Electronic Supplementary Material (ESI) for ChemComm.

Supplementary Information

Visible-light-driven photocatalyst-free deoxygenative alkylation of imines with alcohols

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1. General Information

Commercially Reagents: Commercially reagents were purchased from Sigma Aldrich, Energy Chemical, TCI or Alfa Aesar and used without further purification. All experiments were performed in oven-dried glassware under an atmosphere of N_2. Diethyl ether, 1,4-dioxane were extra-dry solvents with molecular sieve (MS) purchased from Energy Chemical and stored within a N_2 filled glove box.

NMR Spectra: ^{1}H NMR spectra were recorded on a 400 or 600 MHz spectrometer. Chemical shifts are reported in parts per million (ppm) and the spectra are calibrated to the resonance resulting from incomplete deuteration of the solvent ($CDCl_3$: 7.26 ppm). ^{13}C NMR spectra were recorded on the same spectrometer with complete proton decoupling. Chemical shifts are reported in ppm with the solvent resonance as the internal standard ($CDCl_3$: 77.16 ppm, t). Data are reported as follows: chemical shift δ/ppm, integration (^{1}H only), multiplicity (s = singlet, d = doublet, t = triplet, q = quartet, m = multiplet or combinations thereof; ^{13}C signals are singlets unless otherwise stated), coupling constants *J* in Hz, assignment.

Gas Chromatograph-Mass Spectrometer (GC-MS): All GC-MS were recorded on Agilent 5977B-7890B. Measured values are reported to 3 decimal places of the calculated value. The calculated values are based on the most abundant isotope.

Gas Chromatograph (GC): All GC were recorded on Fuli GC9790II.

Chromatography: Analytical thin layer chromatography was performed using Qingdao Puke Parting Materials Co. silica gel plates (Silicagel 60 F254). Visualisation was by ultraviolet fluorescence (λ = 254 nm) and/or staining with phosphomolybdic acid or potassium permanganate ($KMnO_4$). Flash column chromatography was performed using 200-300 mesh silica gel.

UV/Vis: Measurements were made on Shanghai JiaPeng technology co. ZF-7 Spectro Fluorophotometer.

Photoreactor: The photoreactors used in this research were purchased from Changji Engineering Lighting on Taobao (IP66-5054-YV35C2BAXV, Figure S1: 30W and 50 W blue LEDs).

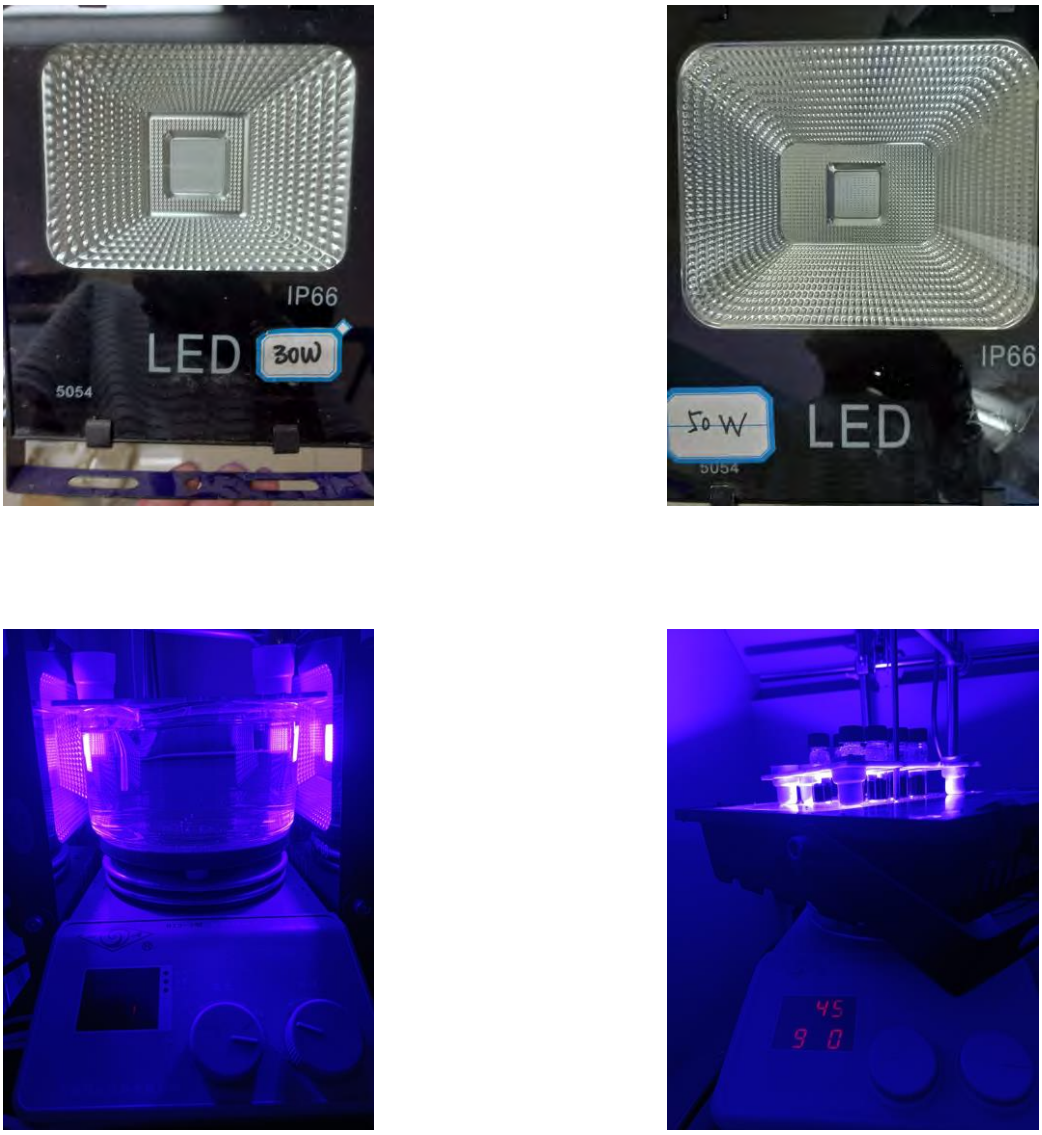


Figure S1. Photoreactor used in this research (30 W and 50 W blue LEDs)

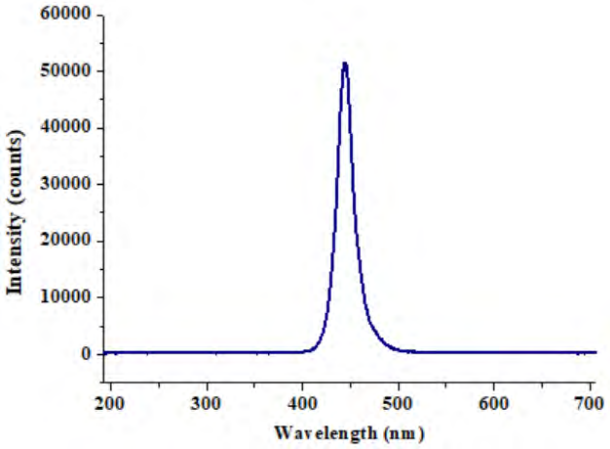
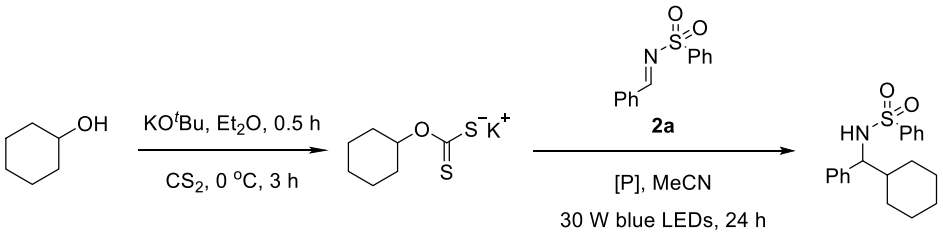


Figure S2. Emission spectra of the 30W blue LEDs, its emission wavelength range is from 401 nm to 510 nm, and its maximum emission wavelength is 444 nm. (The emission spectra was recorded on a Marine optical spectrometer USB2000+)

2. Detailed Optimization of Reaction Conditions

2.1 Optimization of Reaction Conditions of *N*-Sulfonylimide with Alcohols

Table S1. Screening of PR_3[a]

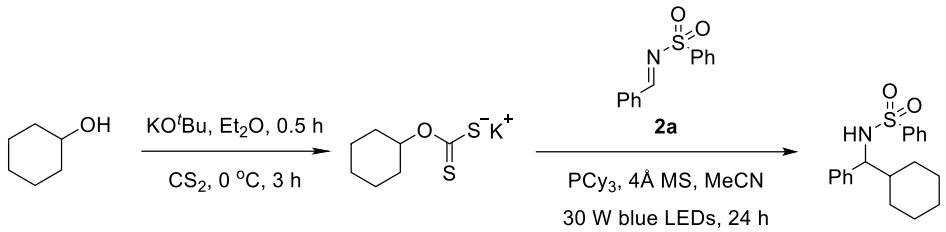


1a **XSa** **3aa**

Entry	PR_3	Yield (%)[b]
1	PCy_3	60
2	PPh_3	55
3	P^nBu_3	21
4	$P(4\text{-}OMeC_6H_4)_3$	22
5	PPh_2OEt	32
6	$P(C_8H_{17})_3$	38
7	$P(OEt)_3$	0
8	H_3PO_3	0

[a]Standard procedure: **1a** (0.30 mmol), KO^{t}Bu (1.05 equiv.), Et_2O (3.0 mL), CS_2 (5.0 equiv.), 3 h. After removing solvent in vacuo, then imine (1.5 equiv.), PR_3 (1.5 equiv.), MeCN (3.0 mL), 24 h 30 W blue LEDs irradiation. [b]Determined by GC analysis using 1,2,4,5-tetramethylbenzene as an internal standard.

Table S2. Screening of Additives[a]

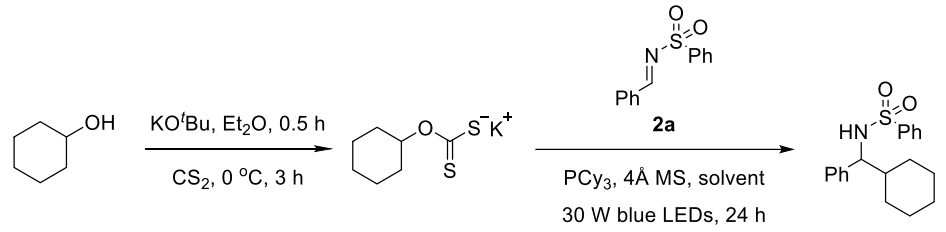


1a **XSa** **3aa**

Entry	Additives	Yield (%)[b]
1	3Å MS (45 mg)	61
2	4Å MS (45 mg)	68
3	5Å MS (45 mg)	61
4	Na_2SO_4 (45 mg)	59
5	$MgSO_4$ (45 mg)	58
6	Celite (45 mg)	58
7	none	60

[a]Standard procedure: **1a** (0.30 mmol), KO^{t}Bu (1.05 equiv.), Et_2O (3.0 mL), CS_2 (5.0 equiv.), 3 h. After removing solvent in vacuo, then imine (1.5 equiv.), PCy_3 (1.5 equiv.), additives (45 mg), MeCN (3.0 mL), 24 h 30 W blue LEDs irradiation. [b]Determined by GC analysis using 1,2,4,5-tetramethylbenzene as an internal standard.

Table S3. Screening of Solvents[a]

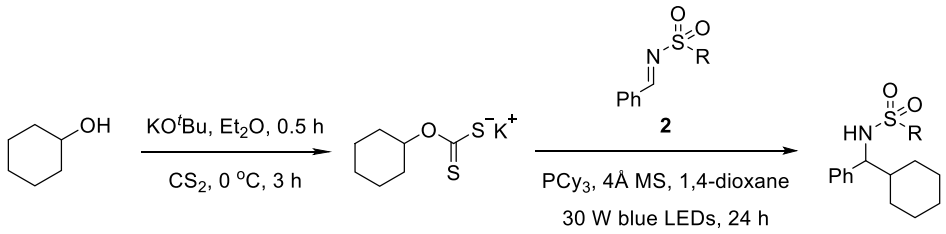


1a **XSa** **3aa**

Entry	Solvent (3.0 mL)	Yield (%)[b]
1	DCM	0
2	DMF	0
3	DMSO	0
4	THF	61
5	$PhCF_3$	66
6	DME	62
7	MeCN	68
8	1,4-dioxane	80

[a]Standard procedure: **1a** (0.30 mmol), KO^{t}Bu (1.05 equiv.), Et_2O (3.0 mL), CS_2 (5.0 equiv.), 3 h. After removing solvent in vacuo, then imine (1.5 equiv.), PCy_3 (1.5 equiv.), 4Å MS (45 mg), solvent (3.0 mL), 24 h 30 W blue LEDs irradiation. [b]Determined by GC analysis using 1,2,4,5-tetramethylbenzene as an internal standard.

Table S4. Screening of *N*-Sulfonylimide[a]

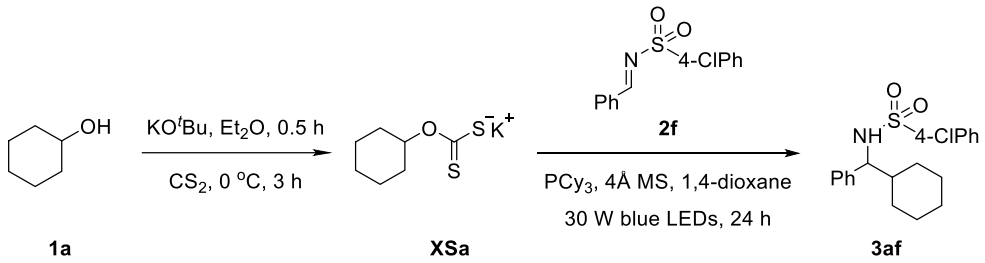


1a **XSa** **3**

Entry	R	Yield (%)[b]
1	Ph (**2a**)	80
2	PMP (**2b**)	65
3	4-MeC$_6$H$_4$ (**2c**)	66
4	4-CF$_3$C$_6$H$_4$ (**2d**)	85
5	4-FC$_6$H$_4$ (**2e**)	81
6	4-ClC$_6$H$_4$ (**2f**)	91(86)
7	Me (**2g**)	62

[a]Standard procedure: **1a** (0.30 mmol), KO^{t}Bu (1.05 equiv.), Et$_2$O (3.0 mL), CS$_2$ (5.0 equiv.), 3 h. After removing solvent in vacuo, then imine (1.5 equiv.), PCy$_3$ (1.5 equiv.), 4Å MS (45 mg), 1,4-dioxane (3.0 mL), 24 h 30 W blue LEDs irradiation. [b]Determined by GC analysis using 1,2,4,5-tetramethylbenzene as an internal standard.

Table S5. Control Experiments[a]



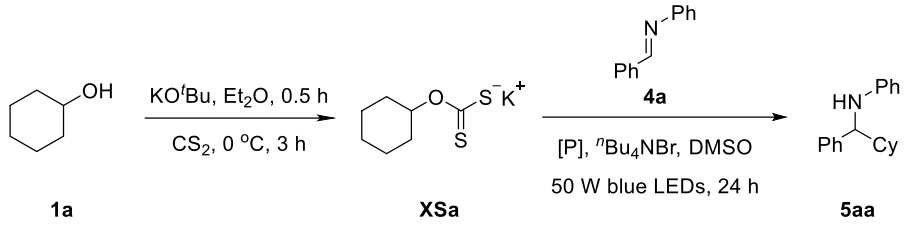
1a **XSa** **3af**

Entry	KO^{t}Bu	CS$_2$	light	PCy$_3$	4Å MS	Yield (%)[b]
1[c]	−	+	+	+	+	N.D.
2[d]	+	−	+	+	+	N.D.
3[e]	+	+	−	+	+	N.D.
4[f]	+	+	+	−	+	N.D.
5[g]	+	+	+	+	−	81
6[a]	+	+	+	+	+	91

[a]Standard procedure: **1a** (0.30 mmol), KO^{t}Bu (1.05 equiv.), Et$_2$O (3.0 mL), CS$_2$ (5.0 equiv.), 3 h. After removing solvent in vacuo, then imine (**2f**) (1.5 equiv.), PCy$_3$ (1.5 equiv.), 4Å MS (45 mg), 1,4-dioxane (3.0 mL), 24 h 30 W blue LEDs irradiation. [b]Determined by GC analysis using 1,2,4,5-tetramethylbenzene as an internal standard. [c]Without KO^{t}Bu. [d]Without CS$_2$. [e]Without light. [f]Without PCy$_3$. [g]Without 4Å MS.

2.2 Optimization of Reaction Conditions of Schiff Base with Alcohols

Table S6. Screening of PR_3[a]

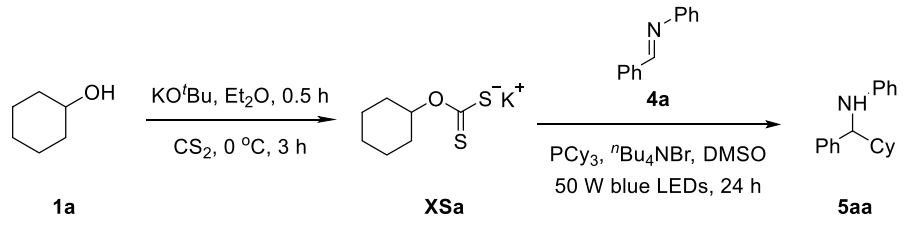


1a **XSa** **5aa**

Entry	PR_3	Yield (%)[b]
1	PCy_3	51
2	$P(Ada)_2{}^nBu$	42
3	P^tBu_3	6
4	$P(4\text{-}OMeC_6H_4)_3$	10
5	PPh_3	8
6	PPh_2Cy	28
7	$P(OEt)_3$	0
8	PPh_2OEt	0

[a]Standard procedure: **1a** (30.4 mg 0.30 mmol), KO^{t}Bu (36.5 mg, 1.05 equiv.), Et_2O (3 mL), CS_2 (114 mg, 5.0 equiv.), 3 h. After removing solvent in vacuo, then imine **4a** (111 mg 2.0 equiv.), PR_3 (2.0 equiv.), $^nBu_4NBr$ (50 mg, 0.50 equiv.), DMSO:$PhCF_3$ = 9:1 (3.0 mL), 24 h 50 W blue LEDs irradiation. [b]Determined by GC analysis using 1,2,4,5-tetramethylbenzene as an internal standard.

Table S7. Screening of Additives[a]

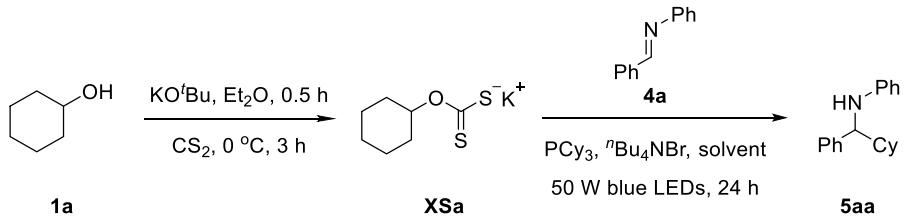


1a **XSa** **5aa**

Entry	Additive	Yield (%)[b]
1	3Å MS	21
2	4Å MS	24
3	5Å MS	19
4	Na_2SO_4	23
5	Et_4NOTf	44
6	Et_4NPF_6	42
7	$^nBu_4NOTf$	47
8	$^nBu_4NBr$	51
9	none	23

[a]Standard procedure: **1a** (30.4 mg 0.30 mmol), KO^{t}Bu (36.5 mg, 1.05 equiv.), Et_2O (3 mL), CS_2 (114 mg, 5.0 equiv.), 3 h. After removing solvent in vacuo, then imine **4a** (111 mg 2.0 equiv.), PCy_3 (172 mg, 2.0 equiv.), ^{n}Bu$_4$NBr (50 mg, 0.50 equiv.), DMSO:$PhCF_3$ = 9:1 (3.0 mL), 24 h 50 W blue LEDs irradiation. [b]Determined by GC analysis using 1,2,4,5-tetramethylbenzene as an internal standard.

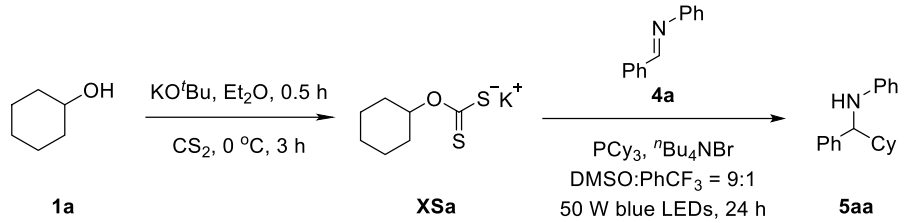
Table S8. Screening of Solvents[a]



Entry	Solvent (3.0 mL)	Yield (%)[b]
1	DCE	0
2	DMF	22
3	DMSO	51
4	THF	28
5	$PhCF_3$	11
6	DME	23
7	MeCN	22
8	1,4-dioxane	0
9	DMSO : DCE (9:1)	15
10	DMSO : 1,4-dioxane (9:1)	46
11	DMSO : THF (9:1)	47
12	DMSO : DME (9:1)	54
13	DMSO : MeCN (9:1)	33
14	DMSO : DMF (9:1)	52
15	DMSO : $PhCF_3$ (9:1)	84(81)

[a]Standard procedure: **1a** (30.4 mg 0.30 mmol), KO^{t}Bu (36.5 mg, 1.05 equiv.), Et_2O (3.0 mL), CS_2 (114 mg, 5.0 equiv.), 3 h. After removing solvent in vacuo, then imine **4a** (111 mg, 2.0 equiv.), PCy_3 (172 mg, 2.0 equiv.), ^{n}Bu$_4$NBr (50.0 mg, 0.50 equiv.), solvent (3.0 mL), 24 h 50 W blue LEDs irradiation. [b]Determined by GC analysis using 1,2,4,5-tetramethylbenzene as an internal standard.

Table S9. Control Experiments[a]

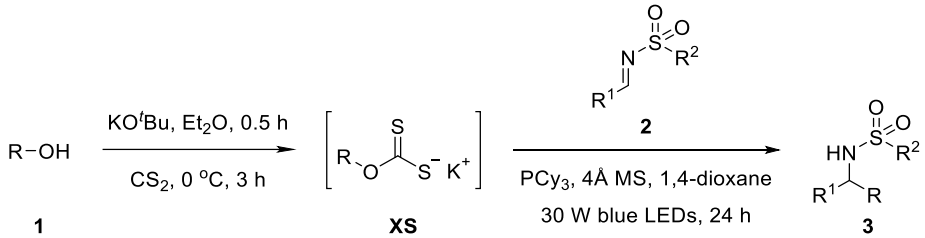


Entry	KO^{t}Bu	CS_2	light	PCy_3	^{n}Bu$_4$NBr	Yield (%)[b]
1[c]	−	+	+	+	+	N.D.
2[d]	+	−	+	+	+	N.D.
3[e]	+	+	−	+	+	N.D.
4[f]	+	+	+	−	+	N.D.
5[g]	+	+	+	+	−	24
6[a]	+	+	+	+	+	84

[a]Standard procedure: **1a** (30.4 mg 0.30 mmol), KO^{t}Bu (36.5 mg, 1.05 equiv.), Et_2O (3 mL), CS_2 (114 mg, 5.0 equiv.), 3 h. After removing solvent in vacuo, then imine **4a** (111 mg 2.0 equiv.), PCy_3 (172 mg, 2.0 equiv.), ^{n}Bu$_4$NBr (50 mg, 0.50 equiv.), DMSO:$PhCF_3$ = 9:1 (2.7:0.3 mL), 24 h 50 W blue LEDs irradiation. [b]Determined by GC analysis using 1,2,4,5-tetramethylbenzene as an internal standard. [c]Without KO^{t}Bu. [d]Without CS_2. [e]Without light. [f]Without PCy_3. [g]Without ^{n}Bu$_4$NBr.

3. General Procedure and Characterization Data of Products

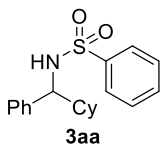
3.1 General Procedure for Deoxygenative Alkylation of Alcohols with *N*-Sulfonylimide



In a N_2-filled glovebox, an oven-dried 12 mL glass vial equipped with a magnetic stir bar was charged sequentially with alcohol **1** (0.30 mmol), KO^{t}Bu (35.3 mg, 0.32 mmol), and dry Et_2O (3.0 mL). After being sealed with a septum cap and transferred out of the glovebox, the reaction mixture was stirred at room temperature for 30 minutes, followed by the addition of CS_2 (114 mg, 90.0 μL, 1.5 mmol) via microsyringe at 0 ℃ and continued to be stirred for 3 hours at 0 ℃ before removing the solvent *in vacuo*. The system was transferred into the glovebox, then *N*-sulfonylimide **2** (0.45

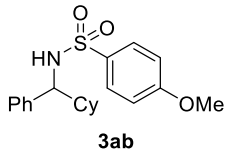
mmol), PCy_3 (129 mg, 0.45 mmol), 4Å MS (45 mg), and 1,4-dioxane (3.0 mL) were added. The vial was sealed with a septum cap and transferred out of the glovebox. The reaction mixture was irradiated with a 30 W blue LEDs lamp, maintained at ambient temperature, and stirred for 24 hours. The solvent was removed *in vacuo* and the residue was purified by column chromatography to afford the product.

3.2 Characterization Data of Products of *N*-Sulfonylimide with Alcohols



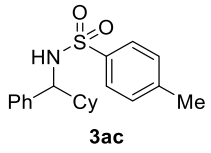
3aa

***N*-(Cyclohexyl(phenyl)methyl)benzenesulfonamide (3aa):** The title compound was isolated by eluting with petroleum ether and ethyl acetate (PE/EA = 25:1) as a white solid (79.0 mg, yield: 80%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.58 (m, 2H), 7.37 (m, 1H), 7.25 (m, 2H), 7.15 – 7.01 (m, 3H), 6.89 (m, 2H), 5.11 (d, *J* = 8.5 Hz, 1H), 4.14 – 4.06 (m, 1H), 2.02 – 1.89 (m, 1H), 1.80 – 1.69 (m, 1H), 1.58 (m, 3H), 1.29 (m, 1H), 1.17 – 0.79 (m, 5H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 140.7, 139.7, 132.0, 128.5, 128.1, 127.2, 127.1, 127.0, 63.5, 43.8, 29.8, 29.4, 26.1, 25.9 (2C). HRMS (EI): m/z $[M + H]^+$ calcd for $C_{19}H_{24}NO_2S$: 330.1522, found: 330.1523.



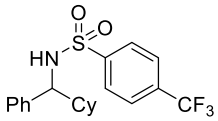
3ab

***N*-(Cyclohexyl(phenyl)methyl)-4-methoxybenzenesulfonamide (3ab):** The title compound was isolated by eluting with petroleum ether and ethyl acetate (PE/EA = 25:1) as a white solid (70.1 mg, yield: 65%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.53 (d, *J* = 8.5 Hz, 2H), 7.18 – 7.00 (m, 3H), 6.95 – 6.89 (m, 2H), 6.69 (d, *J* = 8.6 Hz, 2H), 5.66 (d, *J* = 8.4 Hz, 1H), 4.04 – 3.97 (m, 1H), 3.77 (s, 3H), 1.97 (d, *J* = 12.9 Hz, 1H), 1.79 – 1.46 (m, 4H), 1.35 – 0.75 (m, 6H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 162.4, 140.1, 132.5, 129.2, 128.1, 127.1, 127.0, 113.7, 63.6, 55.6, 43.8, 29.9, 29.6, 26.3, 26.0 (2C). HRMS (EI): m/z $[M + H]^+$ calcd for $C_{20}H_{26}NO_3S$: 360.1628, found: 360.1629.



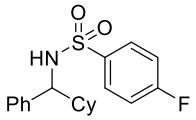
3ac

***N*-(Cyclohexyl(phenyl)methyl)-4-methylbenzenesulfonamide (3ac):** The title compound was isolated by eluting with petroleum ether and ethyl acetate (PE/EA = 25:1) as a white solid (67.9 mg, yield: 66%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.47 (d, *J* = 7.8 Hz, 2H), 7.17 – 6.96 (m, 5H), 6.96 – 6.83 (m, 2H), 5.42 (d, *J* = 8.6 Hz, 1H), 4.06 – 3.99 (m, 1H), 2.31 (s, 3H), 1.95 (d, *J* = 13.1 Hz, 1H), 1.78 – 1.67 (m, 1H), 1.66 – 1.48 (m, 3H), 1.27 (d, *J* = 13.1 Hz, 1H), 1.21 – 0.77 (m, 5H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 142.8, 140.1, 137.8, 129.2, 128.1, 127.1 (2C), 127.0, 63.6, 43.9, 29.9, 29.6, 26.3, 26.0 (2C), 21.5. HRMS (EI): m/z $[M + H]^+$ calcd for $C_{20}H_{26}NO_2S$: 344.1679, found: 344.1680.



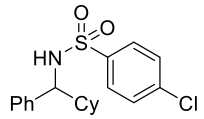
3ad

***N*-(Cyclohexyl(phenyl)methyl)-4-(trifluoromethyl)benzenesulfonamide (3ad):** The title compound was isolated by eluting with petroleum ether and ethyl acetate (PE/EA = 25:1) as a white solid (101.2 mg, yield: 85%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.64 (d, *J* = 8.0 Hz, 2H), 7.43 (d, *J* = 8.1 Hz, 2H), 7.05 (m, 3H), 6.83 (d, *J* = 7.0 Hz, 2H), 5.55 (d, *J* = 8.8 Hz, 1H), 4.11 – 4.04 (m, 1H), 2.02 (m, 1H), 1.81 – 1.69 (m, 1H), 1.67 – 1.50 (m, 3H), 1.27 (m, 1H), 1.21 – 0.77 (m, 5H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 144.3, 139.2, 133.7 (q, *J* = 33 Hz), 128.3, 127.6, 127.4, 127.1, 125.7 (q, *J* = 4 Hz), 123.3 (q, *J* = 265 Hz), 64.0, 43.7, 29.9, 29.8, 26.2, 25.9 (2C). HRMS (EI): m/z $[M + H]^+$ calcd for $C_{20}H_{23}F_3NO_2S$: 398.1396, found: 398.1396.



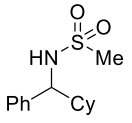
3ae

***N*-(Cyclohexyl(phenyl)methyl)-4-fluorobenzenesulfonamide (3ae):** The title compound was isolated by eluting with petroleum ether and ethyl acetate (PE/EA = 25:1) as a white solid (84.3 mg, yield: 81%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.58 – 7.51 (m, 2H), 7.09 (m, 3H), 6.99 – 6.75 (m, 4H), 5.24 (d, *J* = 8.6 Hz, 1H), 4.08 – 4.02 (m, 1H), 1.98 (d, *J* = 13.0 Hz, 1H), 1.81 – 1.68 (m, 1H), 1.67 – 1.51 (m, 3H), 1.25 (m, 1H), 1.18 – 0.81 (m, 5H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 164.7 (d, *J* = 253 Hz), 139.7, 136.9, 129.8 (d, *J* = 9 Hz), 128.3, 127.3, 127.1, 115.7 (d, *J* = 22 Hz), 63.7, 43.8, 29.9, 29.7, 26.3, 26.0 (2C). HRMS (EI): m/z $[M + H]^+$ calcd for $C_{19}H_{23}FNO_2S$: 348.1428, found: 348.1429.



3af

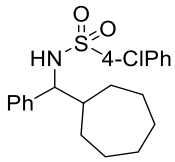
4-Chloro-*N*-(cyclohexyl(phenyl)methyl)benzenesulfonamide (3af): The title compound was isolated by eluting with petroleum ether and ethyl acetate (PE/EA = 25:1) as a white solid (93.9 mg, yield: 86%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.47 (d, *J* = 8.3 Hz, 2H), 7.17 (d, *J* = 8.3 Hz, 2H), 7.14 – 7.00 (m, 3H), 6.88 (m, 2H), 5.49 (d, *J* = 8.7 Hz, 1H), 4.08 – 4.01 (m, 1H), 2.04 – 1.92 (m, 1H), 1.78 – 1.69 (m, 1H), 1.57 (m, 3H), 1.27 (m, 1H), 1.19 – 0.77 (m, 5H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 139.6, 139.4, 138.5, 128.8, 128.5, 128.3, 127.3, 127.1, 63.8, 43.8, 29.9, 29.7, 26.3, 26.0 (2C). HRMS (EI): m/z $[M + H]^+$ calcd for $C_{19}H_{23}ClNO_2S$: 364.1133, found: 364.1133.



3ag

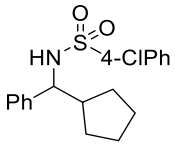
***N*-(Cyclohexyl(phenyl)methyl)methanesulfonamide (3ag):** The title compound was isolated by eluting with petroleum ether and ethyl acetate (PE/EA = 25:1) as a white solid (49.7 mg, yield: 62%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.40 – 7.21 (m, 5H), 5.39 (d, *J* = 8.9 Hz, 1H), 4.21 – 4.13 (m, 1H), 2.51 (s, 3H), 2.03 (m, 1H), 1.84 – 1.73 (m, 1H), 1.71 – 1.55 (m, 3H), 1.41 – 1.33 (m, 1H), 1.27 – 0.89 (m, 5H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 140.8, 128.8, 127.8,

127.3, 63.6, 43.7, 41.8, 30.0, 29.7, 26.3, 26.0, 25.9. HRMS (EI): m/z $[M + H]^+$ calcd for $C_{14}H_{22}NO_2S$: 268.1366, found: 268.1366.



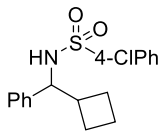
3bf

4-Chloro-*N*-(cycloheptyl(phenyl)methyl)benzenesulfonamide (3bf): The title compound was isolated by eluting with petroleum ether and ethyl acetate (PE/EA = 25:1) as a white solid (83.9 mg, yield: 74%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.42 (d, *J* = 8.2 Hz, 2H), 7.09 (d, *J* = 8.2 Hz, 2H), 7.11 – 7.03 (m, 3H), 6.87 – 6.78 (m, 2H), 5.70 (d, *J* = 8.9 Hz, 1H), 4.15 – 4.09 (m, 1H), 1.93 – 1.85 (m, 1H), 1.82 – 1.74 (m, 1H), 1.54 (m, 1H), 1.50 – 1.12 (m, 9H), 1.12 – 1.01 (m, 1H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 139.8, 139.2, 128.7, 128.4, 128.1, 127.0 (2C), 63.7, 45.2, 31.3, 30.0, 28.2, 28.0, 26.4, 26.3. HRMS (EI): m/z $[M + H]^+$ calcd for $C_{20}H_{25}ClNO_2S$: 378.1289, found: 378.1291.



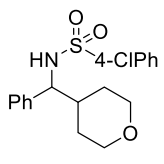
3cf

4-Chloro-*N*-(cyclopentyl(phenyl)methyl)benzenesulfonamide (3cf): The title compound was isolated by eluting with petroleum ether and ethyl acetate (PE/EA = 25:1) as a white solid (85.1 mg, yield: 81%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.49 (d, *J* = 8.2 Hz, 2H), 7.18 (d, *J* = 8.3 Hz, 2H), 7.11 – 7.03 (m, 3H), 7.01 – 6.89 (m, 2H), 5.87 (d, *J* = 8.2 Hz, 1H), 4.08 – 4.01 (m, 1H), 2.20 – 2.08 (m, 1H), 1.95 – 1.83 (m, 1H), 1.72 – 1.37 (m, 5H), 1.31 – 1.20 (m, 1H), 1.10 – 0.97 (m, 1H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 140.4, 139.3, 138.3, 128.6, 128.4, 128.2, 127.2, 126.9, 63.4, 46.5, 30.2, 30.0, 25.1, 25.0. HRMS (EI): m/z $[M + H]^+$ calcd for $C_{18}H_{21}ClNO_2S$: 350.0976, found: 350.0976.



3df

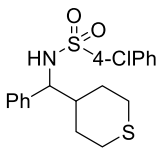
4-Chloro-*N*-(cyclobutyl(phenyl)methyl)benzenesulfonamide (3df): The title compound was isolated by eluting with petroleum ether and ethyl acetate (PE/EA = 25:1) as a white solid (44.4 mg, yield: 44%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.42 (d, *J* = 8.3 Hz, 2H), 7.12 (d, *J* = 8.4 Hz, 2H), 7.03 (m, 3H), 6.87 (d, *J* = 6.9 Hz, 2H), 5.32 (d, *J* = 7.6 Hz, 1H), 4.24 – 4.17 (m, 1H), 2.46 (m, 1H), 2.05 – 1.92 (m, 1H), 1.81 – 1.53 (m, 5H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 139.2, 138.9, 138.5, 128.7, 128.4, 128.3, 127.4, 126.8, 63.5, 41.1, 25.8, 25.1, 17.2. HRMS (EI): m/z $[M + H]^+$ calcd for $C_{17}H_{19}ClNO_2S$: 336.0820, found: 336.0821.



3ef

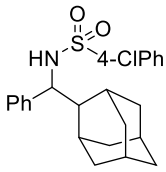
4-Chloro-*N*-((2,3-dihydro-1-H-inden-2-yl)(phenyl)methyl)benzenesulfonamide (3ef): The title compound was isolated by eluting with petroleum ether and ethyl acetate (PE/EA = 25:1) as a white solid (60.4 mg, yield: 55%). ^{1}H NMR (400 MHz,

$CDCl_3$) δ 7.49 (d, *J* = 8.3 Hz, 2H), 7.23 – 7.06 (m, 5H), 6.94 – 6.80 (m, 2H), 5.74 (d, *J* = 9.2 Hz, 1H), 4.08 – 4.01 (m, 1H), 3.67 – 3.43 (m, 4H), 2.36 – 2.25 (m, 1H), 1.67 – 1.55 (m, 2H), 1.46 – 1.21 (m, 2H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 138.9, 138.7, 138.5, 128.8, 128.4, 128.4, 127.5, 126.9, 63.4, 43.2, 30.9, 30.6, 28.4, 28.3. HRMS (EI): m/z $[M + H]^+$ calcd for $C_{18}H_{21}ClNO_3S$: 366.0925, found: 366.0927.



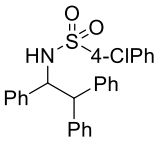
3ff

4-Chloro-*N*-(phenyl(tetrahydro-2-H-thiopyran-4-yl)methyl)benzenesulfonamide (3ff): The title compound was isolated by eluting with petroleum ether and ethyl acetate (PE/EA = 25:1) as a white solid (71.1 mg, yield: 62%). ^1H NMR (400 MHz, $CDCl_3$) δ 7.49 (d, *J* = 8.3 Hz, 2H), 7.23 – 7.06 (m, 5H), 6.87 (d, *J* = 7.0 Hz, 2H), 5.74 (d, *J* = 9.2 Hz, 1H), 4.09 – 4.02 (m, 1H), 2.67 – 2.43 (m, 4H), 2.36 – 2.25 (m, 1H), 1.67 – 1.55 (m, 2H), 1.46 – 1.21 (m, 2H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 138.9, 138.7, 138.5, 128.8, 128.4, 128.4, 127.5, 126.9, 63.4, 43.2, 30.9, 30.6, 28.4, 28.3. HRMS (EI): m/z $[M + H]^+$ calcd for $C_{18}H_{21}ClNO_2S_2$: 382.0697, found: 382.0698.



3gf

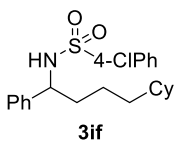
***N*-(((1r,3r,5r,7r)-Adamantan-2-yl)(phenyl)methyl)-4-chlorobenzenesulfonamide (3gf):** The title compound was isolated by eluting with petroleum ether and ethyl acetate (PE/EA = 25:1) as a white solid (74.9 mg, yield: 60%). ^1H NMR (400 MHz, $CDCl_3$) δ 7.34 (d, *J* = 8.3 Hz, 2H), 7.03 (m, 5H), 6.84 (d, *J* = 7.0 Hz, 2H), 5.05 (m, 1H), 4.48 (m, 1H), 2.22 (m, 1H), 1.98 – 1.84 (m, 2H), 1.81 – 1.76 (m, 2H), 1.72 – 1.68 (m, 1H), 1.64 – 1.50 (m, 5H), 1.42 (m, 1H), 1.34 – 1.25 (m, 1H), 1.19 (m, 1H), 1.05 (m, 1H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 139.9, 139.4, 138.4, 128.7, 128.5, 128.4, 127.4, 126.9, 59.3, 50.1, 38.9, 38.8, 38.1, 31.6, 31.3, 28.6, 28.5, 27.9, 27.6. HRMS (EI): m/z $[M + H]^+$ calcd for $C_{23}H_{27}ClNO_2S$: 416.1446, found: 416.1445.



3hf

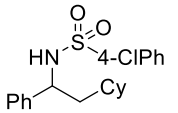
4-Chloro-*N*-(1,2-diphenylethyl)benzenesulfonamide (3hf): The title compound was isolated by eluting with petroleum ether and ethyl acetate (PE/EA = 25:1) as a white solid (56.3 mg, yield: 42%). ^1H NMR (400 MHz, $CDCl_3$) δ 7.26 – 7.15 (m, 7H), 7.04 (d, *J* = 8.3 Hz, 2H), 7.01 – 6.83 (m, 8H), 6.77 (d, *J* = 7.5 Hz, 2H), 5.03 (dd, *J* = 10.3,

5.0 Hz, 1H), 4.94 – 4.81 (m, 1H), 4.03 (d, *J* = 10.3 Hz, 1H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 140.3, 139.6, 138.7, 138.5, 138.4, 129.2, 128.7, 128.6, 128.5, 128.4, 128.3, 127.9, 127.8, 127.5, 127.3, 126.7, 61.3, 58.6. HRMS (EI): m/z $[M + H]^+$ calcd for $C_{26}H_{23}ClNO_2S$: 448.1133, found: 448.1135.



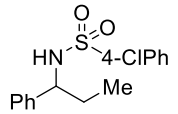
3if

4-Chloro-*N*-(4-cyclohexyl-1-phenylbutyl)benzenesulfonamide (3if): The title compound was isolated by eluting with petroleum ether and ethyl acetate (PE/EA = 25:1) as a white solid (65.8 mg, yield: 54%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.52 (d, *J* = 8.2 Hz, 2H), 7.23 (d, *J* = 8.2 Hz, 2H), 7.17 – 7.09 (m, 3H), 7.01 – 6.95 (m, 2H), 5.33 (d, *J* = 7.6 Hz, 1H), 4.32 – 4.25 (m, 1H), 1.76 – 1.52 (m, 7H), 1.32 – 0.98 (m, 8H), 0.83 – 0.70 (m, 2H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 140.8, 139.4, 1387, 128.9, 128.6, 128.5, 127.5, 126.6, 58.7, 38.0, 37.5, 37.0, 33.4, 33.3, 26.8, 26.5 (2C), 23.3. HRMS (EI): m/z $[M + H]^+$ calcd for $C_{22}H_{29}ClNO_2S$: 406.1602, found: 406.1603.



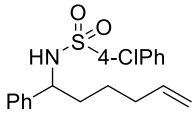
3jf

4-Chloro-*N*-(2-cyclohexyl-1-phenylethyl)benzenesulfonamide (3jf): The title compound was isolated by eluting with petroleum ether and ethyl acetate (PE/EA = 25:1) as a white solid (51.0 mg, yield: 45%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.51 (d, *J* = 8.2 Hz, 2H), 7.22 (d, *J* = 8.3 Hz, 2H), 7.15 – 7.09 (m, 3H), 7.02 – 6.93 (m, 2H), 5.33 (d, *J* = 7.7 Hz, 1H), 4.44 – 4.36 (m, 1H), 1.57 (m, 7H), 1.11 (m, 4H), 0.93 – 0.77 (m, 2H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 141.1, 139.4, 138.6, 128.9, 128.6, 128.5, 127.5, 126.6, 56.1, 45.7, 34.0, 33.3, 32.9, 26.5, 26.2, 26.1. HRMS (EI): m/z $[M + H]^+$ calcd for $C_{20}H_{25}ClNO_2S$: 378.1289, found: 378.1289.



3kf

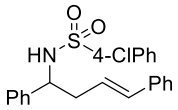
4-Chloro-*N*-(1-phenylpropyl)benzenesulfonamide (3kf): The title compound was isolated by eluting with petroleum ether and ethyl acetate (PE/EA = 25:1) as a white solid (38.9 mg, yield: 42%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.52 (d, *J* = 8.2 Hz, 2H), 7.23 (d, *J* = 8.2 Hz, 2H), 7.16 – 7.11 (m, 3H), 7.00 – 6.95 (m, 2H), 5.33 (d, *J* = 7.6 Hz, 1H), 4.25 – 4.18 (m, 1H), 1.87 – 1.65 (m, 2H), 0.81 (t, *J* = 7.4 Hz, 1H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 140.3, 139.4, 138.7, 128.9, 128.6, 128.5, 127.6, 126.7, 60.2, 30.8, 10.7. HRMS (EI): m/z $[M + H]^+$ calcd for $C_{15}H_{17}ClNO_2S$: 310.0663, found: 310.0665.



