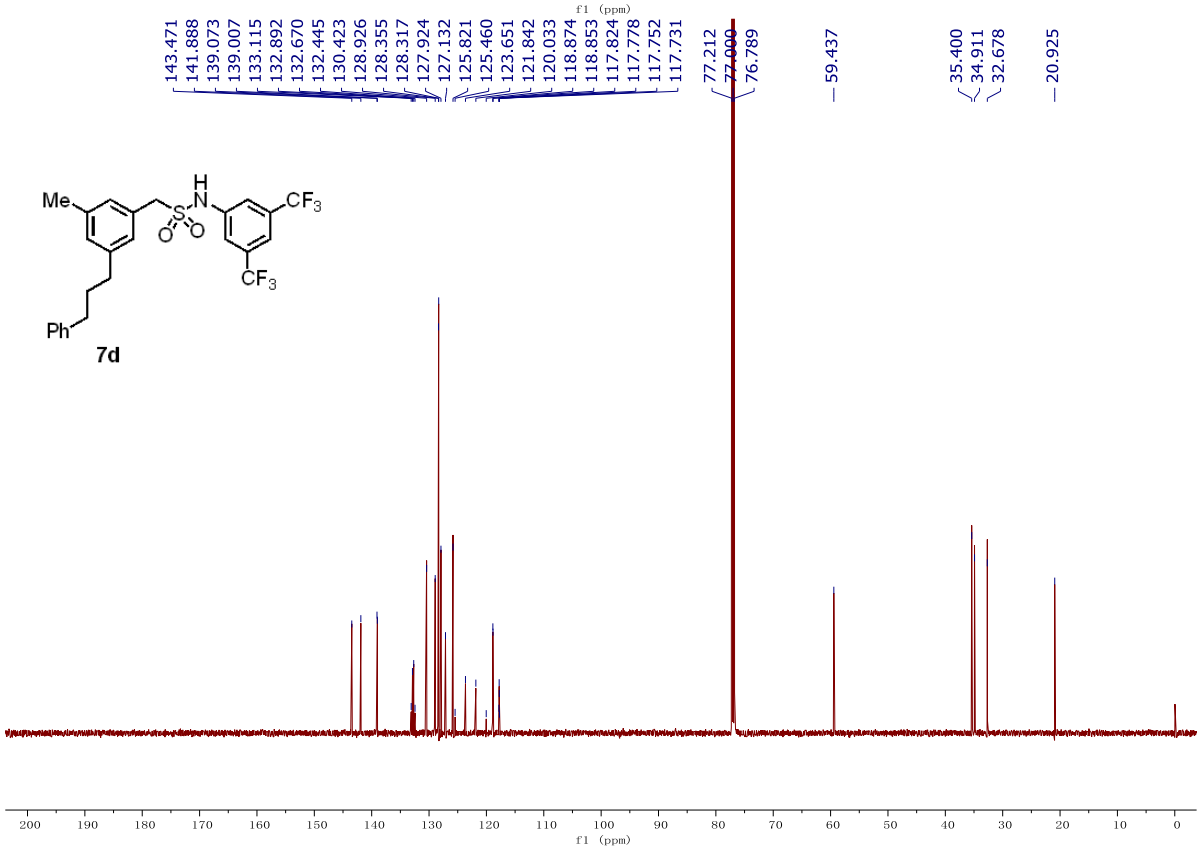

7.559
7.372
7.259
7.082
6.956
6.864
6.814
4.336
2.451
2.438
2.425
2.219
1.592
1.457
1.447
1.445
1.442
1.436
1.432
1.428
1.419
1.416
1.406
1.305
1.292
1.280
1.267
1.259
1.255
1.243
0.884
0.872
0.860
0.000
Me
n-Bu
CF3
CF3
H
N
S
O
O
7b
1.00
2.03
0.98
1.00
1.00
1.02
2.09
2.00
3.08
2.10
2.35
3.16
f1 (ppm)
144.075
139.161
138.927
133.186
132.917
132.650
132.382
130.428
128.771
127.887
127.039
126.024
123.854
121.684
119.513
118.782
118.760
117.795
117.767
117.738
117.708
117.649
117.625
77.254
77.000
76.745
59.498
35.168
33.402
22.332
20.926
13.746

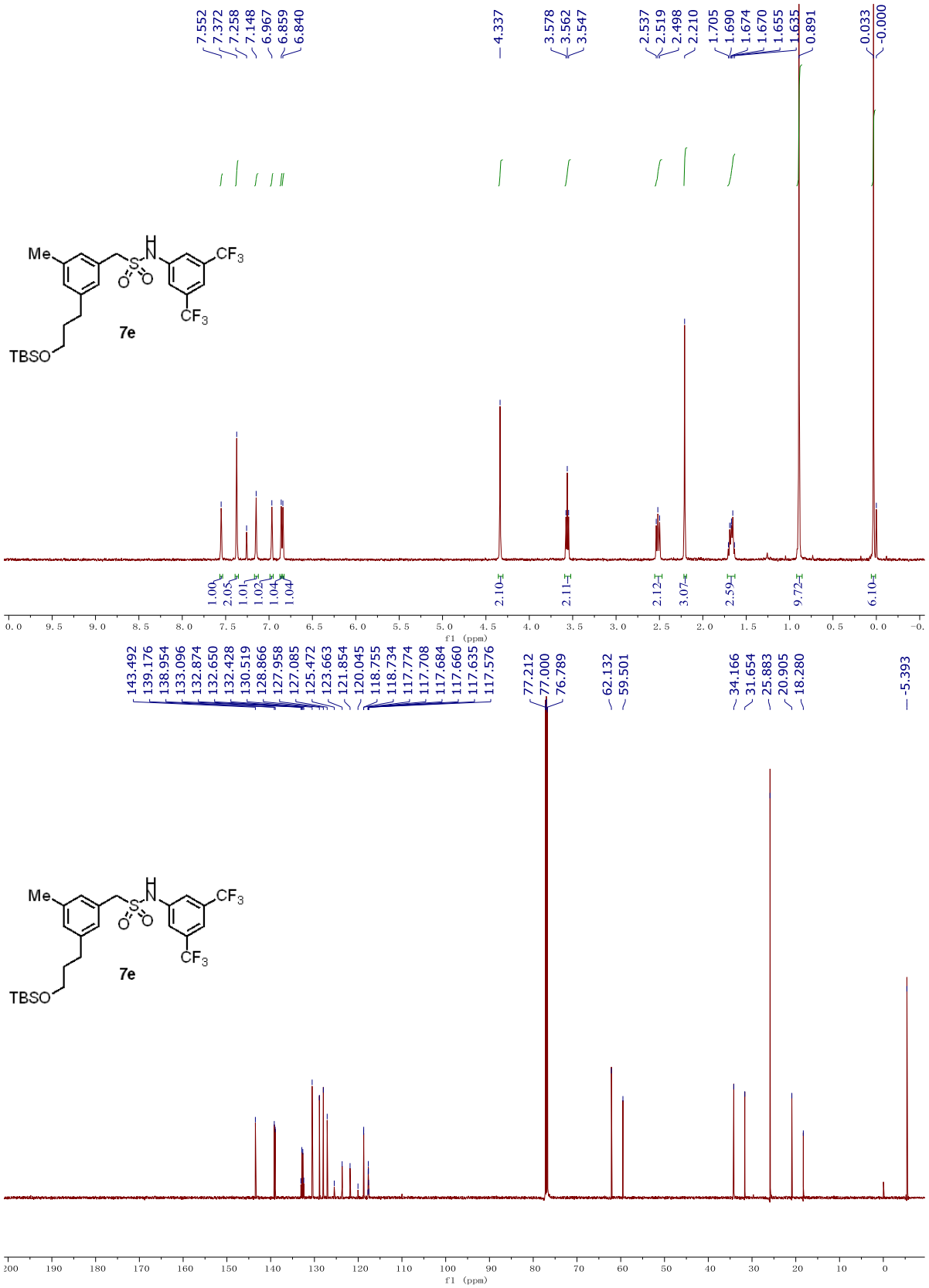

Me
n-Bu
CF3
CF3
H
N
S
O
O
7b
f1 (ppm)

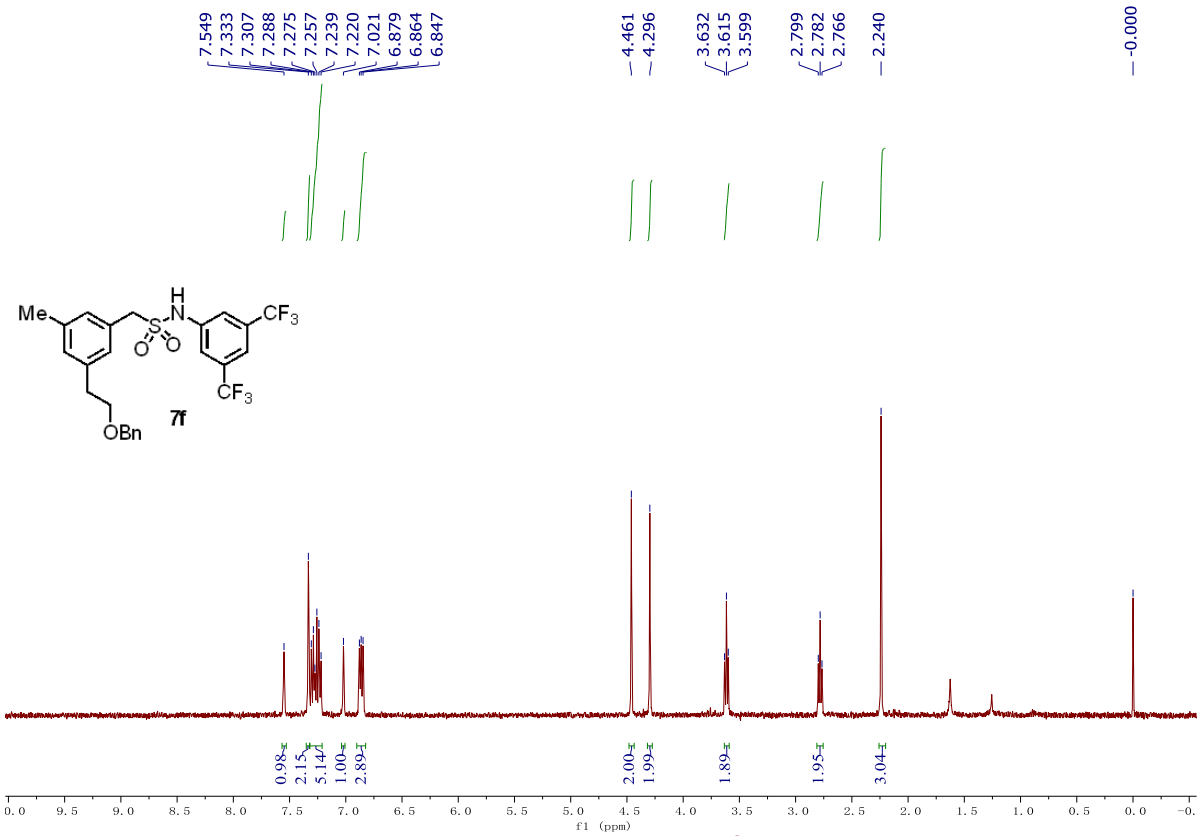

7.567
7.367
7.259
6.971
6.866
6.829
4.342
2.466
2.451
2.434
2.242
1.562
1.486
1.473
1.458
1.444
1.428
1.309
1.295
1.250
0.893
0.879
0.865
0.000
Me
CF3
CF3
n-C9H19
7c
1.00
2.02
1.05
1.05
2.04
2.11
2.12
3.15
2.17
12.02
3.23
f1 (ppm)