3lf

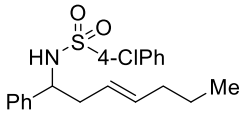
4-Chloro-*N*-(1-phenylhex-5-en-1-yl)benzenesulfonamide (3lf): The title compound was isolated by eluting with petroleum ether and ethyl acetate (PE/EA = 25:1) as a white solid (45.2 mg, yield: 43%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.51 (d, *J* = 8.5 Hz, 2H), 7.23 (d, *J* = 8.5 Hz, 2H), 7.18 – 7.09 (m, 3H), 7.00 – 6.94 (m, 2H), 5.76 – 5.61 (m,

1H), 5.35 – 5.20 (m, 1H), 4.97 – 4.88 (m, 2H), 4.35 – 4.26 (m, 1H), 2.04 – 1.94 (m, 2H), 1.80 – 1.62 (m, 2H), 1.44 – 1.19 (m, 2H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 140.5, 139.4, 138.7, 138.0, 129.0, 128.6, 128.5, 127.7, 126.6, 115.2, 58.6, 37.1, 33.2, 25.2. HRMS (EI): m/z $[M + H]^+$ calcd for $C_{18}H_{21}ClNO_2S$: 350.0976, found: 350.0978.



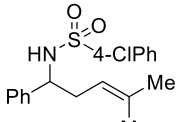
3mf

4-Chloro-*N*-(1,4-diphenylbut-3-en-1-yl)benzenesulfonamide (3mf): The title compound was isolated by eluting with petroleum ether and ethyl acetate (PE/EA = 25:1) as a white solid (86.0 mg, yield: 72%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.47 (d, *J* = 8.3 Hz, 2H), 7.23 – 7.08 (m, 10H), 7.05 – 6.99 (m, 2H), 6.31 (d, *J* = 15.8 Hz, 1H), 5.82 – 5.72 (m, 1H), 5.26 – 5.15 (m, 1H), 4.43 – 4.36 (m, 1H), 2.59 – 2.48 (m, 2H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 140.1, 139.0, 138.9, 136.6, 134.2, 129.0, 128.6, 128.6, 128.5, 127.7, 127.6, 126.5, 126.2, 124.2, 57.8, 41.2. HRMS (EI): m/z $[M + H]^+$ calcd for $C_{22}H_{21}ClNO_2S$: 398.0976, found: 398.0978.



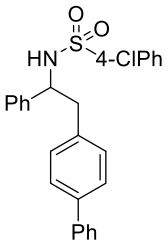
3nf

4-Chloro-*N*-(cyclohex-2-en-1-yl(phenyl)methyl)benzenesulfonamide (3nf): The title compound was isolated by eluting with petroleum ether and ethyl acetate (PE/EA = 25:1) as a white solid (55.7 mg, yield: 51%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.47 (d, *J* = 8.5 Hz, 2H), 7.19 (d, *J* = 8.4 Hz, 2H), 7.13 – 7.04 (m, 3H), 7.00 – 6.92 (m, 2H), 5.50 – 5.40 (m, 1H), 5.25 – 5.05 (m, 2H), 4.38 – 4.30 (m, 1H), 2.52 – 2.32 (m, 2H), 1.93 – 1.82 (m, 2H), 1.34 – 1.21 (m, 2H), 0.77 (t, *J* = 7.4 Hz, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 140.3, 139.3, 138.8, 135.9, 128.9, 128.6, 128.5, 127.5, 126.8, 124.4, 57.9, 40.9, 34.7, 22.5, 22.4, 13.7. HRMS (EI): m/z $[M + H]^+$ calcd for $C_{19}H_{23}ClNO_2S$: 364.1133, found: 364.1135.



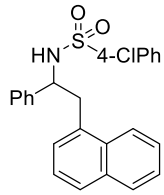
3of

4-Chloro-*N*-(4-methyl-1-phenylpent-3-en-1-yl)benzenesulfonamide (3of): The title compound was isolated by eluting with petroleum ether and ethyl acetate (PE/EA = 25:1) as a white solid (50.4 mg, yield: 48%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.48 (d, *J* = 8.4 Hz, 2H), 7.20 (d, *J* = 8.2 Hz, 2H), 7.13 – 7.06 (m, 3H), 7.01 – 6.95 (m, 2H), 5.13 – 5.00 (m, 1H), 4.81 (t, *J* = 7.4 Hz, 1H), 4.30 – 4.22 (m, 1H), 2.39 – 2.26 (m, 2H), 1.55 (s, 3H), 1.44 (s, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 140.4, 139.1, 138.7, 136.4, 128.9, 128.7, 128.4, 127.4, 126.6, 118.5, 58.1, 36.3, 25.8, 17.9. HRMS (EI): m/z $[M + H]^+$ calcd for $C_{18}H_{21}ClNO_2S$: 350.0976, found: 350.0978.



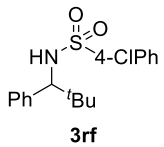
3pf

***N*-([1,1'-Biphenyl]-4-yl(phenyl)methyl)-4-chlorobenzenesulfonamide (3pf):** The title compound was isolated by eluting with petroleum ether and ethyl acetate (PE/EA = 25:1) as a white solid (80.6 mg, yield: 60%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.57 (d, *J* = 7.5 Hz, 2H), 7.48 – 7.33 (m, 7H), 7.23 – 7.16 (m, 5H), 7.13 – 7.08 (m, 2H), 6.94 (d, *J* = 7.8 Hz, 2H), 5.30 – 5.20 (m, 1H), 4.62 – 4.54 (m, 1H), 3.11 – 2.93 (m, 2H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 140.5, 140.3, 139.9, 138.8, 138.7, 135.4, 129.8, 128.9 (2C), 128.6, 128.4, 127.8, 127.5, 127.3, 127.0, 126.8, 59.4, 43.7. HRMS (EI): m/z $[M + H]^+$ calcd for $C_{26}H_{23}ClNO_2S$: 448.1133, found: 448.1137.



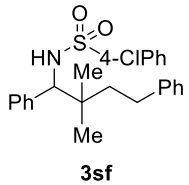
3qf

4-Chloro-*N*-(2-(naphthaleN-1-yl)-1-phenylethyl)benzenesulfonamide (3qf): The title compound was isolated by eluting with petroleum ether and ethyl acetate (PE/EA = 25:1) as a white solid (64.6 mg, yield: 51%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.83 – 7.70 (m, 2H), 7.61 (d, *J* = 8.2 Hz, 1H), 7.44 – 7.33 (m, 2H), 7.21 – 7.13 (m, 6H), 7.07 (d, *J* = 8.6 Hz, 2H), 7.00 (d, *J* = 6.9 Hz, 1H), 6.82 (d, *J* = 8.5 Hz, 2H), 5.30 – 5.18 (m, 1H), 4.58 – 4.50 (m, 1H), 3.40 (dd, *J* = 14.4, 5.4 Hz, 1H), 3.16 (dd, *J* = 14.3, 9.6 Hz, 1H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 141.3, 138.4, 137.7, 134.0, 132.4, 131.5, 129.1, 128.7, 128.6, 128.0, 127.9, 127.8, 127.8, 126.5, 126.4, 125.9, 125.3, 123.0, 58.4, 41.9. HRMS (EI): m/z $[M + H]^+$ calcd for $C_{24}H_{21}ClNO_2S$: 422.0976, found: 422.0979.



3rf

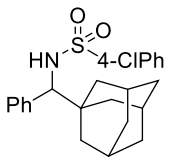
4-Chloro-*N*-(2,2-dimethyl-1-phenylpropyl)benzenesulfonamide (3rf): The title compound was isolated by eluting with petroleum ether and ethyl acetate (PE/EA = 25:1) as a white solid (62.9 mg, yield: 62%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.40 (d, *J* = 8.2 Hz, 2H), 7.13 – 6.99 (m, 5H), 6.80 (d, *J* = 7.0 Hz, 2H), 5.79 (d, *J* = 9.9 Hz, 1H), 4.09 – 4.00 (m, 1H), 0.91 (s, 9H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 138.9, 138.5, 137.9, 128.7, 128.6, 128.2, 127.8, 127.1, 67.3, 35.4, 31.4, 26.7 (3C). HRMS (EI): m/z $[M + H]^+$ calcd for $C_{17}H_{21}ClNO_2S$: 338.0976, found: 338.0976.



3sf

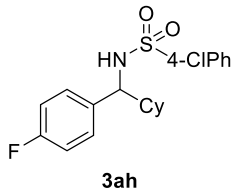
4-Chloro-*N*-(2,2-dimethyl-1,4-diphenylbutyl)benzenesulfonamide (3sf): The title compound was isolated by eluting with petroleum ether and ethyl acetate (PE/EA = 25:1) as a white solid (59.1 mg, yield: 46%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.43 – 7.36 (m, 2H), 7.25 – 7.21 (m, 2H), 7.18 – 7.11 (m, 4H), 7.08 – 6.99 (m, 4H), 6.87 – 6.82 (m, 2H), 5.67 (d, *J* = 9.9 Hz, 1H), 4.17 (d, *J* = 9.9 Hz, 1H), 2.62 – 2.45 (m, 2H), 1.57 – 1.44 (m,

2H), 0.94 (s, 3H), 0.87 (s, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 142.7, 138.9, 138.5, 137.5, 128.7, 128.5 (3C), 128.4, 127.9, 127.2, 125.9, 65.7, 41.7, 38.0, 30.2, 23.9, 23.4. HRMS (EI): m/z $[M + H]^+$ calcd for $C_{24}H_{27}ClNO_2S$: 428.1446, found: 428.1445.



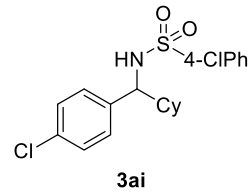
3tf

***N*-((Adamantan-1-yl)(phenyl)methyl)-4-chlorobenzenesulfonamide (3tf):** The title compound was isolated by eluting with petroleum ether and ethyl acetate (PE/EA = 25:1) as a white solid (54.9 mg, yield: 44%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.34 (d, *J* = 8.3 Hz, 2H), 7.03 (m, 5H), 6.84 (d, *J* = 7.0 Hz, 2H), 5.05 (m, 1H), 4.48 (m, 1H), 2.22 (m, 1H), 1.98 – 1.84 (m, 2H), 1.81 – 1.76 (m, 2H), 1.72 – 1.68 (m, 1H), 1.64 – 1.50 (m, 5H), 1.42 (m, 1H), 1.34 – 1.25 (m, 1H), 1.19 (m, 1H), 1.05 (m, 1H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 139.3, 138.7, 138.0, 128.6, 128.4, 128.3, 127.3, 126.8, 59.2, 50.0, 38.8, 38.7, 38.0, 31.5, 31.2, 28.5, 28.4, 27.8, 27.5. HRMS (EI): m/z $[M + H]^+$ calcd for $C_{23}H_{27}ClNO_2S$: 416.1446, found: 416.1446.



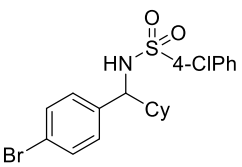
3ah

4-Chloro-*N*-(cyclohexyl(4-fluorophenyl)methyl)benzenesulfonamide (3ah): The title compound was isolated by eluting with petroleum ether and ethyl acetate (PE/EA = 25:1) as a white solid (97.4 mg, yield: 85%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.51 (d, *J* = 8.3 Hz, 2H), 7.23 (d, *J* = 8.3 Hz, 2H), 6.91 – 6.85 (m, 2H), 6.83 – 6.76 (m, 2H), 5.71 (d, *J* = 8.4 Hz, 1H), 4.06 – 3.99 (m, 1H), 1.98 – 1.90 (m, 1H), 1.76 – 1.67 (m, 1H), 1.66 – 1.45 (m, 3H), 1.30 – 1.20 (m, 1H), 1.20 – 0.73 (m, 5H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 161.9 (d, *J* = 244 Hz), 139.3, 138.8, 135.5 (d, *J* = 4 Hz), 128.9, 128.7 (d, *J* = 8 Hz), 128.5, 115.1 (d, *J* = 22 Hz), 63.1, 43.8, 29.8, 29.7, 26.2, 25.9 (2C). HRMS (EI): m/z $[M + H]^+$ calcd for $C_{19}H_{22}ClFNO_2S$: 382.1038, found: 382.1038.



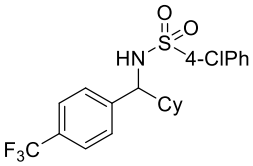
3ai

4-Chloro-*N*-((4-chlorophenyl)(cyclohexyl)methyl)benzenesulfonamide (3ai): The title compound was isolated by eluting with petroleum ether and ethyl acetate (PE/EA = 25:1) as a white solid (99.1 mg, yield: 83%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.54 (d, *J* = 8.3 Hz, 2H), 7.25 (d, *J* = 8.3 Hz, 2H), 7.08 (d, *J* = 8.0 Hz, 2H), 6.88 (d, *J* = 8.1 Hz, 2H), 6.12 – 5.94 (m, 1H), 4.06 – 3.99 (m, 1H), 1.99 – 1.88 (m, 1H), 1.77 – 1.67 (m, 1H), 1.66 – 1.47 (m, 3H), 1.26 (m, 1H), 1.21 – 0.76 (m, 5H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 139.1, 138.8, 138.1, 133.1, 128.8, 128.5, 128.4, 128.3, 63.1, 43.5, 29.6, 29.5, 26.1, 25.8 (2C). HRMS (EI): m/z $[M + H]^+$ calcd for $C_{19}H_{22}Cl_2NO_2S$: 398.0743, found: 398.0745.



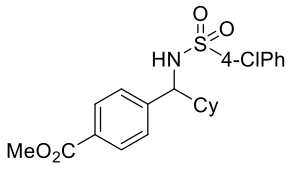
3aj

***N*-((4-Bromophenyl)(cyclohexyl)methyl)-4-chlorobenzenesulfonamide (3aj):** The title compound was isolated by eluting with petroleum ether and ethyl acetate (PE/EA = 25:1) as a white solid (110.3 mg, yield: 83%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.44 (d, *J* = 8.2 Hz, 2H), 7.16 (m, 4H), 6.73 (d, *J* = 8.0 Hz, 2H), 5.77 (d, *J* = 8.2 Hz, 1H), 3.96 – 3.89 (m, 1H), 1.89 – 1.81 (m, 1H), 1.71 – 1.58 (m, 1H), 1.58 – 1.38 (m, 3H), 1.23 – 1.13 (m, 1H), 1.09 – 0.68 (m, 5H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 139.1, 138.9, 138.7, 131.3, 129.0, 128.9, 128.4, 121.2, 63.1, 43.4, 29.7, 29.6, 26.1, 25.9 (2C). HRMS (EI): m/z [M + H]$^+$ calcd for $C_{19}H_{22}BrClNO_2S$: 442.0238, found: 442.0240.



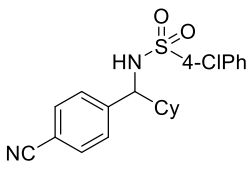
3ak

4-Chloro-*N*-(cyclohexyl(4-(trifluoromethyl)phenyl)methyl)benzenesulfonamide (3ak): The title compound was isolated by eluting with petroleum ether and ethyl acetate (PE/EA = 25:1) as a white solid (110.1 mg, yield: 86%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.48 (d, *J* = 8.3 Hz, 2H), 7.36 (d, *J* = 7.9 Hz, 2H), 7.19 (d, *J* = 8.2 Hz, 2H), 7.05 (d, *J* = 7.9 Hz, 2H), 5.89 – 5.60 (m, 1H), 4.15 – 4.08 (m, 1H), 1.98 – 1.89 (m, 1H), 1.77 – 1.69 (m, 1H), 1.68 – 1.50 (m, 3H), 1.28 – 1.20 (m, 1H), 1.18 – 0.77 (m, 5H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 143.7, 139.0, 138.9, 129.7 (q, *J* = 33 Hz), 129.0, 128.5, 127.7, 125.2 (q, *J* = 4 Hz), 124.0 (q, *J* = 271 Hz), 63.4, 43.5, 29.8, 29.5, 26.1, 25.9 (2C). HRMS (EI): m/z [M + H]$^+$ calcd for $C_{20}H_{22}ClF_3NO_2S$: 432.1006, found: 432.1006.



3al

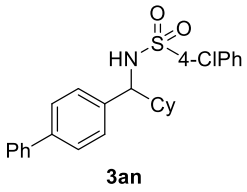
4-Chloro-*N*-(cyclohexyl(*p*-tolyl)methyl)benzenesulfonamide compound with carbon dioxide (3al): The title compound was isolated by eluting with petroleum ether and ethyl acetate (PE/EA = 25:1) as a white solid (107.6 mg, yield: 85%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.79 (d, *J* = 7.9 Hz, 2H), 7.50 (d, *J* = 8.2 Hz, 2H), 7.20 (d, *J* = 8.3 Hz, 2H), 7.01 (d, *J* = 8.0 Hz, 2H), 5.49 (d, *J* = 8.3 Hz, 1H), 4.16 – 4.08 (m, 1H), 3.90 (s, 3H), 1.95 – 1.86 (m, 1H), 1.78 – 1.68 (m, 1H), 1.63 – 1.49 (m, 3H), 1.28 – 1.22 (m, 1H), 1.18 – 0.78 (m, 5H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 166.7, 144.9, 139.1, 138.9, 129.6, 129.3, 129.0, 128.5, 127.2, 63.4, 52.3, 43.7, 29.8, 29.5, 26.1, 25.9 (2C). HRMS (EI): m/z [M + H]$^+$ calcd for $C_{21}H_{25}ClNO_4S$: 422.1187, found: 422.1188.



3am

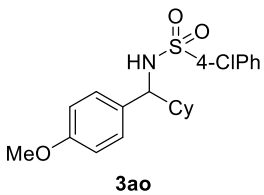
4-Chloro-*N*-((4-cyanophenyl)(cyclohexyl)methyl)benzenesulfonamide (3am): The title compound was isolated by eluting with petroleum ether and ethyl acetate (PE/EA = 25:1) as a white solid (95.7 mg, yield: 82%). ^{1}H NMR

(400 MHz, $CDCl_3$) δ 7.56 (d, *J* = 8.7 Hz, 2H), 7.45 (d, *J* = 8.0 Hz, 2H), 7.28 (d, *J* = 8.4 Hz, 2H), 7.11 (d, *J* = 8.0 Hz, 2H), 5.98 (d, *J* = 8.2 Hz, 1H), 4.13 – 4.06 (m, 1H), 1.89 – 1.82 (m, 1H), 1.75 – 1.67 (m, 1H), 1.66 – 1.49 (m, 3H), 1.29 – 1.17 (m, 1H), 1.16 – 0.77 (m, 5H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 145.7, 139.2, 138.8, 132.0, 129.1, 128.4, 128.0, 118.5, 111.1, 63.2, 43.5, 29.7, 29.2, 26.0, 25.8 (2C). HRMS (EI): m/z $[M + H]^+$ calcd for $C_{20}H_{22}ClN_2O_2S$: 389.1085, found: 389.1085.



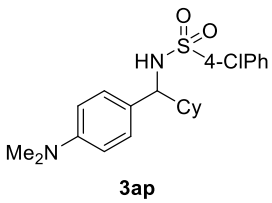
3an

***N*-([1,1'-Biphenyl]-4-yl(cyclohexyl)methyl)-4-chlorobenzenesulfonamide (3an):** The title compound was isolated by eluting with petroleum ether and ethyl acetate (PE/EA = 25:1) as a white solid (100.3 mg, yield: 76%). ^1H NMR (400 MHz, $CDCl_3$) δ 7.54 – 7.48 (m, 4H), 7.46 – 7.40 (m, 2H), 7.37 – 7.28 (m, 3H), 7.19 – 7.15 (m, 2H), 6.99 – 6.94 (m, 2H), 5.85 (d, *J* = 9.5 Hz, 1H), 4.16 – 4.08 (m, 1H), 2.08 – 2.00 (m, 1H), 1.80 – 1.72 (m, 1H), 1.68 – 1.56 (m, 3H), 1.39 – 1.32 (m, 1H), 1.22 – 0.84 (m, 5H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 140.6, 140.3, 139.3, 138.4, 138.3, 128.8, 128.7, 128.5, 127.5, 127.4, 127.1, 126.9, 63.5, 43.5, 29.8, 29.7, 26.2, 25.9 (2C). HRMS (EI): m/z $[M + H]^+$ calcd for $C_{25}H_{27}ClNO_2S$: 440.1446, found: 440.1446.



3ao

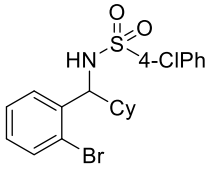
4-Chloro-*N*-(cyclohexyl(4-methoxyphenyl)methyl)benzenesulfonamide (3ao): The title compound was isolated by eluting with petroleum ether and ethyl acetate (PE/EA = 25:1) as a white solid (75.4 mg, yield: 70%). ^1H NMR (400 MHz, $CDCl_3$) δ 7.47 (d, *J* = 8.2 Hz, 2H), 7.18 (d, *J* = 8.2 Hz, 2H), 6.78 (d, *J* = 8.2 Hz, 2H), 6.60 (d, *J* = 8.2 Hz, 2H), 5.53 (d, *J* = 8.6 Hz, 1H), 4.01 – 3.95 (m, 1H), 3.73 (s, 3H), 2.02 – 1.94 (m, 1H), 1.76 – 1.67 (m, 1H), 1.64 – 1.47 (m, 3H), 1.31 – 1.23 (m, 1H), 1.15 – 0.75 (m, 5H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 158.7, 139.4, 131.6, 128.6, 128.4, 128.1, 113.5, 63.3, 55.3, 43.6, 29.8, 29.7, 26.2, 25.9 (2C). HRMS (EI): m/z $[M + H]^+$ calcd for $C_{20}H_{25}ClNO_3S$: 394.1238, found: 394.1240.



3ap

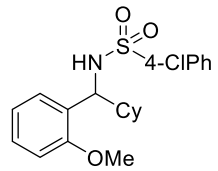
4-Chloro-*N*-(cyclohexyl(4-(dimethylamino)phenyl)methyl)benzenesulfonamide (3ap): The title compound was isolated by eluting with petroleum ether and ethyl acetate (PE/EA = 25:1) as a yellow solid (57.4 mg, yield: 47%). ^1H NMR (400 MHz, $CDCl_3$) δ 7.44 (d, *J* = 8.6 Hz, 2H), 7.14 (d, *J* = 8.6 Hz, 2H), 6.68 (d, *J* = 8.7 Hz, 2H), 6.40 (d, *J* = 8.7 Hz, 2H), 5.31 (d, *J* = 8.5 Hz, 1H), 3.97 – 3.91 (m, 1H), 2.87 (s, 6H), 2.05 – 1.98 (m, 1H), 1.78 – 1.69 (m, 1H), 1.64 – 1.47 (m, 3H), 1.36 – 1.27 (m, 1H),

1.20 – 0.76 (m, 5H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 149.8, 139.6, 138.0, 128.7, 128.6, 127.9, 127.2, 112.2, 63.6, 43.7, 40.7 (2C), 30.0, 29.8, 26.3, 26.0 (2C). HRMS (EI): m/z $[M + H]^+$ calcd for $C_{21}H_{28}ClN_2O_2S$: 407.1555, found: 407.1548.



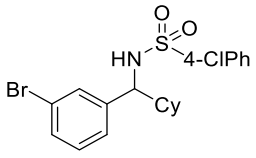
3aq

***N*-((2-Bromophenyl)(cyclohexyl)methyl)-4-chlorobenzenesulfonamide (3aq):** The title compound was isolated by eluting with petroleum ether and ethyl acetate (PE/EA = 25:1) as a yellow solid (115.6 mg, yield: 87%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.57 (d, *J* = 7.2 Hz, 2H), 7.31 (d, *J* = 7.7 Hz, 1H), 7.18 (d, *J* = 8.2 Hz, 2H), 7.10 – 6.93 (m, 3H), 5.96 (d, *J* = 9.3 Hz, 1H), 4.62 (br, 1H), 2.06 – 1.84 (m, 1H), 1.78 – 1.49 (m, 4H), 1.32 – 1.20 (m, 1H), 1.16 – 0.95 (m, 5H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 139.3, 138.7, 138.6, 132.8, 128.8, 128.6, 128.1, 127.5, 123.8, 61.4, 43.4, 29.7, 28.8, 26.2, 26.1, 26.0. HRMS (EI): m/z $[M + H]^+$ calcd for $C_{19}H_{22}BrClNO_2S$: 442.0238, found: 442.0239.



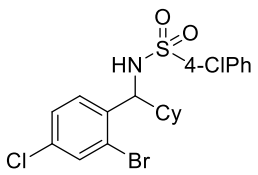
3ar

4-Chloro-*N*-(cyclohexyl(2-methoxyphenyl)methyl)benzenesulfonamide (3ar): The title compound was isolated by eluting with petroleum ether and ethyl acetate (PE/EA = 25:1) as a white solid (92.2 mg, yield: 78%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.44 (d, *J* = 8.5 Hz, 2H), 7.15 – 7.02 (m, 3H), 6.77 – 6.64 (m, 2H), 6.56 (d, *J* = 8.2 Hz, 1H), 5.97 – 5.79 (m, 1H), 4.06 – 3.97 (m, 1H), 3.69 (s, 3H), 2.22 – 2.14 (m, 1H), 1.80 – 1.66 (m, 2H), 1.62 – 1.52 (m, 2H), 1.20 – 0.97 (m, 5H), 0.84 – 0.73 (m, 1H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 156.1, 139.2, 138.0, 129.9, 128.4, 128.3, 128.2, 126.7, 120.2, 110.5, 55.1, 41.6, 30.4, 30.3, 26.3, 25.9, 25.8. HRMS (EI): m/z $[M + H]^+$ calcd for $C_{20}H_{25}ClNO_3S$: 394.1238, found: 394.1240.



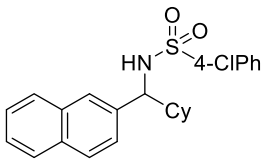
3as

***N*-((3-Bromophenyl)(cyclohexyl)methyl)-4-chlorobenzenesulfonamide (3as):** The title compound was isolated by eluting with petroleum ether and ethyl acetate (PE/EA = 25:1) as a white solid (90.4 mg, yield: 68%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.53 – 7.47 (m, 2H), 7.25 – 7.19 (m, 3H), 7.01 – 6.93 (m, 2H), 6.92 – 6.87 (m, 1H), 5.83 (d, *J* = 8.6 Hz, 1H), 4.03 – 3.97 (m, 1H), 1.99 – 1.91 (m, 1H), 1.75 – 1.67 (m, 1H), 1.65 – 1.48 (m, 3H), 1.29 – 1.21 (m, 1H), 1.19 – 0.77 (m, 5H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 141.8, 139.0, 138.8, 130.3, 130.2, 129.8, 128.8, 128.3, 125.8, 122.4, 63.2, 43.3, 29.7, 29.5, 26.1, 25.8 (2C). HRMS (EI): m/z $[M + H]^+$ calcd for $C_{19}H_{22}BrClNO_2S$: 442.0238, found: 442.0240.



3at

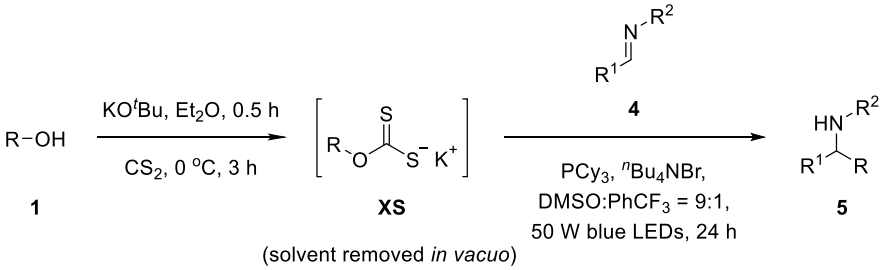
***N*-((2-Bromo-4-chlorophenyl)(cyclohexyl)methyl)-4-chlorobenzenesulfonamide (3at):** The title compound was isolated by eluting with petroleum ether and ethyl acetate (PE/EA = 25:1) as a white solid (110.2 mg, yield: 77%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.60 (d, *J* = 8.2 Hz, 2H), 7.35 (s, 1H), 7.27 (d, *J* = 8.5 Hz, 2H), 7.08 (dd, *J* = 8.2, 2.1 Hz, 1H), 6.99 (d, *J* = 8.1 Hz, 1H), 6.05 (d, *J* = 8.5 Hz, 1H), 4.56 (br, 1H), 2.00 – 1.83 (m, 1H), 1.78 – 1.48 (m, 4H), 1.28 – 1.18 (m, 1H), 1.16 – 0.91 (m, 5H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 139.1, 138.5, 138.0, 133.7, 132.2, 129.2, 128.9, 128.6, 127.8, 123.8, 61.0, 43.4, 29.5, 28.8, 26.1, 26.0, 25.9. HRMS (EI): m/z $[M + H]^+$ calcd for $C_{19}H_{21}BrCl_2NO_2S$: 475.9848, found: 475.9847.



3au

4-Chloro-*N*-(cyclohexyl(naphthalen-1-yl)methyl)benzenesulfonamide (3au): The title compound was isolated by eluting with petroleum ether and ethyl acetate (PE/EA = 25:1) as a white solid (63.7 mg, yield: 56%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.89 – 7.77 (m, 1H), 7.73 – 7.62 (m, 1H), 7.53 (d, *J* = 8.1 Hz, 1H), 7.41 – 7.33 (m, 2H), 7.20 – 7.10 (m, 3H), 7.08 – 7.02 (m, 1H), 6.72 (d, *J* = 8.1 Hz, 2H), 5.62 (d, *J* = 9.1 Hz, 1H), 4.87 (br, 1H), 2.12 – 1.96 (m, 1H), 1.82 – 1.64 (m, 2H), 1.56 – 1.47 (m, 2H), 1.26 – 0.88 (m, 6H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 144.7, 138.5, 138.0, 133.5, 131.0, 128.9, 128.1, 128.0, 127.7, 126.2, 125.5, 125.0, 124.9, 122.6, 60.4, 43.7, 30.2, 29.5, 26.2, 26.0, 25.9. HRMS (EI): m/z $[M + H]^+$ calcd for $C_{23}H_{25}ClNO_2S$: 414.1289, found: 414.1288.

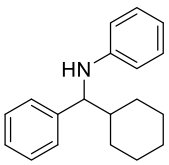
3.3 General Procedure for Deoxygenative Alkylation of Alcohols with schiff base



In a N_2-filled glovebox, an oven-dried 12 mL glass vial equipped with a magnetic stir bar was charged sequentially with alcohol **1** (0.30 mmol), KO^{t}Bu (35.3 mg, 0.32 mmol), and dry Et_2O (3.0 mL). After being sealed with a septum cap and transferred out of the glovebox, the reaction mixture was stirred at room temperature for 30 minutes, followed by the addition of CS_2 (114 mg, 90.0 μL, 1.5 mmol) via microsyringe at 0 ℃ and continued to be stirred for 3 hours at 0 ℃ before removing

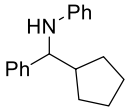
the solvent *in vacuo*. The system was transferred into the glovebox, then schiff base **4** (0.60 mmol), PCy_3 (172 mg, 0.60 mmol), $^nBu_4NBr$ (50 mg, 0.15mmol), and the mixed solvents of DMSO/$PhCF_3$ (2.7 mL/0.3 mL) were added. The vial was sealed with a septum cap and transferred out of the glovebox. The reaction mixture was irradiated with a 50 W blue LEDs lamp, and stirred for 24 hours. The solvent was removed *in vacuo* and the residue was purified by column chromatography to afford the product.

3.4 Characterization Data of Products of schiff base with Alcohols



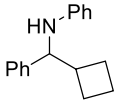
5aa

***N*-Phenyl-(1-phenyl-1-cyclohexyl-methyl)amine (5aa):** The title compound was isolated by eluting with petroleum ether and ethyl acetate (PE/EA = 200:1) as a light yellow oil (62.0 mg, yield: 78%). ^1H NMR (400 MHz, $CDCl_3$): δ 7.28 – 7.27 (m, 4H), 7.21 – 7.18 (m, 1H), 7.06 – 7.02 (m, 2H), 6.64 – 6.55 (m, 1H), 6.48 (d, *J* = 7.72 Hz, 2H), 4.12 (br, 1H), 4.10 (d, *J* = 6.32 Hz, 1H), 1.89 – 1.86 (m, 1H), 1.76 – 1.60 (m, 4H), 1.54 – 1.47 (m, 1H), 1.26 – 1.00 (m, 5H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 147.8, 142.7, 129.0, 128.2, 127.2, 126.7, 116.9, 113.1, 63.4, 44.9, 30.2, 29.4, 26.4, 26.3, 26.2. HRMS (EI): m/z $[M + H]^+$ calcd for $C_{19}H_{24}N$: 266.1903, found: 266.1903.



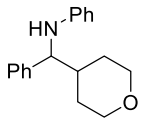
5ca

***N*-(Cyclopentyl(phenyl)methyl)aniline (5ca):** The title compound was isolated by eluting with petroleum ether and ethyl acetate (PE/EA = 200:1) as a light yellow oil (59.8 mg, yield: 80%). ^1H NMR (400 MHz, $CDCl_3$) δ 7.29 – 7.16 (m, 4H), 7.15 – 7.09 (m, 1H), 7.01 – 6.94 (m, 2H), 6.55 – 6.49 (m, 1H), 6.42 (d, *J* = 7.9 Hz, 2H), 4.10 (br, 1H), 4.00 (d, *J* = 8.4 Hz, 1H), 2.14 – 2.02 (m, 1H), 1.86 – 1.76 (m, 1H), 1.65 – 1.29 (m, 6H), 1.25 – 1.16 (m, 1H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 147.8, 144.1, 129.2, 128.4, 127.1, 126.9, 117.1, 113.4, 63.2, 47.9, 30.3, 30.1, 25.4, 25.3. HRMS (EI): m/z $[M + H]^+$ calcd for $C_{18}H_{22}N$: 252.1746, found: 252.1747.



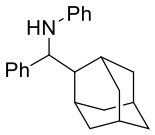
5da

***N*-(Cyclobutyl(phenyl)methyl)aniline (5da):** The title compound was isolated by eluting with petroleum ether and ethyl acetate (PE/EA = 200:1) as a light yellow oil (39.1 mg, yield: 54%). ^1H NMR (400 MHz, $CDCl_3$) δ 7.29 – 7.17 (m, 4H), 7.17 – 7.09 (m, 1H), 7.03 – 6.94 (m, 2H), 6.56 – 6.51 (m, 1H), 6.41 (d, *J* = 7.9 Hz, 2H), 4.08 (d, *J* = 9.1 Hz, 1H), 3.95 (br, 1H), 2.48 – 2.42 (m, 1H), 2.06 – 2.03 (m, 1H), 1.83 – 1.68 (m, 4H), 1.27 – 1.18 (m, 1H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 147.8, 142.6, 129.2, 128.5, 127.0, 126.7, 117.3, 113.5, 63.9, 42.7, 26.2, 25.6, 17.7. HRMS (EI): m/z $[M + H]^+$ calcd for $C_{17}H_{20}N$: 238.1590, found: 238.1590.



5ea

***N*-(Phenyl(tetrahydro-2H-pyran-4-yl)methyl)aniline (5ea):** The title compound was isolated by eluting with petroleum ether and ethyl acetate (PE/EA = 200:1) as a light yellow oil (59.0 mg, yield: 73%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.34 – 7.25 (m, 4H), 7.23 – 7.18 (m, 1H), 7.10 – 7.01 (m, 2H), 6.65 – 6.57 (m, 1H), 6.51 (d, *J* = 7.9 Hz, 2H), 4.12 (d, *J* = 7.5 Hz, 2H), 4.05 – 3.86 (m, 2H), 3.40 – 3.20 (m, 2H), 1.90 – 1.74 (m, 2H), 1.52 – 1.39 (m, 2H), 1.35 – 1.21 (m, 1H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 147.5, 141.9, 129.2, 128.5, 127.2 (2C), 117.4, 113.4, 68.1, 68.0, 63.0, 42.3, 30.3, 29.9. HRMS (EI): m/z $[M + H]^+$ calcd for $C_{18}H_{22}NO$: 268.1698, found: 268.1694.

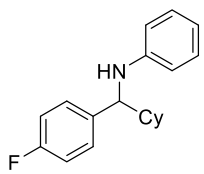


5ga

***N*-((Adamantan-2-yl)(phenyl)methyl)aniline (5ga):** The title compound was isolated by eluting with petroleum ether and ethyl acetate (PE/EA = 200:1) as a light yellow oil (69.1 mg, yield: 73%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.36 – 7.24 (m, 4H), 7.21 – 7.14 (m, 1H), 7.09 – 6.98 (m, 2H), 6.61 – 6.50 (m, 3H), 4.54 (d, *J* = 10.7 Hz, 1H), 4.16 – 3.91 (br, 1H), 2.32 – 2.26 (m, 1H), 2.07 – 1.92 (m, 3H), 1.90 – 1.67 (m, 7H), 1.61 – 1.45 (m, 3H), 1.31 – 1.26 (m, 1H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 147.9, 143.7, 129.2, 128.5, 127.2, 126.9, 116.9, 113.2, 58.3, 51.7, 39.2, 39.1, 38.2, 32.2, 32.0, 29.2, 28.8, 28.1, 27.9. HRMS (EI): m/z $[M + H]^+$ calcd for $C_{23}H_{28}N$: 318.2216, found: 318.2216.

5ra

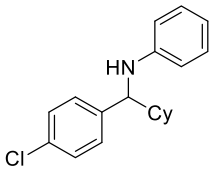
***N*-(2,2-Dimethyl-1-phenylpropyl)aniline (5ra):** The title compound was isolated by eluting with petroleum ether and ethyl acetate (PE/EA = 200:1) as a light yellow oil (45.1 mg, yield: 64%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.36 – 7.23 (m, 5H), 7.10 – 6.98 (m, 2H), 6.61 – 6.55 (m, 1H), 6.48 (d, *J* = 8.0 Hz, 2H), 4.25 (br, 1H), 4.04 (s, 1H), 0.99 (s, 9H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 147.8, 141.2, 129.0, 128.5, 127.7, 126.8, 116.9, 113.2, 67.2, 34.9, 27.1 (3 C). HRMS (EI): m/z $[M + H]^+$ calcd for $C_{17}H_{22}N$: 240.1747, found: 240.1746.



5ab

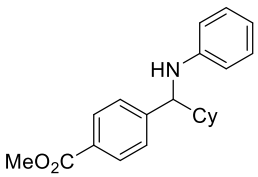
***N*-(Cyclohexyl(4-fluorophenyl)methyl)aniline (5ab):** The title compound was isolated by eluting with petroleum ether and ethyl acetate (PE/EA = 200:1) as a light yellow oil (69.2 mg, yield: 82%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.26 – 7.20 (m, 2H), 7.08 – 7.02 (m, 2H), 6.99 – 6.93 (m, Hz, 2H), 6.63 – 6.57 (m, 1H), 6.46 (d, *J* = 7.9 Hz, 2H), 4.14 – 4.07 (m, 2H), 1.93 – 1.80 (m, 1H), 1.79 – 1.45 (m, 5H), 1.27 – 0.94 (m, 5H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 161.8 (d, *J* = 243 Hz), 147.7, 138.3 (d, *J* = 3 Hz), 129.2, 128.7 (d, *J* =

8 Hz), 117.2, 115.1 (d, J = 21 Hz), 113.3, 62.9, 45.0, 30.2, 29.5, 26.5, 26.4, 26.4. HRMS (EI): m/z $[M + H]^+$ calcd for $C_{19}H_{23}FN$: 284.1809, found: 284.1808.



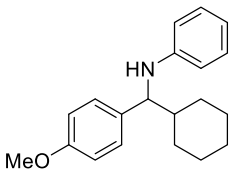
5ac

***N*-((4-Chlorophenyl)(cyclohexyl)methyl)aniline (5ac):** The title compound was isolated by eluting with petroleum ether and ethyl acetate (PE/EA = 200:1) as a light yellow oil (66.3 mg, yield: 74%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.29 – 7.19 (m, 4H), 7.09 – 7.03 (m, 2H), 6.64 – 6.58 (m, 2H), 6.60 (t, J = 7.3 Hz, 1H), 6.46 (d, J = 7.9 Hz, 2H), 4.14 – 4.06 (m, 2H), 1.90 – 1.80 (m, 2H), 1.79 – 1.69 (m, 2H), 1.68 – 1.49 (m, 4H), 1.24 – 0.96 (m, 5H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 147.6, 141.3, 132.4, 129.2, 128.7, 128.5, 117.3, 113.3, 63.0, 45.0, 30.2, 29.5, 26.5, 26.4, 26.4. HRMS (EI): m/z $[M + H]^+$ calcd for $C_{19}H_{23}ClN$: 300.1514, found: 300.1513.



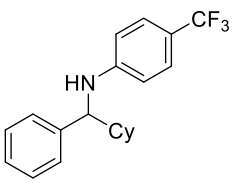
5ad

Methyl 4-(cyclohexyl(phenylamino)methyl)benzoate (5ad): The title compound was isolated by eluting with petroleum ether and ethyl acetate (PE/EA = 200:1) as a light yellow oil (80.7 mg, yield: 78%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.97 (d, J = 8.3 Hz, 2H), 7.37 (d, J = 8.1 Hz, 2H), 7.09 – 7.01 (m, 2H), 6.65 – 6.59 (m, 1H), 6.46 (d, J = 7.9 Hz, 2H), 4.17 (d, J = 6.1 Hz, 2H), 3.88 (s, 3H), 1.90 – 1.82 (m, 1H), 1.80 – 1.61 (m, 4H), 1.57 – 1.49 (m, 1H), 1.27 – 1.00 (m, 5H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 167.2, 148.5, 147.5, 129.7, 129.2, 128.9, 127.4, 117.4, 113.3, 63.4, 52.1, 44.9, 30.3, 29.4, 26.5 (2C), 26.4. HRMS (EI): m/z $[M + H]^+$ calcd for $C_{21}H_{26}NO_2$: 324.1958, found: 324.1958.



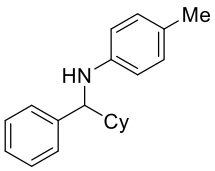
5ae

***N*-(Cyclohexyl(4-(trifluoromethyl)phenyl)methyl)aniline (5ae):** The title compound was isolated by eluting with petroleum ether and ethyl acetate (PE/EA = 200:1) as a light yellow oil (71.2 mg, yield: 80%). ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.22 (d, J = 8.3 Hz, 2H), 7.12 – 7.05 (m, 2H), 6.86 (d, J = 8.7 Hz, 2H), 6.65 – 6.59 (m, 1H), 6.52 (d, J = 7.9 Hz, 2H), 4.09 (d, J = 6.2 Hz, 1H), 3.79 (s, 3H), 1.95 – 1.87 (m, 1H), 1.84 – 1.52 (m, 5H), 1.31 – 1.00 (m, 5H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 158.5, 147.9, 134.7, 129.1, 128.3, 117.0, 113.7, 113.3, 62.9, 55.3, 45.1, 30.2, 29.7, 26.6, 26.5, 26.4. HRMS (EI): m/z $[M + H]^+$ calcd for $C_{20}H_{26}NO$: 296.2009, found: 296.2006.



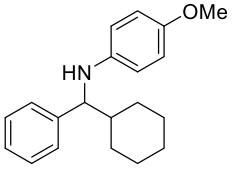
5af

***N*-(Cyclohexyl(phenyl)methyl)-4-(trifluoromethyl)aniline (5af):** The title compound was isolated by eluting with petroleum ether and ethyl acetate (PE/EA = 200:1) as a light yellow oil (74.9 mg, yield: 75%). ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.25 – 7.14 (m, 7H), 6.43 (d, *J* = 8.79 Hz, 2H), 4.46 (br, 1H), 4.04 (d, *J* = 6.16 Hz, 1H), 1.86 – 1.78 (m, 1H), 1.74 – 1.54 (m, 4H), 1.50 – 1.41 (m, 1H), 1.20 – 0.94 (m, 5H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 150.2, 141.8, 128.5, 127.2, 126.5 (q, *J* = 4 Hz), 125.1 (q, *J* = 214 Hz), 118.6 (q, *J* = 27 Hz), 112.4, 63.2, 44.8, 30.3, 29.6, 26.5, 26.4, 26.3. HRMS (EI): m/z $[M + H]^+$ calcd for $C_{20}H_{23}F_3N$: 334.1777, found: 334.1776.



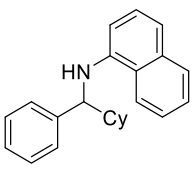
5ag

***N*-(Cyclohexyl(phenyl)methyl)-4-methylaniline (5ag):** The title compound was isolated by eluting with petroleum ether and ethyl acetate (PE/EA = 200:1) as a light yellow oil (66.1 mg, yield: 78%). ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.25 – 7.07 (m, 5H), 6.79 (d, *J* = 8.0 Hz, 2H), 6.33 (d, *J* = 8.3 Hz, 2H), 4.00 (d, *J* = 6.2 Hz, 1H), 2.08 (s, 3H), 1.85 – 1.75 (m, 1H), 1.71 – 1.50 (m, 4H), 1.48 – 1.44 (m, 1H), 1.18 – 0.91 (m, 5H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 145.7, 143.0, 129.7, 128.3, 127.4, 126.8, 126.1, 113.4, 63.8, 45.1, 30.4, 29.6, 26.6, 26.5, 26.5, 20.4. HRMS (EI): m/z $[M + H]^+$ calcd for $C_{20}H_{26}N$: 280.2060, found: 280.2060.



5ah

***N*-(Cyclohexyl(phenyl)methyl)-4-methoxyaniline (5ah):** The title compound was isolated by eluting with petroleum ether and ethyl acetate (PE/EA = 200:1) as a light yellow oil (72.6 mg, yield: 82%). ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.26 – 7.07 (m, 5H), 6.58 (d, *J* = 9.0 Hz, 2H), 6.37 (d, *J* = 8.9 Hz, 2H), 3.96 (d, *J* = 6.1 Hz, 1H), 3.59 (s, 3H), 1.86 – 1.77 (m, 1H), 1.71 – 1.50 (m, 4H), 1.48 – 1.44 (m, 1H), 1.19 – 0.89 (m, 5H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 151.8, 143.0, 142.2, 128.3, 127.4, 126.8, 114.9, 114.5, 64.4, 55.9, 45.1, 30.3, 29.6, 26.6, 26.5, 26.5. HRMS (EI): m/z $[M + H]^+$ calcd for $C_{20}H_{26}NO$: 296.2009, found: 296.2007.

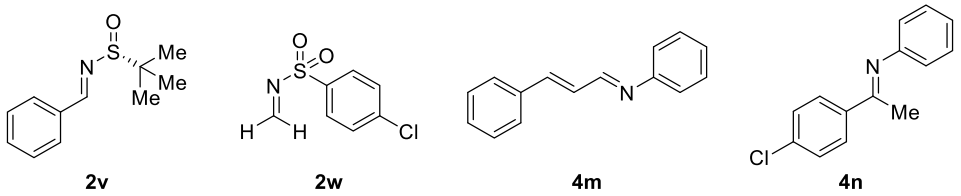


5ai

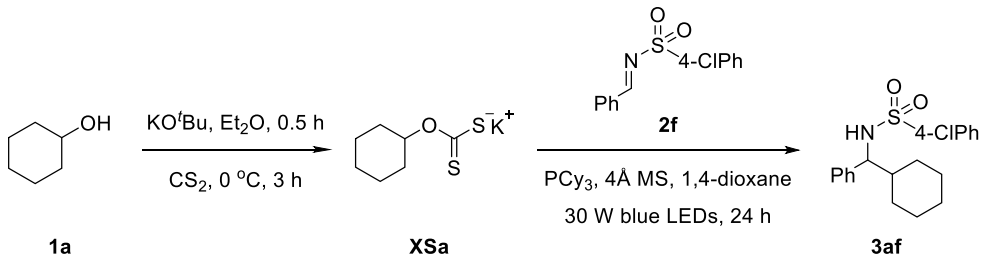
***N*-(Cyclohexyl(phenyl)methyl)naphthalen-1-amine (5ai):** The title compound was isolated by eluting with petroleum ether and ethyl acetate (PE/EA = 200:1) as a light yellow oil (48.1 mg, yield: 51%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.97 – 7.92 (m, 1H), 7.80 – 7.75 (m, 1H), 7.52 – 7.41 (m, 2H), 7.38 – 7.33 (m, 2H), 7.32 – 7.27 (m, 2H), 7.24 – 7.19 (m, 1H), 7.17 – 7.11 (m, 2H), 6.35 – 6.30 (m, 1H), 4.92 (br, 1H), 4.32 (d, *J* =

6.0 Hz, 1H), 2.01 – 1.94 (m, 1H), 1.85 – 1.63 (m, 5H), 1.26 – 1.06 (m, 5H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 142.6, 142.4, 134.4, 128.9, 128.3, 127.3, 127.0, 126.8, 125.7, 124.7, 123.5, 119.7, 116.9, 105.7, 63.5, 45.2, 30.6, 29.6, 26.6 (2C), 26.6. HRMS (EI): m/z $[M + H]^+$ calcd for $C_{23}H_{26}N$: 316.2060, found: 316.2059.

Table S10. Unsuccessful substrates.



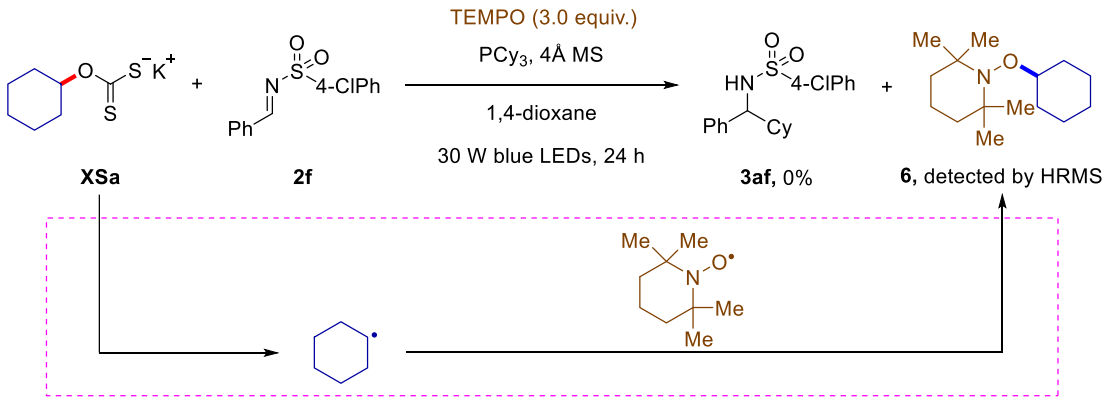
4. Procedure for Gram-Scale Reaction



An oven-dried 100 mL Schlenk tube equipped with a magnetic stir bar was charged sequentially with alcohol **1a** (0.507 g, 5.0 mmol), KO^{t}Bu (0.608 g, 5.25 mmol). The reaction vessel was evacuated and backfilled with nitrogen (three cycles) and dry 1,4-dioxane (30 mL) was added under nitrogen atmosphere, a balloon was attached. Then the reaction mixture was stirred at room temperature for 30 minutes, followed by the addition of CS_2 (1.89 g, 1.5 mL, 25 mmol) via syringe at 0 ℃ and stirred for 3 hours at 0 ℃ before removing the solvent *in vacuo*. Then *N*-sulfonylimide **2f** (2.10 g, 7.5 mmol), PCy_3 (2.15 g, 7.5 mmol), 4 Å MS (0.50 g), were added. The Schlenk tube was sealed with a rubber plug, evacuated and backfilled with nitrogen (three cycles), and a nitrogen balloon was attached, followed by the addition of 1,4-dioxane (30 mL) via syringe. The reaction mixture was irradiated with a 30 W blue LEDs lamp, and stirred for 72 hours. The solvent was removed *in vacuo* and the residue was purified by column chromatography to afford the product **3af** as a white solid (1.32 g, 73% yield).

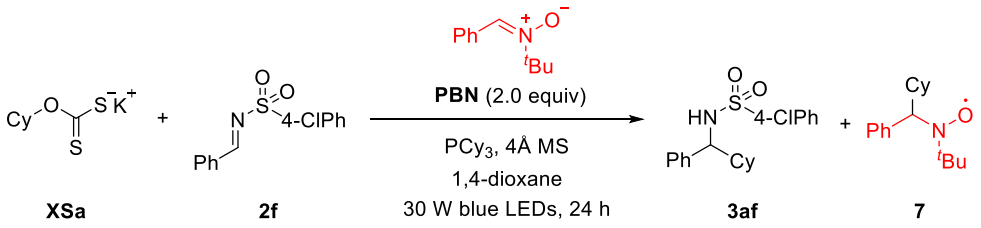
5. Mechanism Studies

5.1 TEMPO Trapping Experiments



In a N_2-filled glovebox, an oven-dried 12 mL glass vial equipped with a magnetic stir bar was charged sequentially with **XSa** (64.7 mg, 0.30 mmol), **2f** (132 mg, 0.45 mmol), PCy_3 (129 mg, 0.45 mmol), 4 Å MS (45 mg) and TEMPO (141 mg, 0.9 mmol) in the solvent of 1,4-dioxane (3.0 mL). The vial was sealed with a septum cap and transferred out of the glovebox. The reaction mixture was irradiated with a 30 W blue LEDs lamp, maintained at ambient temperature, and stirred for 24 hours. The solvent was removed *in vacuo* and the residue was purified by column chromatography to afford **6**.

5.2 EPR Experiments



In a N_2-filled glovebox, an oven-dried 12 mL glass vial equipped with a magnetic stir bar was charged sequentially with **XSa** (64.7 mg, 0.30 mmol), **2f** (132 mg, 0.45 mmol), PCy_3 (129 mg, 0.45 mmol), and 4 Å MS (45 mg) in the solvent of 1,4-dioxane (3.0 mL). The vial was sealed with a septum cap and transferred out of the glovebox. The reaction mixture was irradiated with a 30 W blue LEDs lamp, maintained at ambient temperature, and stirred for 1 hour. Then *tert*-butyl-*α*-phenylnitrone (PBN) (106mg, 0.60 mmol) was added. The electron paramagnetic

resonance (EPR) spectroscopy was recorded on a Bruker EMXmicro-6/1. With the addition of PBN as a free radical spin trap, we detected signals that are clearly identified as EPR signals of the CyPBN adduct according to the literature data.[3] EPR spectra obtained in MeCN at 298 K in the presence of PBN. Line I: A solution of PBN (106 mg, 0.6 mmol) in 1,4-dioxane (3.0 mL). Line II: A solution of **XSa** (64.7 mg, 0.30 mmol), **2f** (132 mg, 0.45 mmol), PCy_3 (129 mg, 0.45 mmol), 4 Å MS (45 mg) and PBN (106 mg, 0.6 mmol) in the solvent of 1,4-dioxane (3.0 mL).

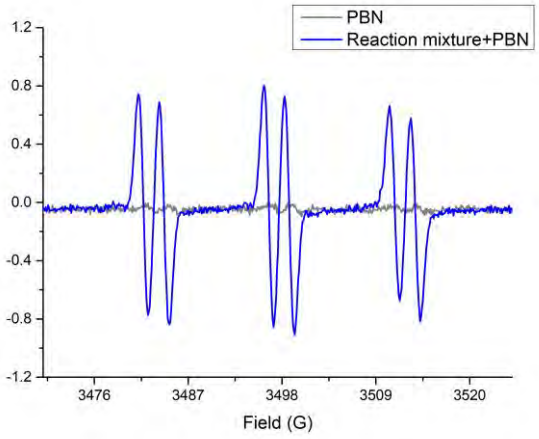
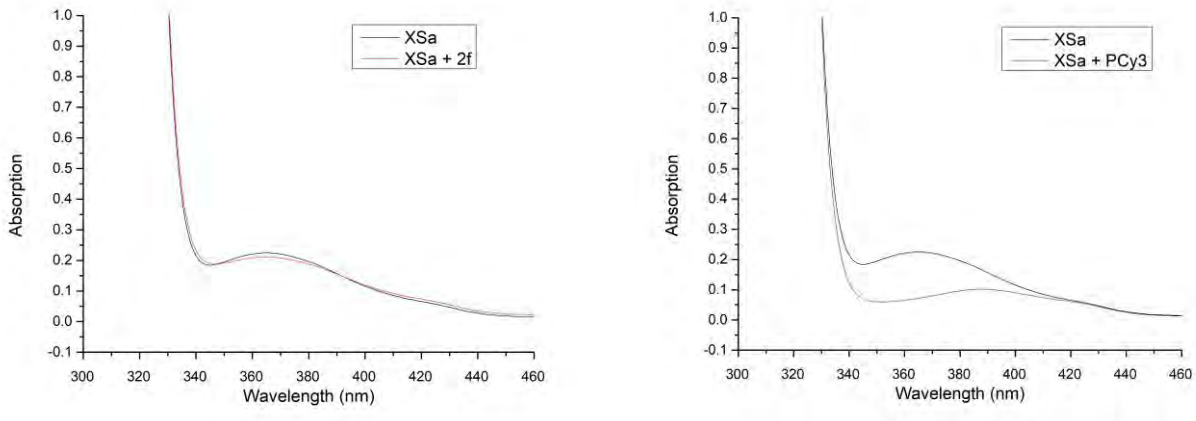


Figure S3. EPR spectra. AN ≈ 14.5 G, AH ≈2.2 G.

5.3 Exclusion of EDA Complexes



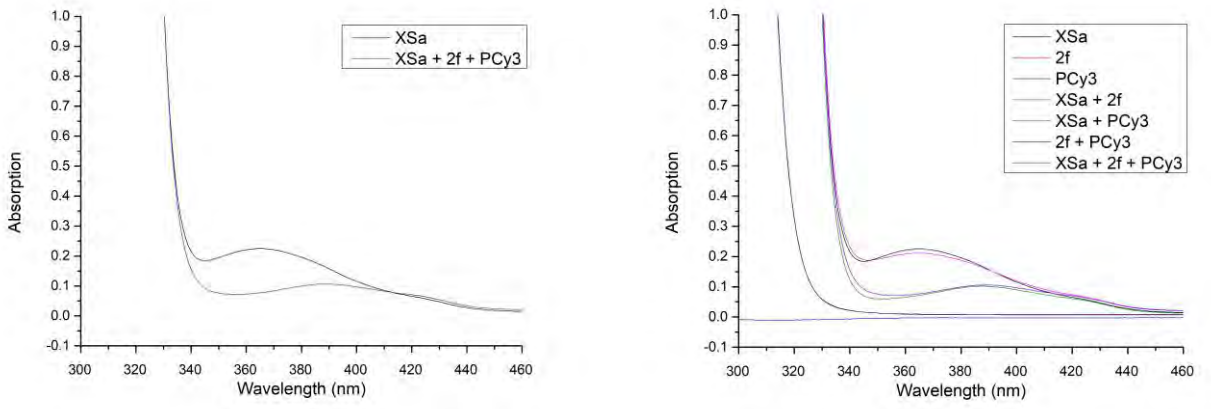


Figure S4. UV/Vis absorption spectrum of the combined reaction components

The UV-Vis Absorption Spectra of all solution was introduced to a 1 cm path length quartz cuvette and analyzed using a Shimadzu UV/Vis spectrophotometer UV-2600. **XSa**: 1.0 x 10^{-3} M in 1,4-dioxane. **2f**: 1.5 x 10^{-3} M in 1,4-dioxane**.** PCy_3: 1.5 x 10^{-3} M in 1,4-dioxane**.**

5.4 Luminescence Quenching Experiments

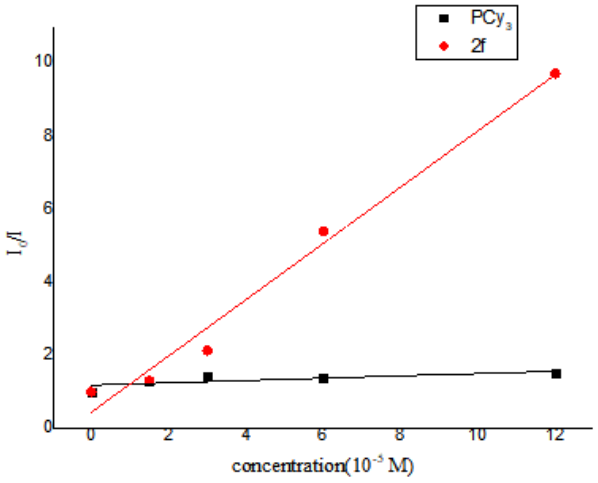


Figure S5. **XSa** emission quenching by **2f** and **PCy_3**.

Fluorescence spectra was collected on Shimadzu Fluorescence Spectrophotometer RF-5301PC for all experiments. All **XSa** solutions were excited at 390 nm and the emission intensity was collected at 447 nm[1]. In a typical experiment, the emission spectrum of a 10.×10^{-3} M solution of **XSa** in 1,4-dioxane was collected. The significant decrease of **XSa** luminescence could be observed in the presence of substrate **2f**.

5.5 Cyclic Voltammetry

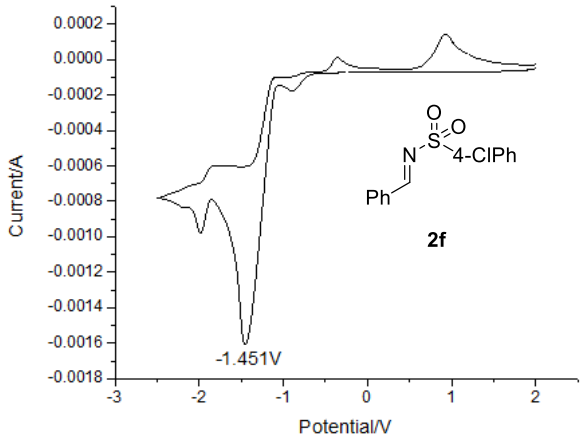
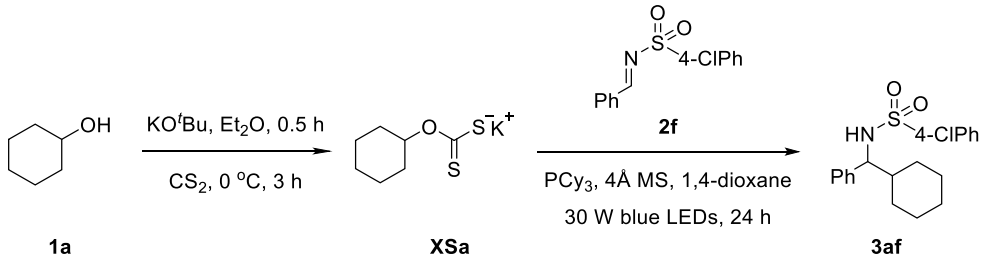


Figure S6. Cyclic voltammetry of **2f** in MeCN (5×10^{-3} M).

Cyclic voltammetry (CV) was taken using a CHI830C potentiostation. CV measurement was performed in a three-electrode cell (volume 30 mL), MeCN as solvent, $^{n}Bu_4PF_6$ (0.1 M) as the supporting electrolyte, 5×10^{-3} M concentration of **2f** with glassy carbon as working electrode, Pt wire as the auxiliary electrode, and saturated calomel electrode as the reference electrode. Samples were examined at a scan rate of 0.1 V/s.

5.6 Light On-Off Experiments



In a N_2-filled glove box, add **1a** (0.3 mmol, 30.4 mg), KO^{t}Bu (0.32 mmol, 37.1 mg) and Et_2O (3.0 mL) to an oven-dried 12 mL glass vial equipped with a magnetic stir bar in sequence, seal the lid, take it out and stir at room temperature. After half an hour, the reaction flask was then placed in a cold trap at 0 °C, and CS_2 (1.5 mmol, 114 mg) was added dropwise to the system under stirring, and the reaction was continued for 3 hours. After 3 hours, the reaction flask was taken out, and the solvent was removed under vacuum with a rotary evaporator to obtain **XSa**. Then **2f** (132 mg, 0.45

mmol), PCy_3 (129 mg, 0.45 mmol), 4 Å MS (45 mg) and 1,4-dioxane (3.0 mL) were added in glovebox. The reaction mixture was irradiated with a 30 W blue LEDs lamp, and stirred for 2 hours. The vial was wrapped in tin foil and a 50 μL sample of the reaction mixture was taken with a syringe and measured by GC. After being stirred for 2 hours, a 50 μL sample of the reaction mixture was taken with a syringe and measured by GC. The reaction mixture was then irradiated with a 30 W blue LEDs lamp, and stirred for 2 hours. Repeating this process three times.

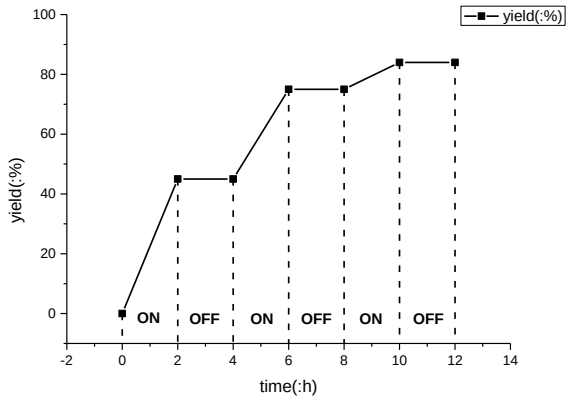


Figure S7. Light on-off experiments.

5.7 Measurement of Quantum Yields

The photon flux of blue LED was determined by standard ferrioxalate actinometry.

0.15 M solution of ferrioxalate was prepared by dissolving potassium ferrioxalate hydrate (328 mg, 0.750 mmol) in 5.0 mL of 0.20 M aqueous sulfuric acid.

0.15 M buffered solution of 1,10-phenanthroline was prepared by dissolving 1,10-phenanthroline (54.1 mg, 0.300 mmol) and sodium acetate (1.23 g, 15.0 mmol) in 20 mL of 0.20 M aqueous sulfuric acid.

The actinometry measurements were done as follows:

To a 4-mL borosilicate vial equipped with a stir bar was added 0.50 mL of the ferrioxalate solution. The vial was sealed and placed 2 cm away from a 25 W blue LEDs. After irradiation for 10 seconds, 1.5 mL of the aqueous sulfuric acid and 2.0 mL of the buffered solution was added to the vial. The solution was then allowed to rest for 1 hour to allow the resultant ferrous ions to react completely with 1,10-phenanthroline. 50 μL of the resulting solution was taken as an aliquot and

diluted with 3.0 mL of 0.20 M aqueous sulfuric acid. The absorbance of the resulting solution in a cuvette (l = 1.0 cm) at 510 nm was measured by UV-Vis spectrometer. A non-irradiated sample was also prepared and the absorbance at 510 nm was measured.

The amount of ferrous ion formed was calculated as follows:

$$\text{mol } Fe^{2+} = \frac{v \times \Delta A}{l \times \varepsilon}$$

where V is the total volume (0.24 L) of the solution that was analyzed, ΔA is the difference in absorbance at 510 nm between the irradiated and non-irradiated samples, l is the path length (1.00 cm), and ε is the molar absorptivity at 510 nm (11,100 L/mol•cm).

The photon flux was calculated as follows:

$$\text{photo flux} = \frac{\text{mol } Fe^{2+}}{\Phi \times t \times f}$$

where Φ is the quantum yield for the ferrioxalate actinometer (approximated as 0.845, which was reported for a 0.15 M solution at λ = 457.9 nm) , t is the irradiation time, and f is the fraction of light absorbed at 450 nm (0.9870).

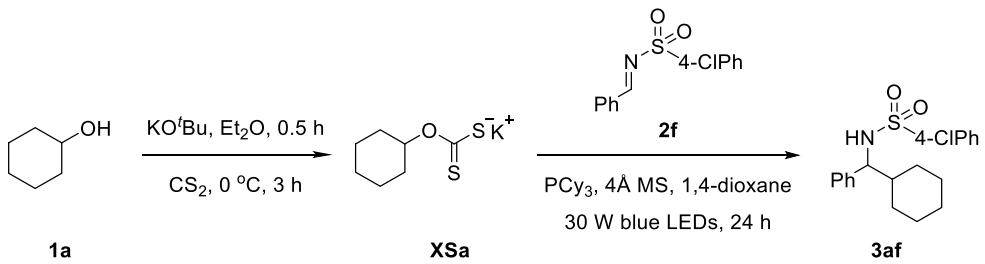
The fraction of light absorbed was determined by the following equation:

$$f = 1.0000 - 10^{-A}$$

where A is the measured absorbance (1.887) of the 0.15 M solution of potassium ferrioxalate at 450 nm.

The photo flux is 5. 62 × 10^{-7} Einstein/s.

Determination of quantum yield:



In a N_2-filled glove box, add **1a** (0.3 mmol, 30.4 mg), KO^{t}Bu (0.32 mmol, 37.1 mg) and Et_2O (3 mL) to an oven-dried 12 mL glass vial equipped with a magnetic stir bar in sequence, seal the lid,

take it out and stir at room temperature. After half an hour, the reaction flask was then placed in a cold trap at 0 °C, and CS_2 (1.5 mmol, 114 mg) was added dropwise to the system under stirring, and the reaction was continued for 3 hours. After 3 hours, the reaction flask was taken out, and the solvent was removed under vacuum with a rotary evaporator to obtain **XSa**. Then **2f** (132 mg, 0.45 mmol), PCy_3 (129 mg, 0.45 mmol), 4 Å MS (45 mg) and the solvent of 1,4-dioxane were added in glovebox. The vial was sealed with a septum cap and transferred out of the glovebox, and placed 2 cm away from 25 W blue LEDs. After irradiation for 1 hours. The moles of product **3af** formed for the model reaction were determined by GC measurement using 1,2,4,5-tetramethylbenzene as internal standard, and revealed 11% yield of **3af** (0.033 mmol).

The quantum yield was calculated as follows:

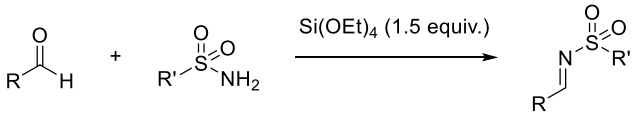
$$\Phi = \frac{\text{mol product}}{\text{flux} \times t \times f}$$

where flux is the photon flux determined by ferrioxalate actinometry (5.62×10^{-7} Einstein/s), t is the time (3600 s), and f is the fraction of light absorbed by the irradiated reaction system at 450 nm, and the absorbance of the irradiated reaction system at 450 nm was 0.565. The fraction of light absorbed at 450 nm was calculated: $f = 1.0000 - 10^{-A} = 1.0000 - 10^{-0.028} = 0.728$.

The quantum yield was calculated: **Φ = 0.022**

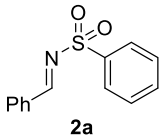
6. Preparation and Characterization Data of Substrates

6.1 General Procedure for Synthesis of *N*-Sulfonylimide



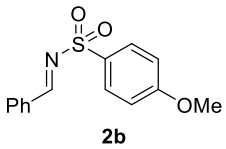
A mixture of aldehyde (5.0 mmol), sulfonamide (3.0 mmol), and tetraethoxysilane (4.37 g, 5.0 mL, 21.0 mmol) was heated at 120 °C for 5 h, and then cooled to room temperature. The mixture was crystallized with ethyl acetate and petroleum ether (10:1 to 1:1), and the resulting solid was collected by filtration and then dried in vacuum to afford the desired product.[2]

6.2 Characterization Data of *N*-Sulfonylimide



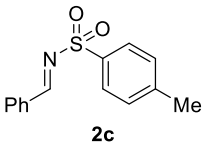
2a

***N*-Benzylidenebenzenesulfonamide (2a):** White solid, 574 mg, yield: 78%. ^{1}H NMR (400 M Hz, $CDCl_3$) δ 9.06 (s, 1H), 8.02 (d, *J* = 7.7 Hz, 2H), 7.94 (d, *J* = 7.7 Hz, 2H), 7.67 – 7.59 (m, 2H), 7.59 – 7.53 (m, 2H), 7.52 – 7.46 (m, 2H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 170.8, 138.3, 135.2, 133.7, 132.4, 131.5, 129.3(2C), 128.2. HRMS (EI): m/z $[M + H]^+$ calcd for $C_{13}H_{12}NO_2S$: 246.0583, found: 246.0583.



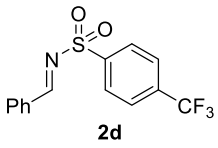
2b

***N*-Benzylidene-4-methoxybenzenesulfonamide (2b):** Pale yellow solid, 583 mg, yield: 71%. ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.01 (s, 1H), 7.96 – 7.90 (m, 4H), 7.64 – 7.58 (m, 1H), 7.50 – 7.46 (m, 2H), 7.07 – 6.95 (m, 2H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 169.7, 163.8, 135.0, 132.6, 131.4, 130.4, 129.7, 129.3, 114.6, 55.8. HRMS (EI): m/z $[M + H]^+$ calcd for $C_{14}H_{14}NO_3S$: 276.0689, found: 276.0689.



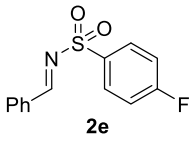
2c

***N*-Benzylidene-4-methylbenzenesulfonamide (2c):** White solid, 609 mg, yield: 78%. ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.03 (s, 1H), 7.95 – 7.87 (m, 4H), 7.63 – 7.60 (m, 1H), 7.51 – 7.47 (m, 2H), 7.35 (d, *J* = 8.0 Hz, 2H), 2.44 (s, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 170.1, 144.6, 135.2, 134.9, 132.4, 131.3, 129.8, 129.2, 128.1, 21.7. HRMS (EI): m/z $[M + H]^+$ calcd for $C_{14}H_{13}NO_2S$: 260.0740, found: 260.0739.



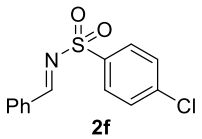
2d

***N*-Benzylidene-4-(trifluoromethyl)benzenesulfonamide (2d):** White solid, 563 mg, yield: 60%. ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.11 (s, 1H), 8.16 (d, *J* = 8.1 Hz, 2H), 7.95 (d, *J* = 7.7 Hz, 2H), 7.82 (d, *J* = 8.2 Hz, 2H), 7.68 – 7.62 (m, 1H), 7.54 – 7.48 (m, 2H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 171.9, 142.1, 135.8, 135.3 (q, *J* = 33 Hz), 132.2, 131.7, 129.4, 128.7, 126.4 (q, *J* = 4 Hz), 123.3 (q, *J* = 271 Hz). ^{19}F NMR (376 MHz, $CDCl_3$) δ -63.20. HRMS (EI): m/z $[M + H]^+$ calcd for $C_{14}H_{11}F_3NO_2S$: 314.0457, found: 314.0457.



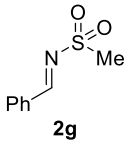
2e

***N*-Benzylidene-4-fluorobenzenesulfonamide (2e):** White solid, 574 mg, yield: 73%. ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.06 (s, 1H), 8.07 – 8.01 (m, 2H), 7.94 (d, *J* = 7.6 Hz, 2H), 7.67 – 7.61 (m, 1H), 7.54 – 7.48 (m, 2H), 7.27 – 7.20 (m, 2H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 170.8, 167.1, 135.4, 132.3, 131.6, 131.1, 131.0, 129.4, 116.6. ^{19}F NMR (376 MHz, $CDCl_3$) δ -103.59. HRMS (EI): m/z $[M + H]^+$ calcd for $C_{13}H_{11}FNO_2S$: 264.0489, found: 264.0488.



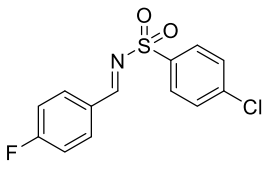
2f

***N*-Benzylidene-4-chlorobenzenesulfonamide (2f):** White solid, 704 mg, yield: 84%. ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.06 (s, 1H), 7.97 – 7.91 (m, 4H), 7.67 – 7.61 (m, 1H), 7.55 – 7.47 (m, 4H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 171.1, 140.4, 136.9, 135.4, 132.3, 131.6, 129.6, 129.4, 128.1. HRMS (EI): m/z $[M + H]^+$ calcd for $C_{13}H_{11}ClNO_2S$: 280.0194, found: 280.0193.



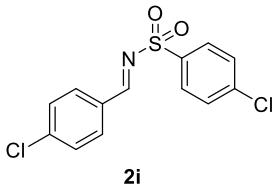
2g

***N*-Benzylidenemethanesulfonamide (2g):** White solid, 428 mg, yield: 78%. ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.04 (s, 1H), 7.96 (d, J = 7.6 Hz, 2H), 7.69 – 7.61 (m, 1H), 7.57 – 7.51 (m, 2H), 3.14 (s, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 171.8, 135.3, 132.6, 131.5, 129.4, 40.4. HRMS (EI): m/z $[M + H]^+$ calcd for $C_8H_{10}NO_2S$: 184.0427, found: 184.0426.



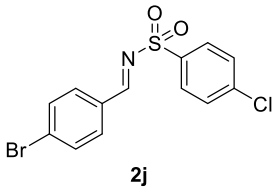
2h

4-Chloro-*N*-(4-fluorobenzylidene)benzenesulfonamide (2h): White solid, 635 mg, yield: 71%. ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.02 (s, 1H), 8.00 – 7.92 (m, 4H), 7.53 (d, J = 8.7 Hz, 2H), 7.23 – 7.16 (m, 2H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 169.3, 167.2 (d, J = 258 Hz), 140.4, 136.7, 134.1 (d, J = 9 Hz), 129.6, 129.5, 128.6, 116.7 (d, J = 22 Hz). HRMS (EI): m/z $[M + H]^+$ calcd for $C_{13}H_{10}ClFNO_2S$: 298.0099, found: 298.0100.



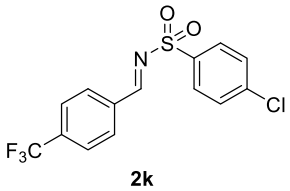
2i

4-Chloro-*N*-(4-chlorobenzylidene)benzenesulfonamide (2i): White solid, 724 mg, yield: 77%. ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.02 (s, 1H), 7.99 – 7.91 (m, 2H), 7.91 – 7.83 (m, 2H), 7.57 – 7.44 (m, 4H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 169.6, 142.0, 140.6, 136.6, 132.6, 130.7, 129.8, 129.7, 129.7. HRMS (EI): m/z $[M + H]^+$ calcd for $C_{13}H_{10}Cl_2NO_2S$: 313.9804, found: 313.9803.



2j

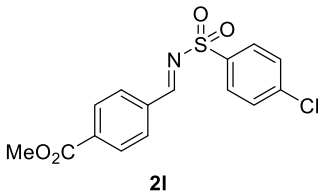
***N*-(4-Bromobenzylidene)-4-chlorobenzenesulfonamide (2j):** White solid, 886 mg, yield: 82%. ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.01 (s, 1H), 7.98 – 7.88 (m, 2H), 7.83 – 7.74 (m, 2H), 7.69 – 7.60 (m, 2H), 7.57 – 7.48 (m, 2H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 169.8, 140.6, 136.6, 132.8, 132.6, 131.1, 130.8, 129.7, 129.6. HRMS (EI): m/z $[M + H]^+$ calcd for $C_{13}H_{10}BrClNO_2S$: 357.9299, found: 357.9300.



2k

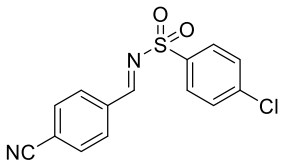
4-Chloro-*N*-(4-(trifluoromethyl)benzylidene)benzenesulfonamide (2k): White solid, 692 mg, yield: 66%. ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.11 (s, 1H), 8.06 (d, J = 8.1 Hz, 2H), 8.00 – 7.92 (m, 2H), 7.77 (d, J = 8.2 Hz, 2H), 7.59

– 7.51 (m, 2H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 169.4, 140.9, 136.4, 136.3, 136.1, 135.3, 131.6, 129.8, 126.3 (q, J = 4 Hz), 123.4 (q, J = 271 Hz). HRMS (EI): m/z $[M + H]^+$ calcd for $C_{14}H_{10}ClF_3NO_2S$: 348.0067, found: 348.0067.



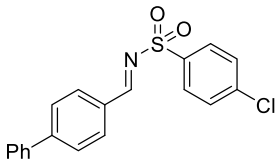
2l

Methyl 4-((((4-chlorophenyl)sulfonyl)imino)methyl)benzoate (2l): White solid, 729 mg, yield: 72%. ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.10 (s, 1H), 8.18 – 8.11 (m, 2H), 8.05 – 7.91 (m, 4H), 7.58 – 7.50 (m, 2H), 3.95 (s, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 169.7, 165.8, 140.6, 136.2, 135.6, 131.2, 130.2, 129.7, 129.6, 100.0, 52.7. HRMS (EI): m/z $[M + H]^+$ calcd for $C_{15}H_{13}ClNO_4S$: 338.0248, found: 338.0248.



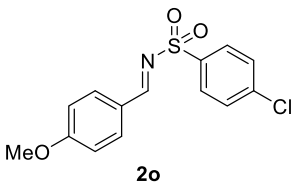
2m

4-Chloro-*N*-(4-cyanobenzylidene)benzenesulfonamide (2m): White solid, 748 mg, yield: 82%. ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.09 (s, 1H), 8.04 (d, J = 8.1 Hz, 2H), 7.95 (d, J = 8.7 Hz, 2H), 7.80 (d, J = 8.1 Hz, 2H), 7.55 (d, J = 8.9 Hz, 2H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 168.8, 141.0, 136.0, 135.8, 133.0, 131.5, 129.9, 129.8, 118.1, 117.7. HRMS (EI): m/z $[M + H]^+$ calcd for $C_{14}H_{10}ClN_2O_2S$: 305.0146, found: 305.0146.



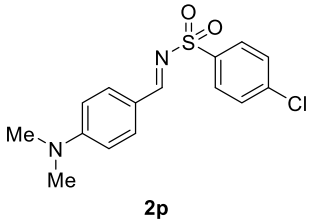
2n

***N*-([1,1'-Biphenyl]-4-ylmethylene)-4-chlorobenzenesulfonamide (2n):** White solid, 815 mg, yield: 76%. ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.12 (s, 1H), 8.01 (m, 4H), 7.76 (m, 2H), 7.70 – 7.62 (m, 2H), 7.51 (m, 5H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 170.5, 148.1, 140.2, 139.3, 136.9, 132.0, 131.0, 129.5, 129.5, 129.1, 128.8, 127.8, 127.3. HRMS (EI): m/z $[M + H]^+$ calcd for $C_{19}H_{15}ClNO_2S$: 356.0507, found: 356.0506.



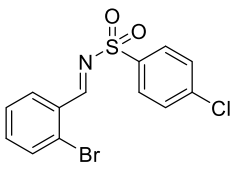
2o

4-Chloro-*N*-(4-methoxybenzylidene)benzenesulfonamide (2o): White solid, 744 mg, yield: 80%. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.96 (s, 1H), 8.00 – 7.80 (m, 4H), 7.59 – 7.41 (m, 2H), 7.05 – 6.89 (m, 2H), 3.89 (s, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 170.0, 165.6, 139.9, 137.4, 134.0, 129.4, 129.3, 125.0, 114.8, 55.7. HRMS (EI): m/z $[M + H]^+$ calcd for $C_{14}H_{13}ClNO_3S$: 310.0299, found: 310.0300.



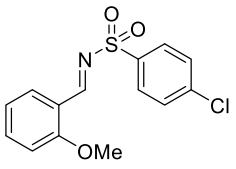
2p

4-Chloro-*N*-(4-(dimethylamino)benzylidene)benzenesulfonamide (2p): Yellow solid, 620 mg, yield: 64%. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.82 (s, 1H), 7.91 (d, *J* = 8.5 Hz, 2H), 7.77 (d, *J* = 8.6 Hz, 2H), 7.47 (d, *J* = 8.4 Hz, 2H), 6.67 (d, *J* = 8.7 Hz, 2H), 3.11 (s, 6H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 169.5, 155.1, 139.2, 138.5, 129.2, 129.0 (2C), 119.6, 111.4, 40.1. HRMS (EI): m/z $[M + H]^+$ calcd for $C_{15}H_{16}ClN_2O_2S$: 323.0616, found: 323.0616.



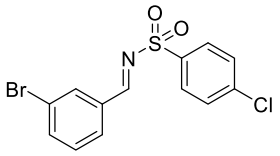
2q

***N*-(2-Bromobenzylidene)-4-chlorobenzenesulfonamide (2q):** White solid, 811 mg, yield: 75%. ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.40 (s, 1H), 8.07 (m, 1H), 7.89 (m, 2H), 7.68 – 7.57 (m, 1H), 7.47 (m, 2H), 7.43 – 7.28 (m, 2H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 170.0, 140.5, 136.3, 136.0, 133.9, 131.0, 130.7, 129.7, 129.6, 129.1, 128.0. HRMS (EI): m/z $[M + H]^+$ calcd for $C_{13}H_{10}BrClNO_2S$: 357.9299, found: 357.9300.



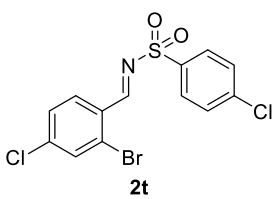
2r

4-Chloro-*N*-(2-methoxybenzylidene)benzenesulfonamide (2r): White solid, 717 mg, yield: 77%. ^{1}H NMR (600 MHz, $CDCl_3$) δ 9.56 (s, 1H), 8.05 – 8.03 (m, 1H), 7.96 – 7.91 (m, 2H), 7.58 (m, 1H), 7.52 – 7.48 (m, 2H), 7.01 – 6.94 (m, 2H), 3.93 (s, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 167.2, 161.9, 139.9, 137.3 (2C), 129.4, 129.4, 121.0, 120.7, 111.5, 55.8. HRMS (EI): m/z $[M + H]^+$ calcd for $C_{14}H_{13}ClNO_3S$: 310.0299, found: 310.0300.



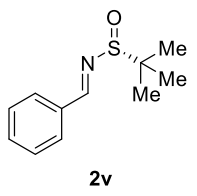
2s

***N*-(3-Bromobenzylidene)-4-chlorobenzenesulfonamide (2s):** White solid, 674 mg, yield: 63%. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.93 (s, 1H), 8.03 (t, *J* = 1.9 Hz, 1H), 7.92 – 7.82 (m, 2H), 7.76 (d, *J* = 7.7 Hz, 1H), 7.72 – 7.64 (m, 1H), 7.47 (d, *J* = 8.3 Hz, 2H), 7.35 – 7.29 (m, 1H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 169.3, 140.6, 137.9, 134.0, 133.4, 130.7, 130.4, 129.6 (2C), 123.5, 100.0. HRMS (EI): m/z $[M + H]^+$ calcd for $C_{13}H_{10}BrClNO_2S$: 357.9299, found: 357.9300.



2t

***N*-(2-Bromo-4-chlorobenzylidene)-4-chlorobenzenesulfonamide (2t):** White solid, 726 mg, yield: 68%. ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.40 (s, 1H), 8.14 – 8.04 (m, 1H), 8.01 – 7.90 (m, 2H), 7.71 (s, 1H), 7.55 (d, *J* = 6.5 Hz, 2H), 7.39 (d, *J* = 8.5 Hz, 1H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 168.7, 142.1, 140.7, 136.1, 133.6, 131.4, 129.7, 129.6, 129.5, 129.3, 128.6. HRMS (EI): m/z $[M + H]^+$ calcd for $C_{13}H_9BrCl_2NO_2S$: 391.8909, found: 391.8909.



2v

(R)-*N*-benzylidene-2-methylpropane-2-sulfinamide (2v): White solid, 439 mg, yield: 70%. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.58 (s, 1H), 7.84 (d, *J* = 7.0 Hz, 2H), 7.52 – 7.48 (m, 1H), 7.47 – 7.43 (m, 2H), 1.25 (s, 9H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 162.8, 134.2, 132.5, 129.4, 129.0, 57.8, 22.7.[4]

7. References

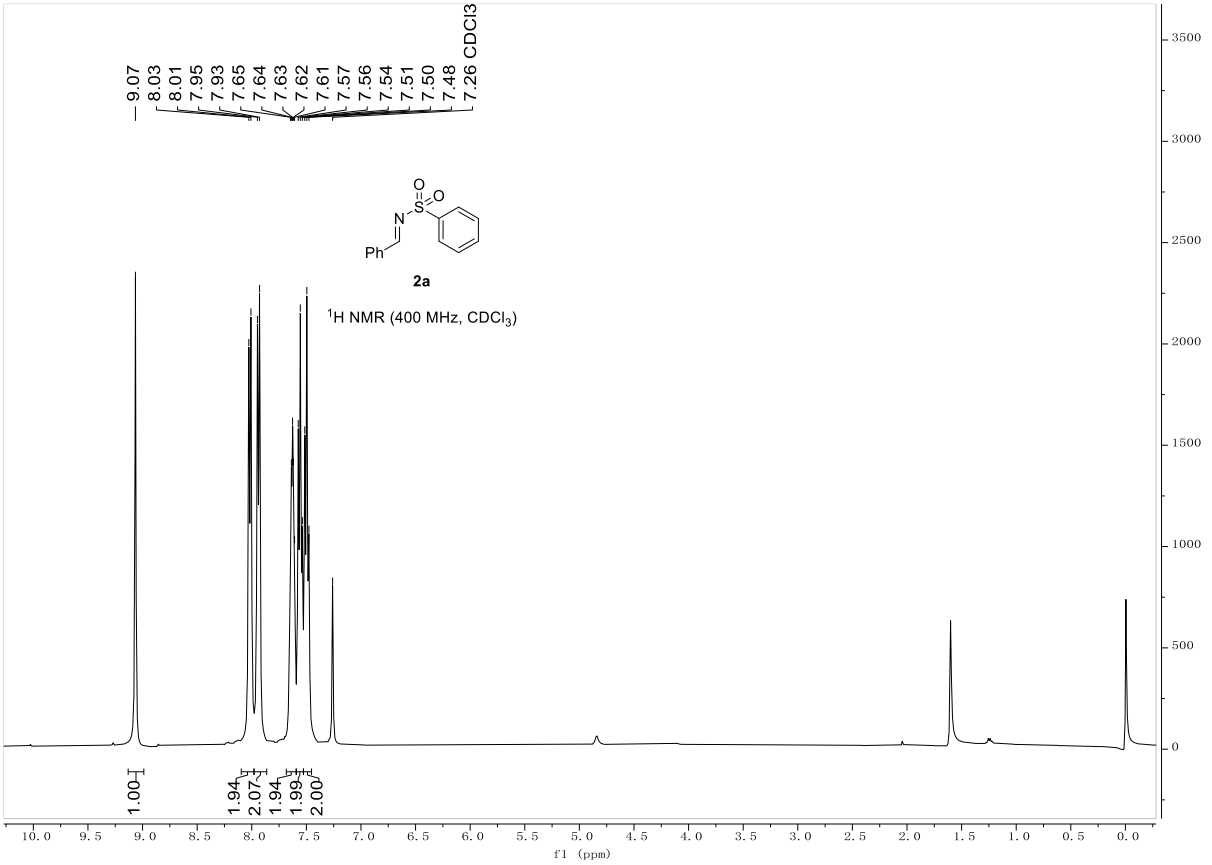
(1) H.-M. Guo, X. Wu, Selective deoxygenative alkylation of alcohols via photocatalytic domino radical fragmentations. *Nat. Commun*., 2021, **12**, 5365.