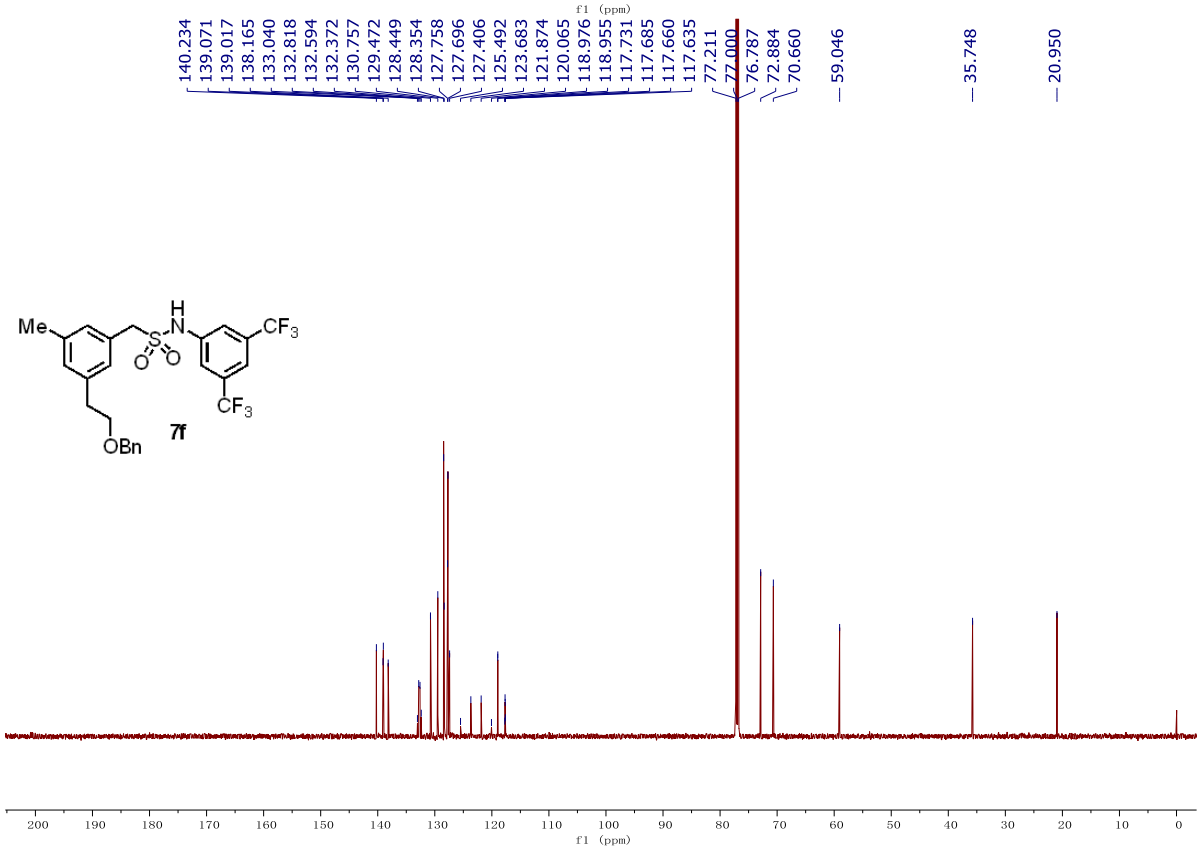

144.139
139.060
138.921
133.113
132.889
132.665
132.443
130.408
128.766
127.883
127.108
125.460
123.651
121.842
120.033
118.930
118.910
117.842
117.821
117.772
117.746
77.212
77.001
76.789
59.428
35.512
31.846
31.374
29.490
29.372
29.341
29.275
22.654
20.966
14.089
Me
CF3
CF3
n-C9H19
7c
f1 (ppm)


7.551
7.358
7.285
7.276
7.267
7.252
7.248
7.192
7.175
7.156
7.140
7.121
6.965
6.852
6.830
4.328
2.607
2.588
2.569
2.510
2.491
2.471
2.217
1.855
1.834
1.815
1.796
1.775
1.577
-0.000
Me
H
N
S
O
O
CF3
CF3
Ph
7d
0.98
2.00
2.28
2.89
1.94
1.96
2.00
2.03
2.01
3.01
2.00
f1 (ppm)


143.471
141.888
139.073
139.007
133.115
132.892
132.670
132.445
130.423
128.926
128.355
128.317
127.924
127.132
125.821
125.460
123.651
121.842
120.033
118.874
118.853
117.824
117.778
117.752
117.731
77.212
77.000
76.789
59.437
35.400
34.911
32.678
20.925
Me
H
N
S
O
O
CF3
CF3
Ph
7d
f1 (ppm)


7.552
7.372
7.258
7.148
6.967
6.859
6.840
4.337
3.578
3.562
3.547
2.537
2.519
2.498
2.210
1.705
1.690
1.674
1.670
1.655
1.635
0.891
0.033
-0.000
Me
CF3
CF3
TBSO
7e
f1 (ppm)
143.492
139.176
138.954
133.096
132.874
132.650
132.428
130.519
128.866
127.958
127.085
125.472
123.663
121.854
120.045
118.755
118.734
117.774
117.708
117.684
117.660
117.635
117.576
77.212
77.000
76.789
62.132
59.501
34.166
31.654
25.883
20.905
18.280
-5.393
Me
CF3
CF3
TBSO
7e
f1 (ppm)


7.549
7.333
7.307
7.288
7.275
7.257
7.239
7.220
7.021
6.879
6.864
6.847
4.461
4.296
3.632
3.615
3.599
2.799
2.782
2.766
2.240
-0.000
Me
H
N
S
O
O
CF3
CF3
OBn
7f
0.98
2.15
5.14
1.00
2.89
2.00
1.99
1.89
1.95
3.04
f1 (ppm)