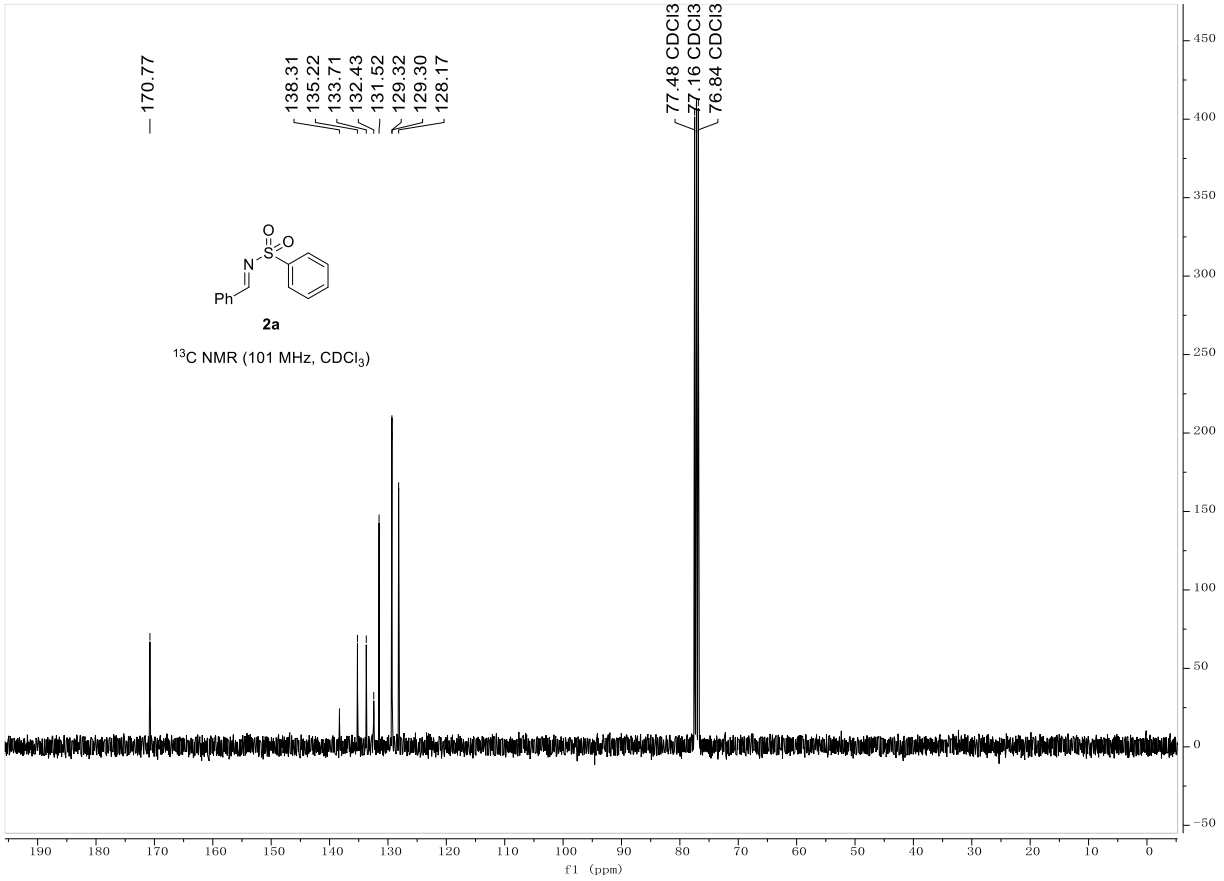
(2) D.-J. Cheng, Y. Tian, S.-K. Tian, Catalytic asymmetric synthesis of dihydroquinazolinones from imines and 2-aminobenzamides. *Adv. Syn. Catal.*, 2012, **354**, 995-999.

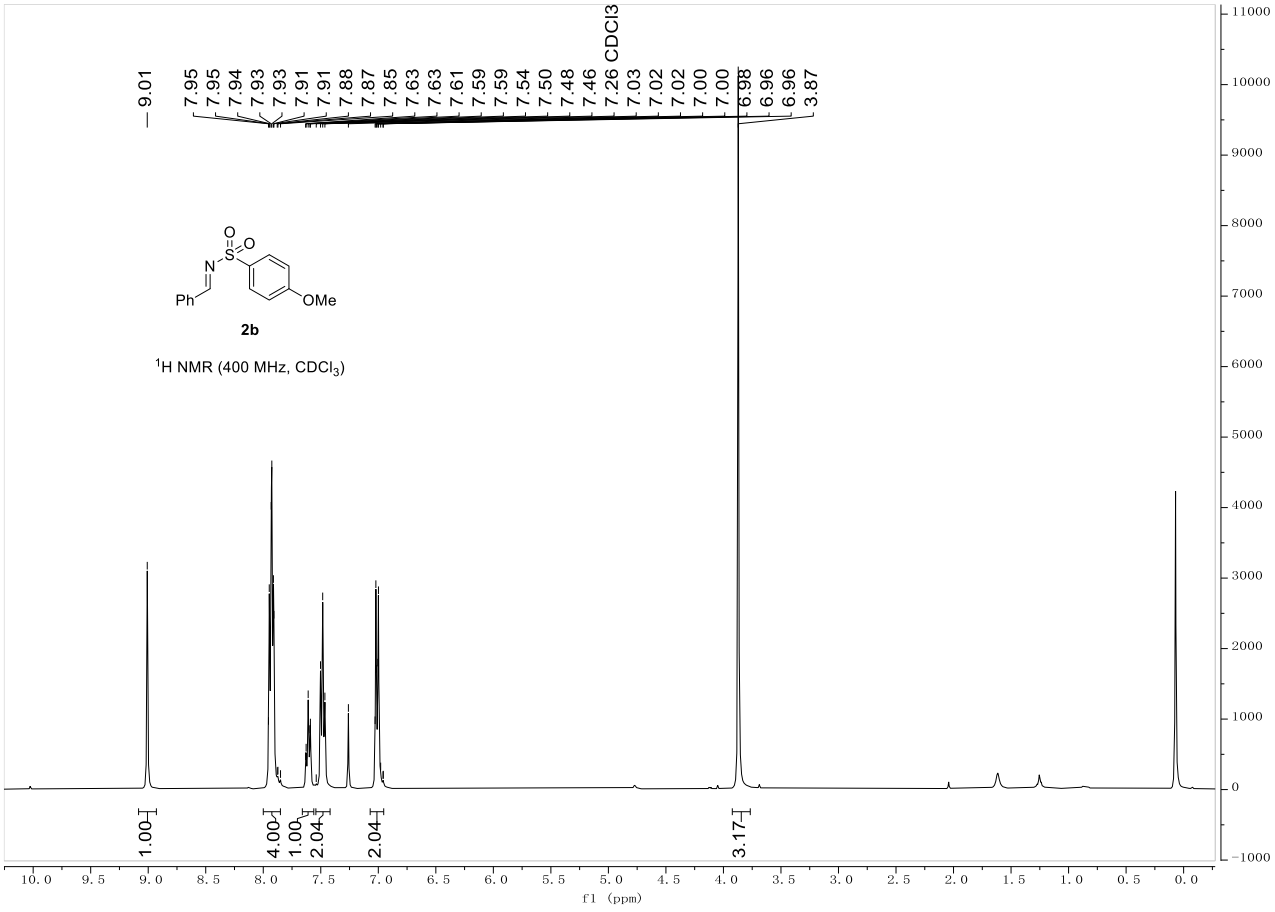
(3) L. I. Panferova, M. O. Zubkov, V. A. Kokorekin, V. V. Levin, A. D. Dilman, Application of chiral *N*-tert-butylsulfinyl vinyl aziridines in Rh(I) catalyzed 1,4-addition of aryl boronic acids to cyclic enones. *Angew. Chem., Int. Ed.* 2021, **60**, 2849–2854.

(4) Q. Chen, C. Chen, F. Guo, W. Xia, Using the thiyl radical for aliphatic hydrogen-atom transfer: thiolation of unactivated C–H bonds. *Chem. Commun.*. 2013, **49**, 6433-6435.

8. NMR Spectra

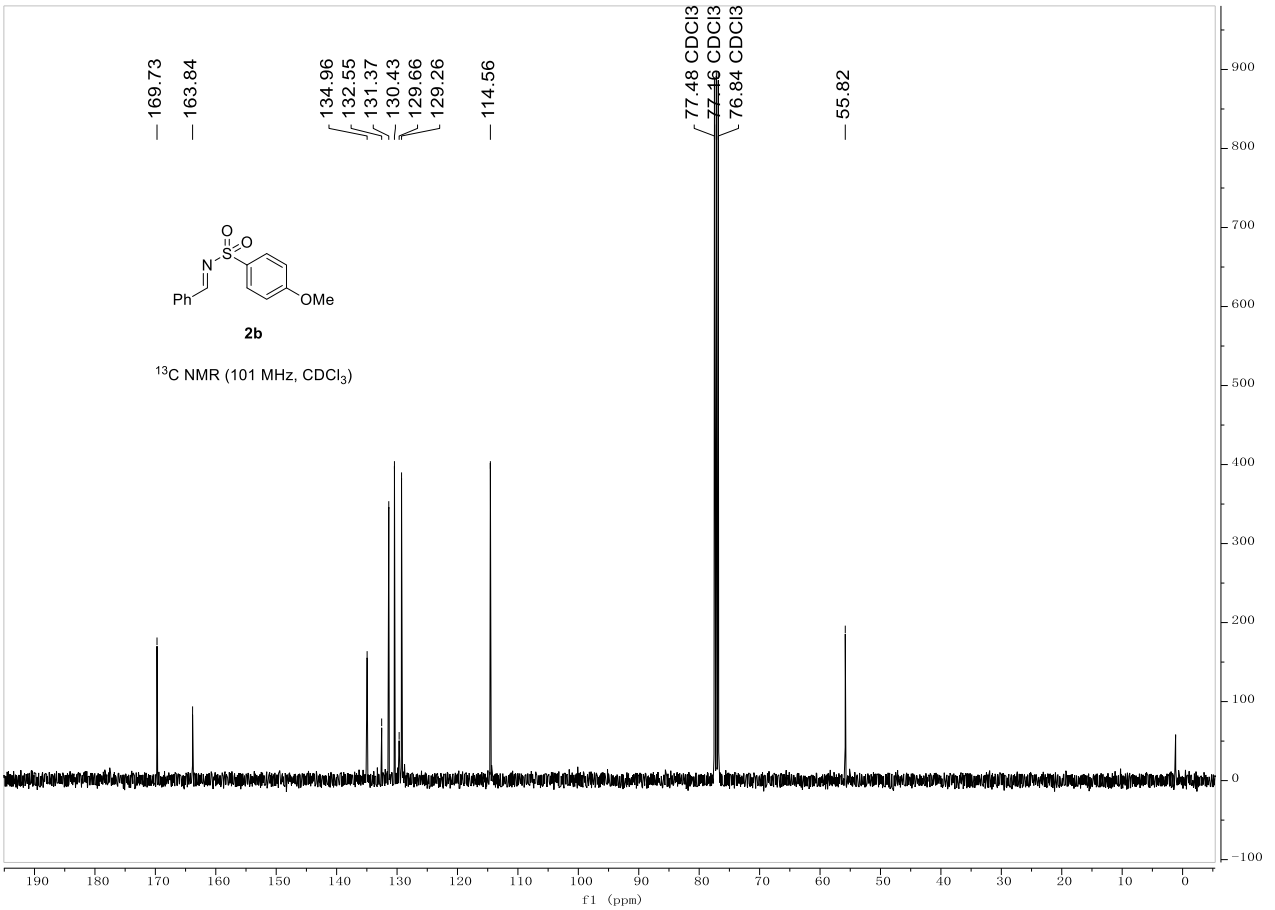






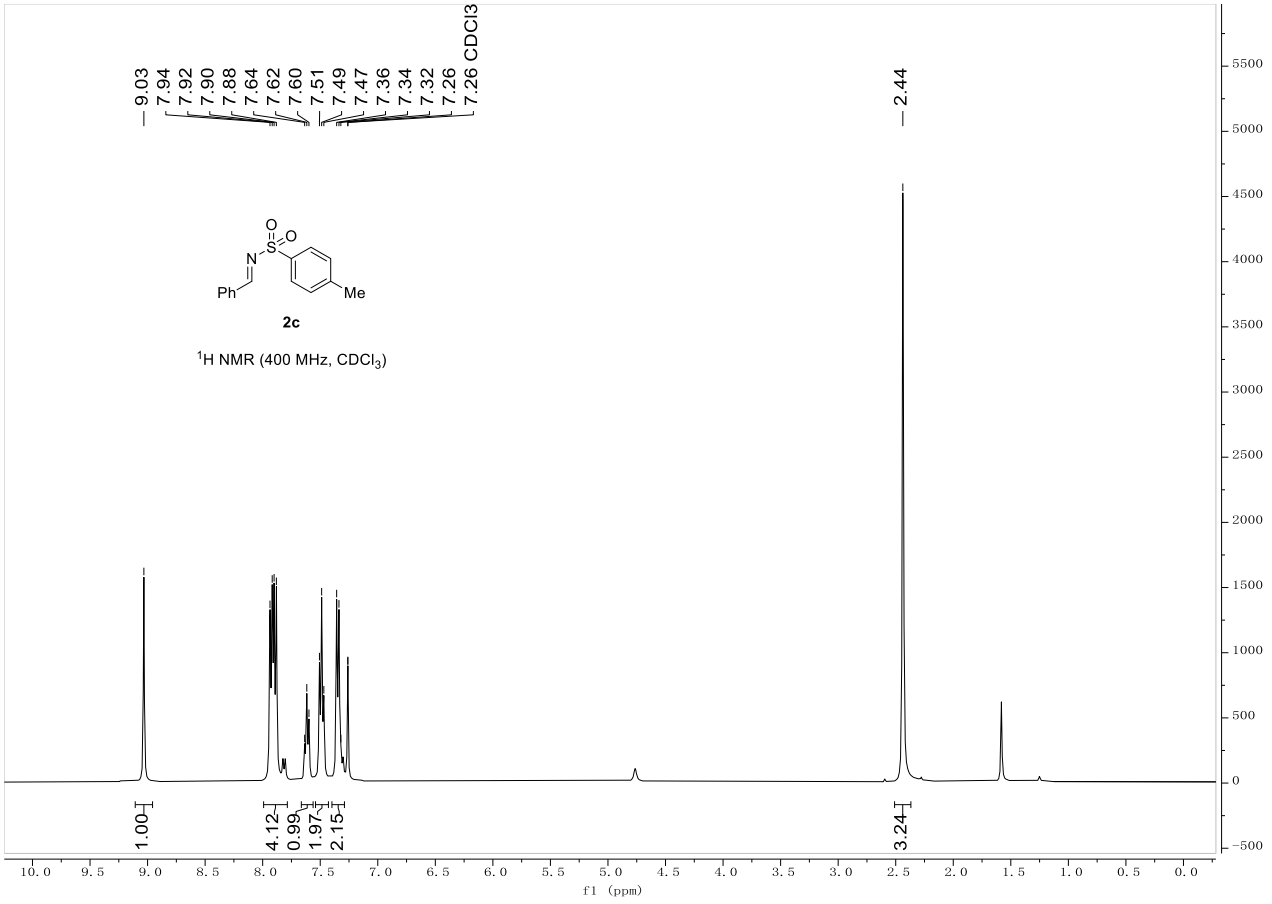
2b

^{1}H NMR (400 MHz, $CDCl_3$)



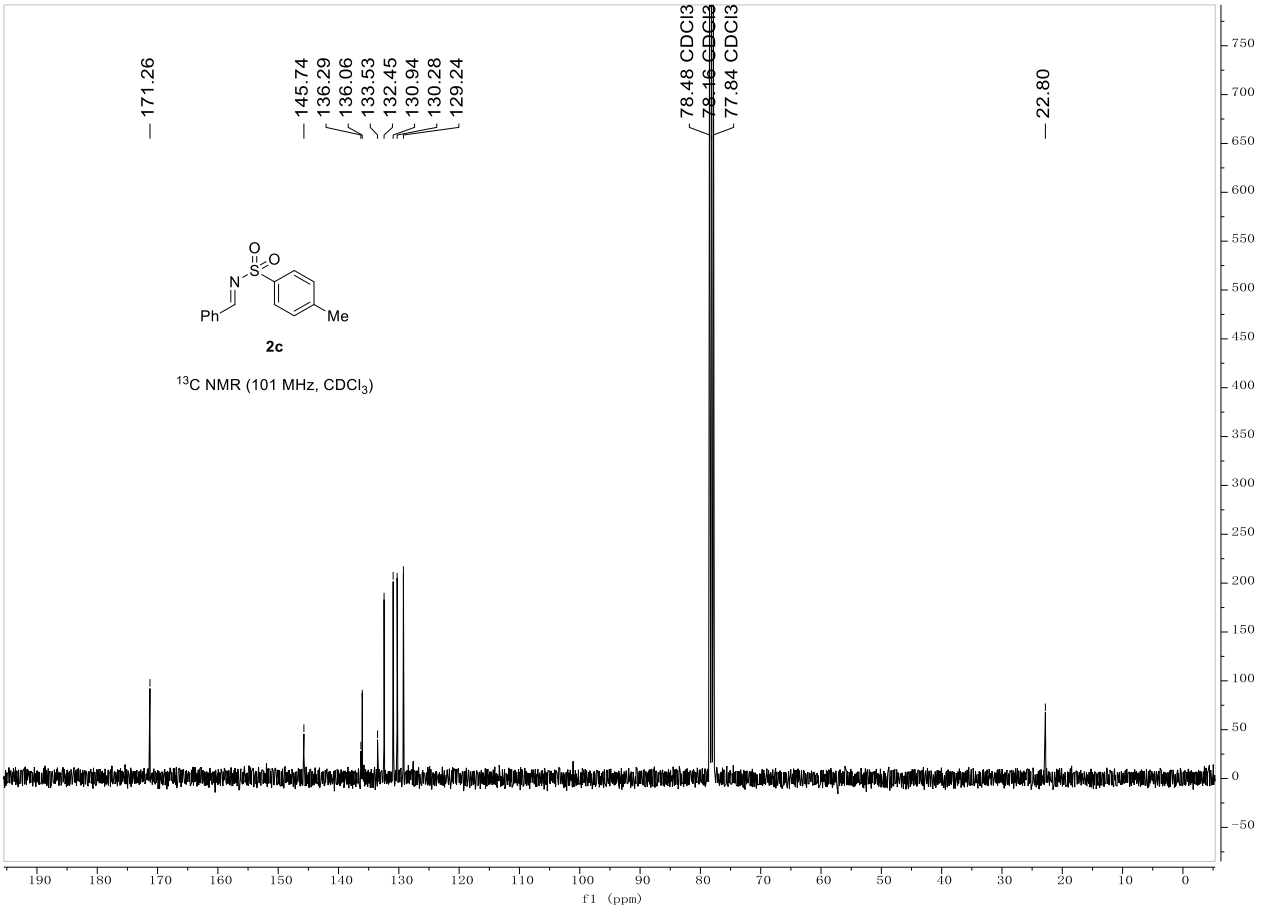
2b

^{13}C NMR (101 MHz, $CDCl_3$)



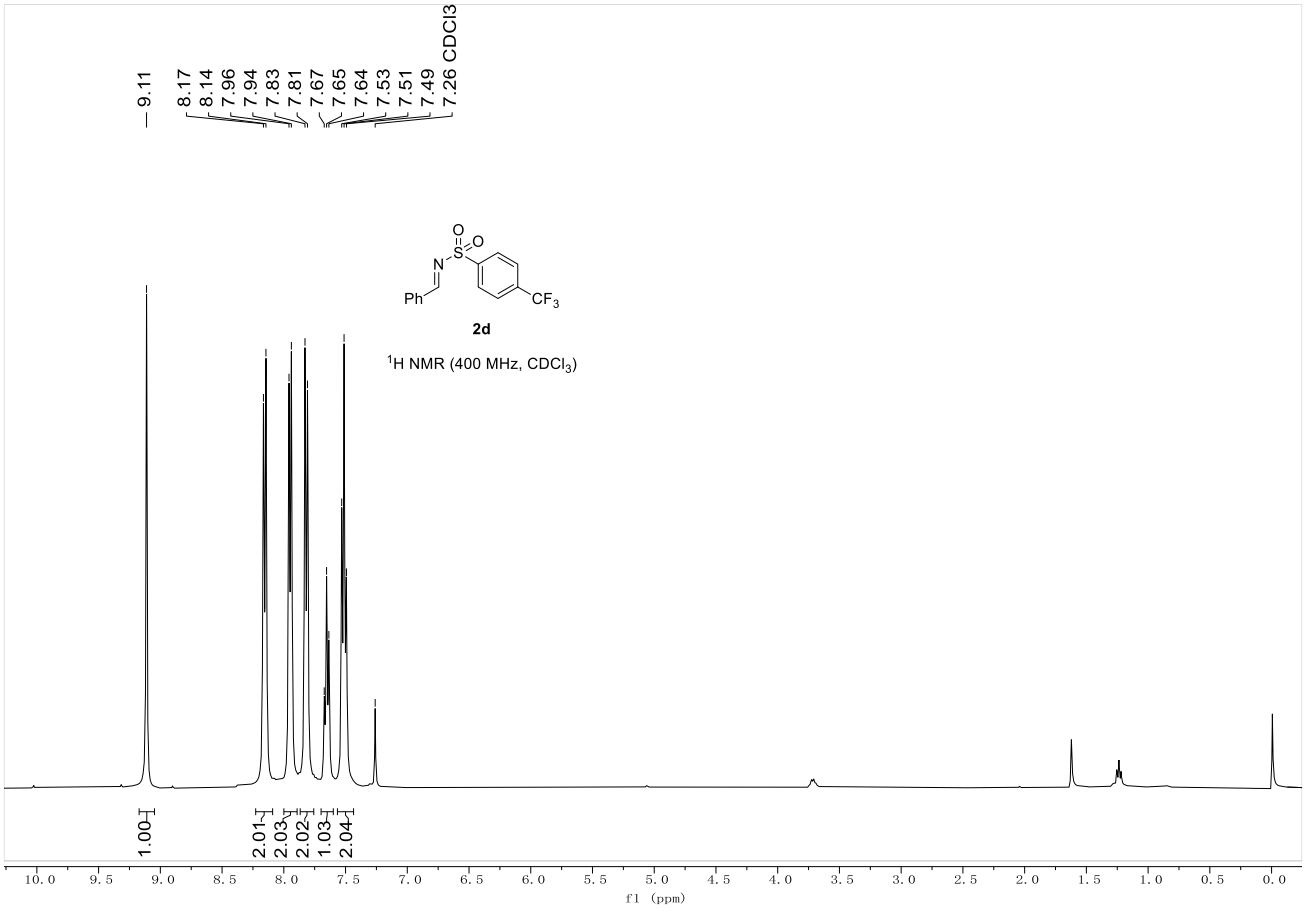
2c

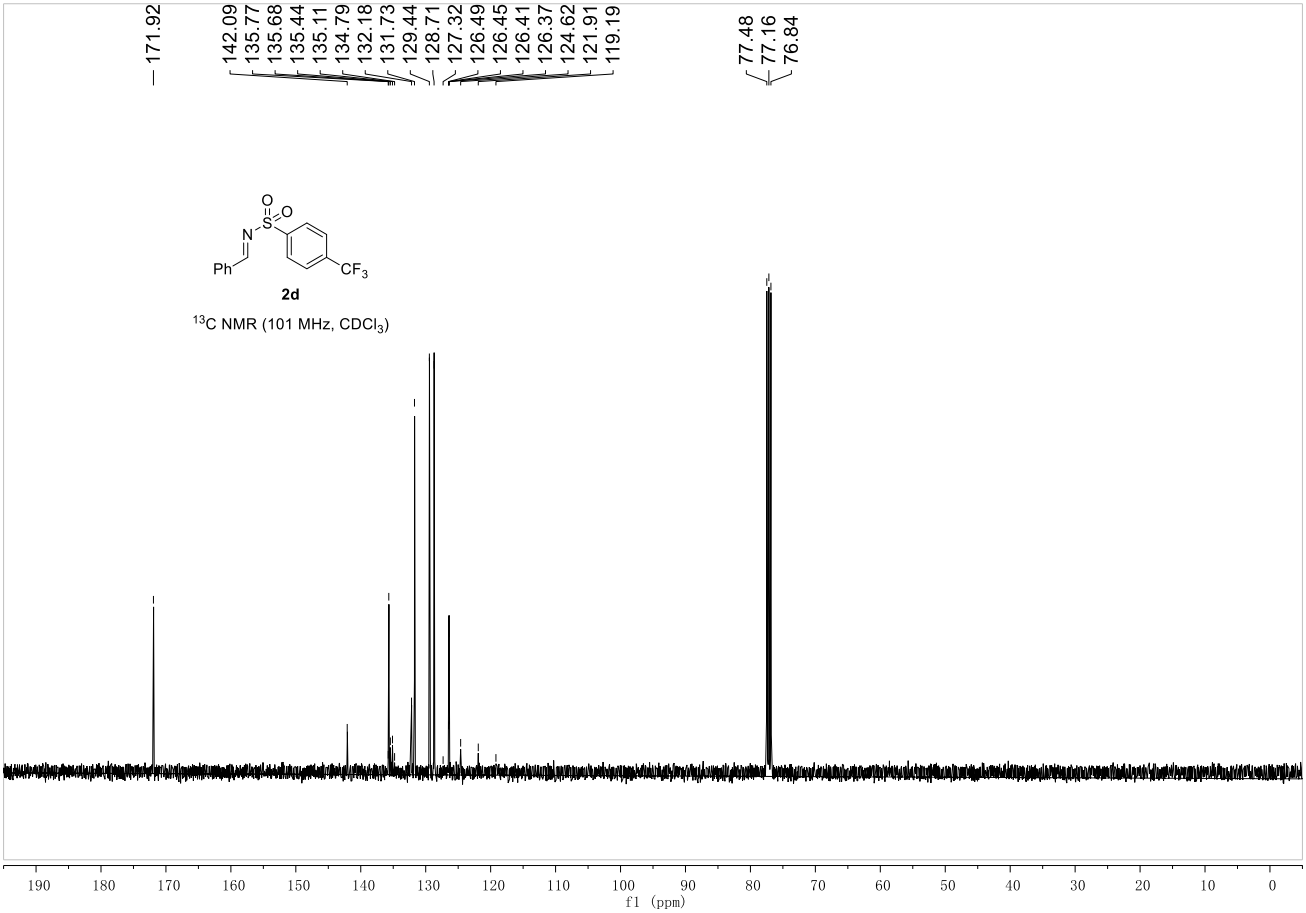
^{1}H NMR (400 MHz, $CDCl_3$)

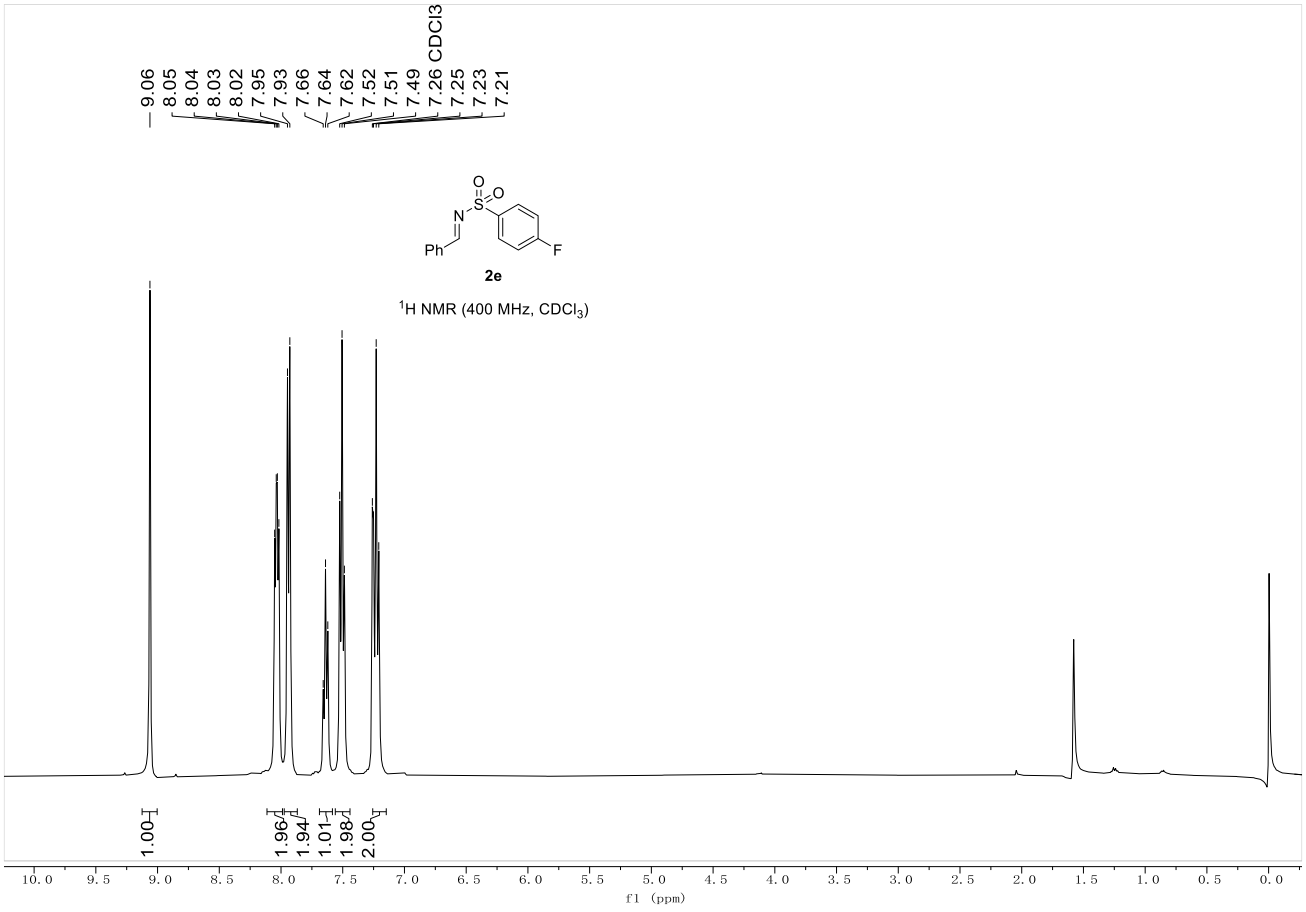


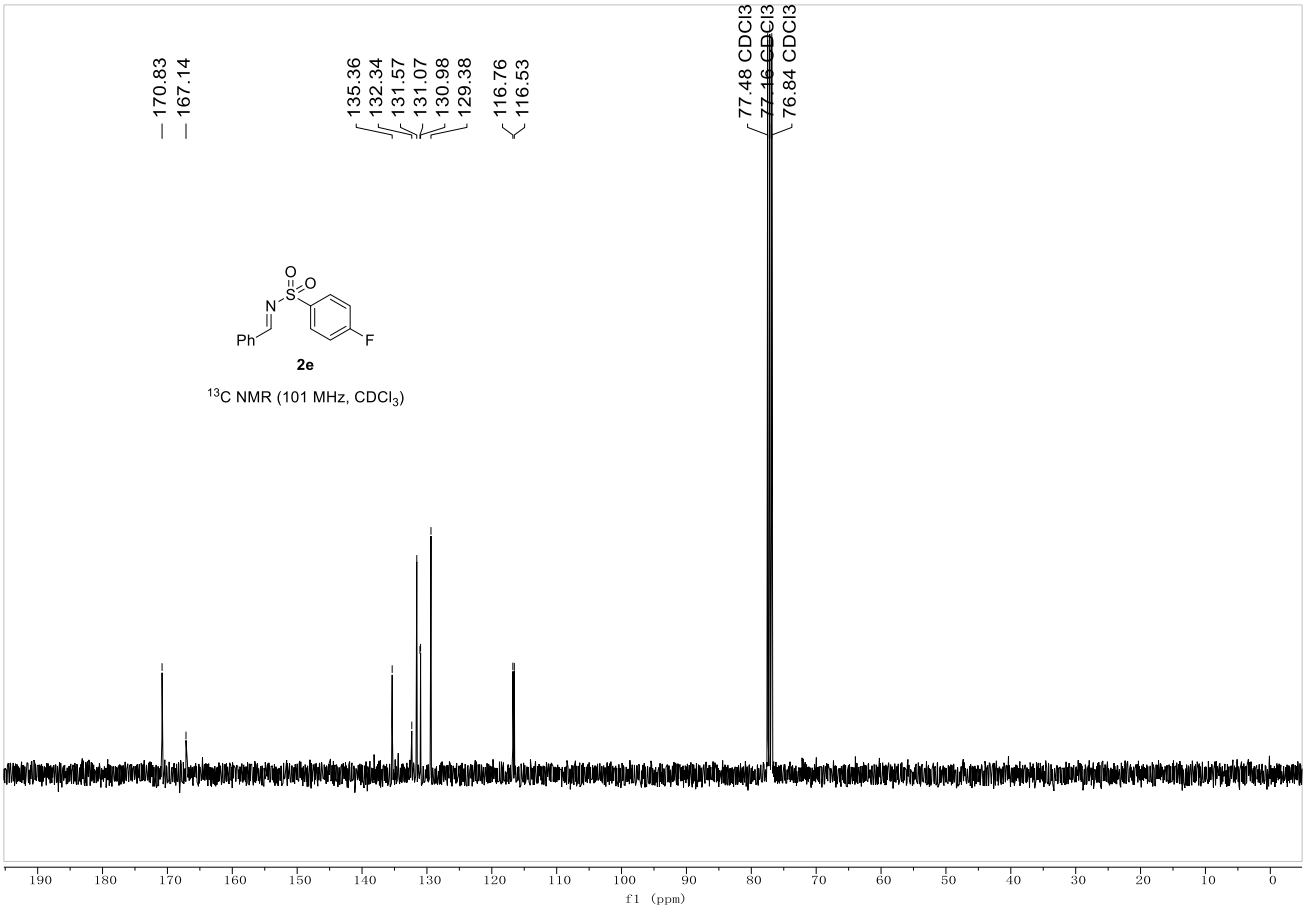
2c

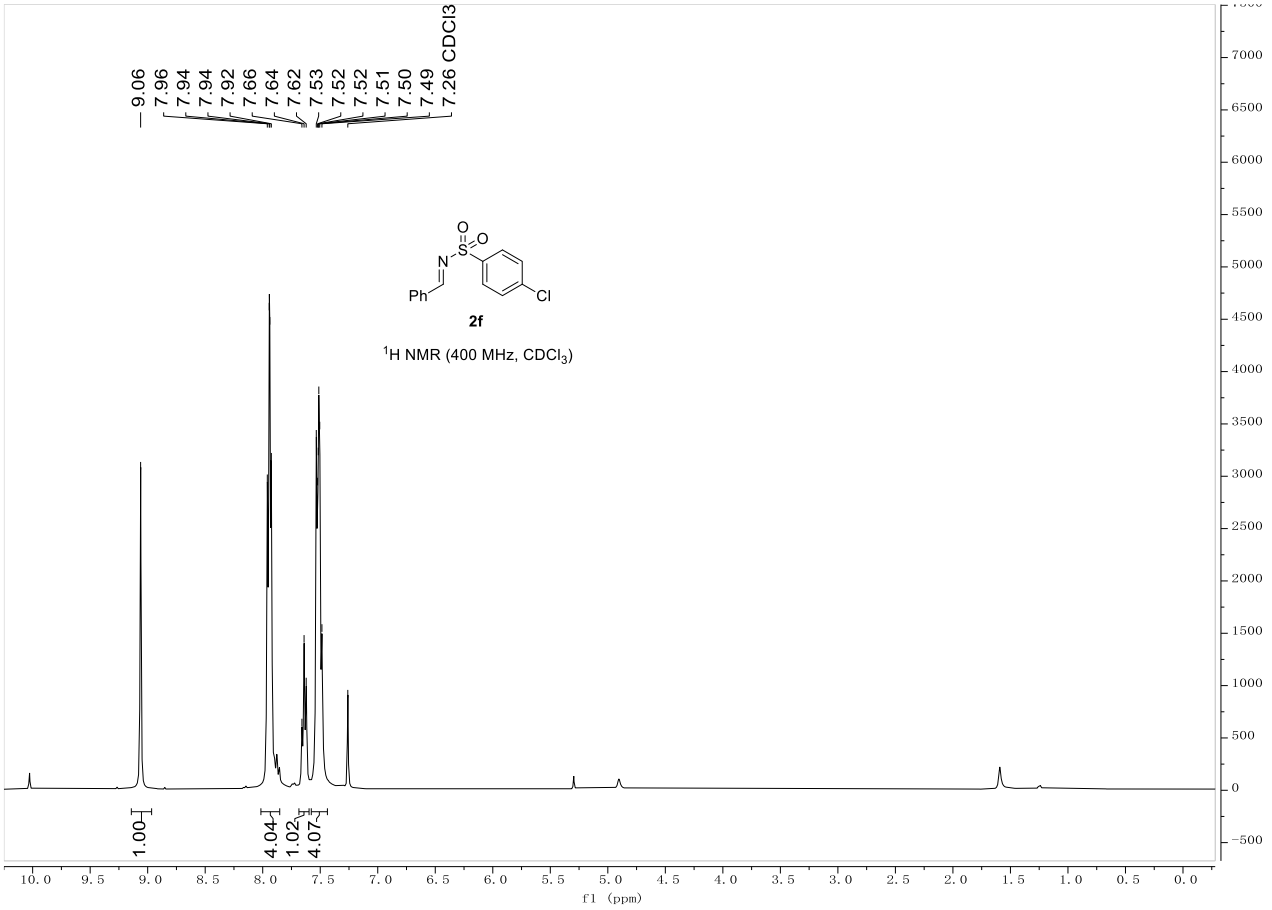
^{13}C NMR (101 MHz, $CDCl_3$)

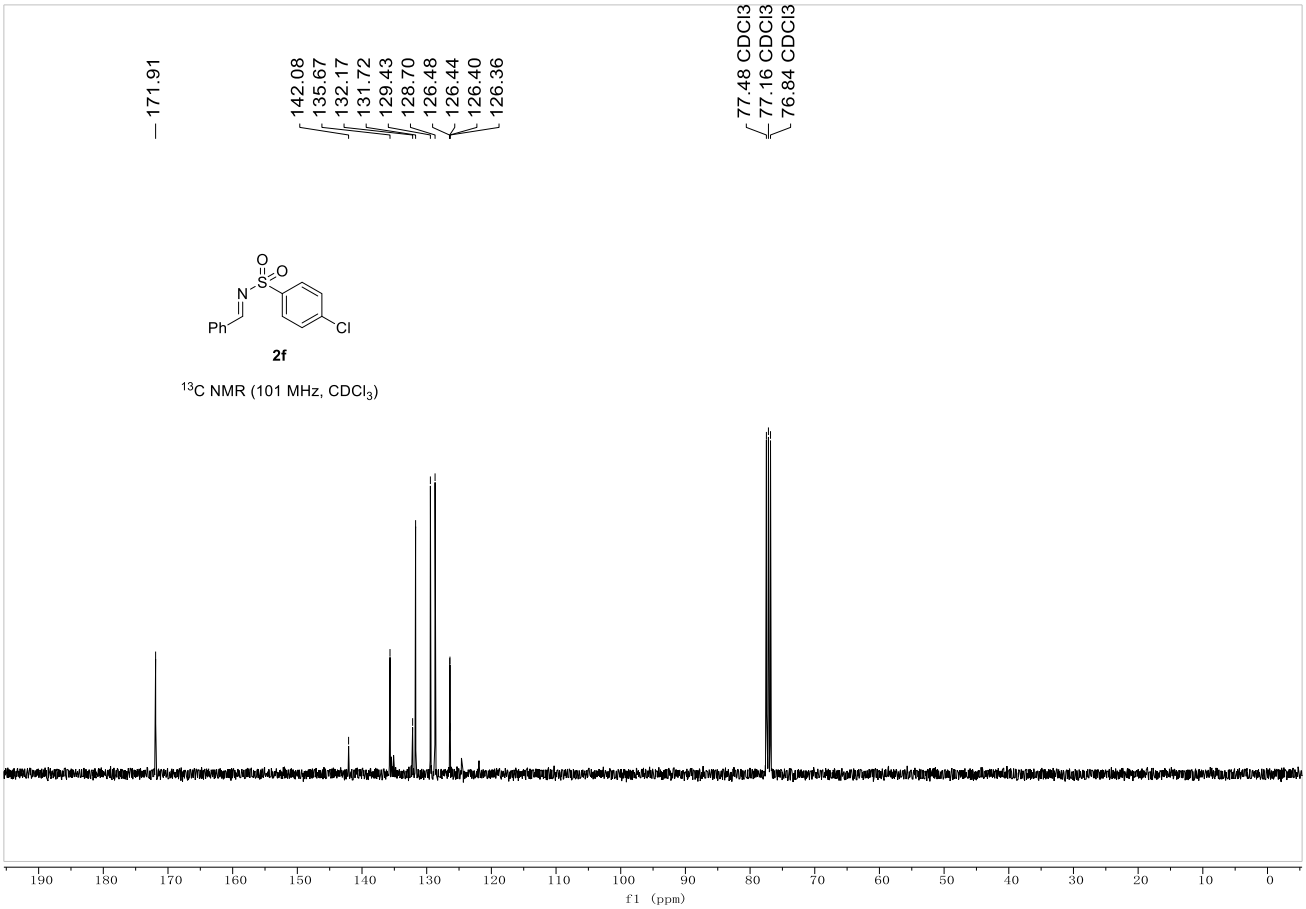

9.11
8.17
8.14
7.96
7.94
7.83
7.81
7.67
7.65
7.64
7.53
7.51
7.49
7.26 CDCl3
Ph
CF3
2d
1H NMR (400 MHz, CDCl3)
1.00
2.01
2.03
2.02
1.03
2.04
f1 (ppm)


171.92
142.09
135.77
135.68
135.44
135.11
134.79
132.18
131.73
129.44
128.71
127.32
126.49
126.45
126.41
126.37
124.62
121.91
119.19
77.48
77.16
76.84
Ph
CF3
2d
13C NMR (101 MHz, CDCl3)
f1 (ppm)


9.06
8.05
8.04
8.03
8.02
7.95
7.93
7.66
7.64
7.62
7.52
7.51
7.49
7.26 CDCl3
7.25
7.23
7.21
Ph
F
2e
1H NMR (400 MHz, CDCl3)
1.00
1.96
1.94
1.01
1.98
2.00
f1 (ppm)


170.83
167.14
135.36
132.34
131.57
131.07
130.98
129.38
116.76
116.53
77.48 CDCl3
77.16 CDCl3
76.84 CDCl3
Ph
F
2e
13C NMR (101 MHz, CDCl3)
f1 (ppm)


9.06
7.96
7.94
7.94
7.92
7.66
7.64
7.62
7.53
7.52
7.52
7.51
7.50
7.49
7.26 CDCl3
Ph
N
S
O
O
Cl
2f
1H NMR (400 MHz, CDCl3)
1.00
4.04
1.02
4.07
f1 (ppm)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142.08
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132.17
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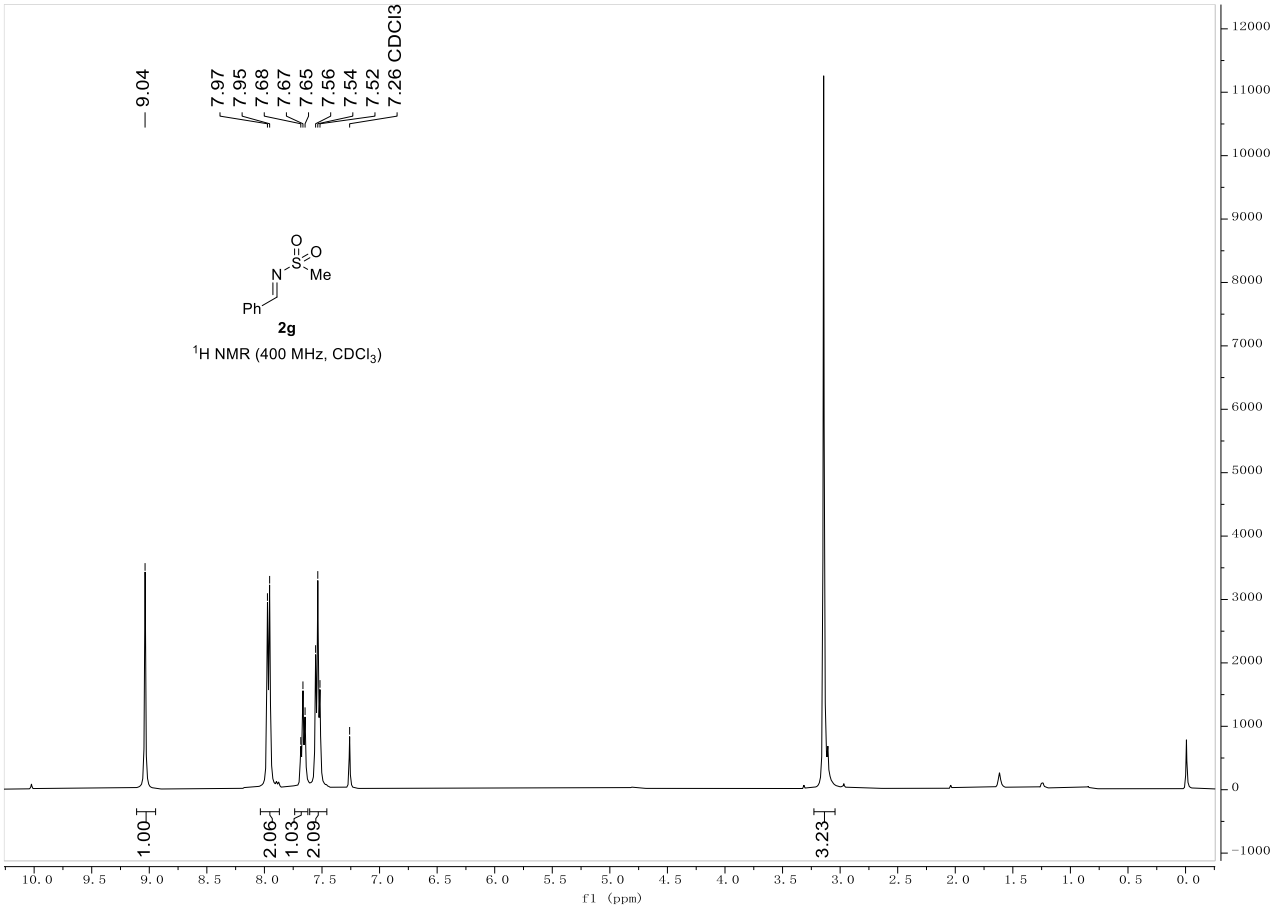
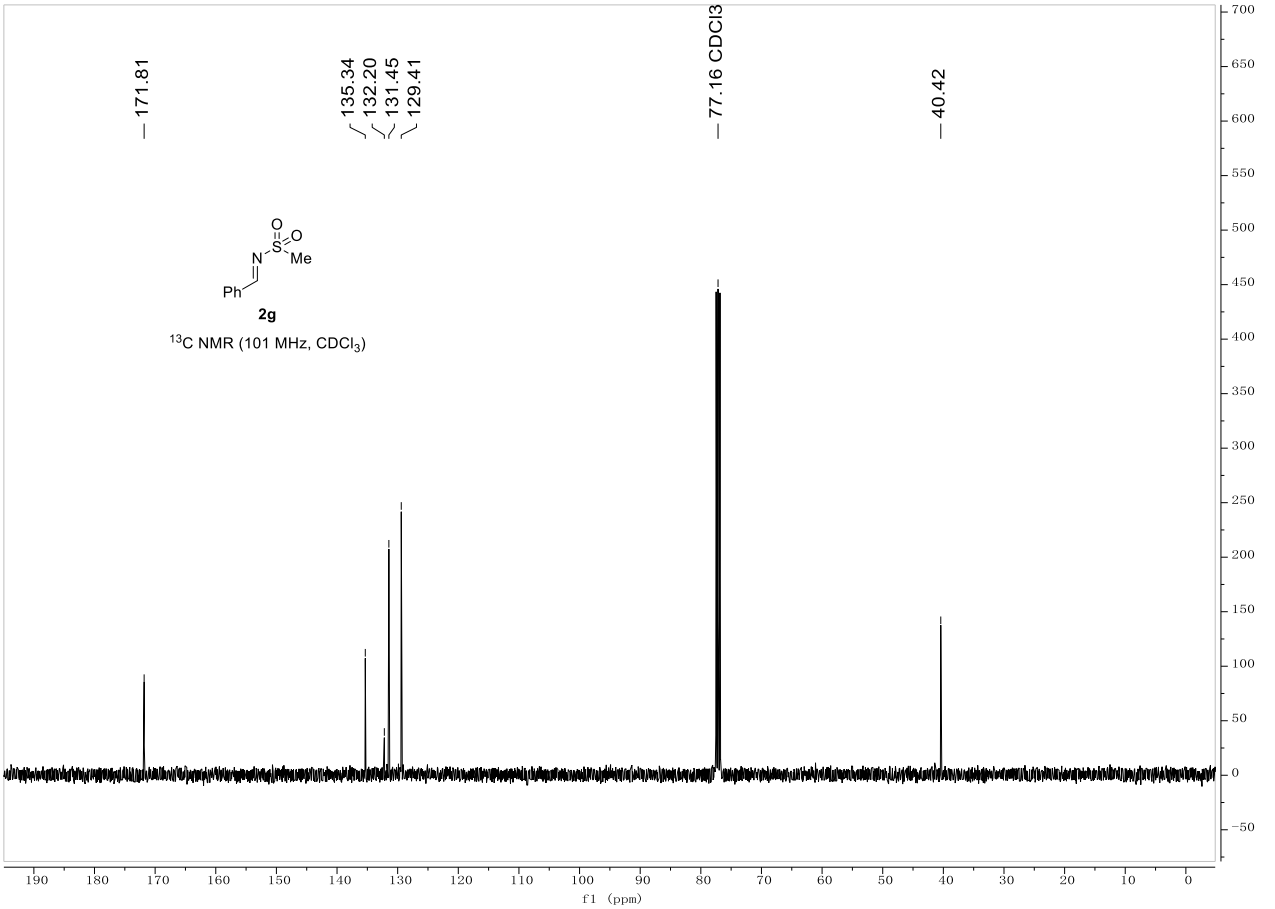
126.44
126.40
126.36
77.48 CDCl3
77.16 CDCl3
76.84 CDCl3
Ph
N
S
O
O
Cl
2f
13C NMR (101 MHz, CDCl3)
f1 (ppm)



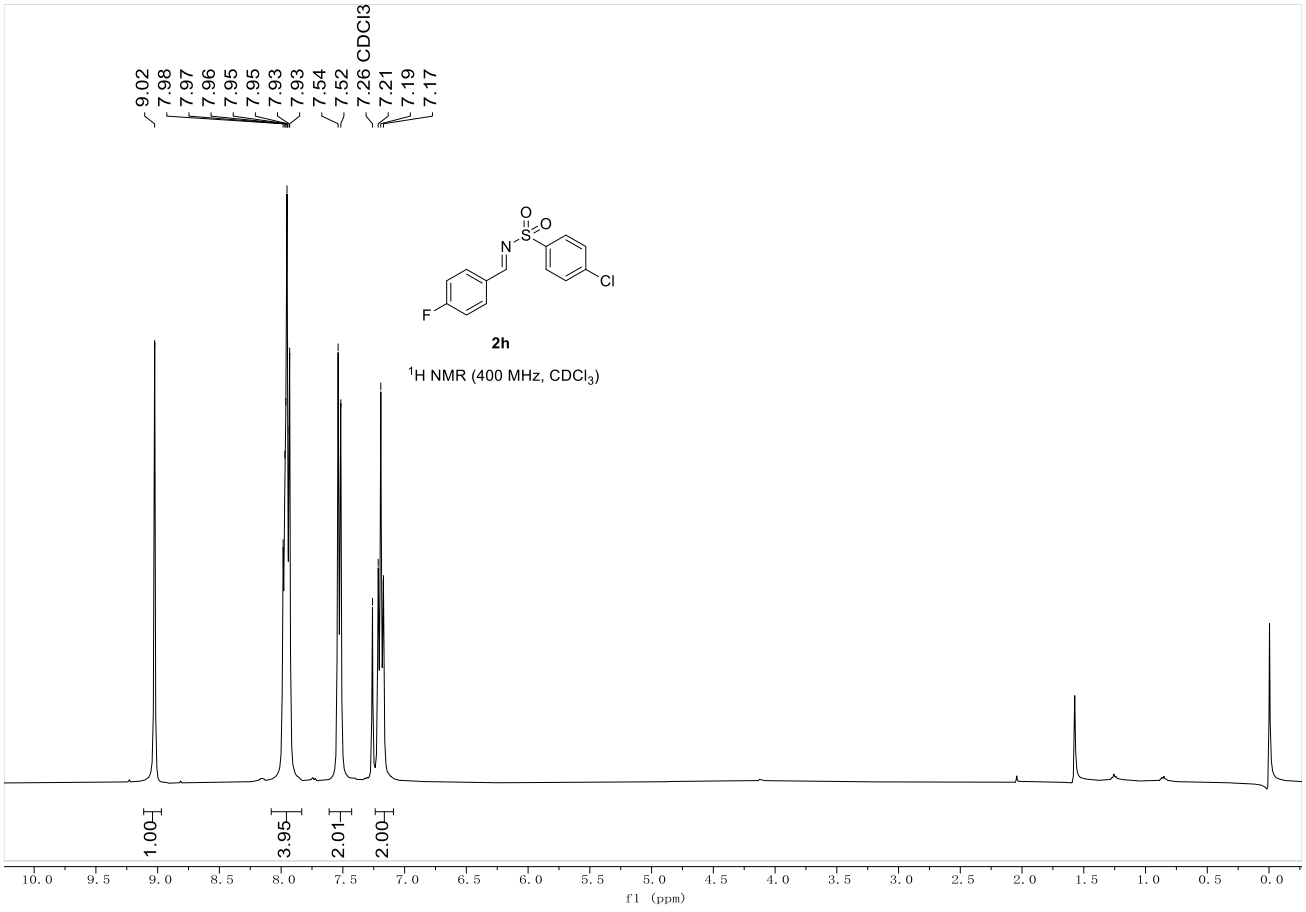
2g

^{1}H NMR (400 MHz, $CDCl_3$)



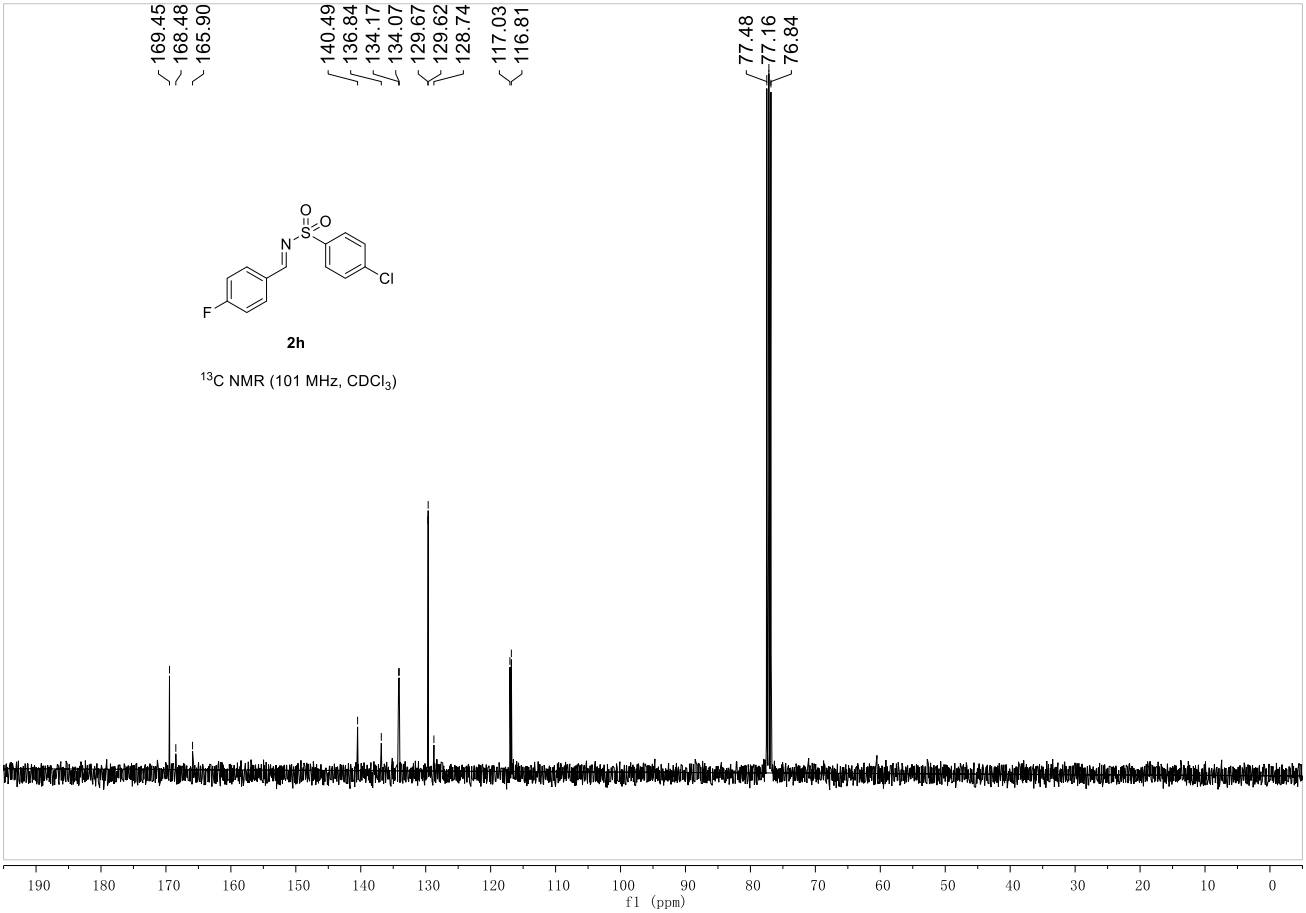
2g

^{13}C NMR (101 MHz, $CDCl_3$)



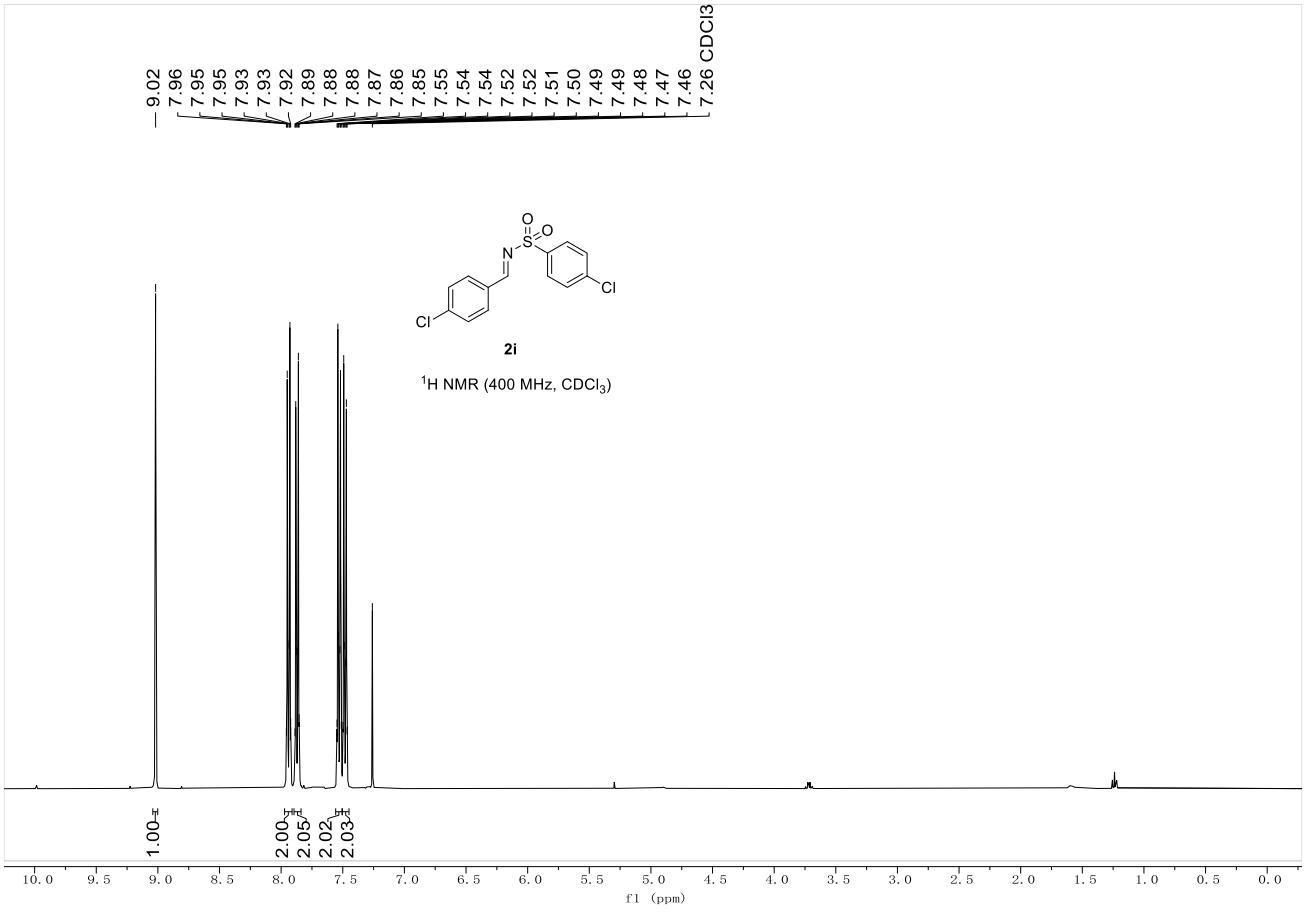
2h

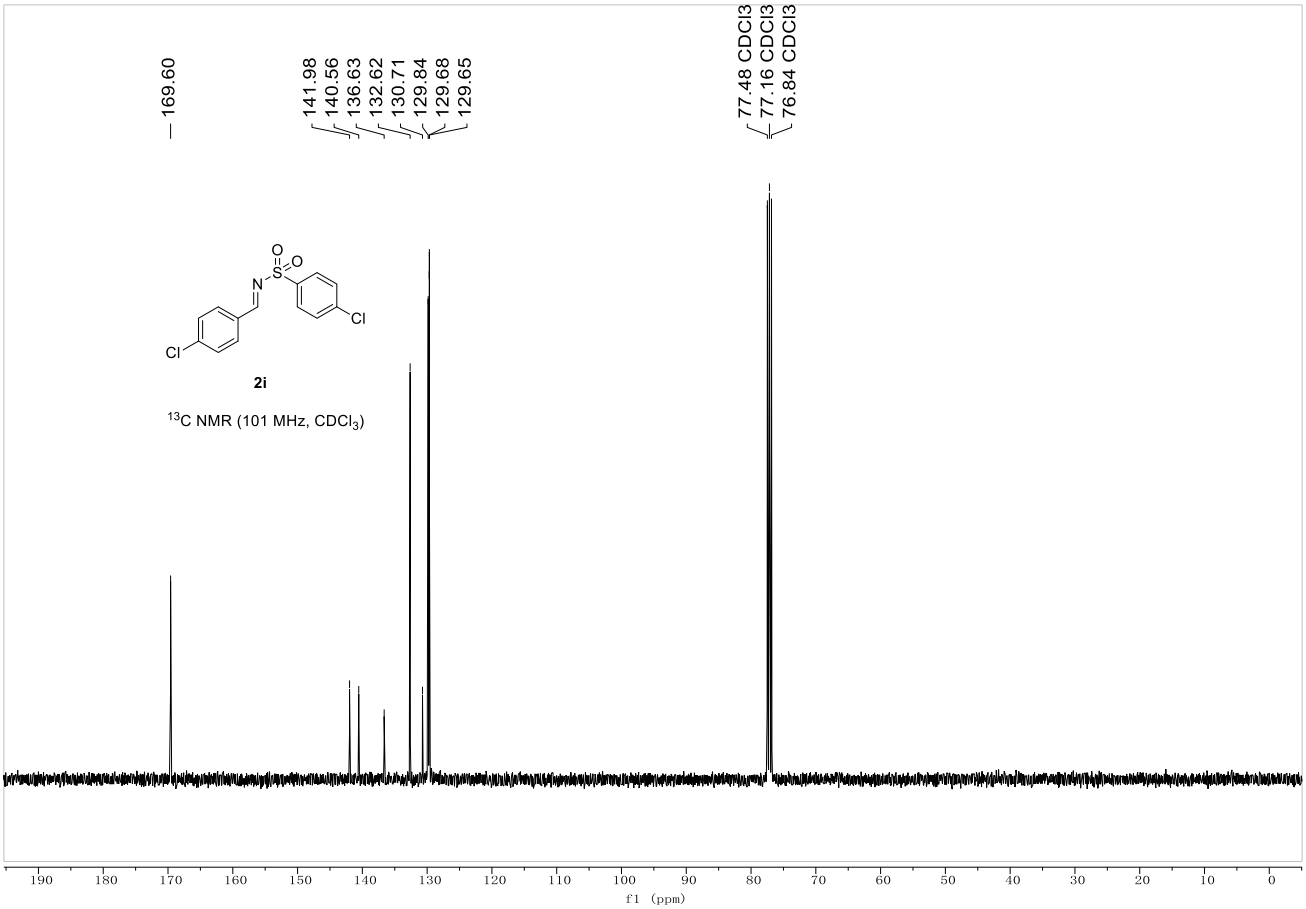
^{1}H NMR (400 MHz, $CDCl_3$)

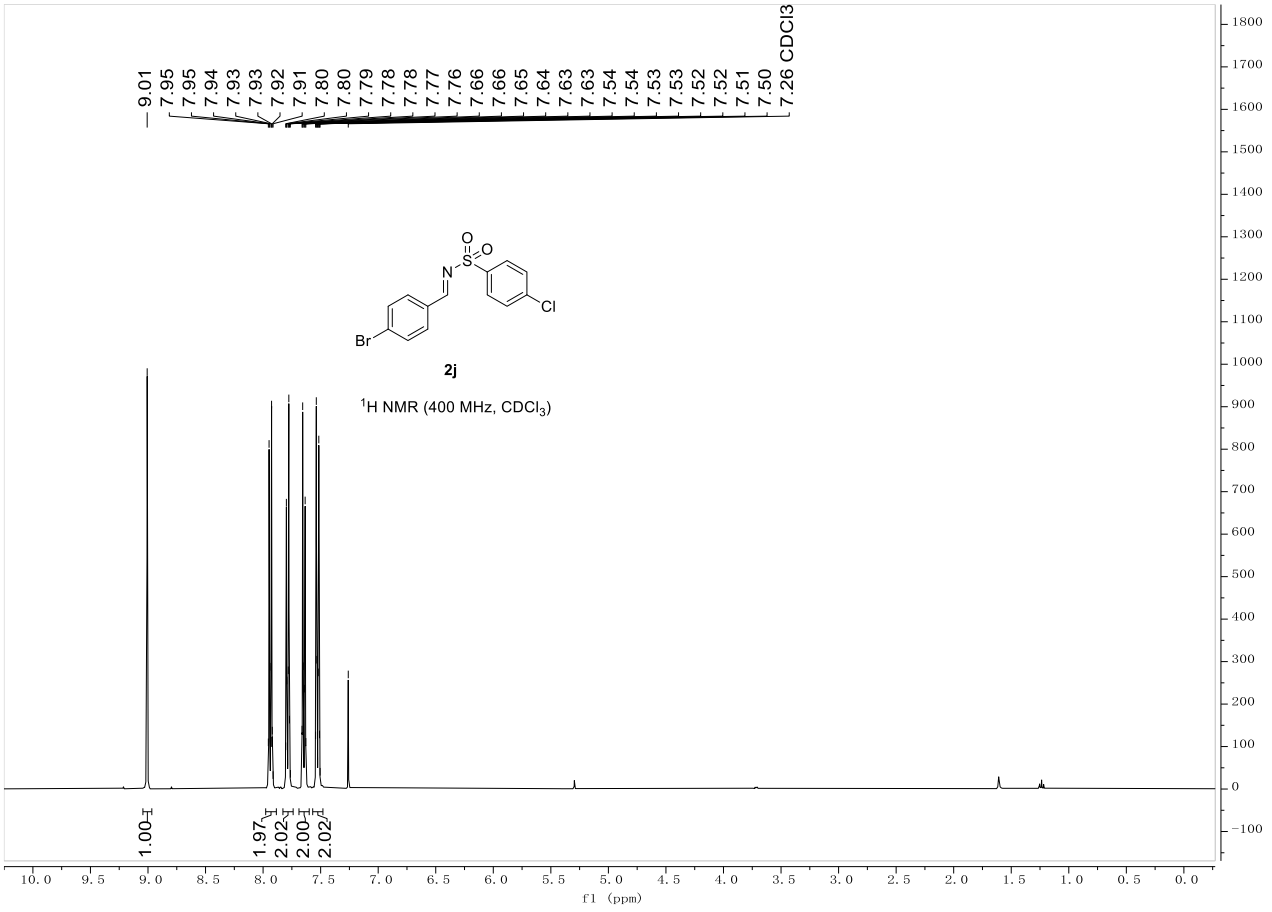


2h

^{13}C NMR (101 MHz, $CDCl_3$)


9.02
7.96
7.95
7.95
7.93
7.93
7.92
7.89
7.88
7.88
7.87
7.86
7.85
7.55
7.54
7.54
7.52
7.52
7.51
7.50
7.49
7.49
7.48
7.47
7.46
7.26 CDCl3
2i
1H NMR (400 MHz, CDCl3)
1.00
2.00
2.05
2.02
2.03
f1 (ppm)


169.60
141.98
140.56
136.63
132.62
130.71
129.84
129.68
129.65
77.48 CDCl3
77.16 CDCl3
76.84 CDCl3
2i
13C NMR (101 MHz, CDCl3)
f1 (ppm)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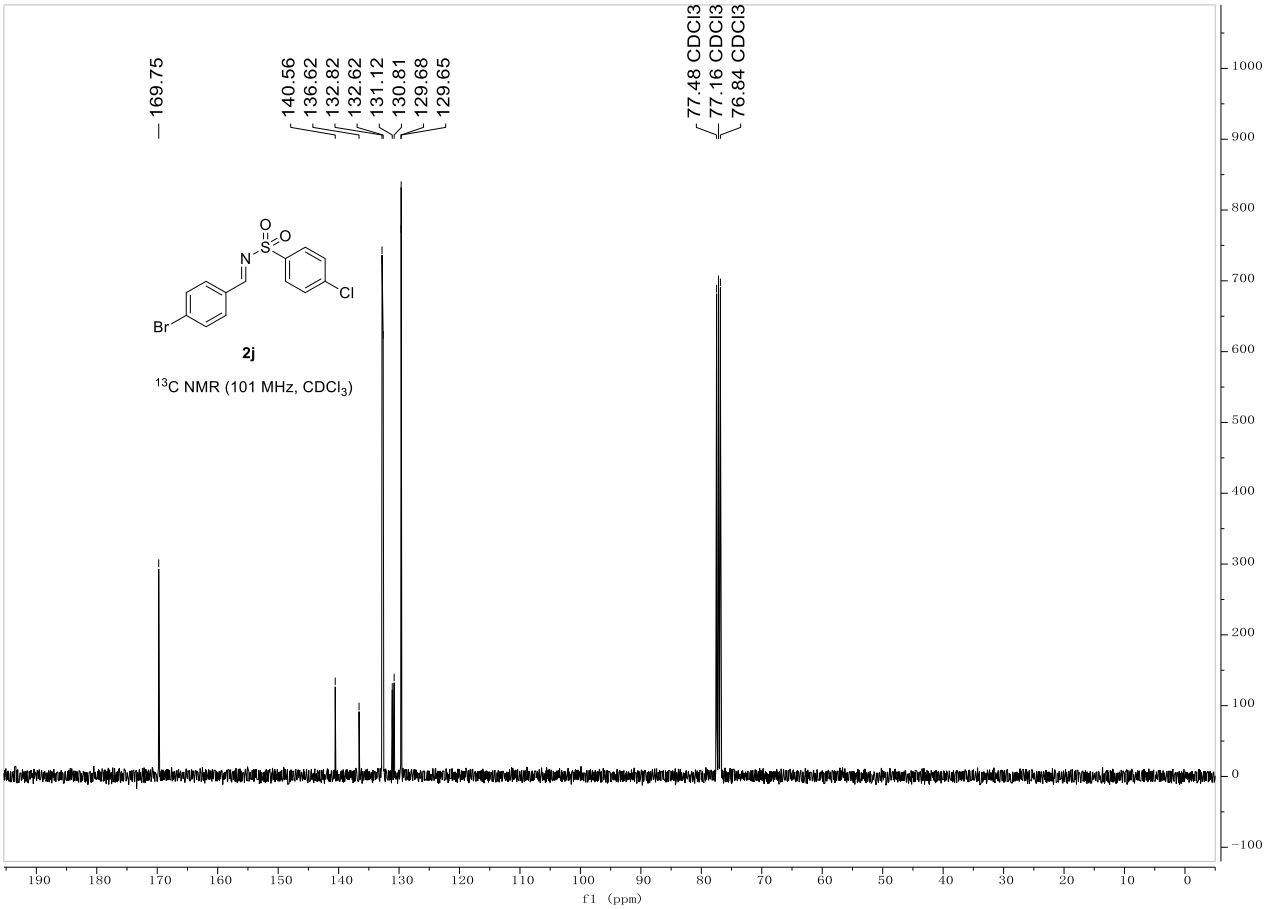
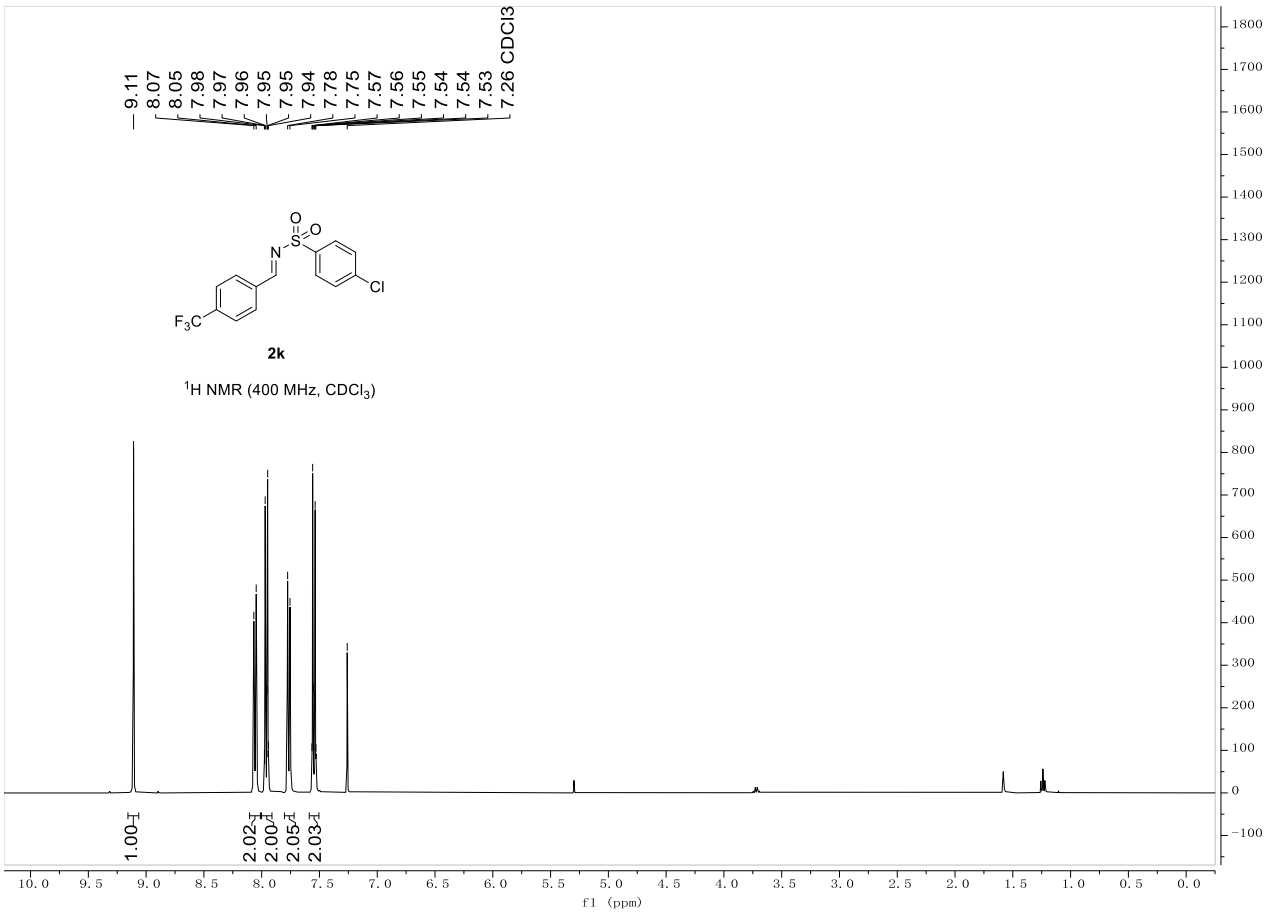
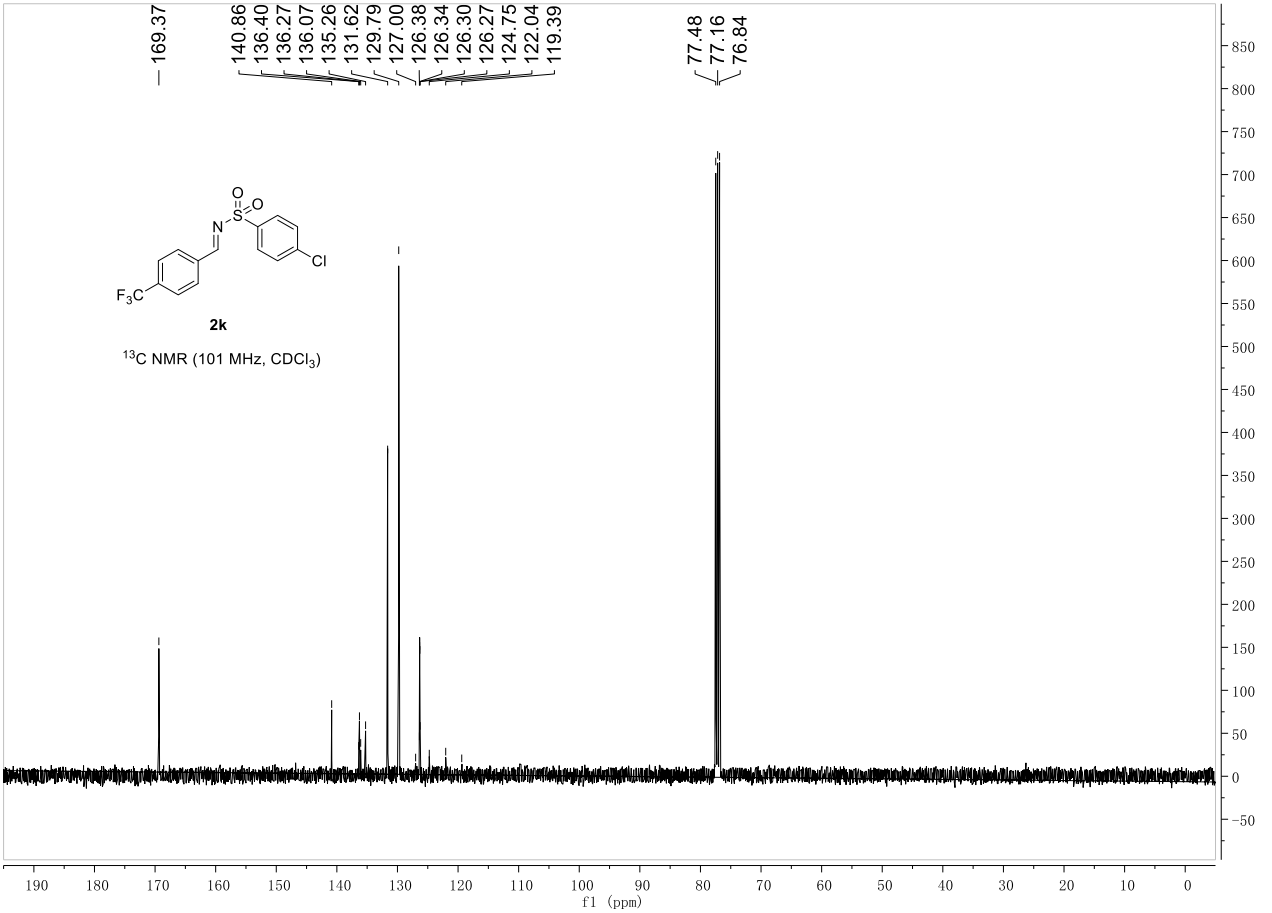
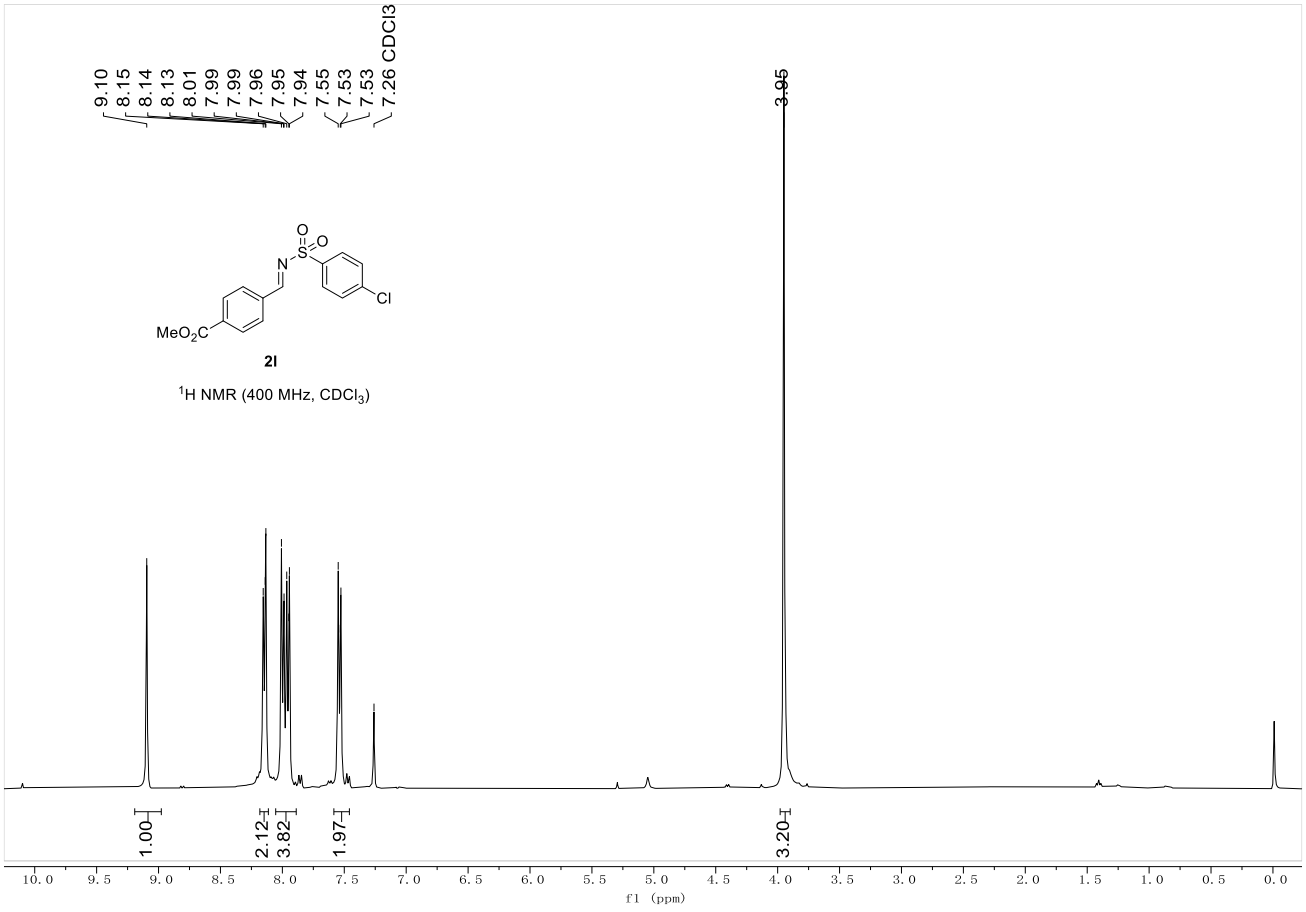
7.95
7.95
7.94
7.93
7.93
7.92
7.91
7.80
7.80
7.79
7.78
7.78
7.77
7.76
7.66
7.66
7.65
7.64
7.63
7.63
7.54
7.54
7.53
7.53
7.52
7.52
7.51
7.50
7.26 CDCl3
Br
Cl
2j
1H NMR (400 MHz, CDCl3)
1.00
1.97
2.02
2.00
2.02
f1 (ppm)


169.75
140.56
136.62
132.82
132.62
131.12
130.81
129.68
129.65
77.48 CDCl3
77.16 CDCl3
76.84 CDCl3
Br
Cl
2j
13C NMR (101 MHz, CDCl3)
f1 (ppm)

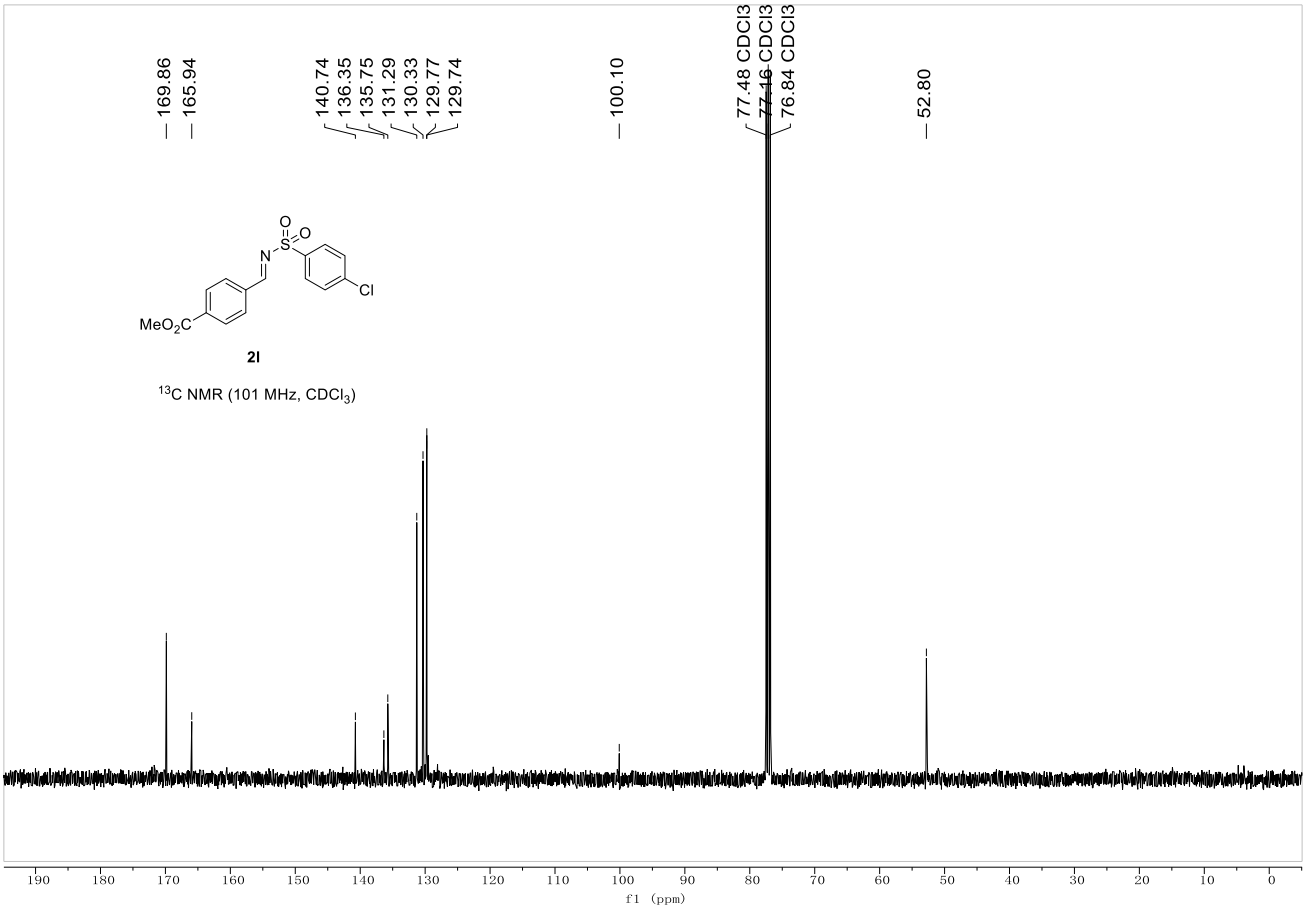

9.11
8.07
8.05
7.98
7.97
7.96
7.95
7.95
7.94
7.78
7.75
7.57
7.56
7.55
7.54
7.54
7.53
7.26 CDCl3
O
S
O
N
Cl
F3C
2k
1H NMR (400 MHz, CDCl3)
1.00
2.02
2.00
2.05
2.03
f1 (ppm)