140.234
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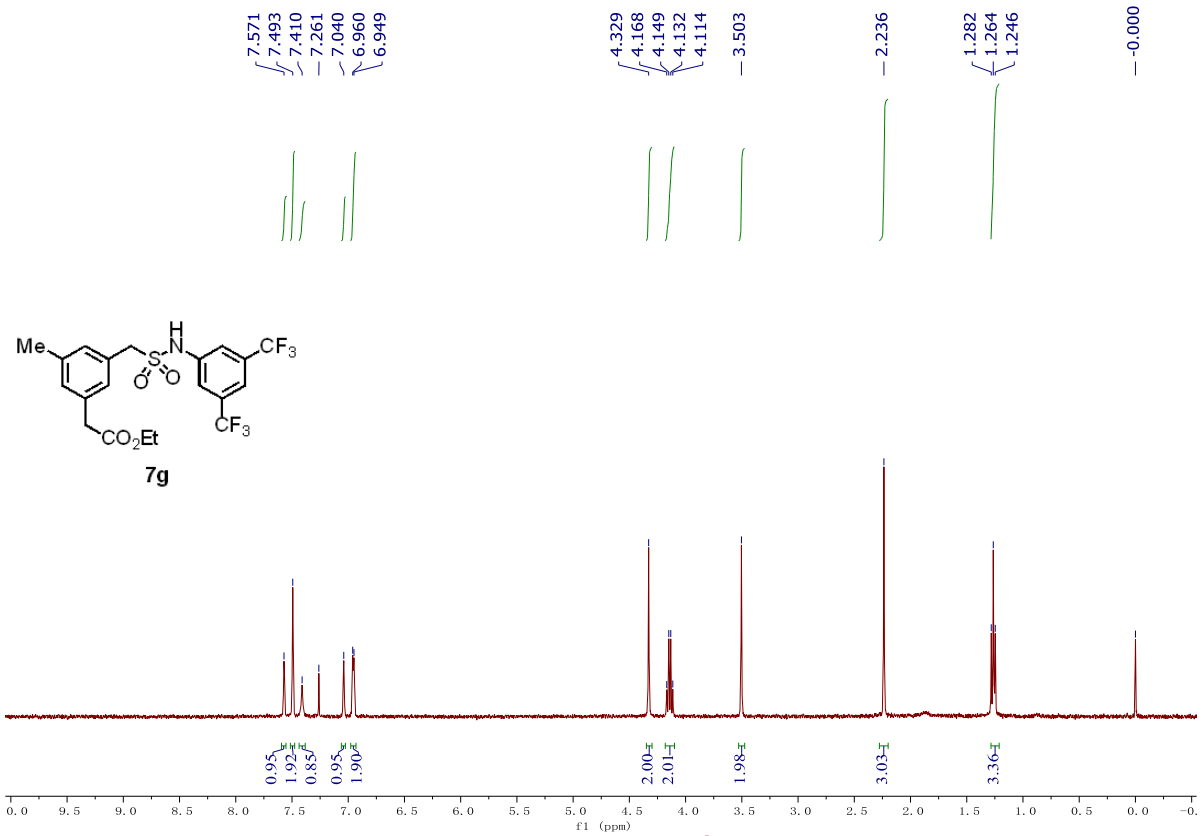
138.165
133.040
132.818
132.594
132.372
130.757
129.472
128.449
128.354
127.758
127.696
127.406
125.492
123.683
121.874
120.065
118.976
118.955
117.731
117.685
117.660
117.635
77.211
77.000
76.787
72.884
70.660
59.046
35.748
20.950
Me
H
N
S
O
O
CF3
CF3
OBn
7f
f1 (ppm)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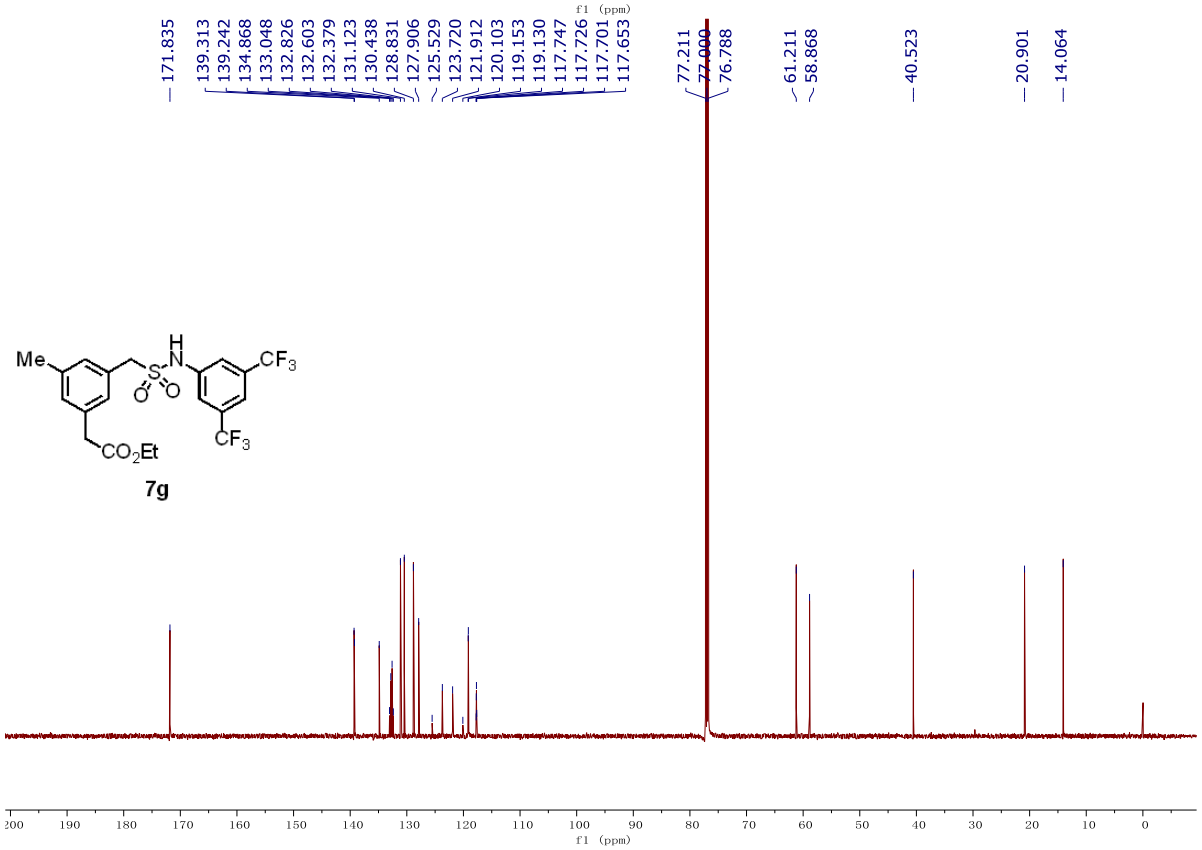
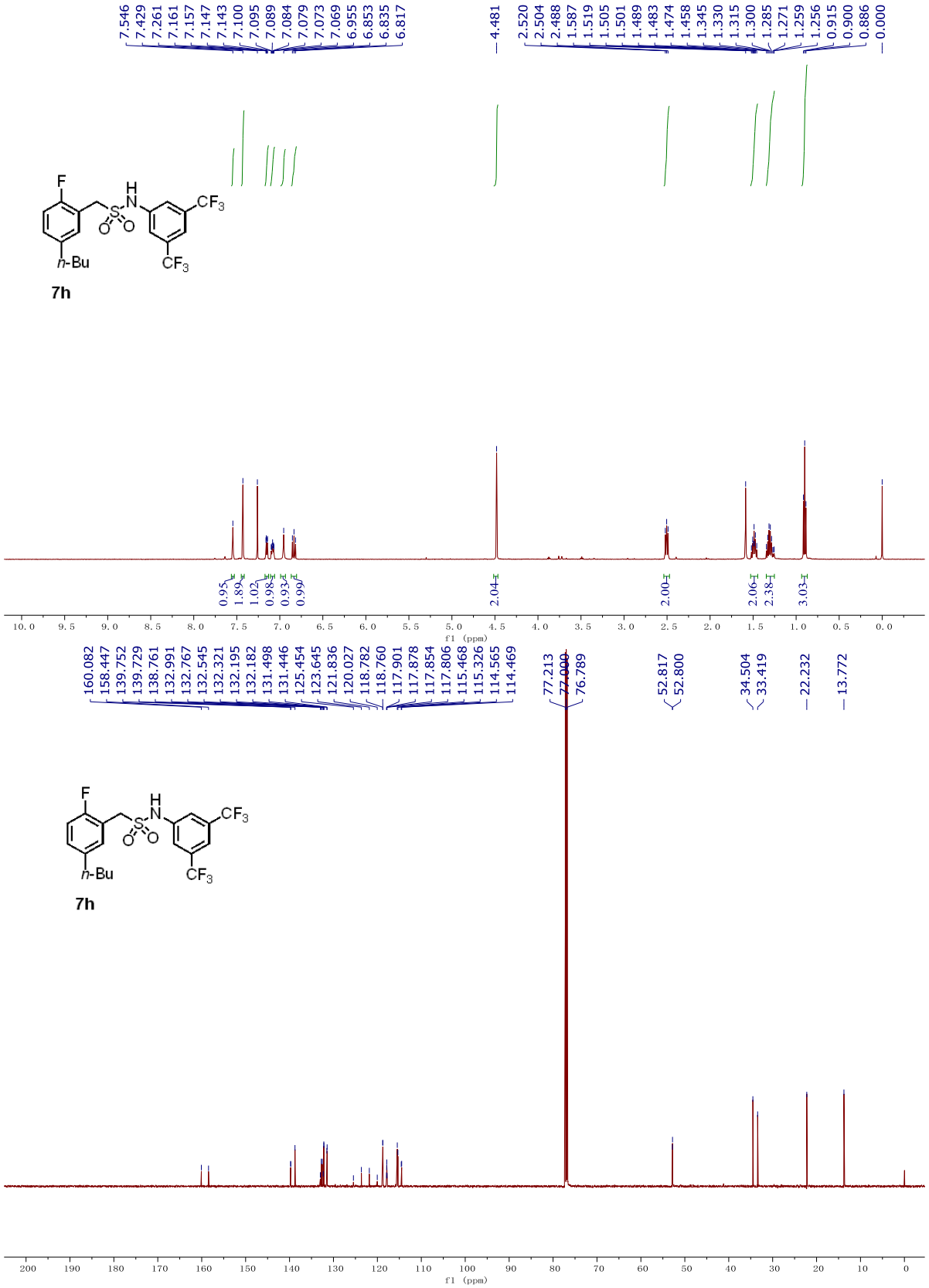
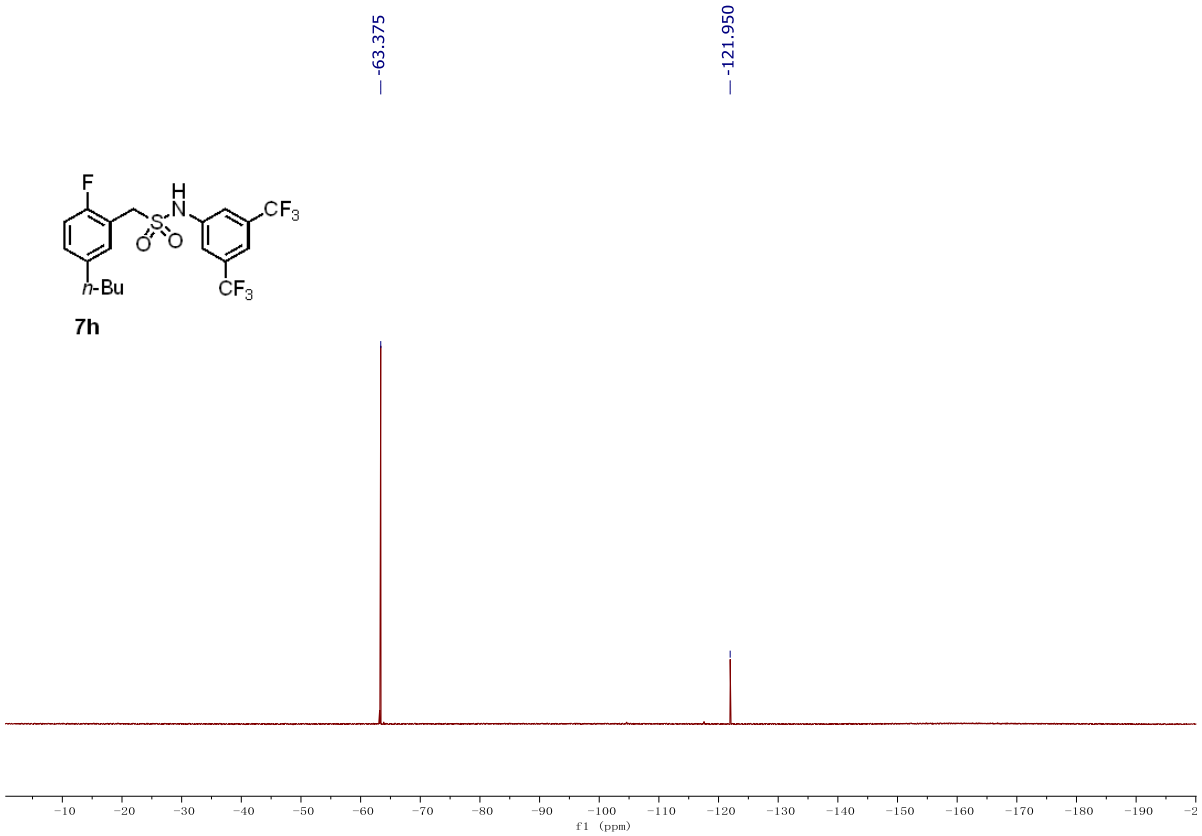
7.493
7.410
7.261
7.040
6.960
6.949
4.329
4.168
4.149
4.132
4.114
3.503
2.236
1.282
1.264
1.246
-0.000
Me
CF3
CF3
CO2Et
7g
0.95
1.92
0.85
0.95
1.90
2.00
2.01
1.98
3.03
3.36
f1 (ppm)