169.37
140.86
136.40
136.27
136.07
135.26
131.62
129.79
127.00
126.38
126.34
126.30
126.27
124.75
122.04
119.39
77.48
77.16
76.84
O
S
O
N
Cl
F3C
2k
13C NMR (101 MHz, CDCl3)
f1 (ppm)



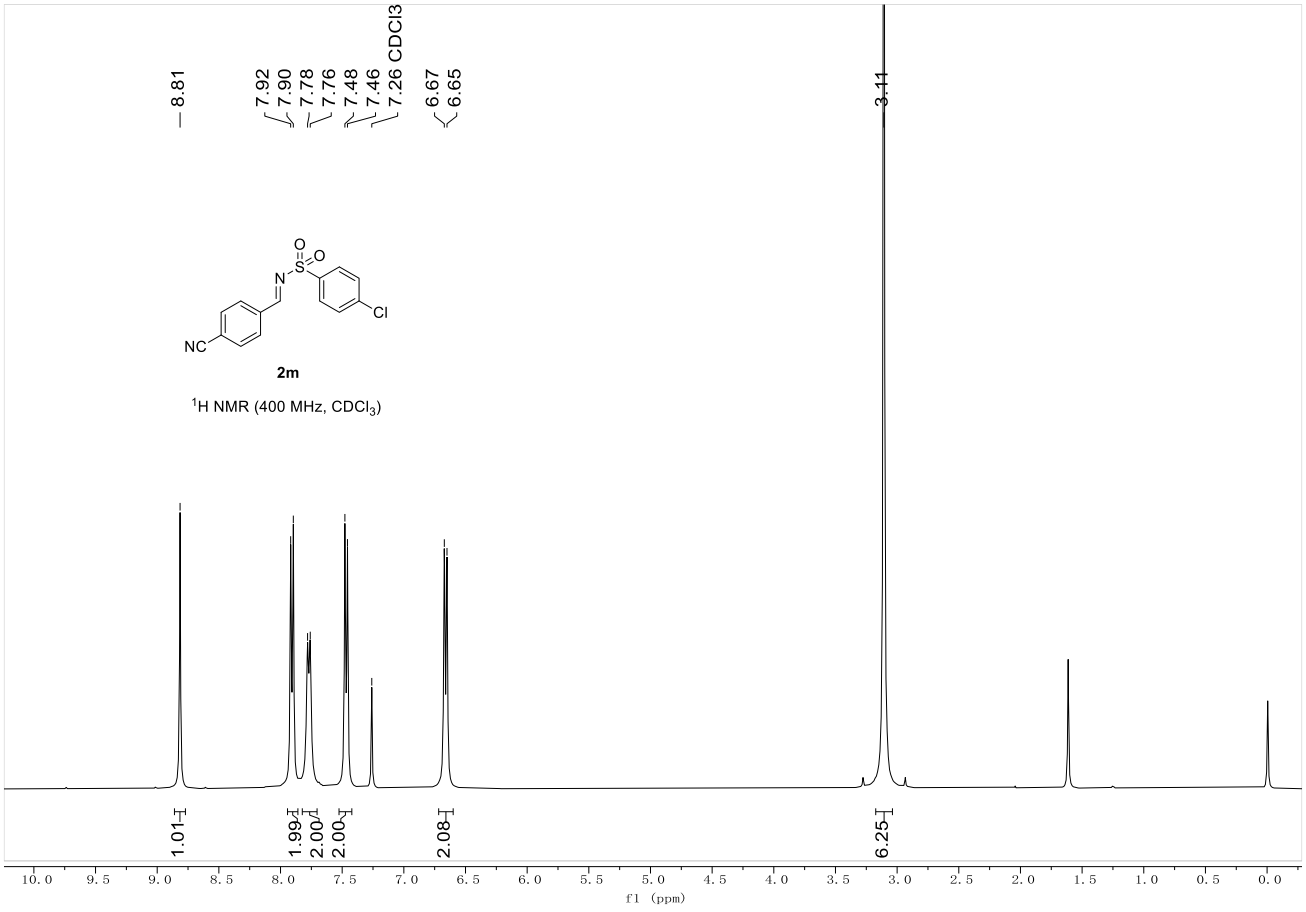
2l

^{1}H NMR (400 MHz, $CDCl_3$)



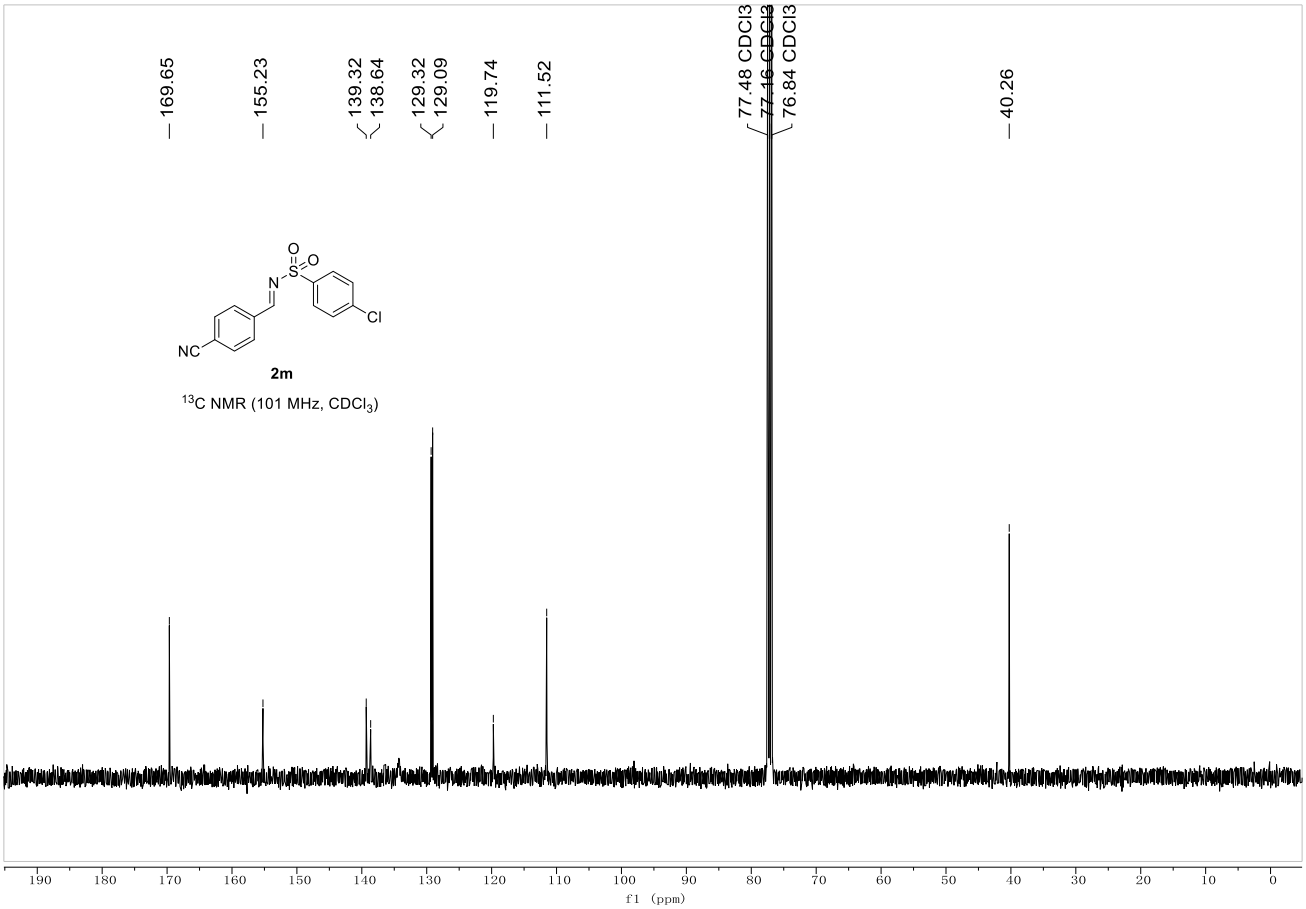
2l

^{13}C NMR (101 MHz, $CDCl_3$)



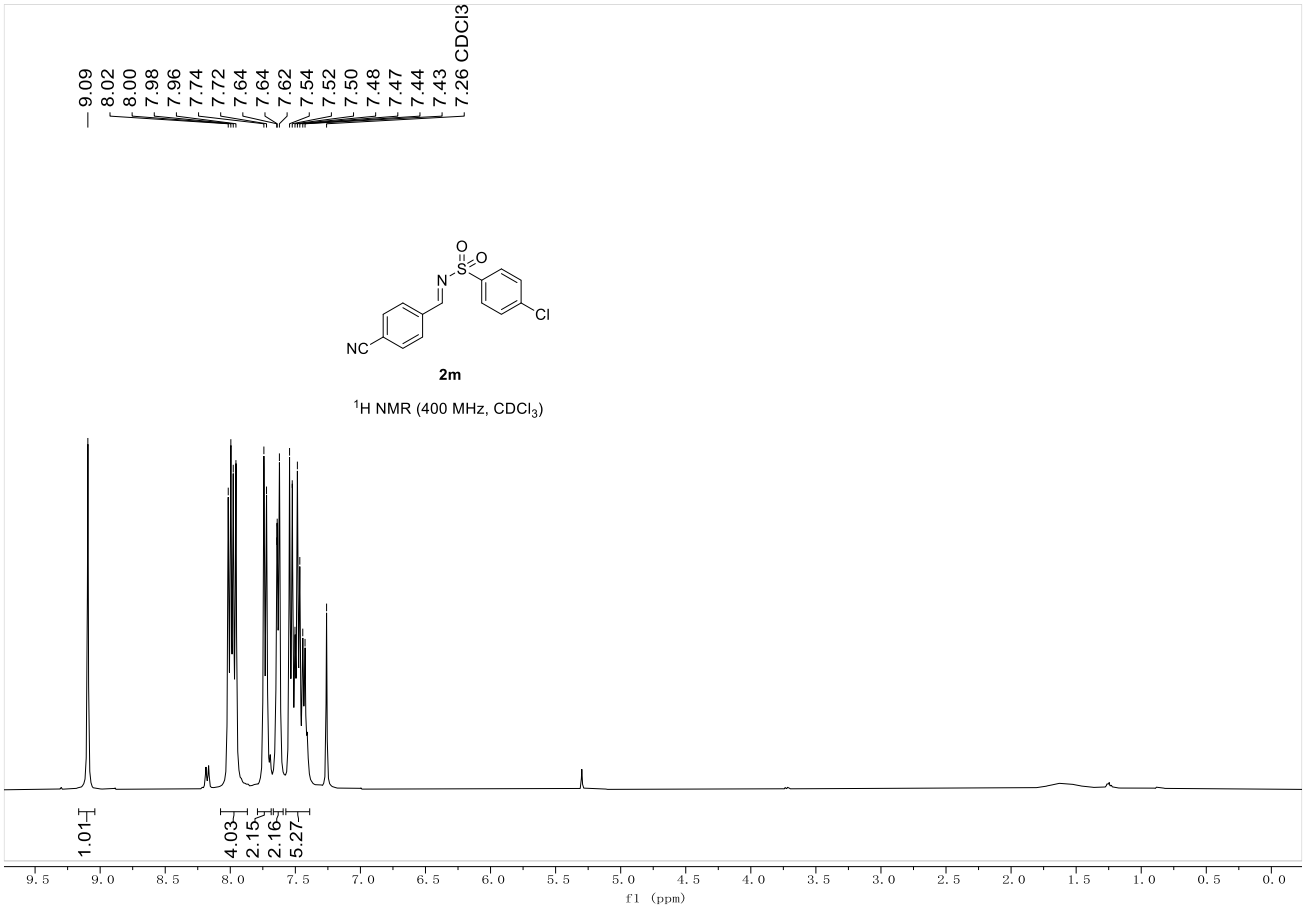
2m

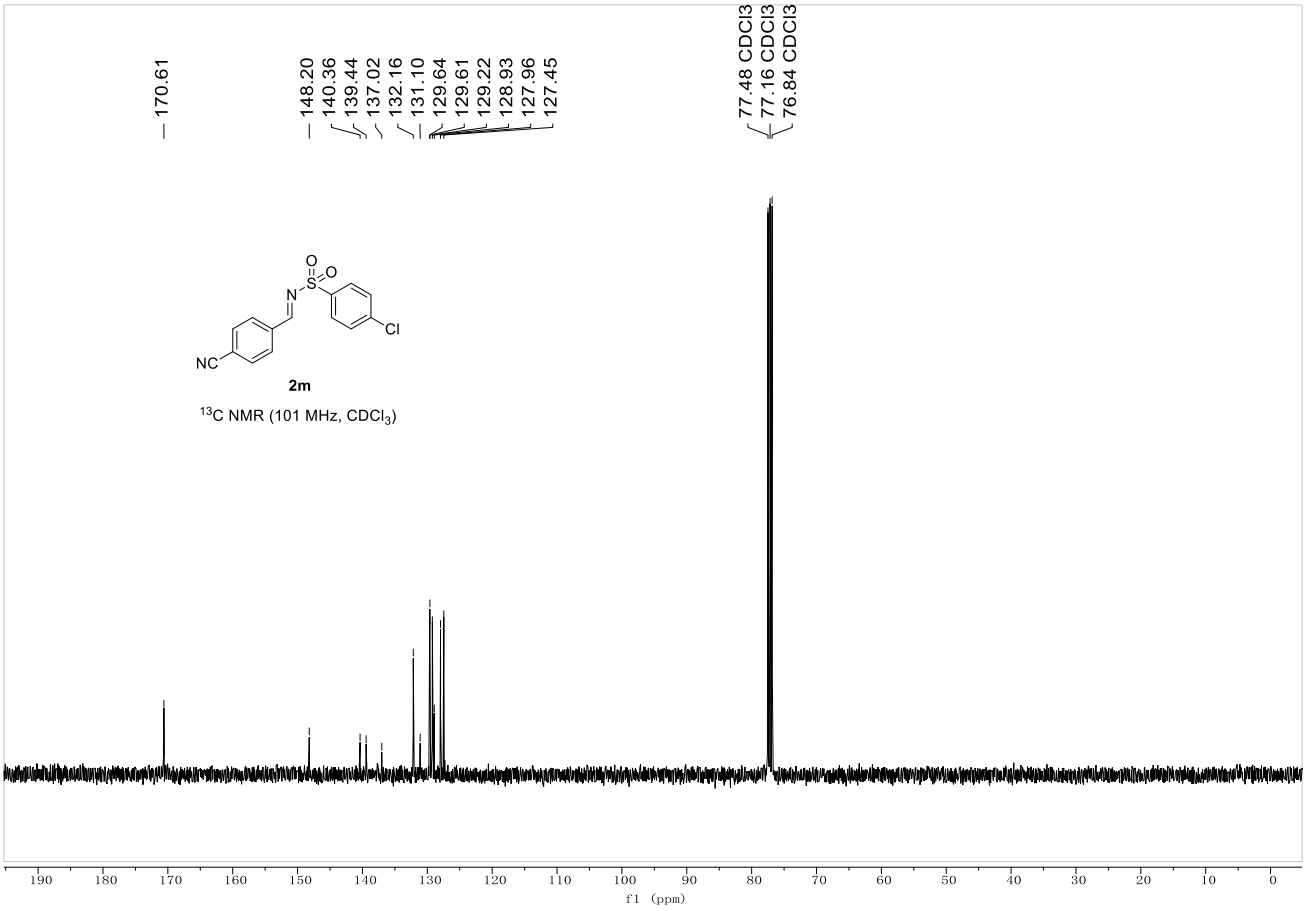
^{1}H NMR (400 MHz, $CDCl_3$)

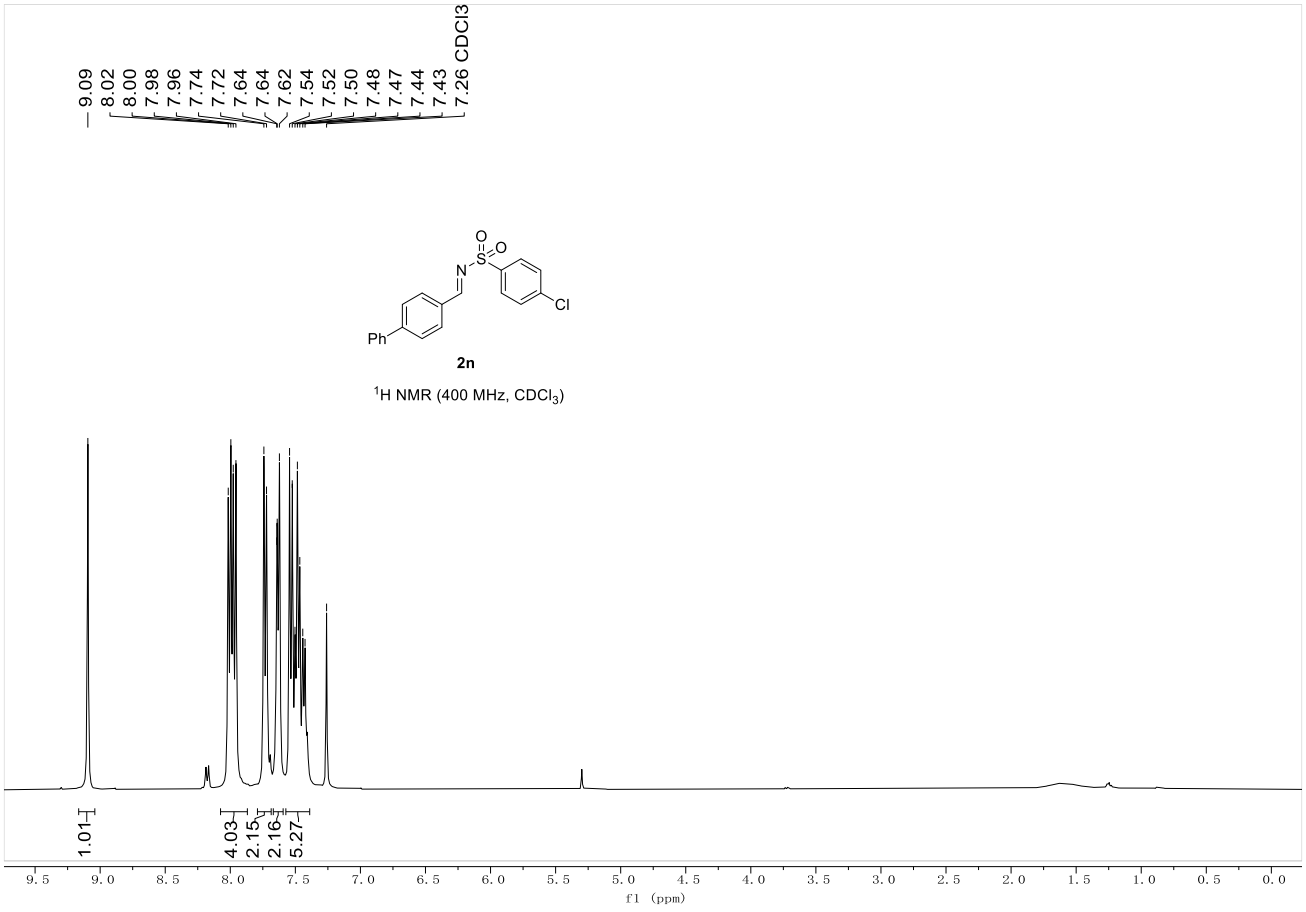


2m

^{13}C NMR (101 MHz, $CDCl_3$)

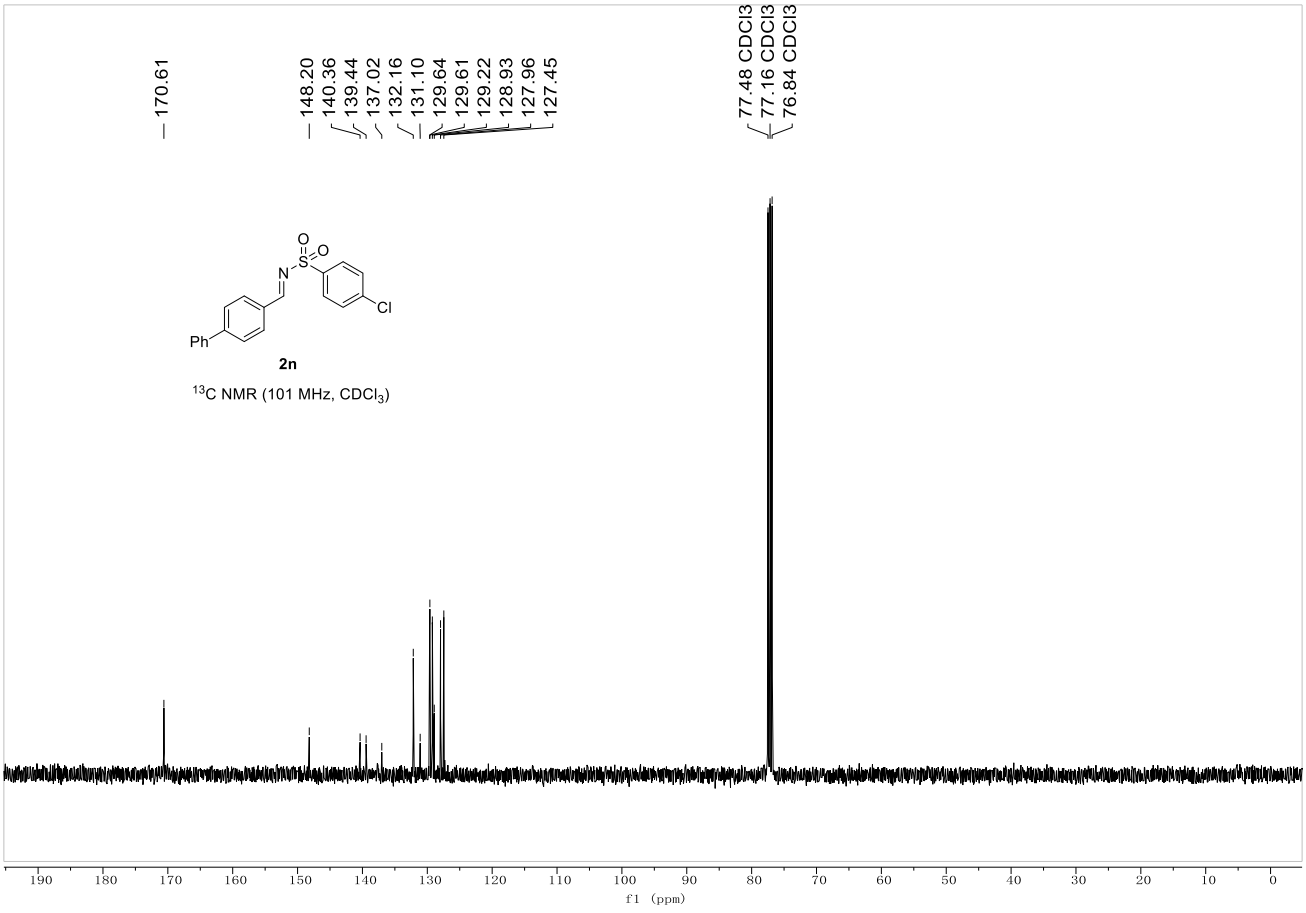

9.09
8.02
8.00
7.98
7.96
7.74
7.72
7.64
7.64
7.62
7.54
7.52
7.50
7.48
7.47
7.44
7.43
7.26 CDCl3
O
O
S
N
Cl
NC
2m
1H NMR (400 MHz, CDCl3)
1.01
4.03
2.15
2.16
5.27
f1 (ppm)


170.61
148.20
140.36
139.44
137.02
132.16
131.10
129.64
129.61
129.22
128.93
127.96
127.45
77.48 CDCl3
77.16 CDCl3
76.84 CDCl3
O
O
S
N
Cl
NC
2m
13C NMR (101 MHz, CDCl3)
f1 (ppm)



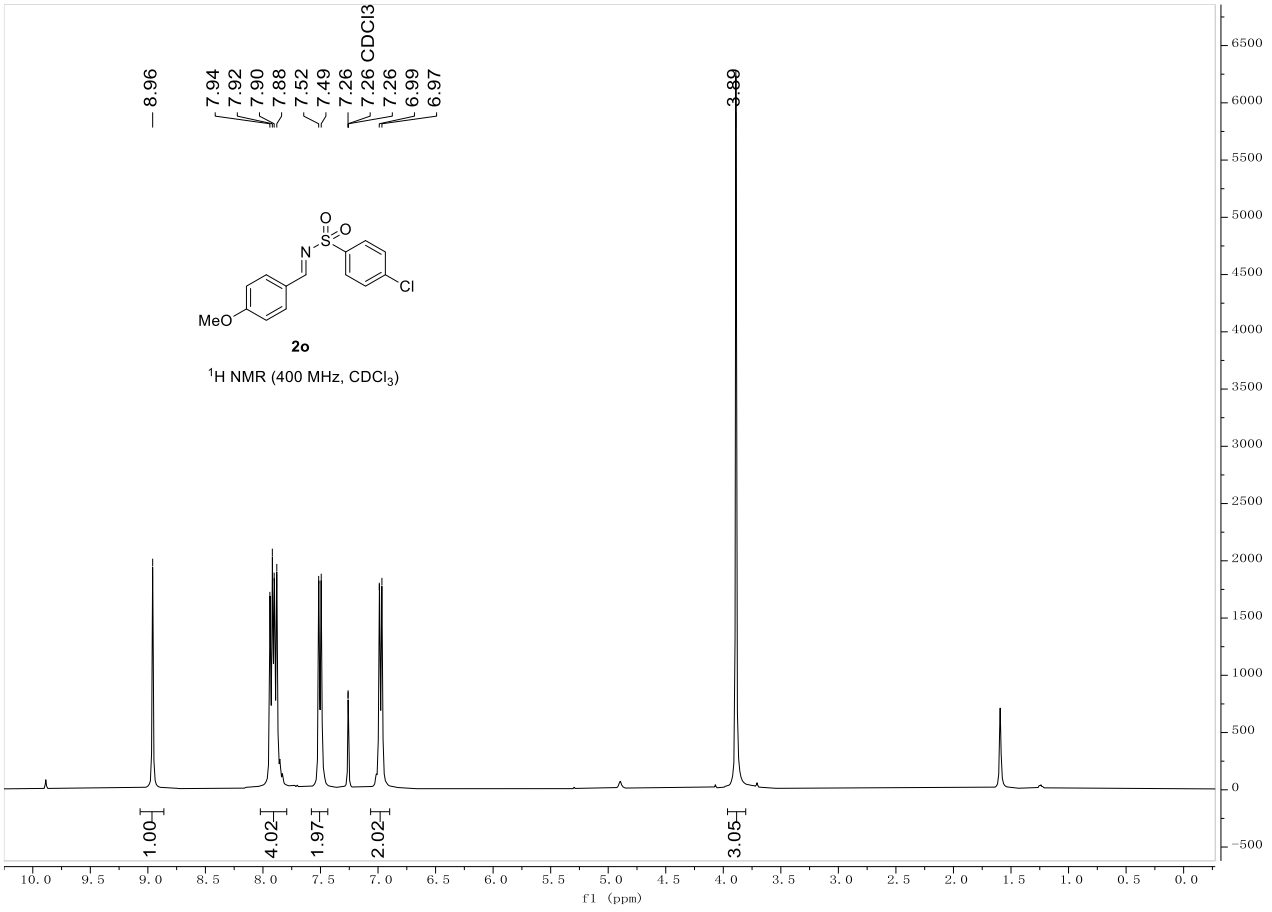
2n

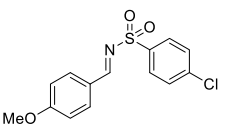
^{1}H NMR (400 MHz, $CDCl_3$)



2n

^{13}C NMR (101 MHz, $CDCl_3$)



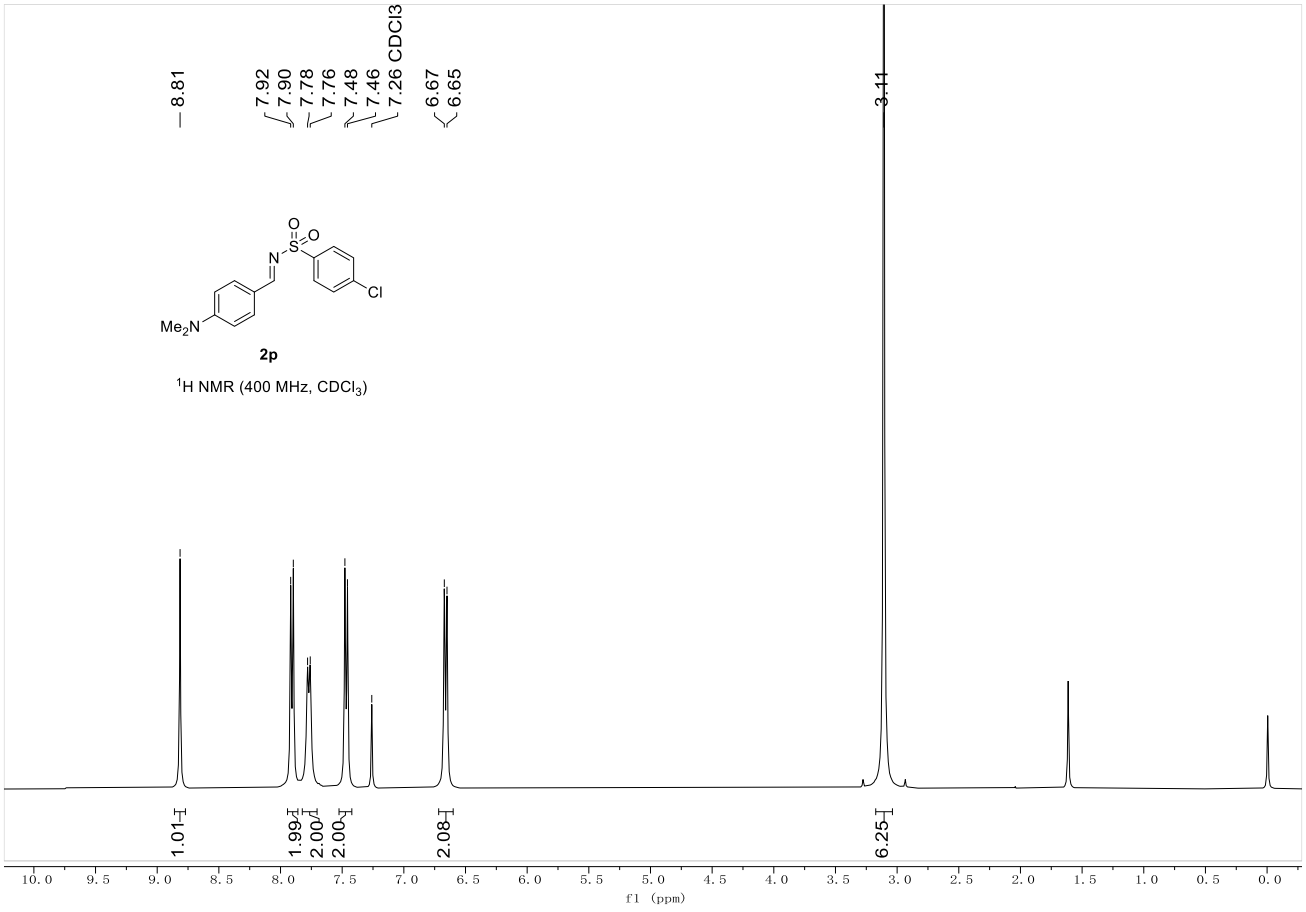


2o

^{1}H NMR (400 MHz, $CDCl_3$)

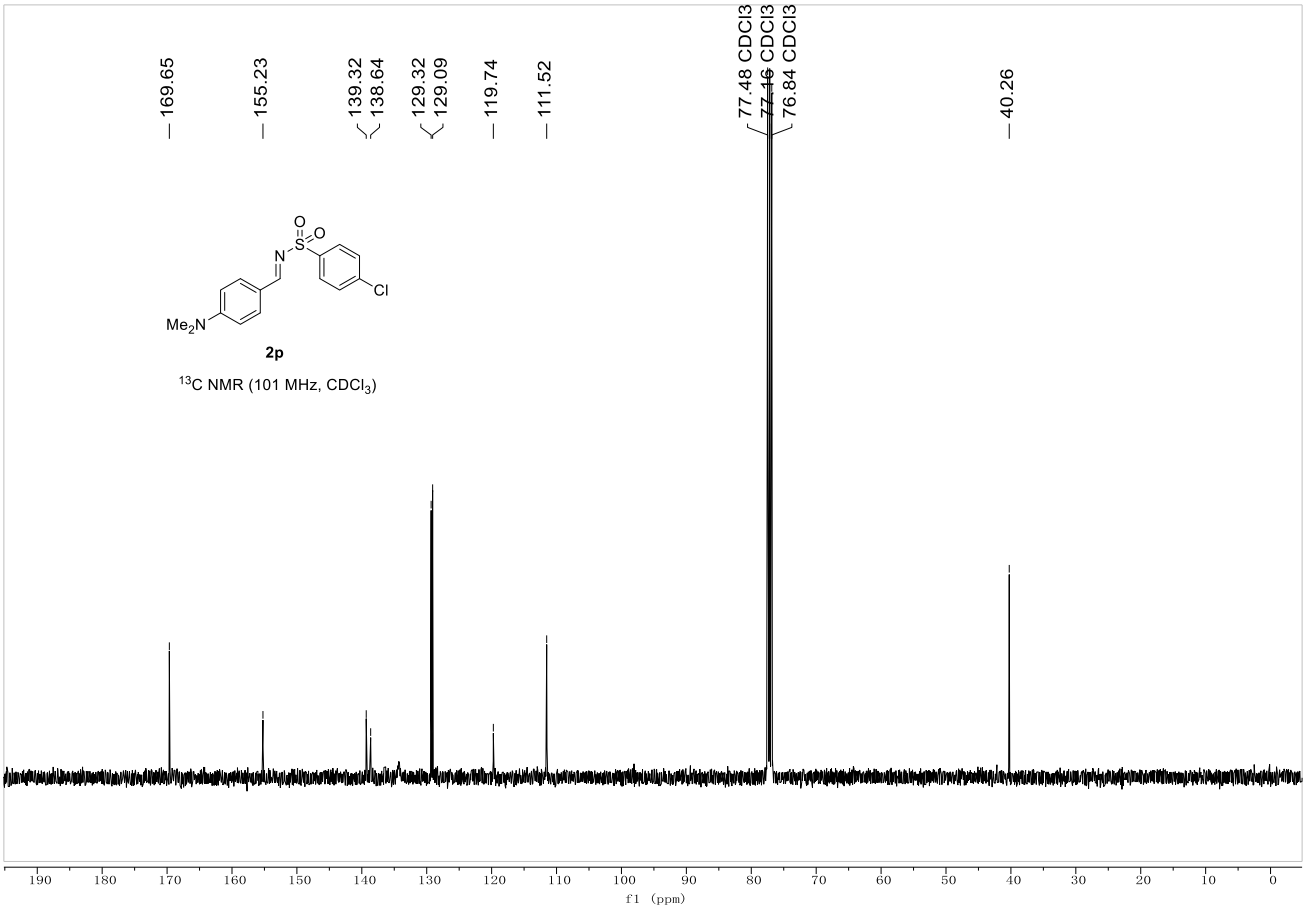
2o

^{13}C NMR (101 MHz, $CDCl_3$)



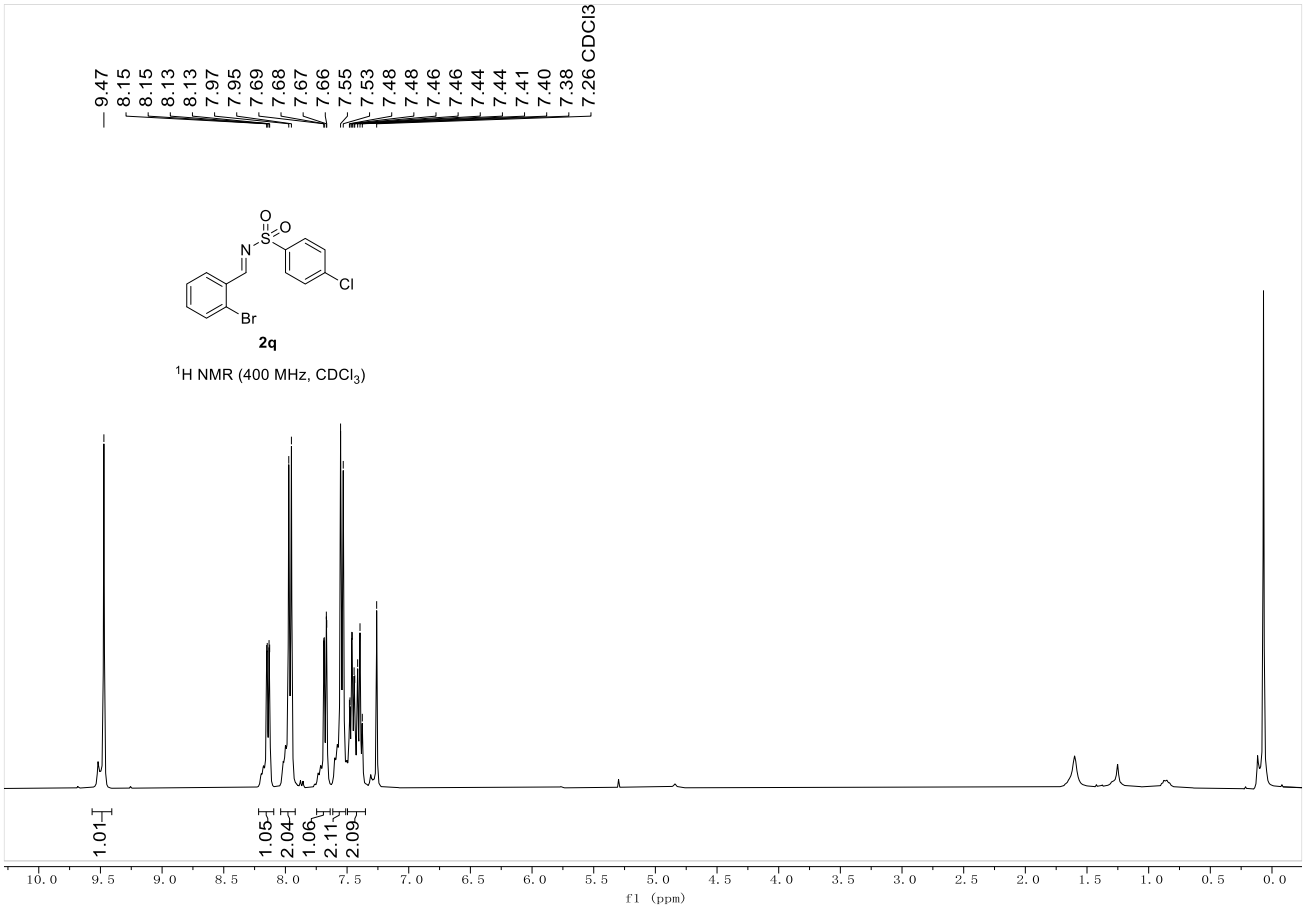
2p

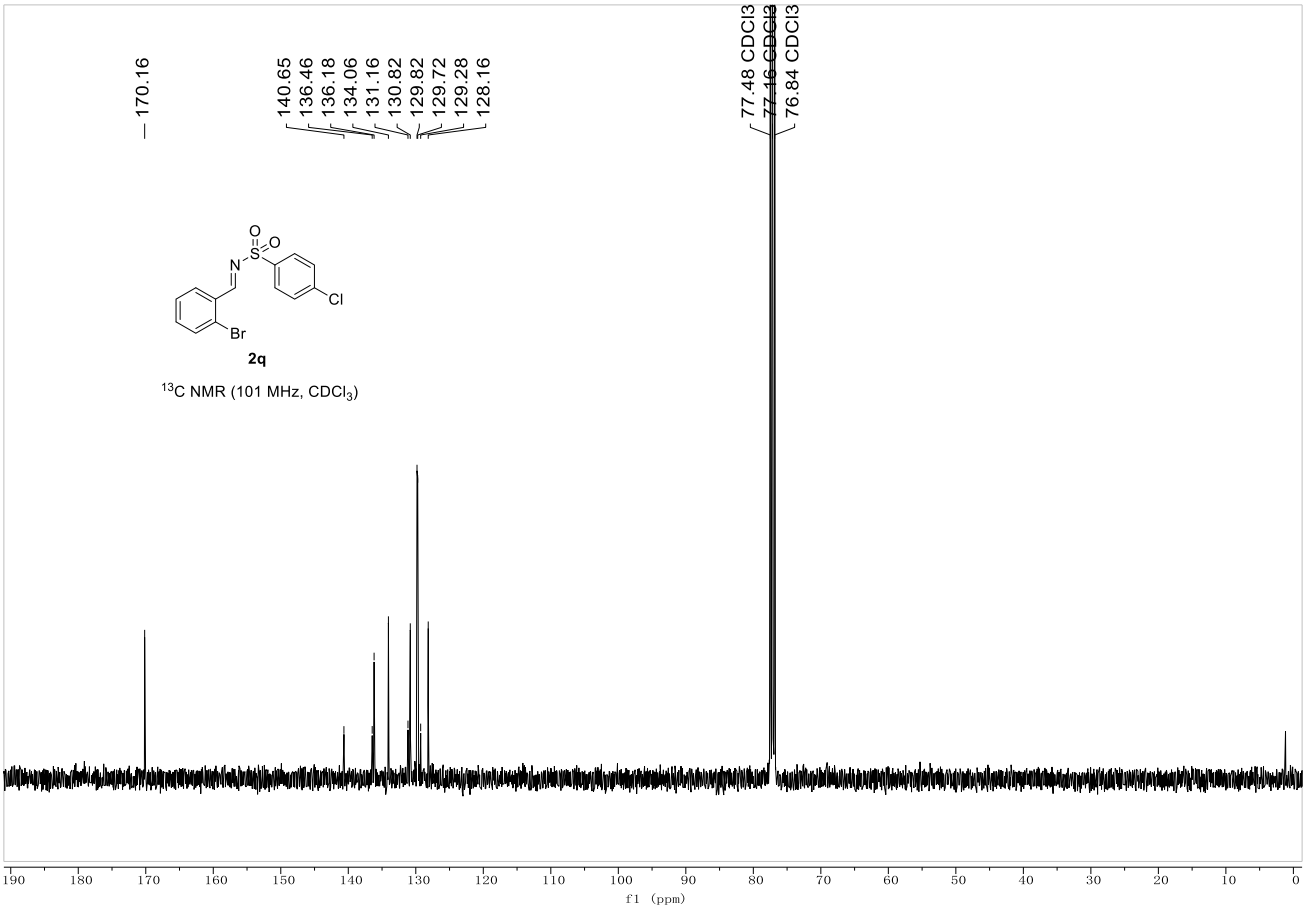
^{1}H NMR (400 MHz, $CDCl_3$)