171.835
139.313
139.242
134.868
133.048
132.826
132.603
132.379
131.123
130.438
128.831
127.906
125.529
123.720
121.912
120.103
119.153
119.130
117.747
117.726
117.701
117.653
77.211
77.000
76.788
61.211
58.868
40.523
20.901
14.064
Me
CF3
CF3
CO2Et
7g
f1 (ppm)


7.546
7.429
7.261
7.161
7.157
7.147
7.143
7.100
7.095
7.089
7.084
7.079
7.073
7.069
6.955
6.853
6.835
6.817
4.481
2.520
2.504
2.488
1.587
1.519
1.505
1.501
1.489
1.483
1.474
1.458
1.345
1.330
1.315
1.300
1.285
1.271
1.259
1.256
0.915
0.900
0.886
0.000
F
H
N
S
O
O
CF3
CF3
n-Bu
7h
0.95
1.89
1.02
0.98
0.93
0.99
2.04
2.00
2.06
2.38
3.03
f1 (ppm)
160.082
158.447
139.752
139.729
138.761
132.991
132.767
132.545
132.321
132.195
132.182
131.498
131.446
125.454
123.645
121.836
120.027
118.782
118.760
117.901
117.878
117.854
117.806
115.468
115.326
114.565
114.469
77.213
77.000
76.789
52.817
52.800
34.504
33.419
22.232
13.772
F
H
N
S
O
O
CF3
CF3
n-Bu
7h
f1 (ppm)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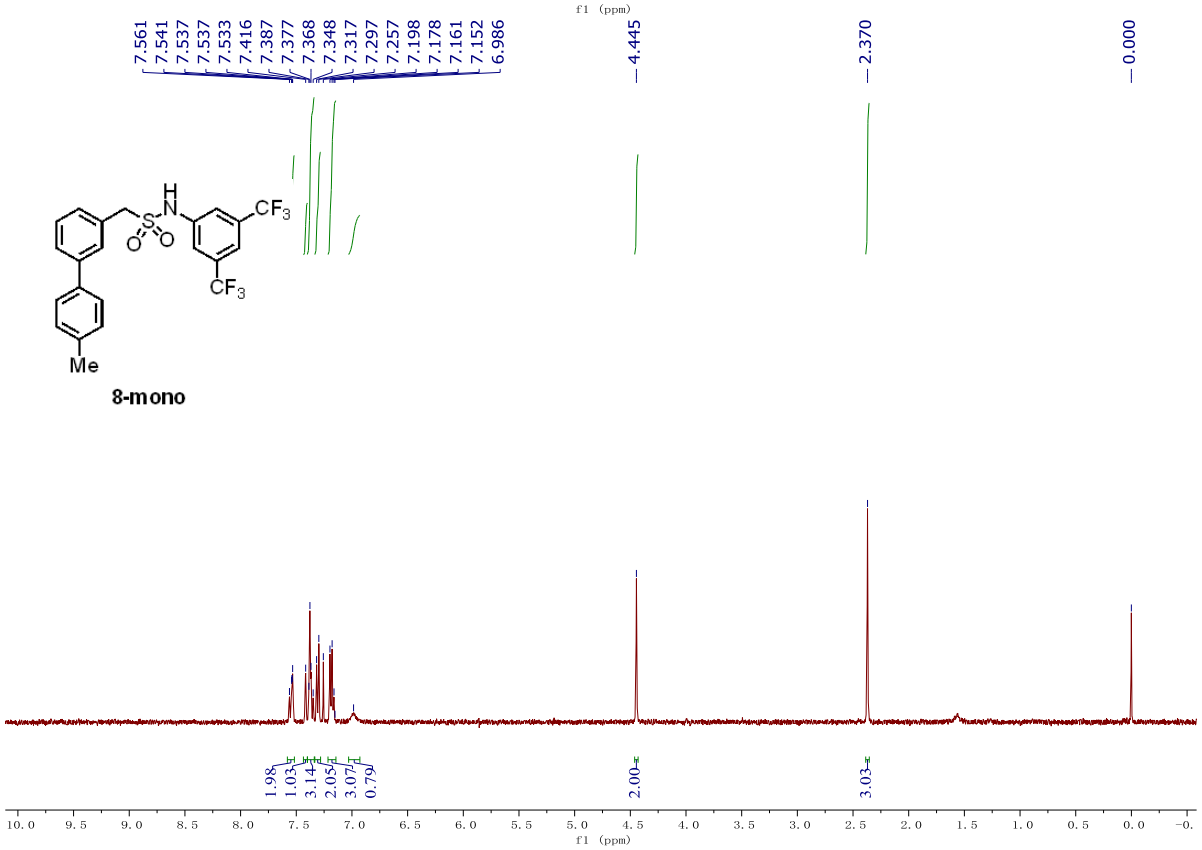
-121.950
F
H
N
S
O
O
CF3
CF3
n-Bu
7h
f1 (ppm)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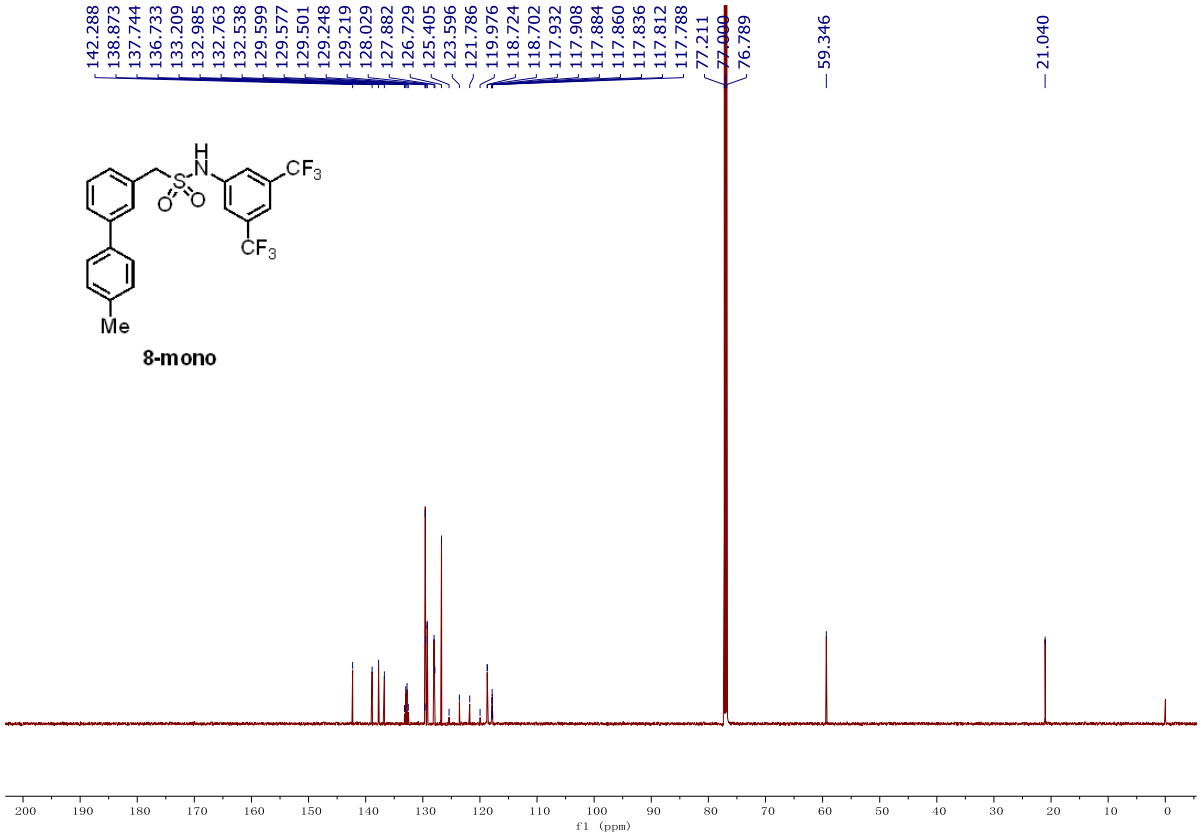
7.541
7.537
7.537
7.533
7.416
7.387
7.377
7.368
7.348
7.317
7.297
7.257
7.198
7.178
7.161
7.152
6.986
4.445
2.370
0.000
H
N
S
O
O
CF3
CF3
Me
8-mono
1.98
1.03
3.14
2.05
3.07
0.79
2.00
3.03
f1 (ppm)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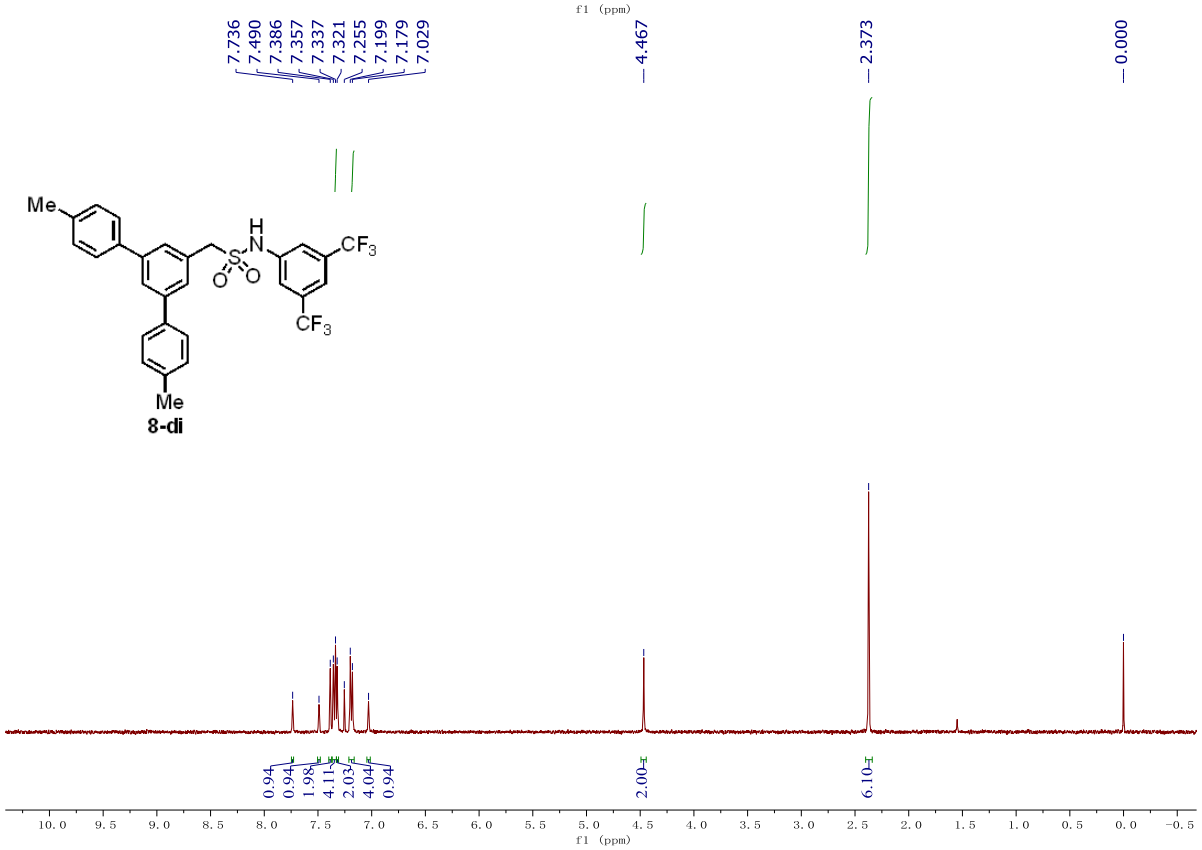
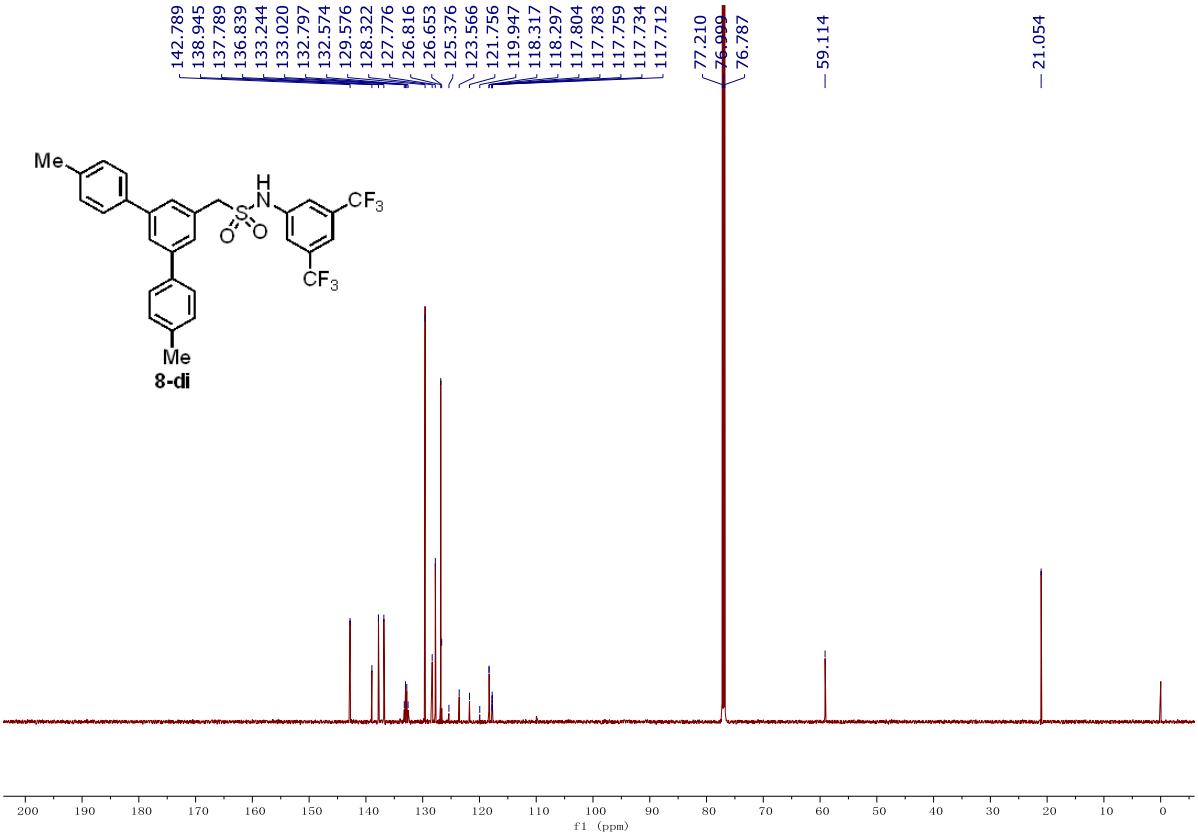
137.744
136.733
133.209
132.985
132.763
132.538
129.599
129.577
129.501
129.248
129.219
128.029
127.882
126.729
125.405
123.596
121.786
119.976
118.724
118.702
117.932
117.908
117.884
117.860
117.836
117.812
117.788
77.211
77.000
76.789
59.346
21.040
H
N
S
O
O
CF3
CF3
Me
8-mono
f1 (ppm)