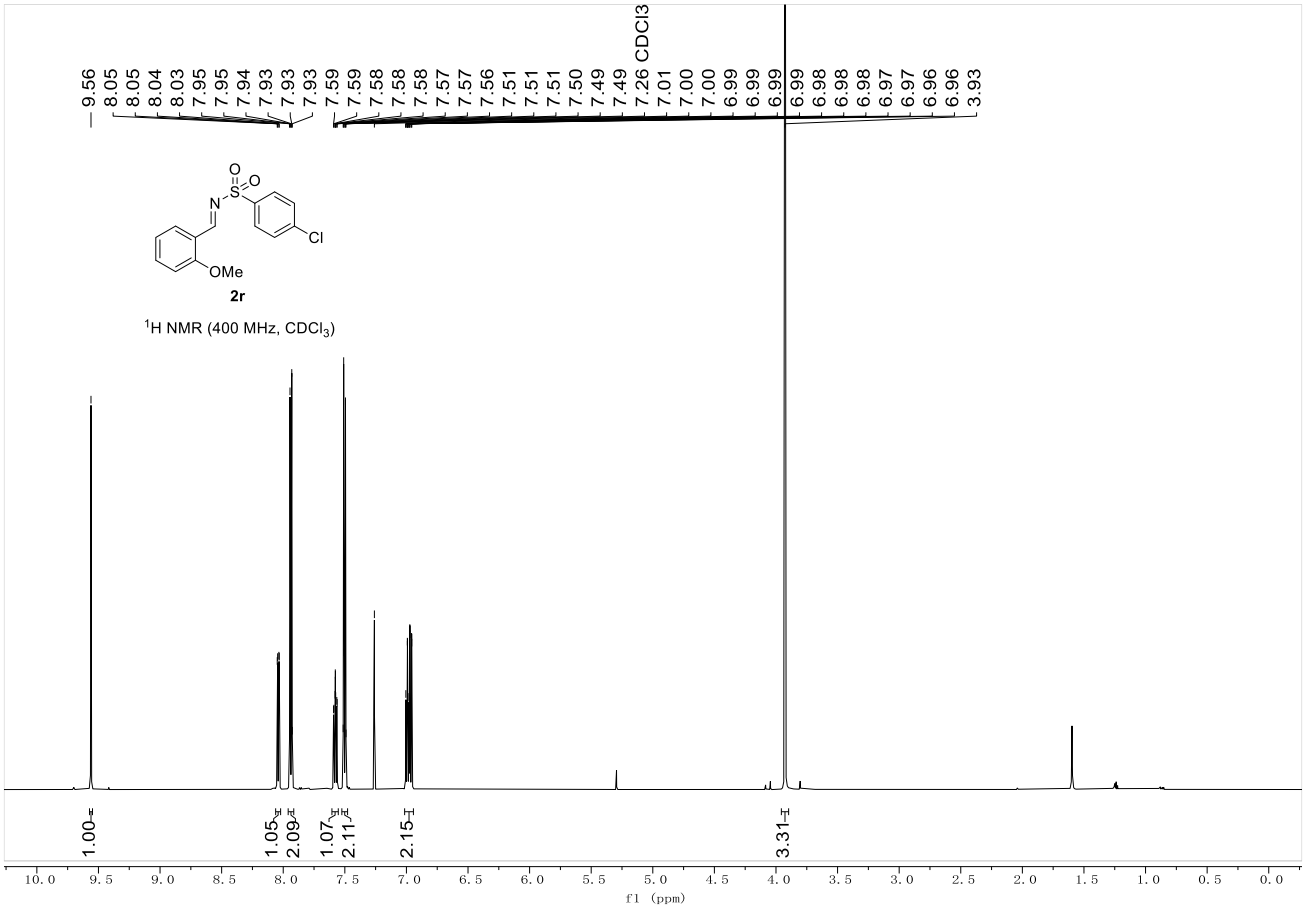


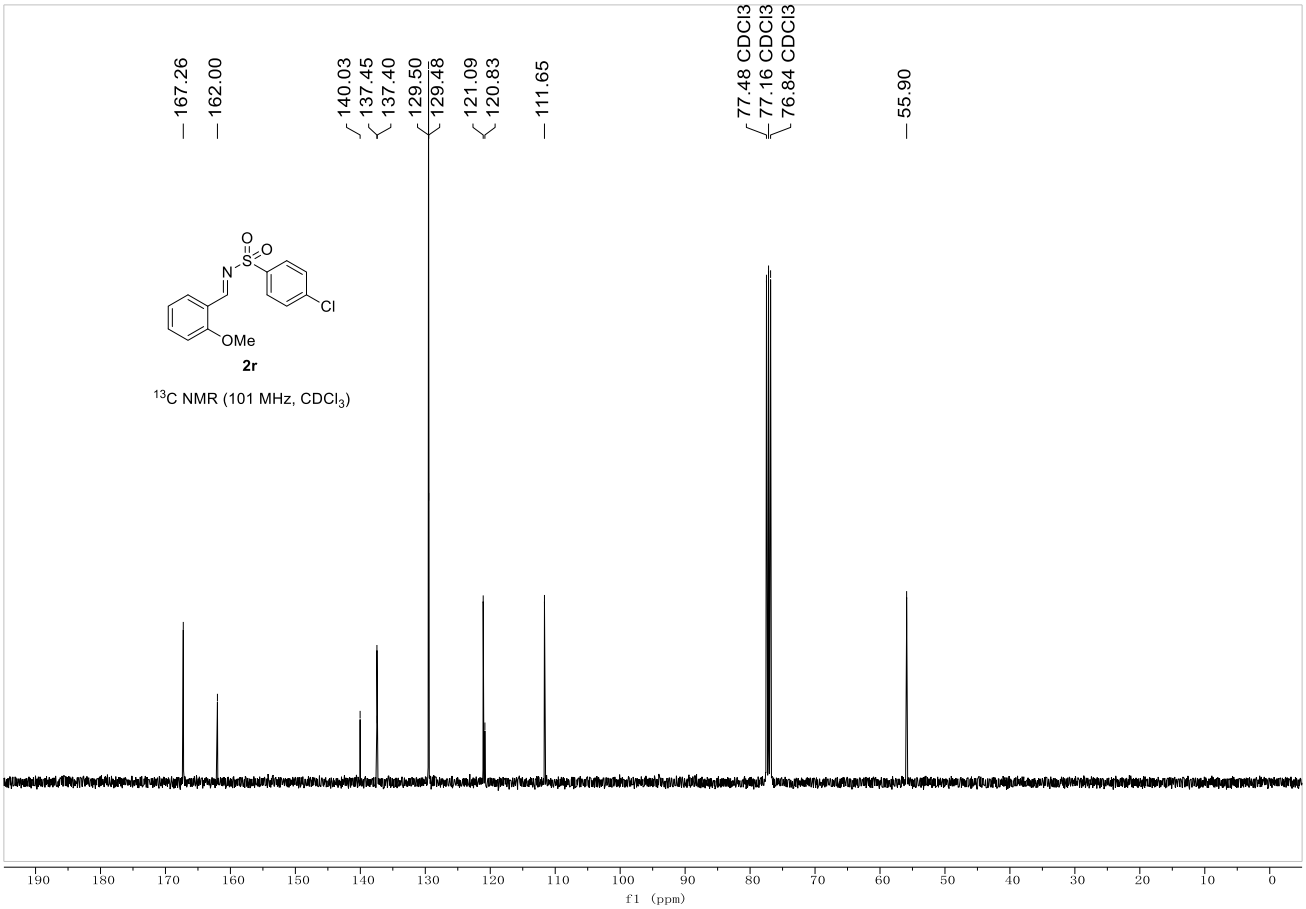
2p

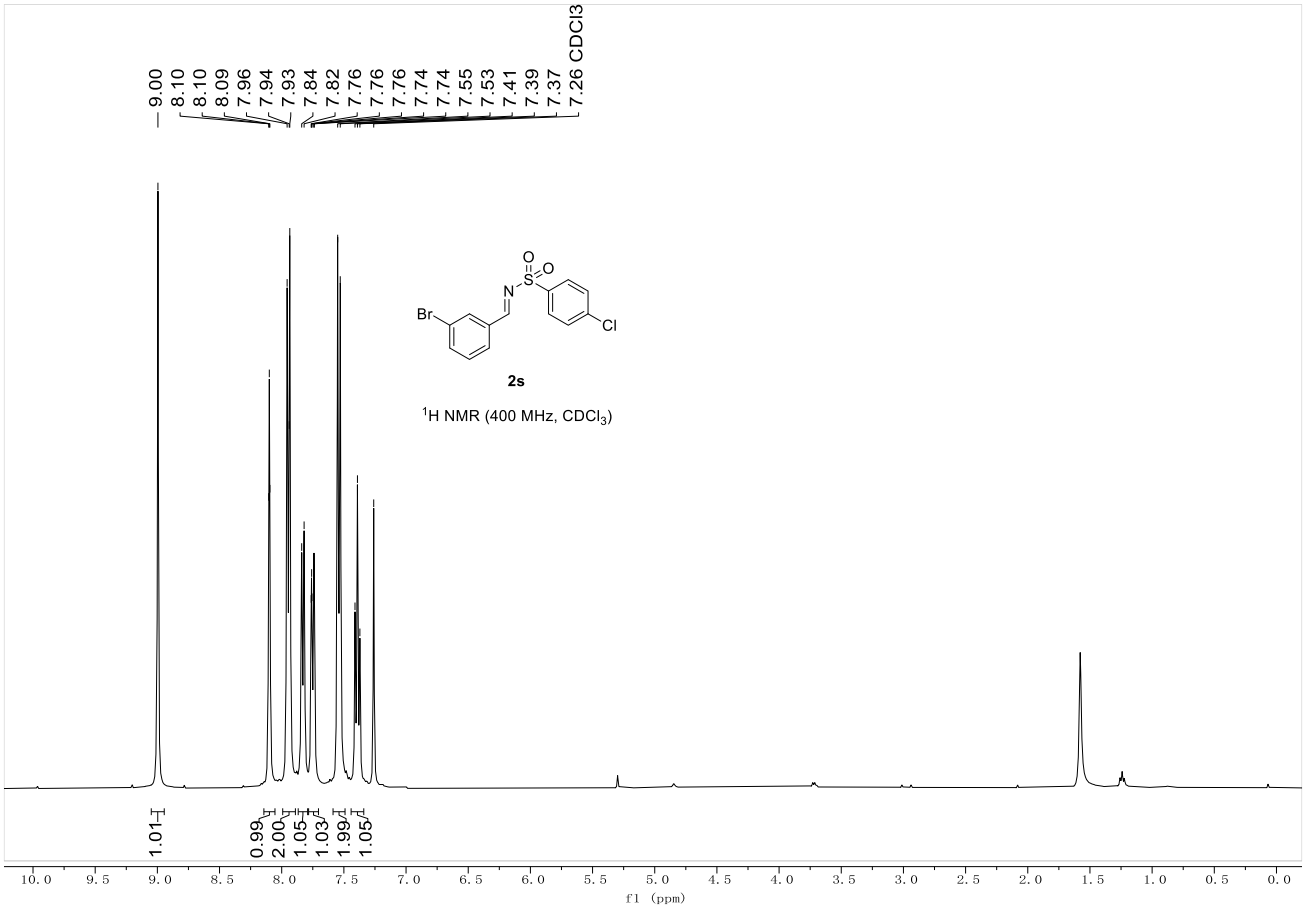
^{13}C NMR (101 MHz, $CDCl_3$)


9.47
8.15
8.15
8.13
8.13
7.97
7.95
7.69
7.68
7.67
7.66
7.55
7.53
7.48
7.48
7.46
7.46
7.44
7.44
7.41
7.40
7.38
7.26 CDCl3
O
S
O
N
Cl
Br
2q
1H NMR (400 MHz, CDCl3)
1.01
1.05
2.04
1.06
2.11
2.09
f1 (ppm)

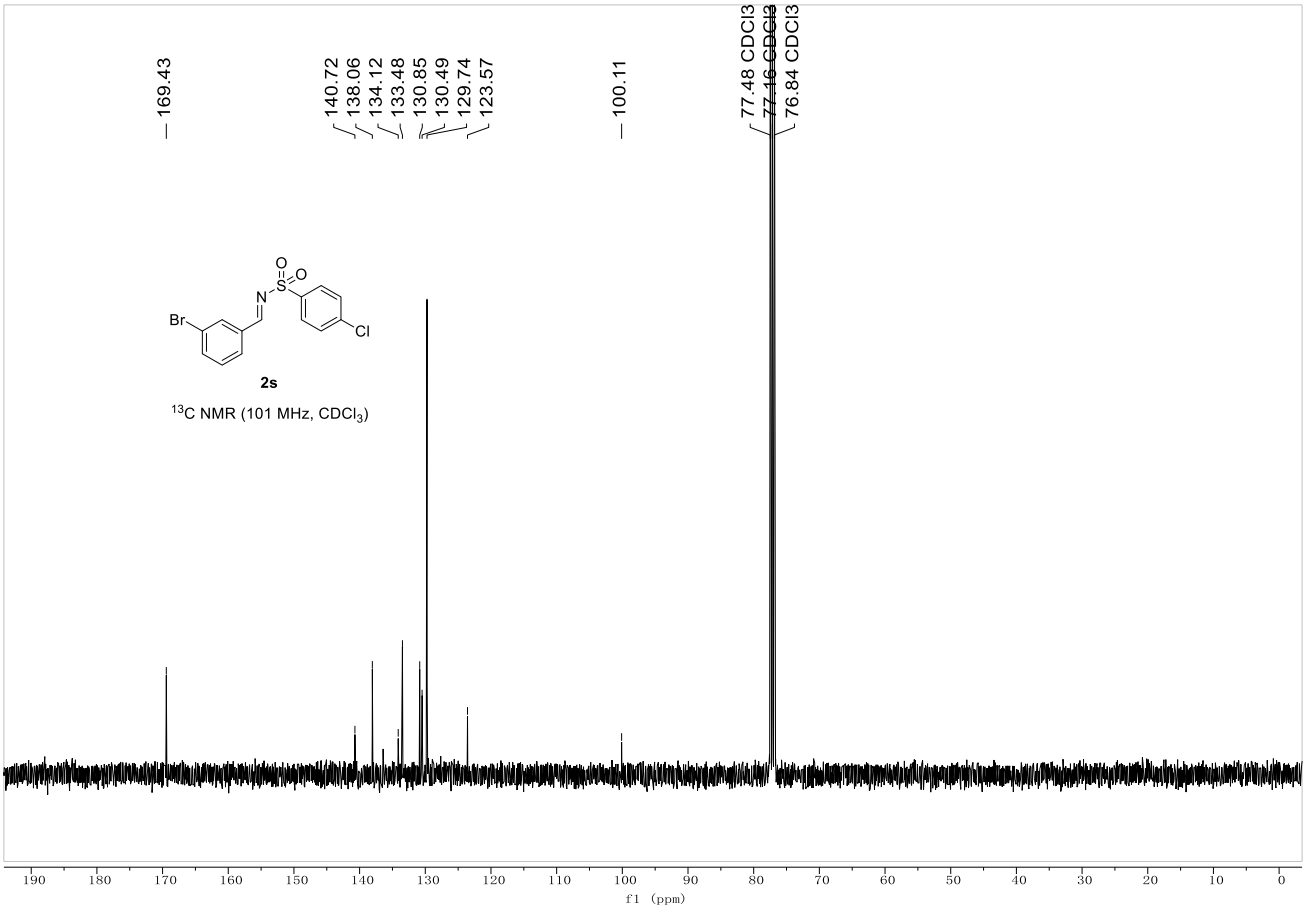

170.16
140.65
136.46
136.18
134.06
131.16
130.82
129.82
129.72
129.28
128.16
77.48 CDCl3
77.16 CDCl3
76.84 CDCl3
O
S
O
N
Cl
Br
2q
13C NMR (101 MHz, CDCl3)
f1 (ppm)


9.56
8.05
8.05
8.04
8.03
7.95
7.95
7.94
7.93
7.93
7.93
7.59
7.59
7.58
7.58
7.58
7.57
7.57
7.56
7.51
7.51
7.51
7.50
7.49
7.26 CDCl3
7.01
7.00
7.00
6.99
6.99
6.99
6.98
6.98
6.98
6.97
6.97
6.96
6.96
3.93
O
S
O
N
Cl
OMe
2r
1H NMR (400 MHz, CDCl3)
1.00
1.05
2.09
1.07
2.11
2.15
3.31
f1 (ppm)

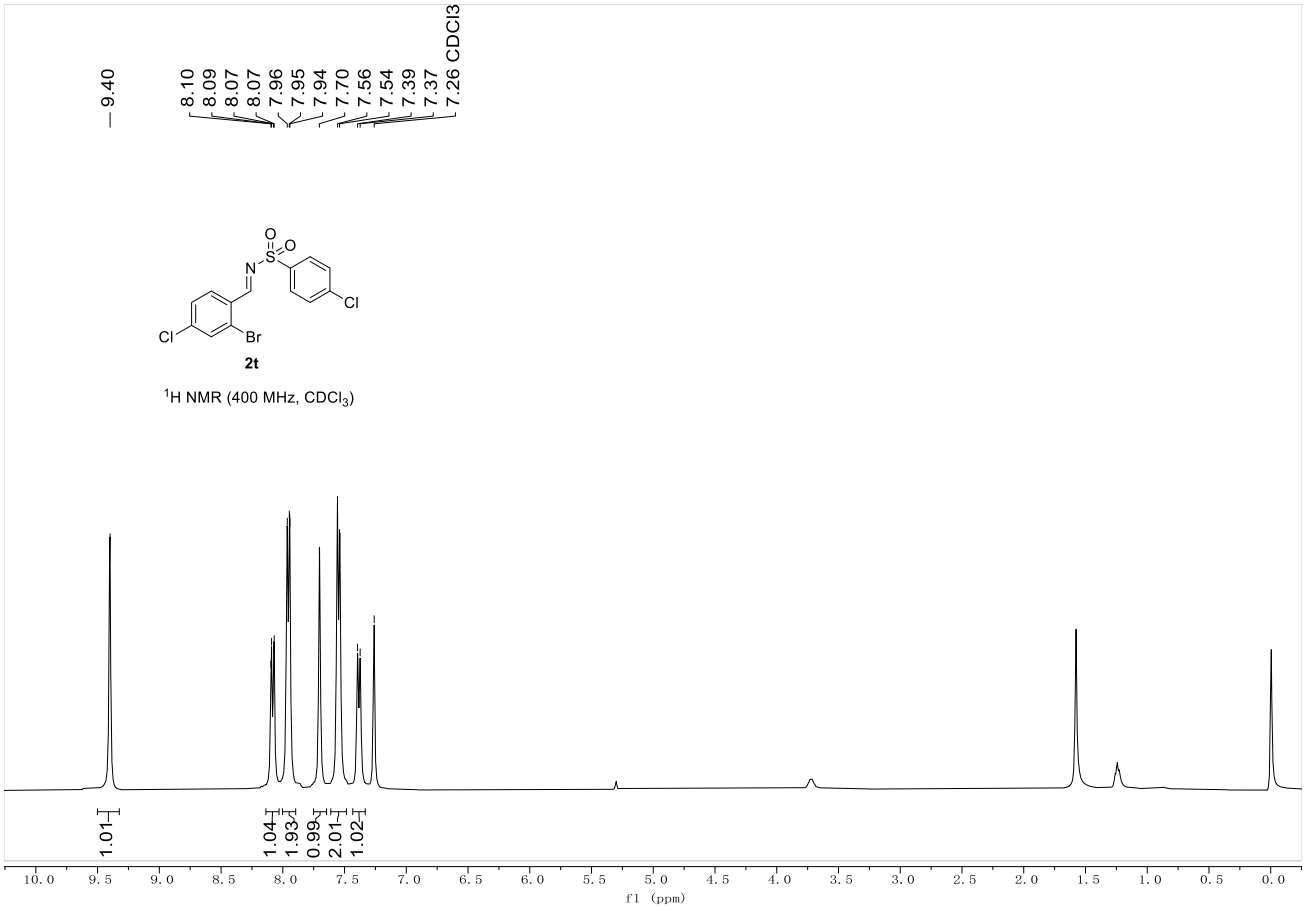

167.26
162.00
140.03
137.45
137.40
129.50
129.48
121.09
120.83
111.65
77.48 CDCl3
77.16 CDCl3
76.84 CDCl3
55.90
O
S
O
N
Cl
OMe
2r
13C NMR (101 MHz, CDCl3)
f1 (ppm)

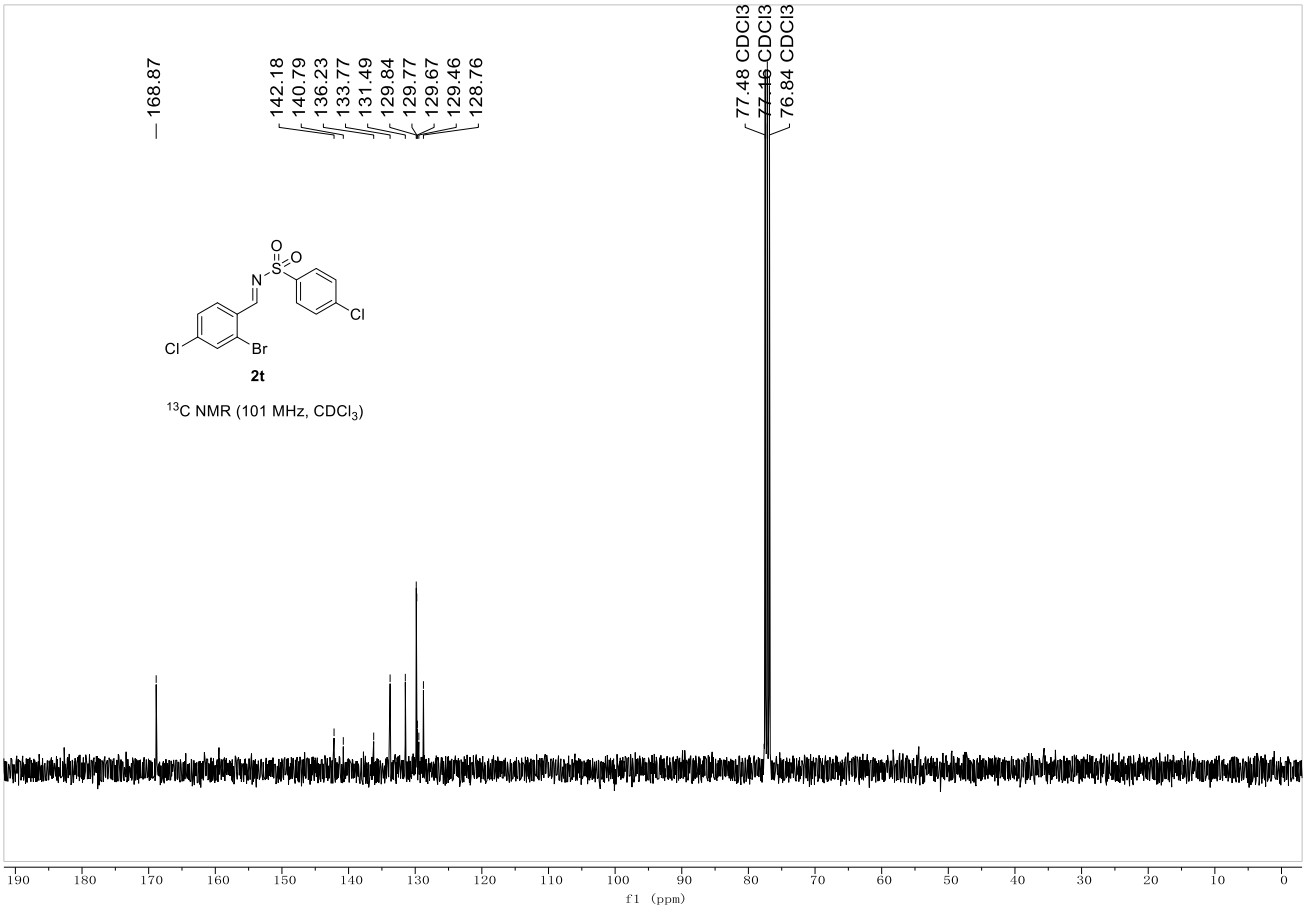


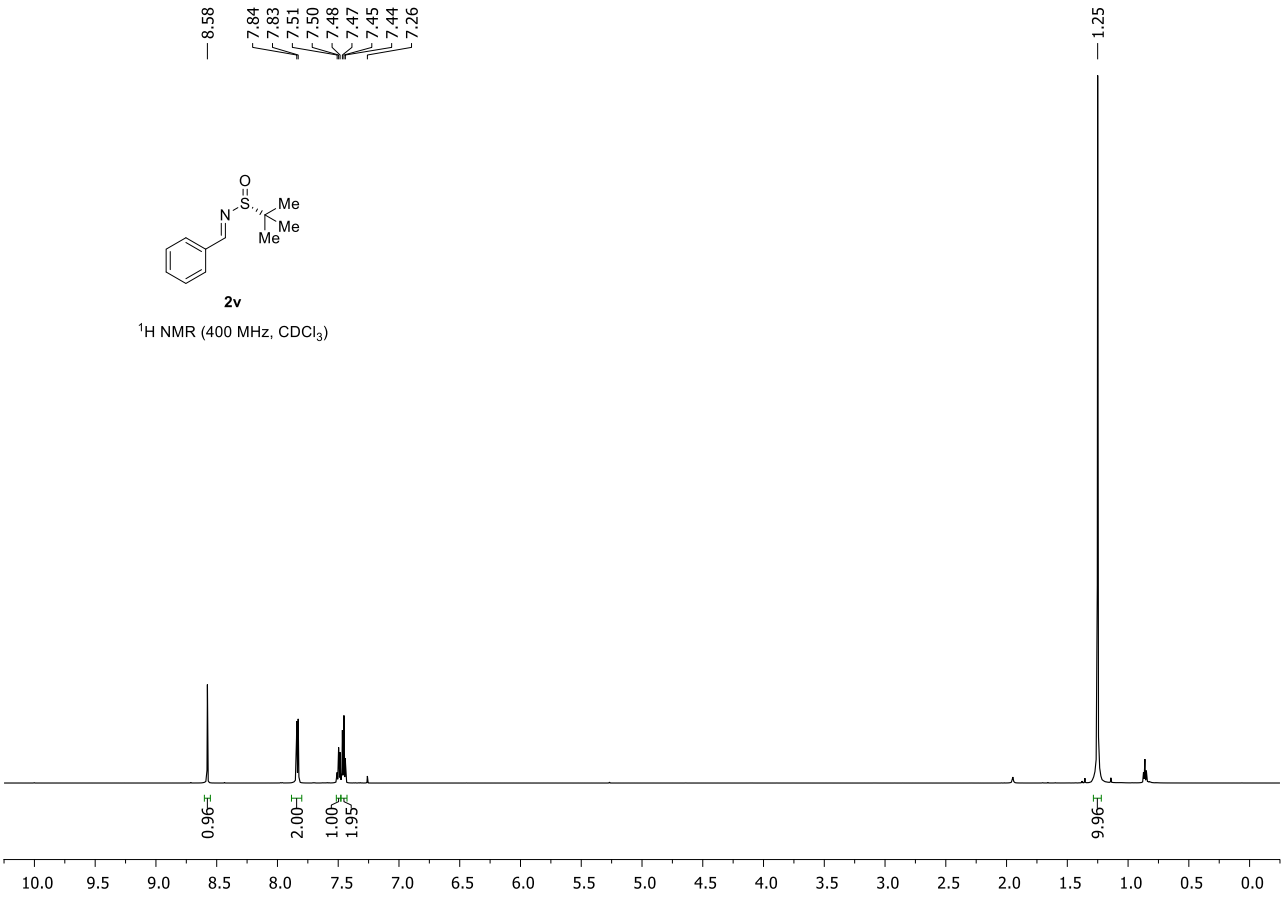
^{1}H NMR (400 MHz, $CDCl_3$)



^{13}C NMR (101 MHz, $CDCl_3$)

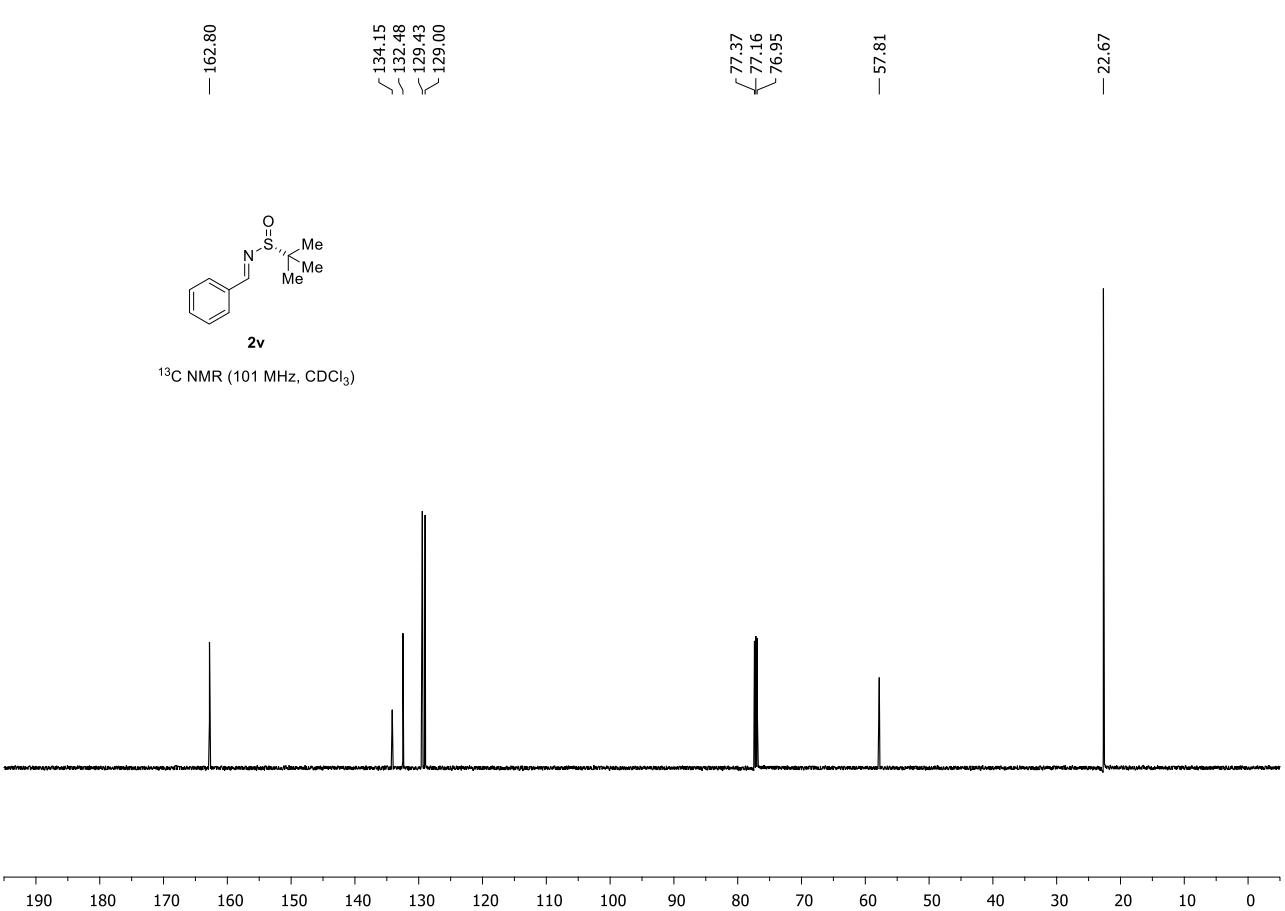

9.40
8.10
8.09
8.07
8.07
7.96
7.95
7.94
7.70
7.56
7.54
7.39
7.37
7.26 CDCl3
Cl
Br
Cl
2t
1H NMR (400 MHz, CDCl3)
1.01
1.04
1.93
0.99
2.01
1.02
f1 (ppm)


168.87
142.18
140.79
136.23
133.77
131.49
129.84
129.77
129.67
129.46
128.76
77.48 CDCl3
77.16 CDCl3
76.84 CDCl3
Cl
Br
Cl
2t
13C NMR (101 MHz, CDCl3)
f1 (ppm)



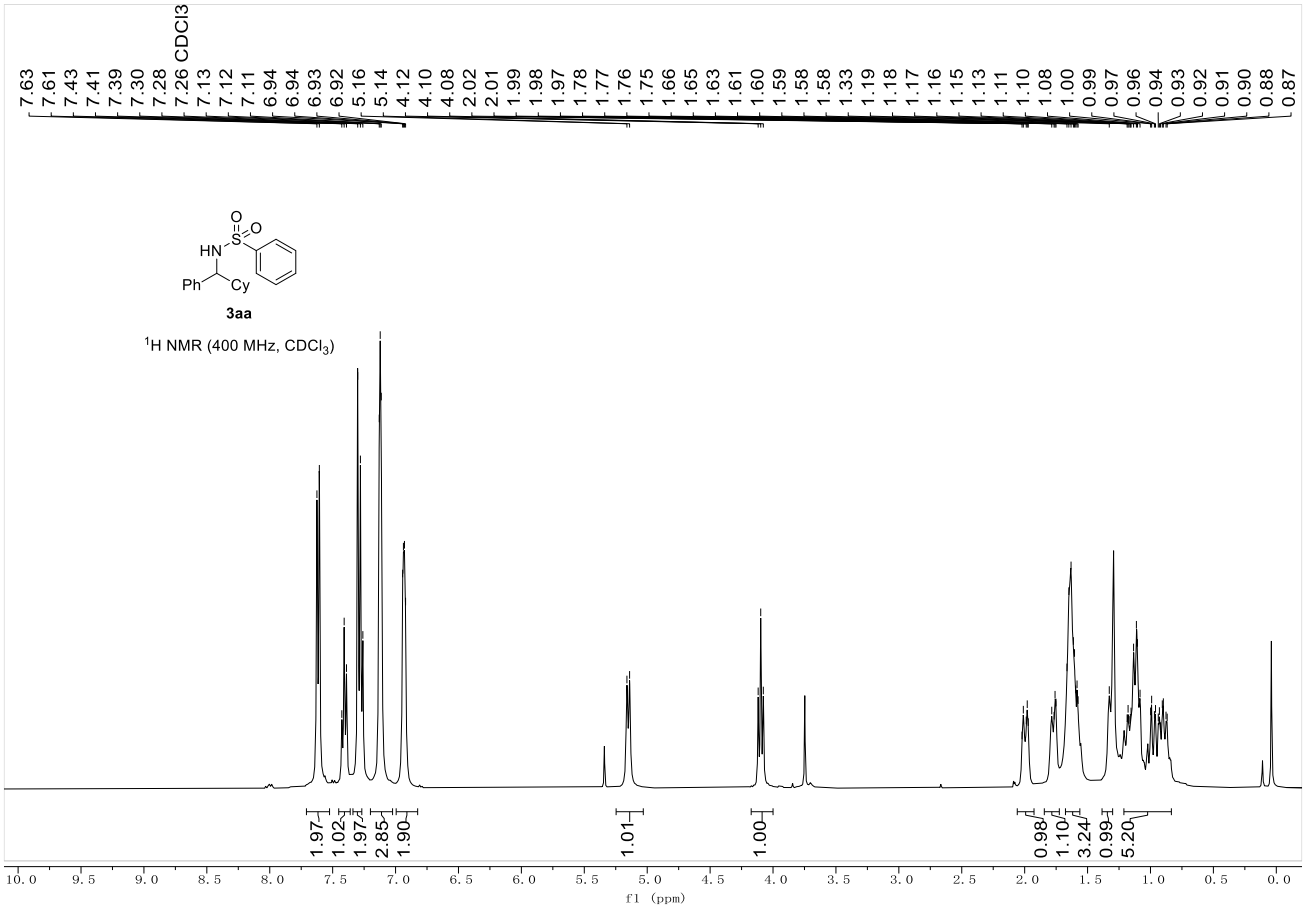
2v

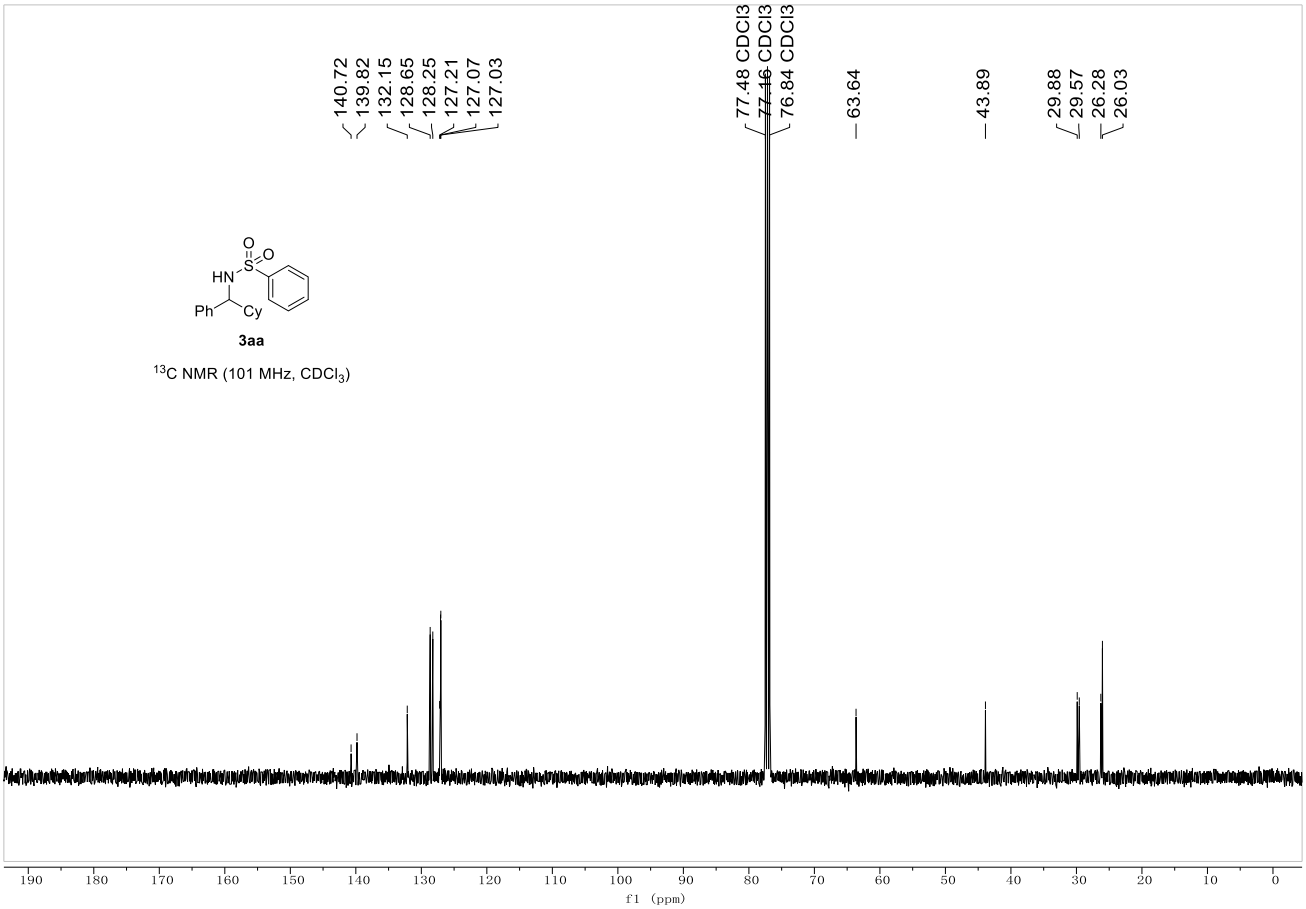
^{1}H NMR (400 MHz, $CDCl_3$)

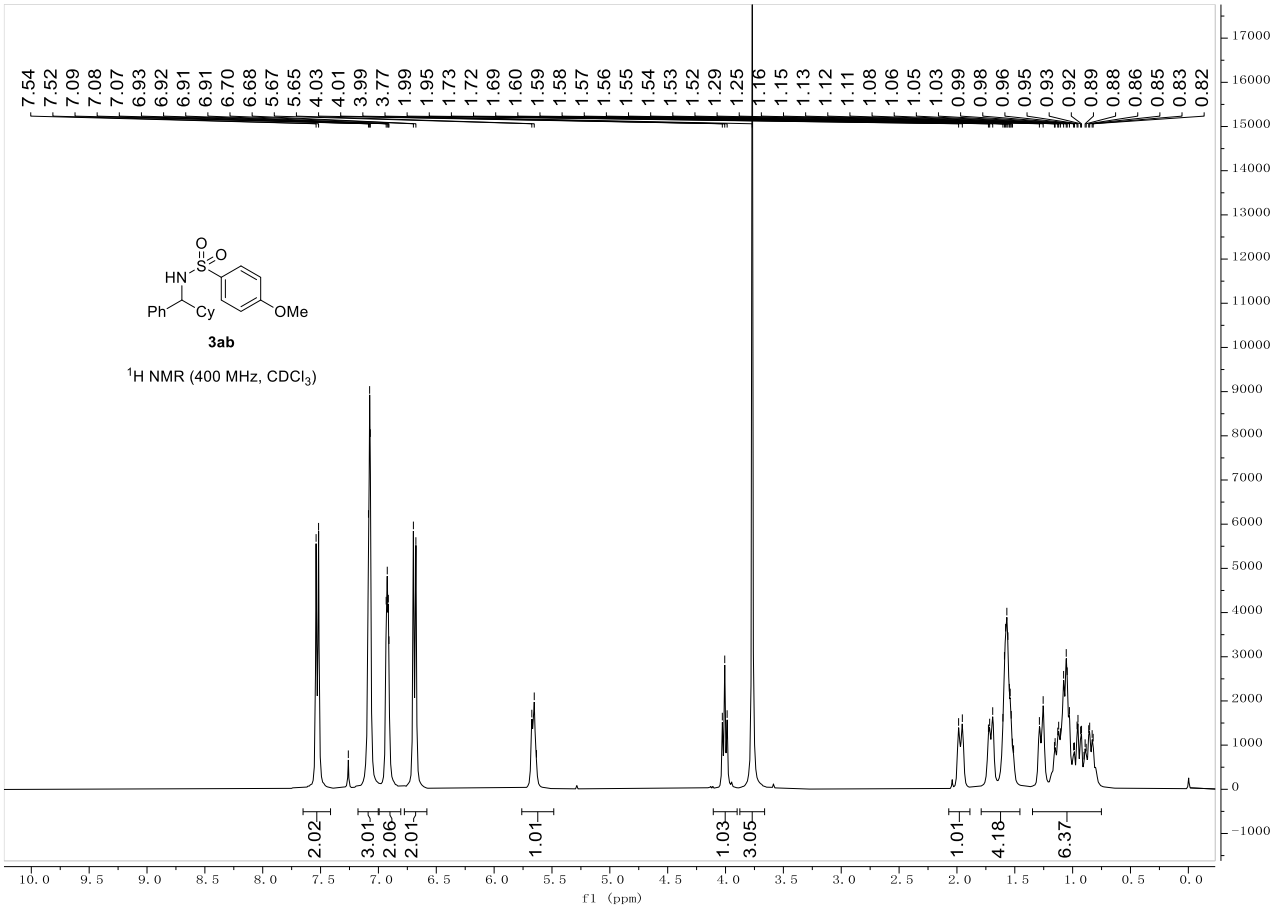


2v

^{13}C NMR (101 MHz, $CDCl_3$)

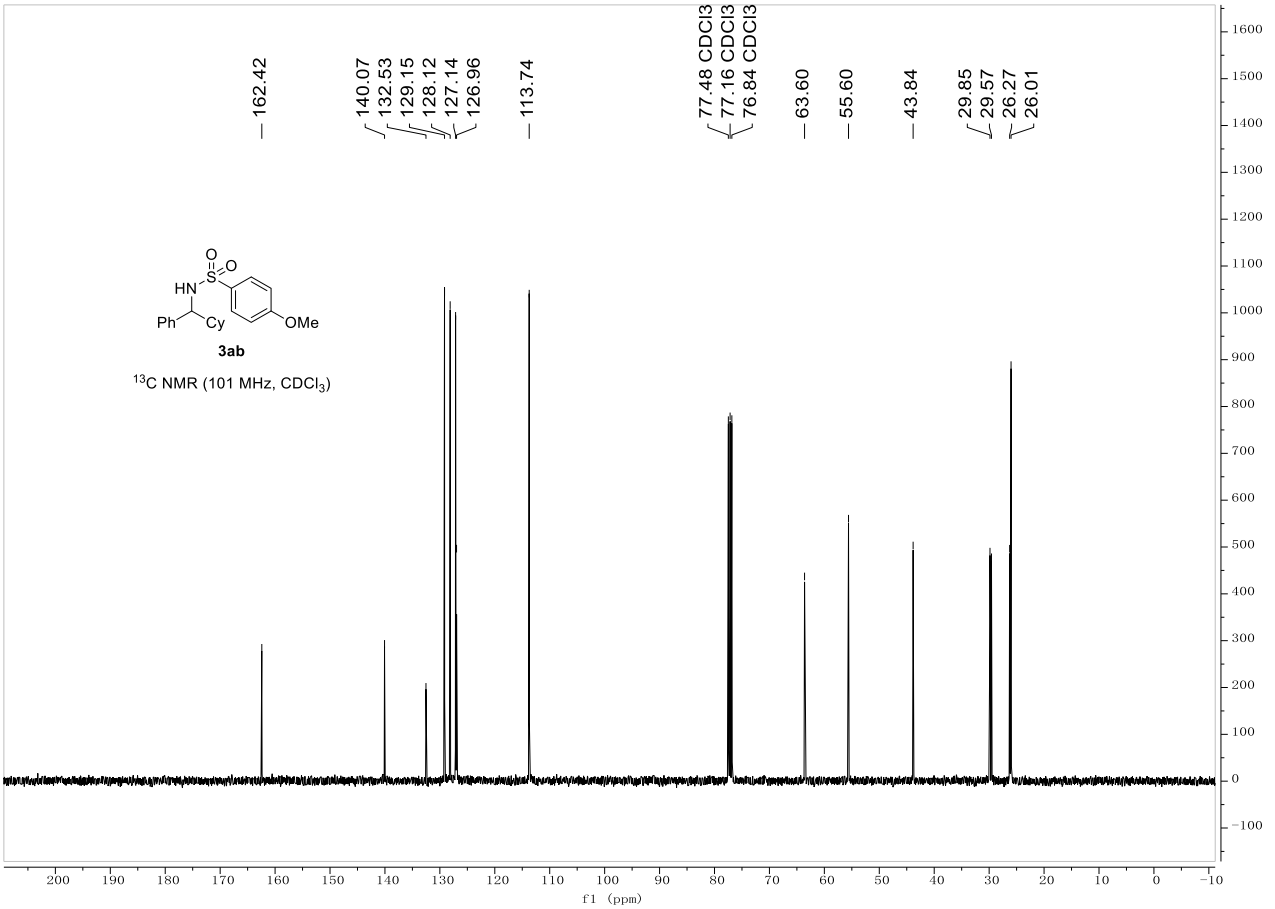

7.63 7.61 7.43 7.41 7.39 7.30 7.28 7.26 CDCl3 7.13 7.12 7.11 6.94 6.94 6.93 6.92 5.16 5.14 4.12 4.10 4.08 2.02 2.01 1.99 1.98 1.97 1.78 1.77 1.76 1.75 1.66 1.65 1.63 1.61 1.60 1.59 1.58 1.58 1.33 1.19 1.18 1.17 1.16 1.15 1.13 1.11 1.10 1.08 1.00 0.99 0.97 0.96 0.94 0.93 0.92 0.91 0.90 0.88 0.87
HN
Ph
Cy
3aa
1H NMR (400 MHz, CDCl3)
1.97 1.02 1.97 2.85 1.90 1.01 1.00 0.98 1.10 3.24 0.99 5.20
f1 (ppm)