7.736
7.490
7.386
7.357
7.337
7.321
7.255
7.199
7.179
7.029
4.467
2.373
0.000
Me
H
N
S
O
O
CF3
CF3
Me
8-di
0.94
0.94
1.98
4.11
2.03
4.04
0.94
2.00
6.10
f1 (ppm)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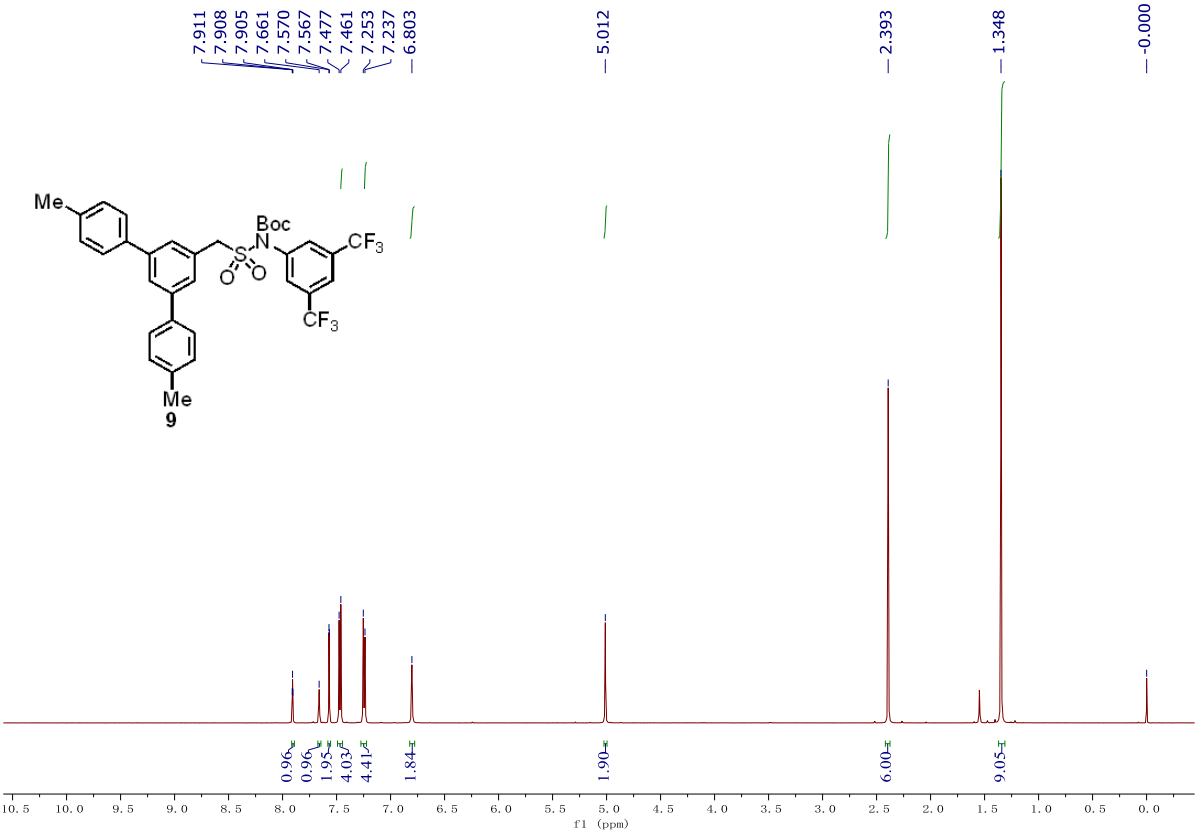
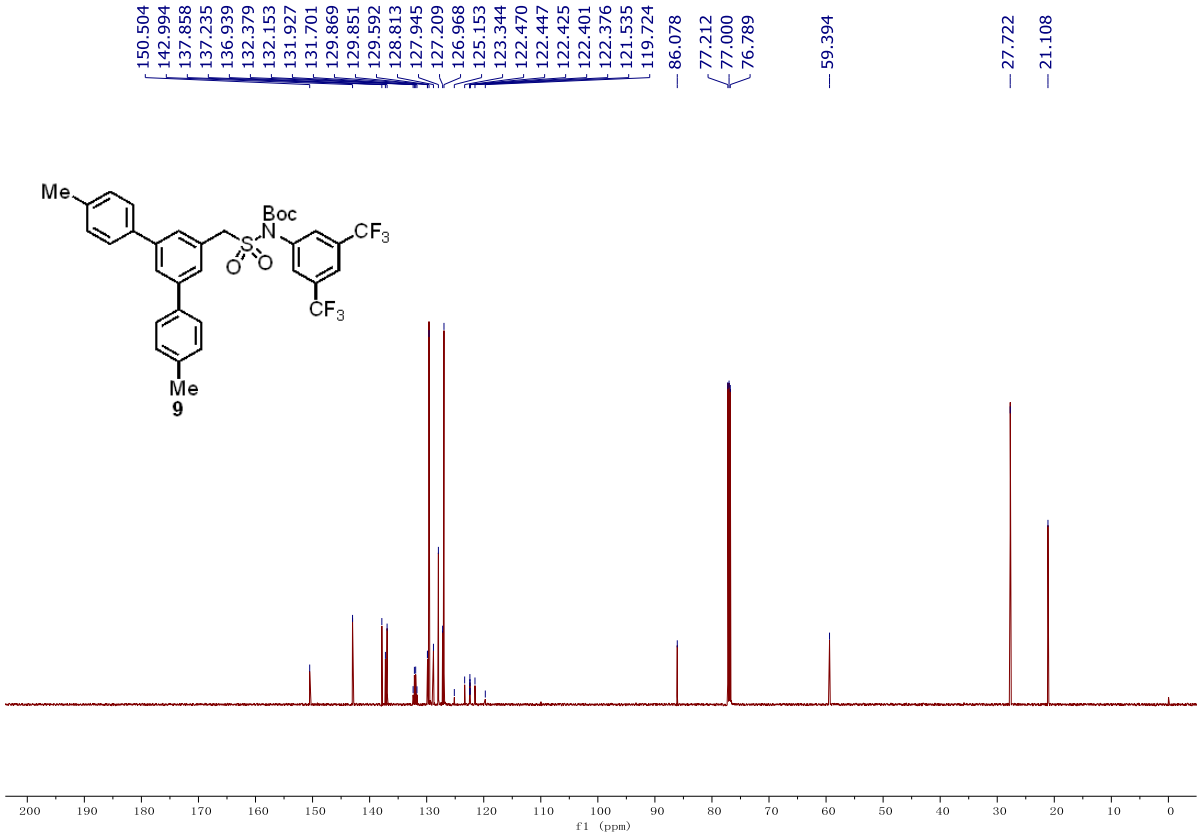
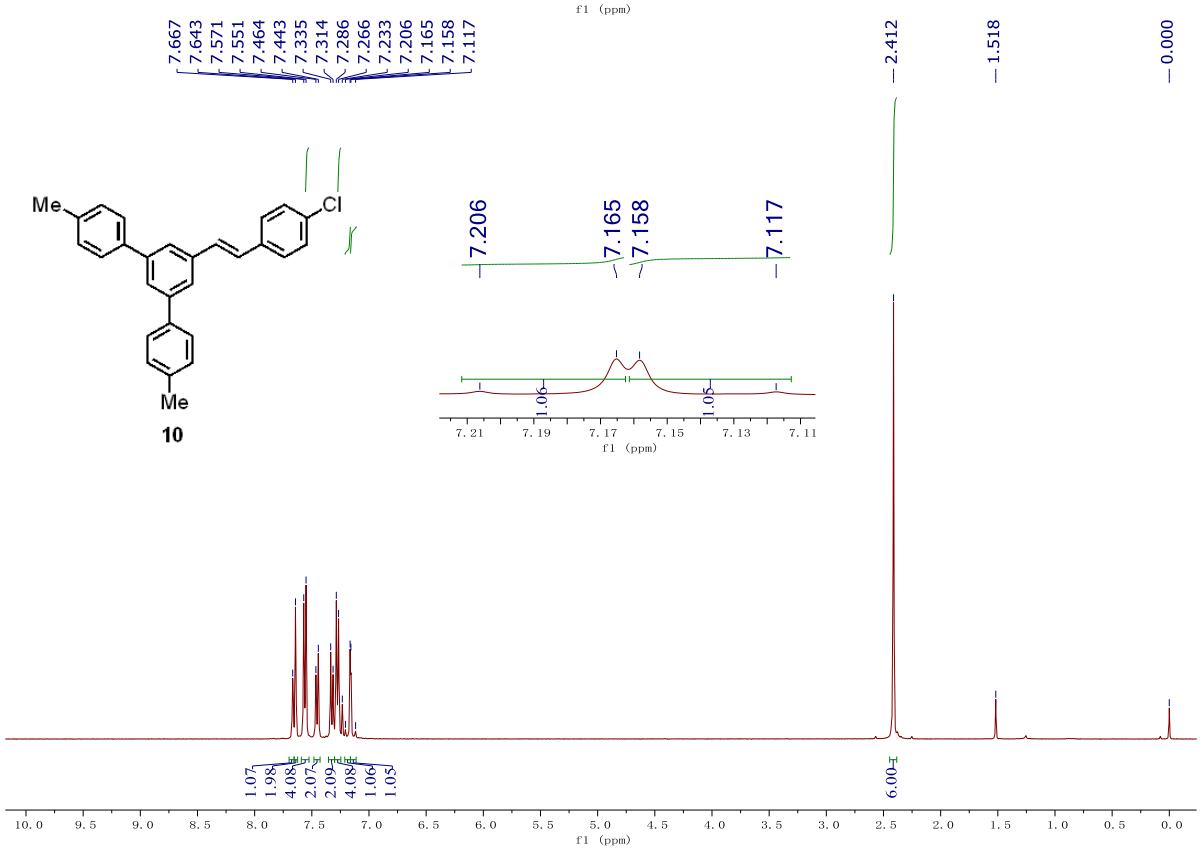
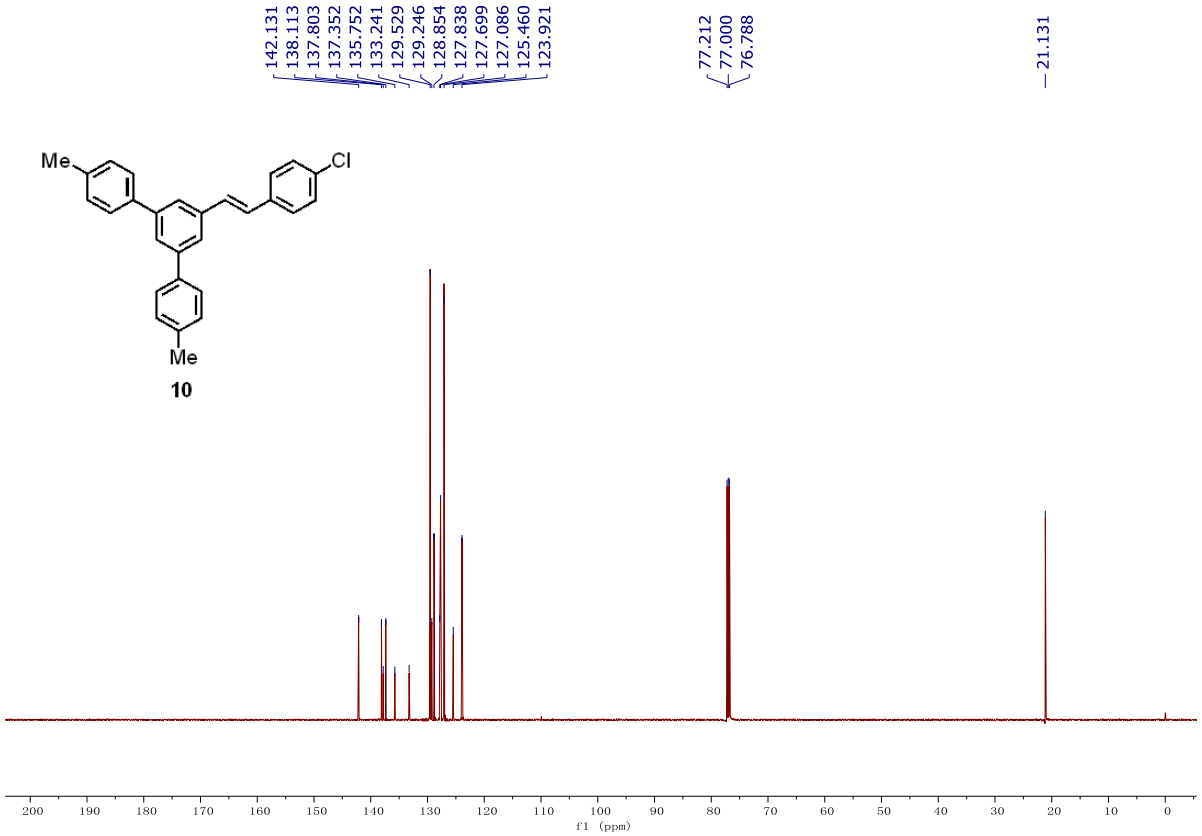
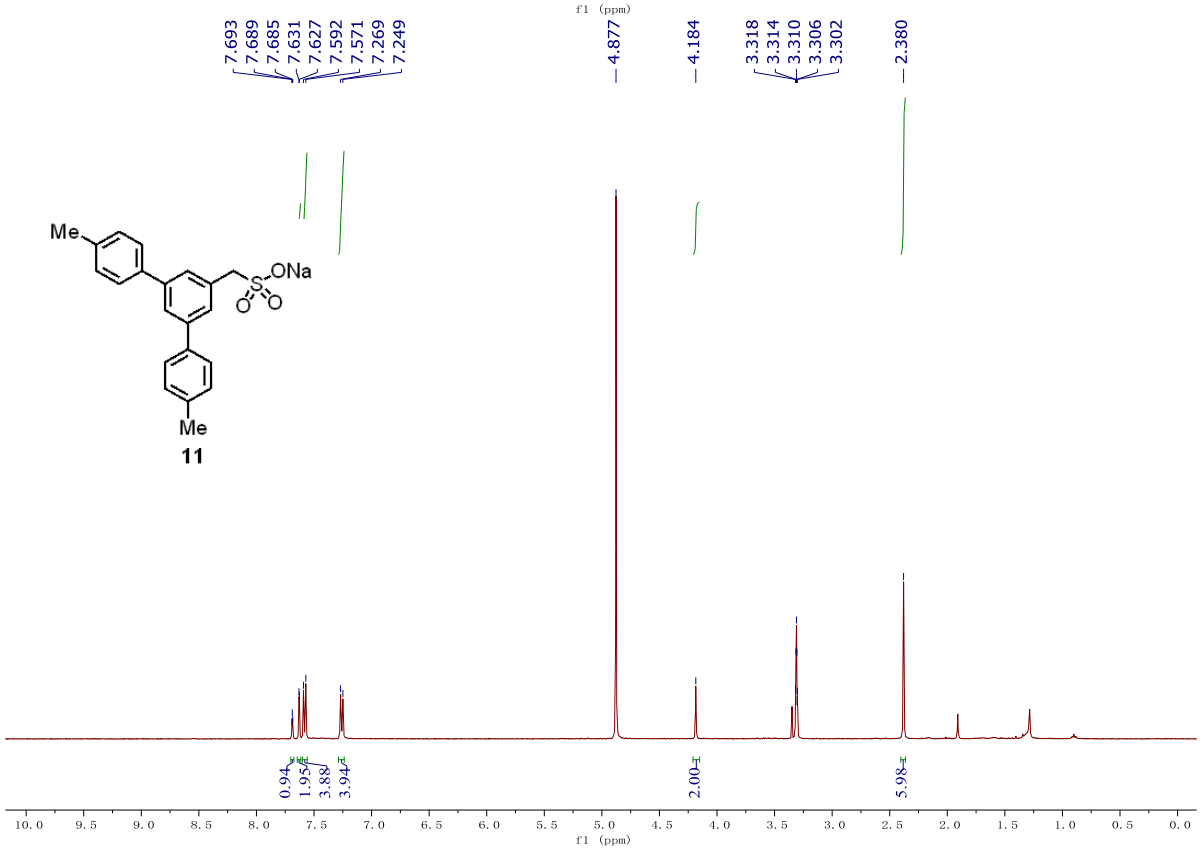
138.945
137.789
136.839
133.244
133.020
132.797
132.574
129.576
128.322
127.776
126.816
126.653
125.376
123.566
121.756
119.947
118.317
118.297
117.804
117.783
117.759
117.734
117.712
77.210
76.999
76.787
59.114
21.054
Me
H
N
S
O
O
CF3
CF3
Me
8-di
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

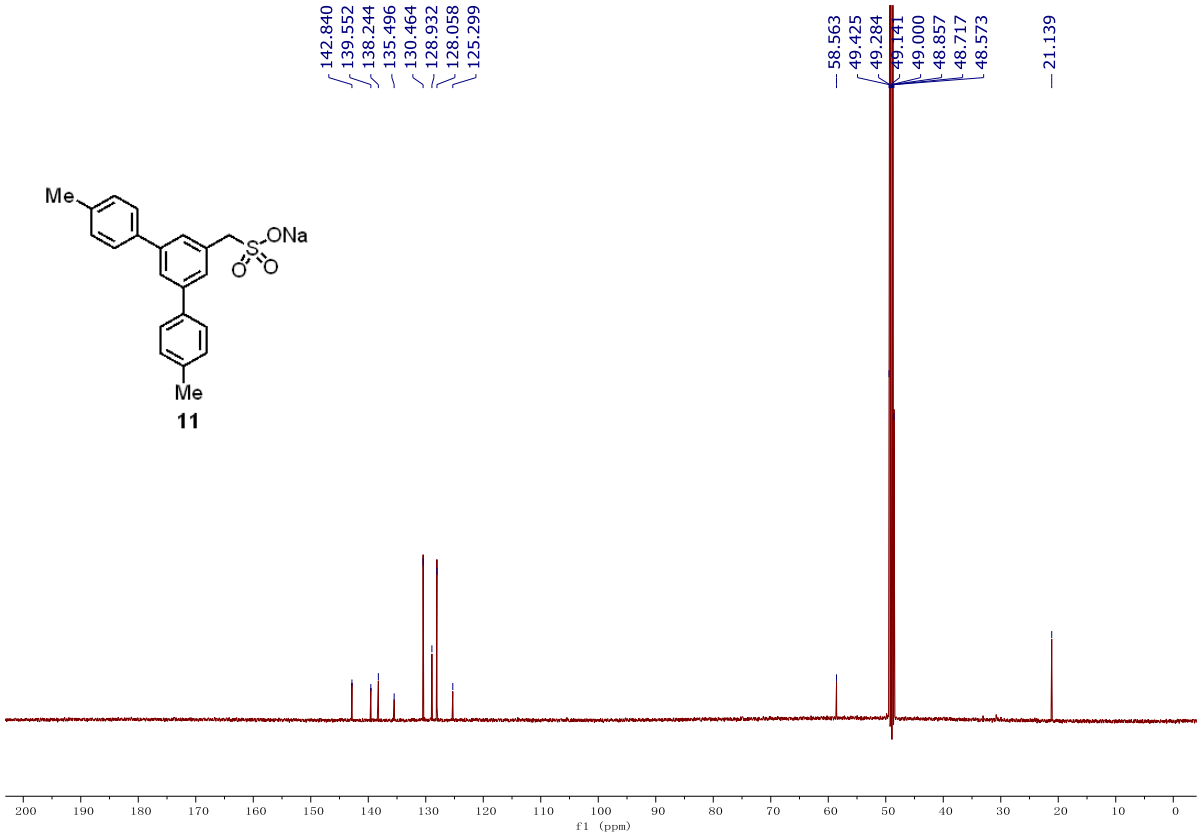

7.911
7.908
7.905
7.661
7.570
7.567
7.477
7.461
7.253
7.237
6.803
5.012
2.393
1.348
-0.000
Me
Boc
N
S
O
O
CF3
CF3
Me
9
0.96
0.96
1.95
4.03
4.41
1.84
1.90
6.00
9.05
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

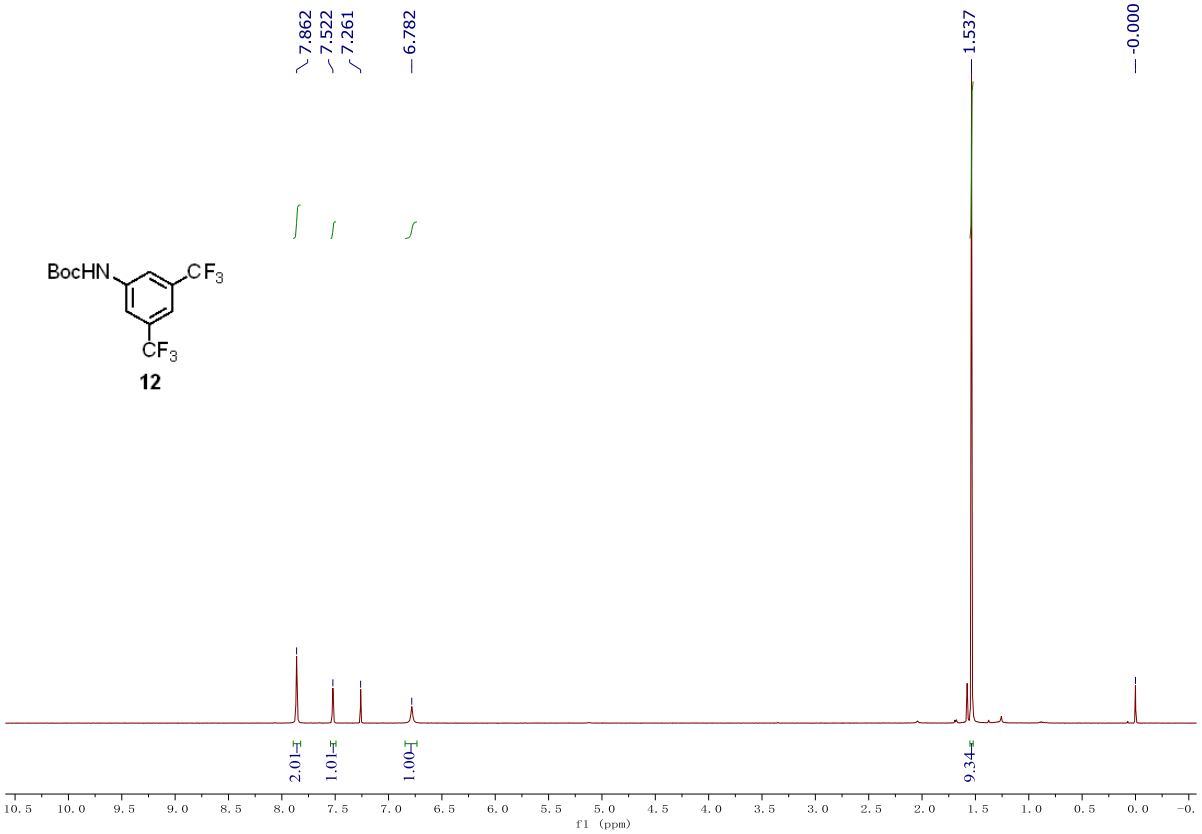

150.504
142.994
137.858
137.235
136.939
132.379
132.153
131.927
131.701
129.869
129.851
129.592
128.813
127.945
127.209
126.968
125.153
123.344
122.470
122.447
122.425
122.401
122.376
121.535
119.724
86.078
77.212
77.000
76.789
59.394
27.722
21.108
Me
Boc
N
S
O
O
CF3
CF3
Me
9
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

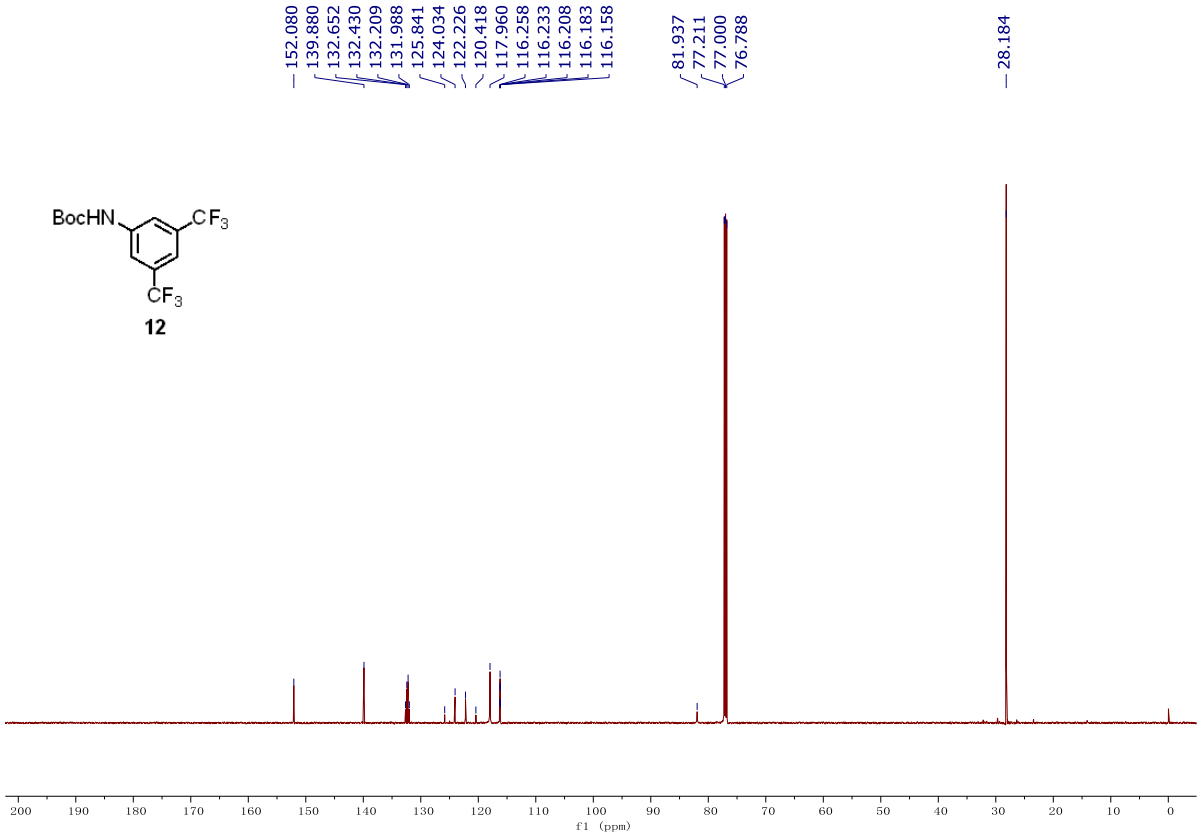

7.667
7.643
7.571
7.551
7.464
7.443
7.335
7.314
7.286
7.266
7.233
7.206
7.165
7.158
7.117
2.412
1.518
0.000
Me
Cl
Me
10
7.206
7.165
7.158
7.117
1.06
1.05
7.21
7.19
7.17
7.15
7.13
7.11
f1 (ppm)
1.07
1.98
4.05
2.07
2.09
4.08
1.06
1.05
6.00
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

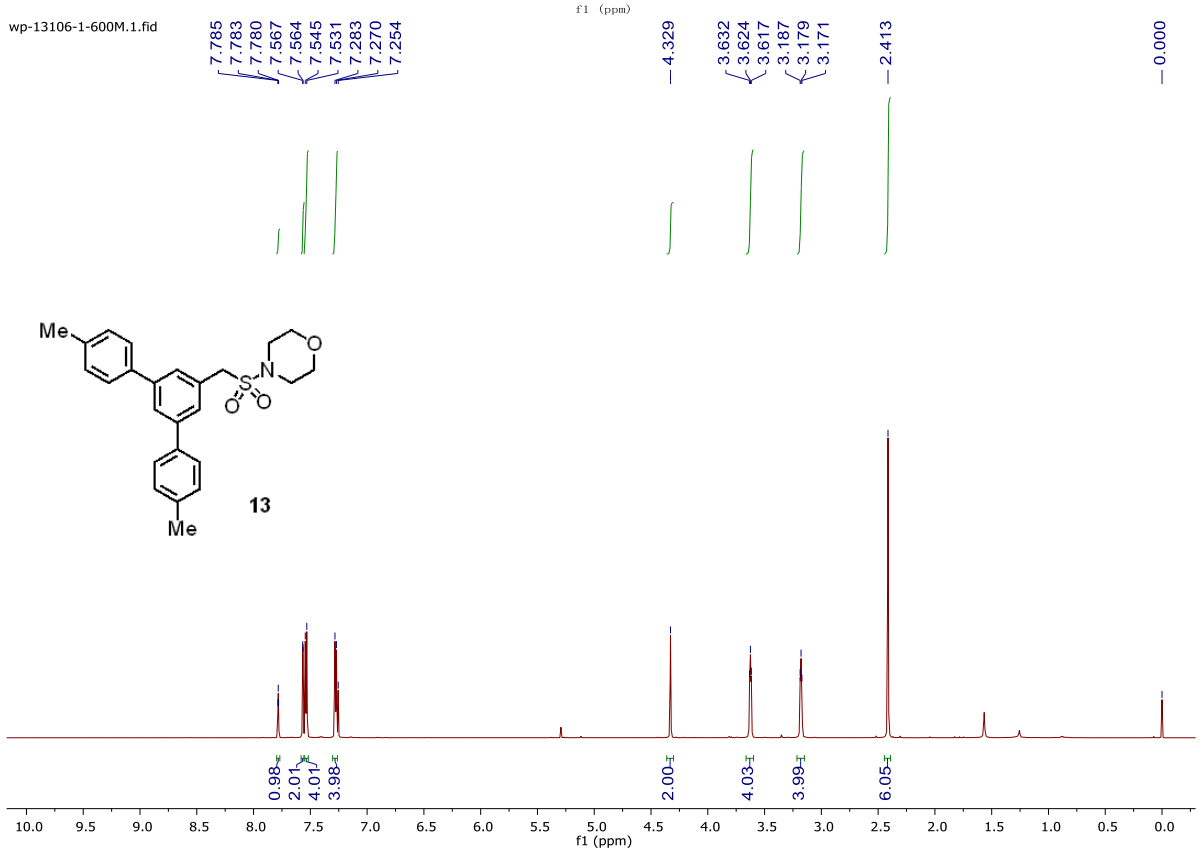

142.131
138.113
137.803
137.352
135.752
133.241
129.529
129.246
128.854
127.838
127.699
127.086
125.460
123.921
77.212
77.000
76.788
21.131
Me
Cl
Me
10
f1 (ppm)


7.693
7.689
7.685
7.631
7.627
7.592
7.571
7.269
7.249
4.877
4.184
3.318
3.314
3.310
3.306
3.302
2.380
Me
ONa
O
O
Me
11
0.94
1.95
3.88
3.94
2.00
5.98
f1 (ppm)


142.840
139.552
138.244
135.496
130.464
128.932
128.058
125.299
58.563
49.425
49.284
49.141
49.000
48.857
48.717
48.573
21.139
Me
ONa
Me
11
f1 (ppm)


7.862
7.522
7.261
6.782
1.537
-0.000
BocHN
CF3
CF3
12
2.01
1.01
1.00
9.34
f1 (ppm)


152.080
139.880
132.652
132.430
132.209
131.988
125.841
124.034
122.226
120.418
117.960
116.258
116.233
116.208
116.183
116.158
81.937
77.211
77.000
76.788
28.184
BocHN
CF3
CF3
12
f1 (ppm)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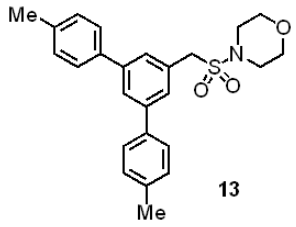
7.785
7.783
7.780
7.567
7.564
7.545
7.531
7.283
7.270
7.254
4.329
3.632
3.624
3.617
3.187
3.179
3.171
2.413
0.000
Me
O
N
S
O
O
13
Me
0.98
2.01
4.01
3.98
2.00
4.03
3.99
6.05
f1 (ppm)

wp-13106-1-C13-600M.1.fid

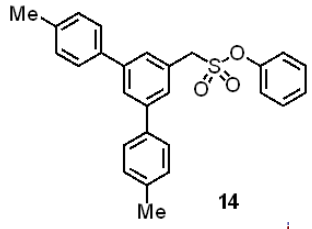
142.26
137.69
137.34
129.62
129.37
127.79
127.03
126.12
77.21
77.00
76.79
66.70
56.72
46.26
21.13



13

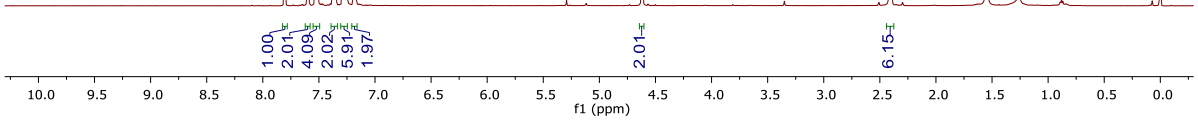
wp-13104-1-600M.1.fid

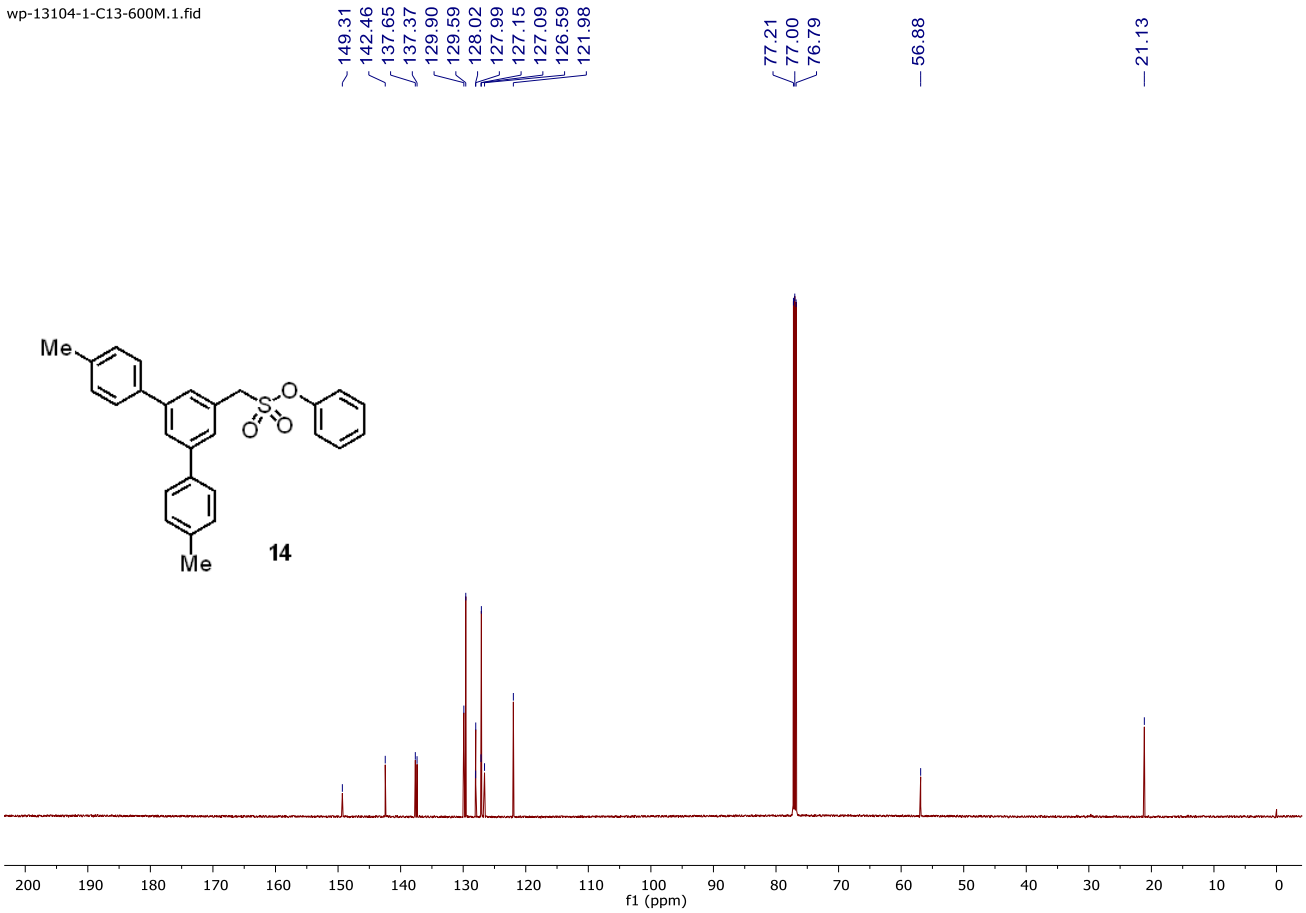
7.808
7.805
7.802
7.597
7.529
7.516
7.376
7.363
7.350
7.293
7.280
7.271
7.258
7.254
7.188
7.174
4.618
2.405
0.000



14

1.00
2.01
4.09
2.02
5.91
1.97
2.01
6.15




wp-13104-1-C13-600M.1.fid
149.31
142.46
137.65
137.37
129.90
129.59
128.02
127.99
127.15
127.09
126.59
121.98
77.21
77.00
76.79
56.88
21.13
Me
Me
14
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)