140.72 139.82 132.15 128.65 128.25 127.21 127.07 127.03
77.48 CDCl3 77.16 CDCl3 76.84 CDCl3
63.64
43.89
29.88 29.57 26.28 26.03
HN
Ph
Cy
3aa
13C NMR (101 MHz, CDCl3)
f1 (ppm)



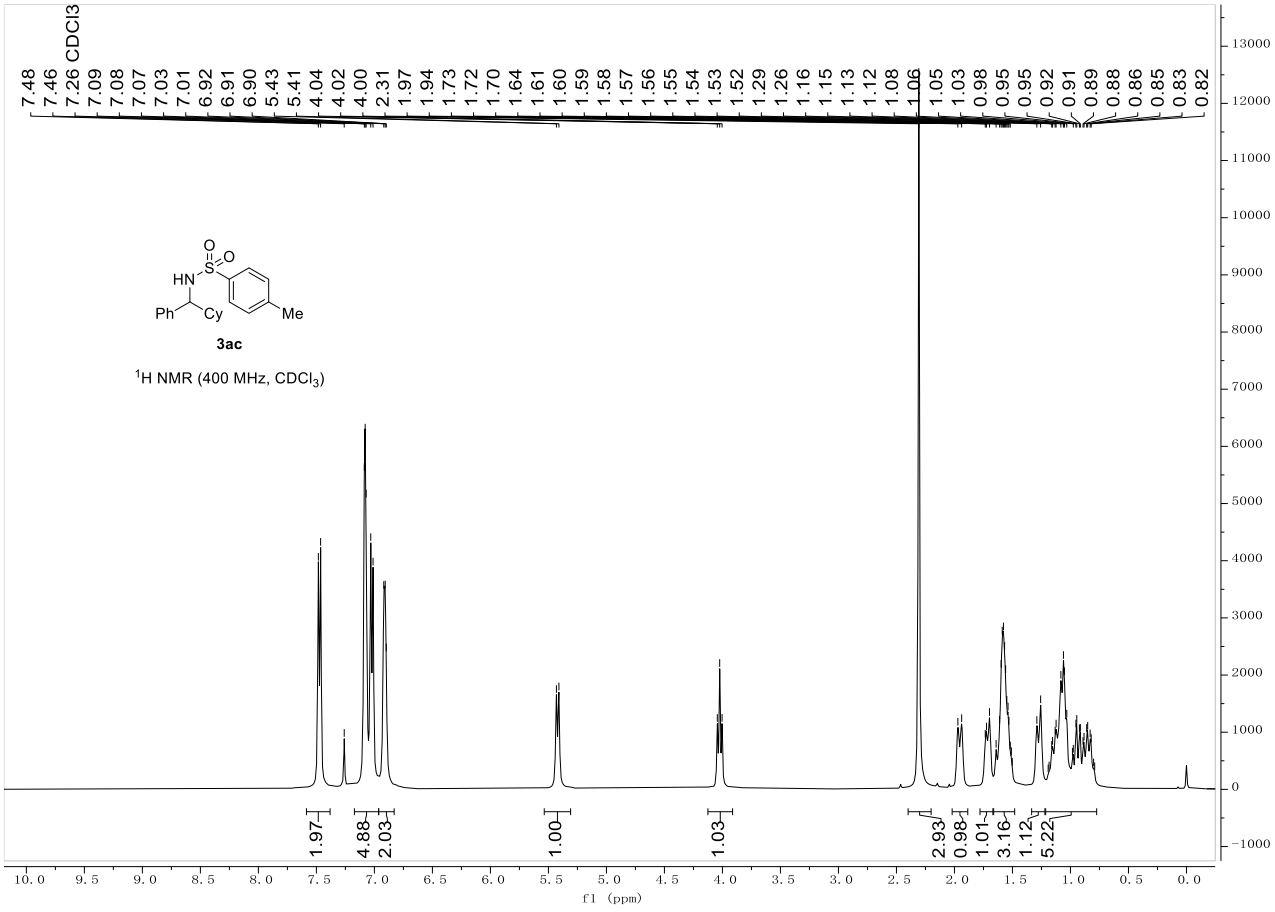
3ab

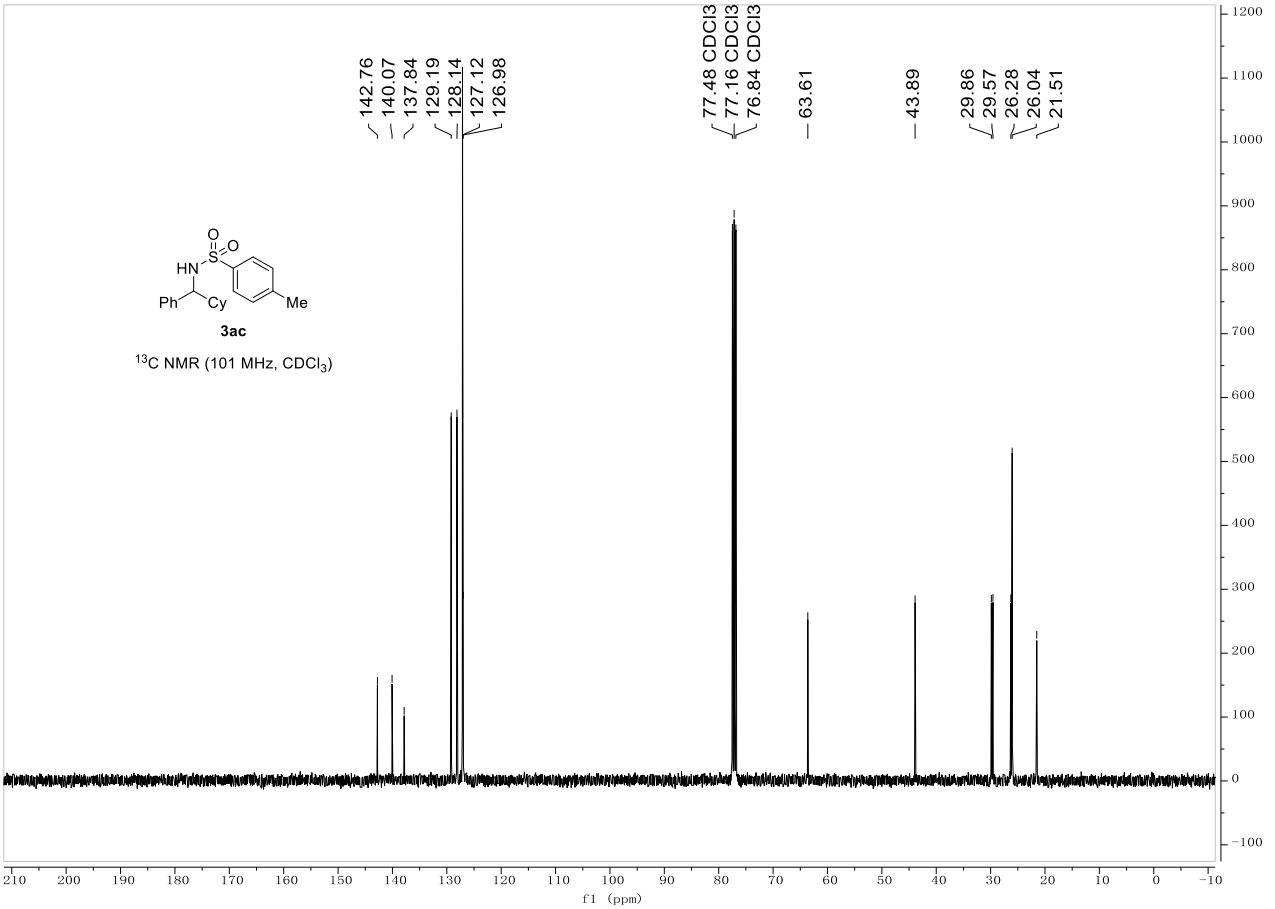
^{1}H NMR (400 MHz, $CDCl_3$)

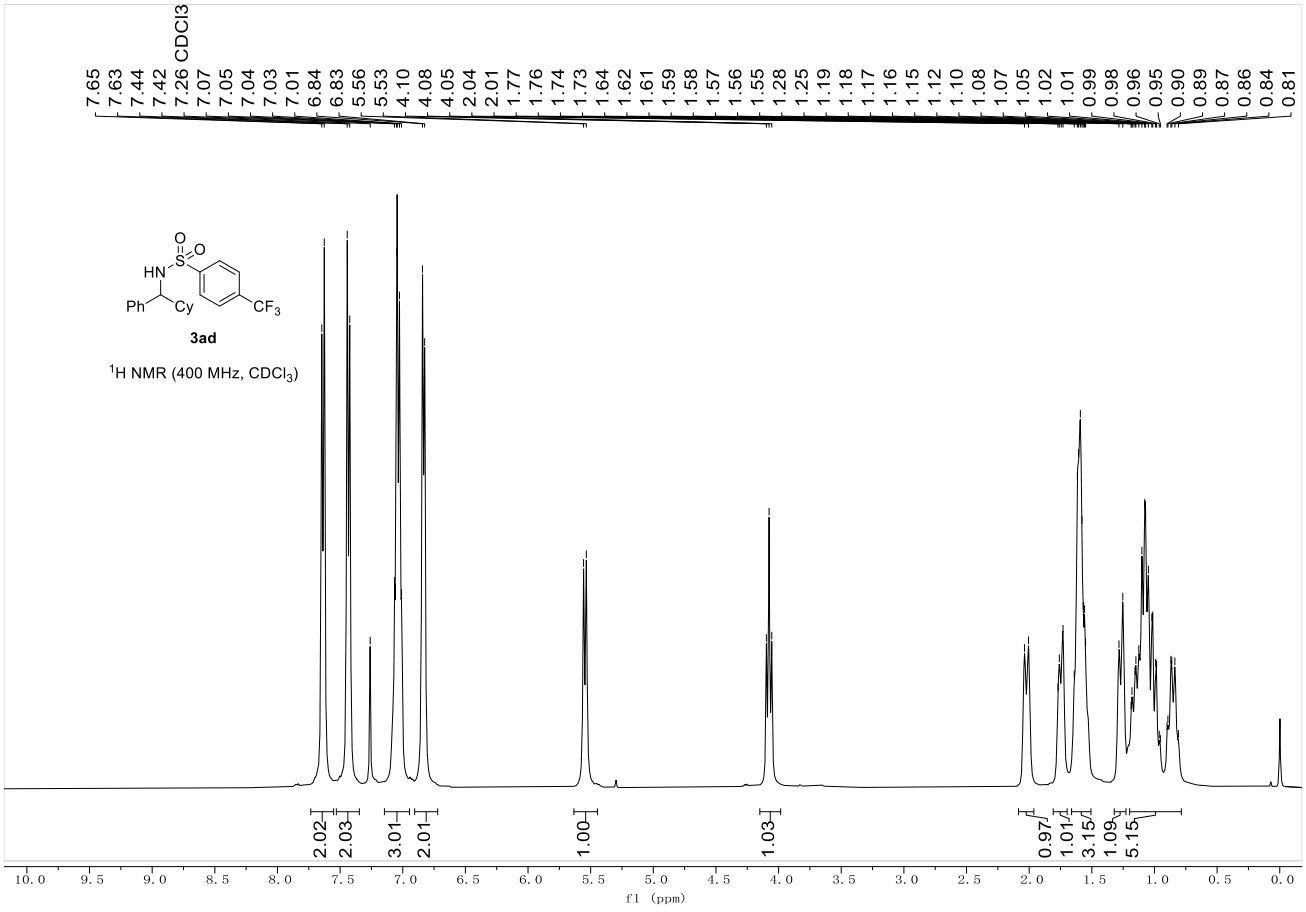


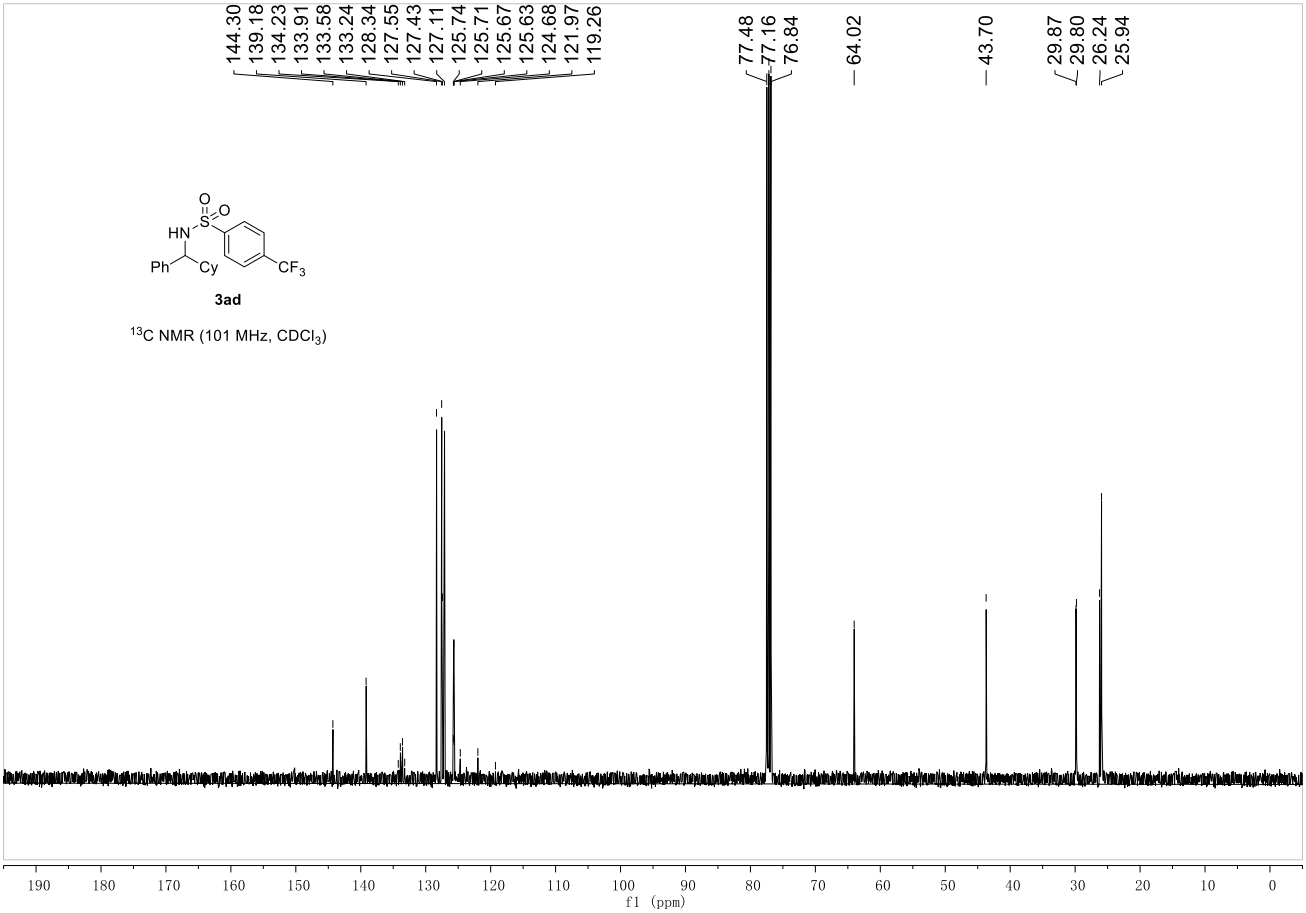
3ab

^{13}C NMR (101 MHz, $CDCl_3$)


7.48
7.46
7.26 CDCl3
7.09
7.08
7.07
7.03
7.01
6.92
6.91
6.90
5.43
5.41
4.04
4.02
4.00
2.31
1.97
1.94
1.73
1.72
1.70
1.64
1.61
1.60
1.59
1.58
1.57
1.56
1.55
1.54
1.53
1.52
1.29
1.26
1.16
1.15
1.13
1.12
1.08
1.06
1.05
1.03
0.98
0.95
0.95
0.92
0.91
0.89
0.88
0.86
0.85
0.83
0.82
HN
Ph
Cy
Me
3ac
1H NMR (400 MHz, CDCl3)
1.97
4.88
2.03
1.00
1.03
2.93
0.98
1.01
3.16
1.12
5.22
f1 (ppm)


142.76
140.07
137.84
129.19
128.14
127.12
126.98
77.48 CDCl3
77.16 CDCl3
76.84 CDCl3
63.61
43.89
29.86
29.57
26.28
26.04
21.51
HN
Ph
Cy
Me
3ac
13C NMR (101 MHz, CDCl3)
f1 (ppm)


7.65
7.63
7.44
7.42
7.26 CDCl3
7.07
7.05
7.04
7.03
7.01
6.84
6.83
5.56
5.53
4.10
4.08
4.05
2.04
2.01
1.77
1.76
1.74
1.73
1.64
1.62
1.61
1.59
1.58
1.57
1.56
1.55
1.28
1.25
1.19
1.18
1.17
1.16
1.15
1.12
1.10
1.08
1.07
1.05
1.02
1.01
0.99
0.98
0.96
0.95
0.90
0.89
0.87
0.86
0.84
0.81
3ad
1H NMR (400 MHz, CDCl3)
2.02
2.03
3.01
2.01
1.00
1.03
0.97
1.01
3.15
1.09
5.15
f1 (ppm)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139.18
134.23
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133.24
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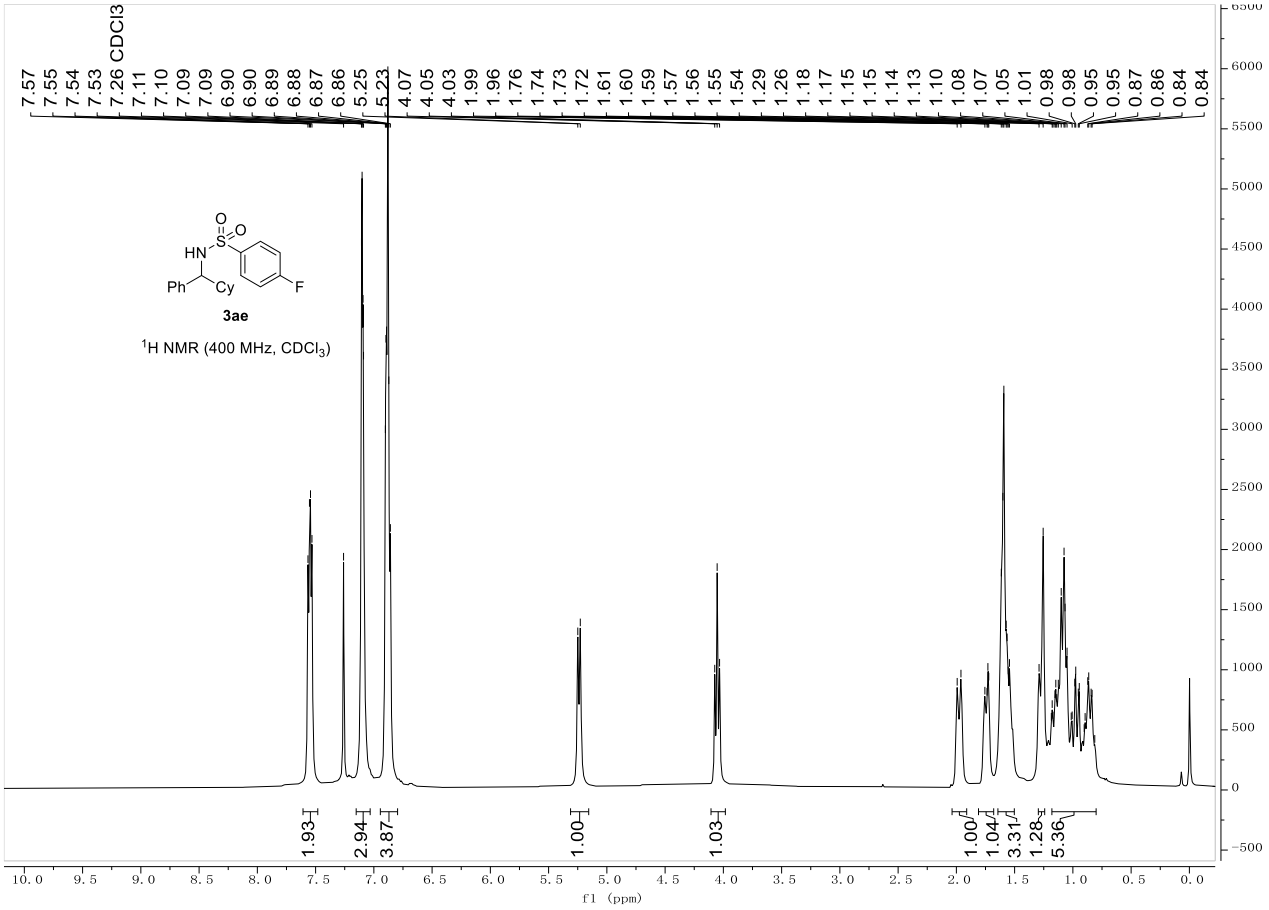
127.55
127.43
127.11
125.74
125.71
125.67
125.63
124.68
121.97
119.26
77.48
77.16
76.84
64.02
43.70
29.87
29.80
26.24
25.94
3ad
13C NMR (101 MHz, CDCl3)
f1 (ppm)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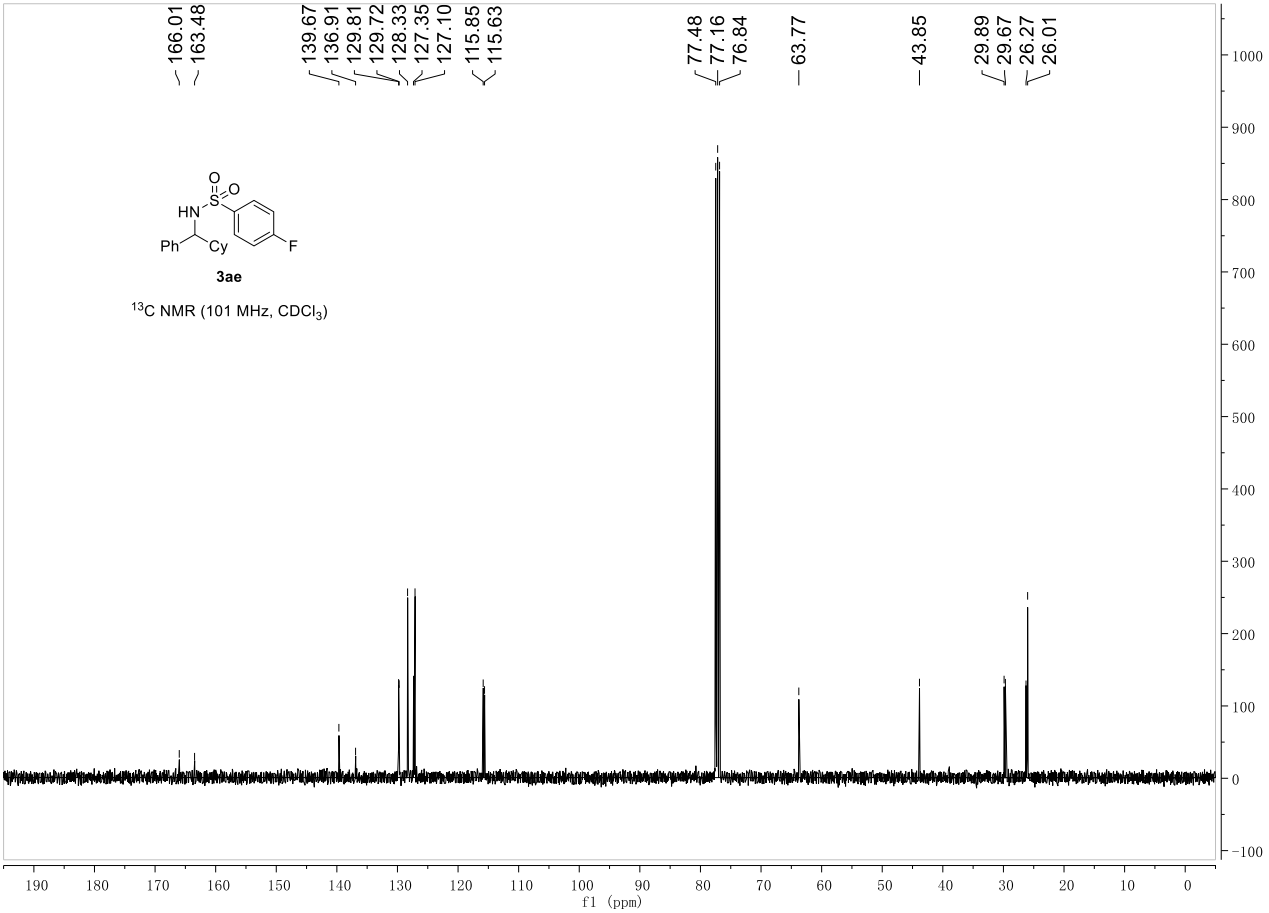
7.55
7.54
7.53
7.26 CDCl3
7.11
7.10
7.09
7.09
6.90
6.90
6.89
6.88
6.87
6.86
5.25
5.23
4.07
4.05
4.03
1.99
1.96
1.76
1.74
1.73
1.72
1.61
1.60
1.59
1.57
1.56
1.55
1.54
1.29
1.26
1.18
1.17
1.15
1.15
1.14
1.13
1.10
1.08
1.07
1.05
1.01
0.98
0.98
0.95
0.95
0.87
0.86
0.84
0.84
HN
Ph
Cy
F
3ae
1H NMR (400 MHz, CDCl3)
1.93
2.94
3.87
1.00
1.03
1.00
1.04
3.31
1.28
5.36
f1 (ppm)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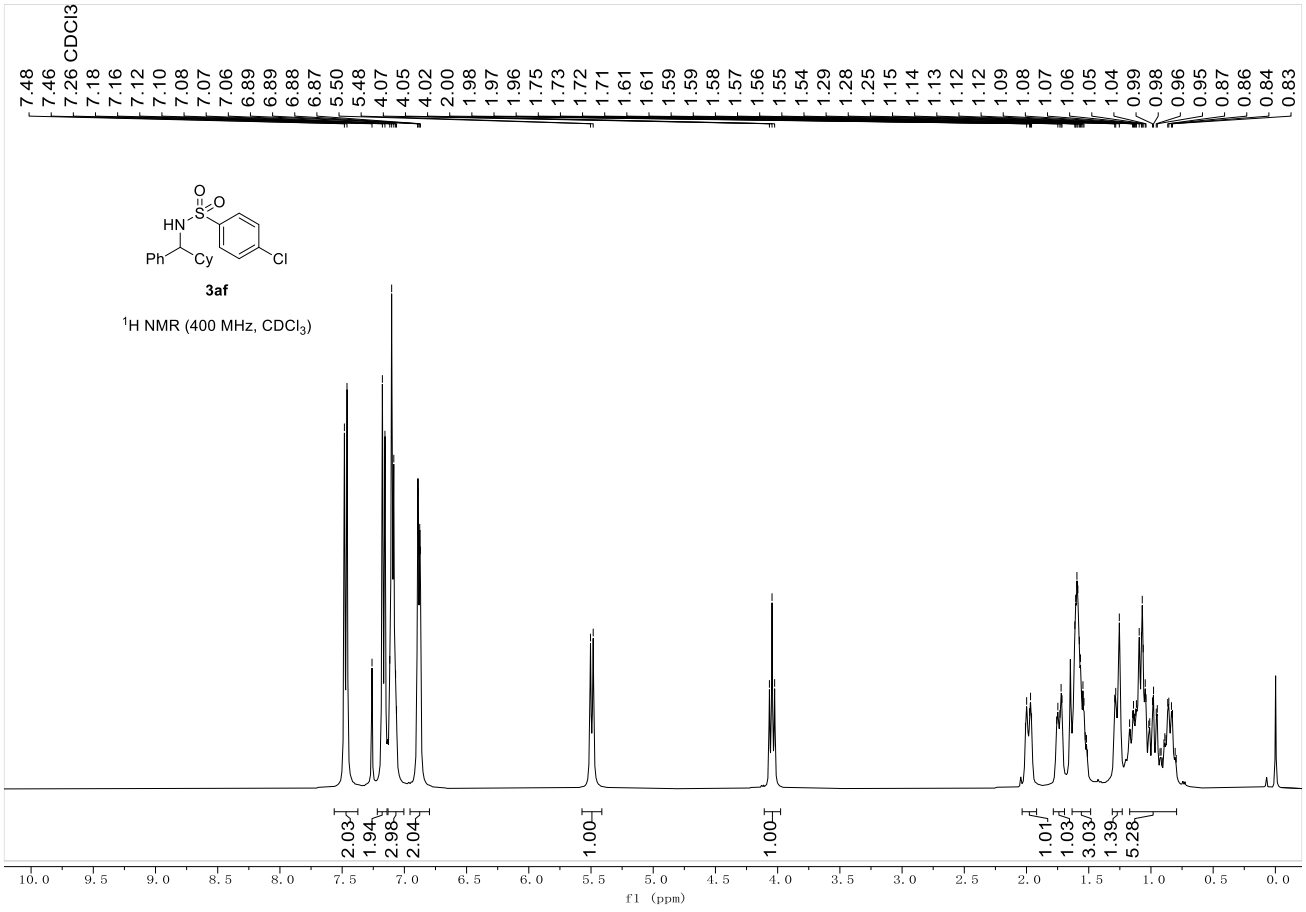
163.48
139.67
136.91
129.81
129.72
128.33
127.35
127.10
115.85
115.63
77.48
77.16
76.84
63.77
43.85
29.89
29.67
26.27
26.01
HN
Ph
Cy
F
3ae
13C NMR (101 MHz, CDCl3)
f1 (ppm)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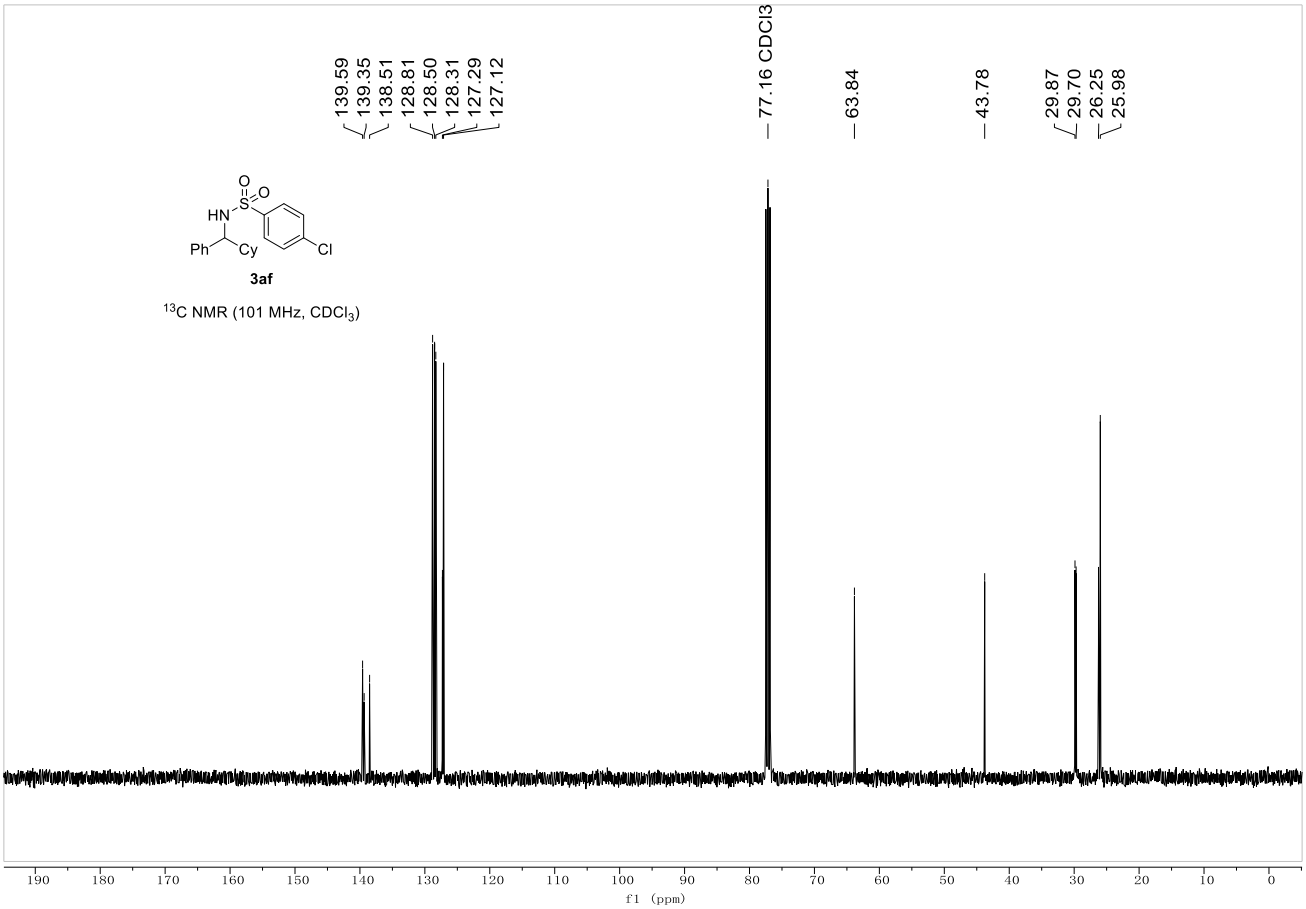
HN
S
O
O
Ph
Cy
Cl
3af
1H NMR (400 MHz, CDCl3)
2.03 1.94 2.98 2.04 1.00 1.00 1.01 1.03 3.03 1.39 5.28
f1 (ppm)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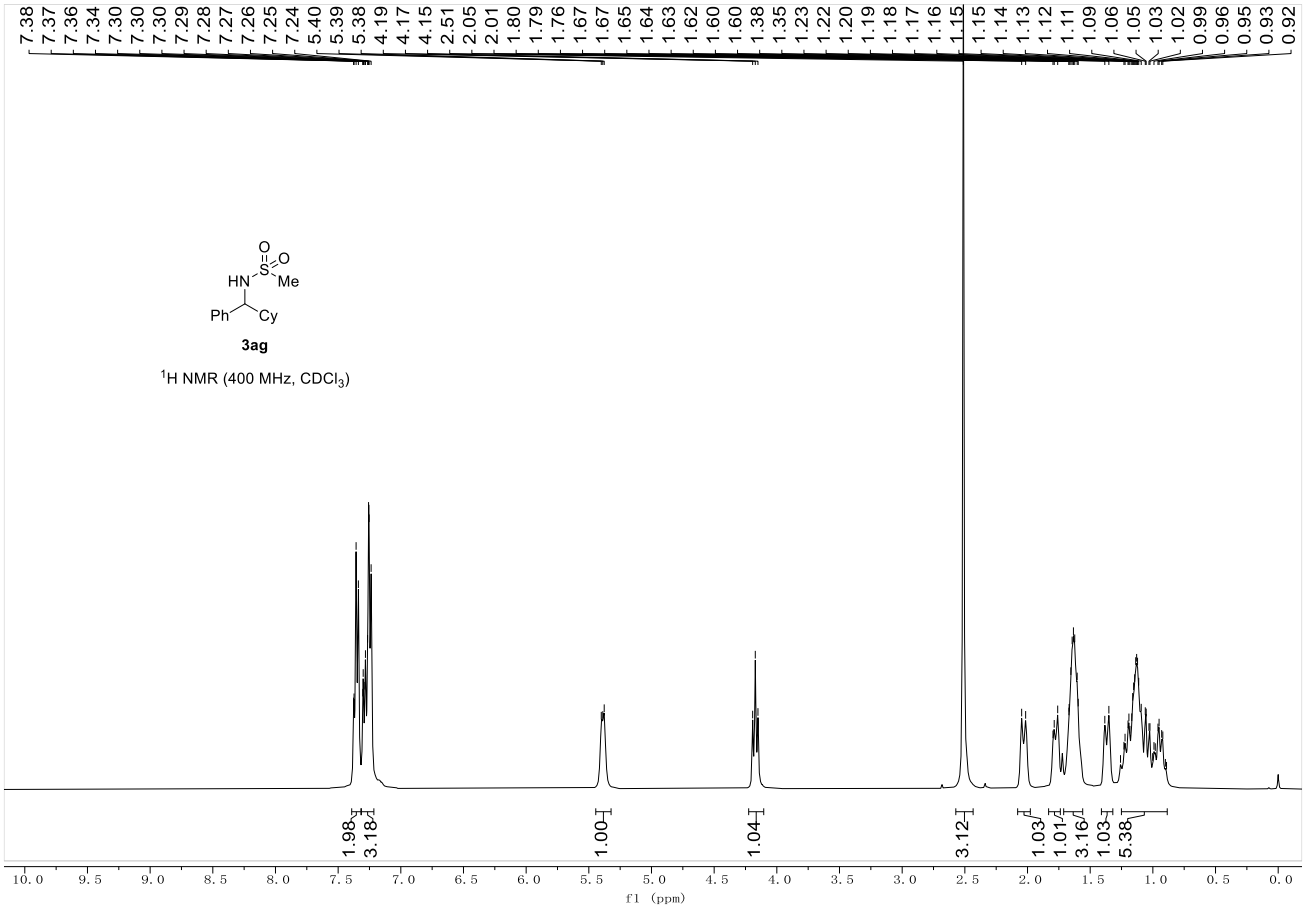
77.16 CDCl3
63.84
43.78
29.87 29.70 26.25 25.98
HN
S
O
O
Ph
Cy
Cl
3af
13C NMR (101 MHz, CDCl3)
f1 (ppm)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HN
S
O
O
Me
Ph
Cy
3ag
1H NMR (400 MHz, CDCl3)
1.98
3.18
1.00
1.04
3.12
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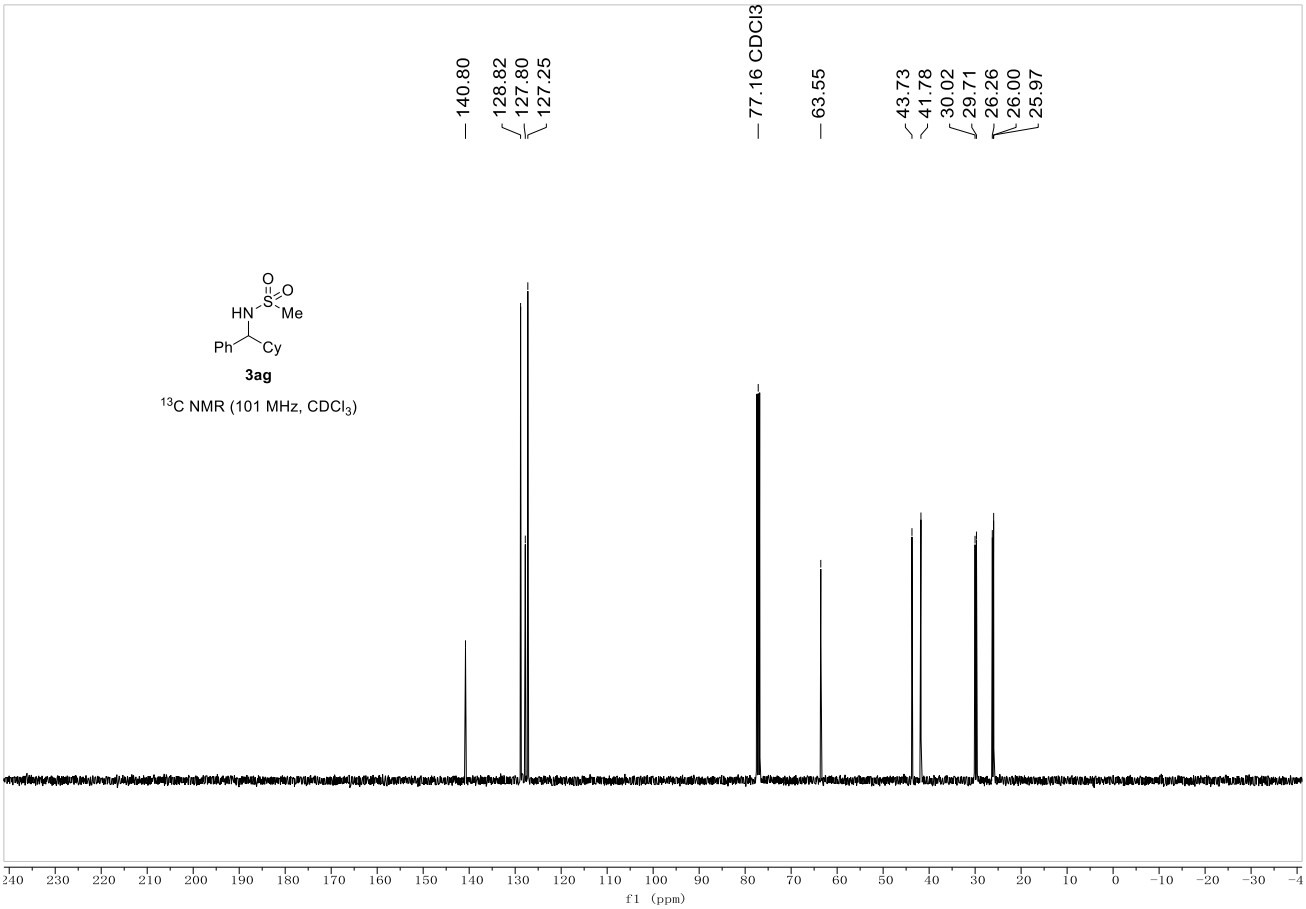
1.01
3.16
1.03
5.38
f1 (ppm)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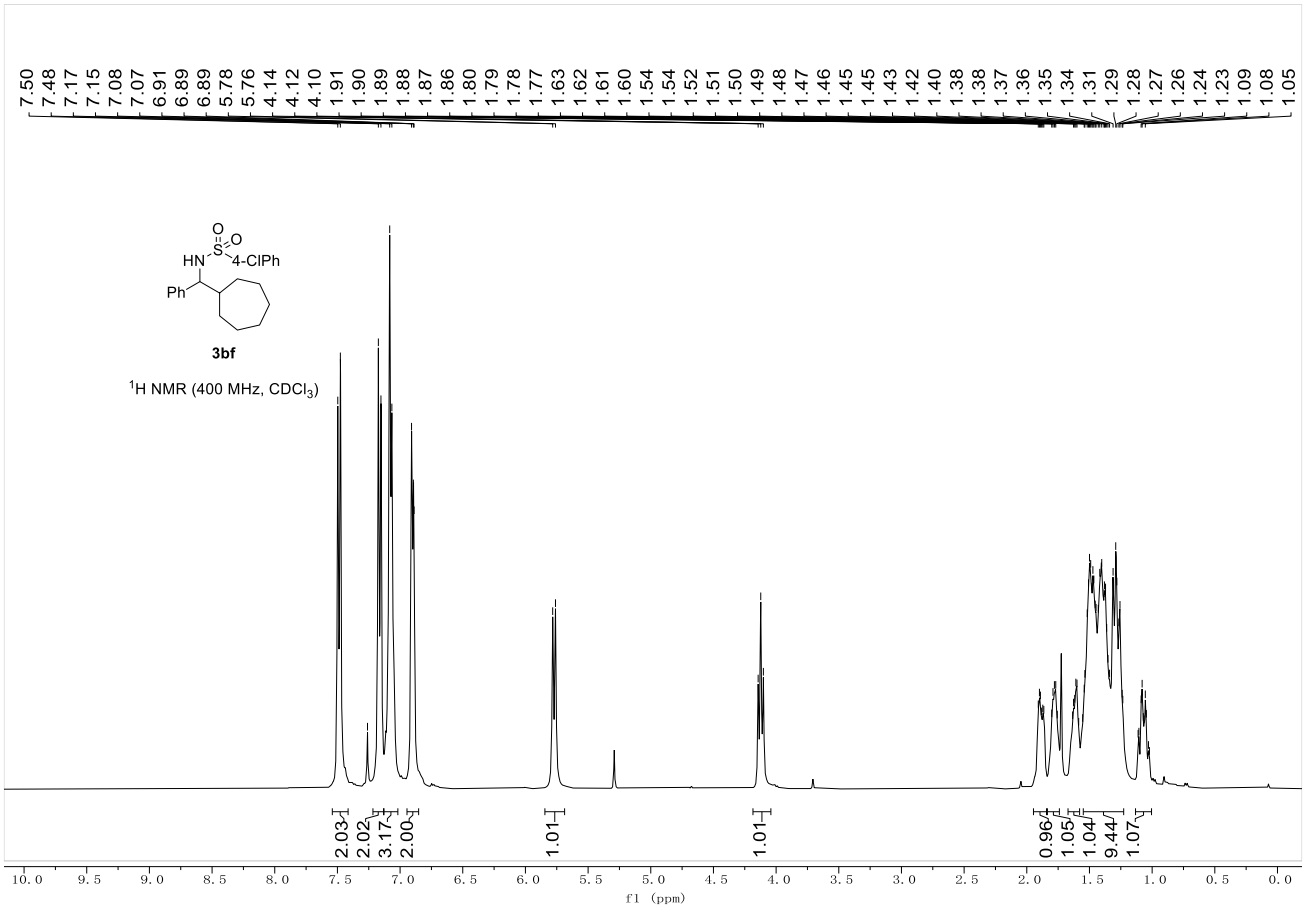
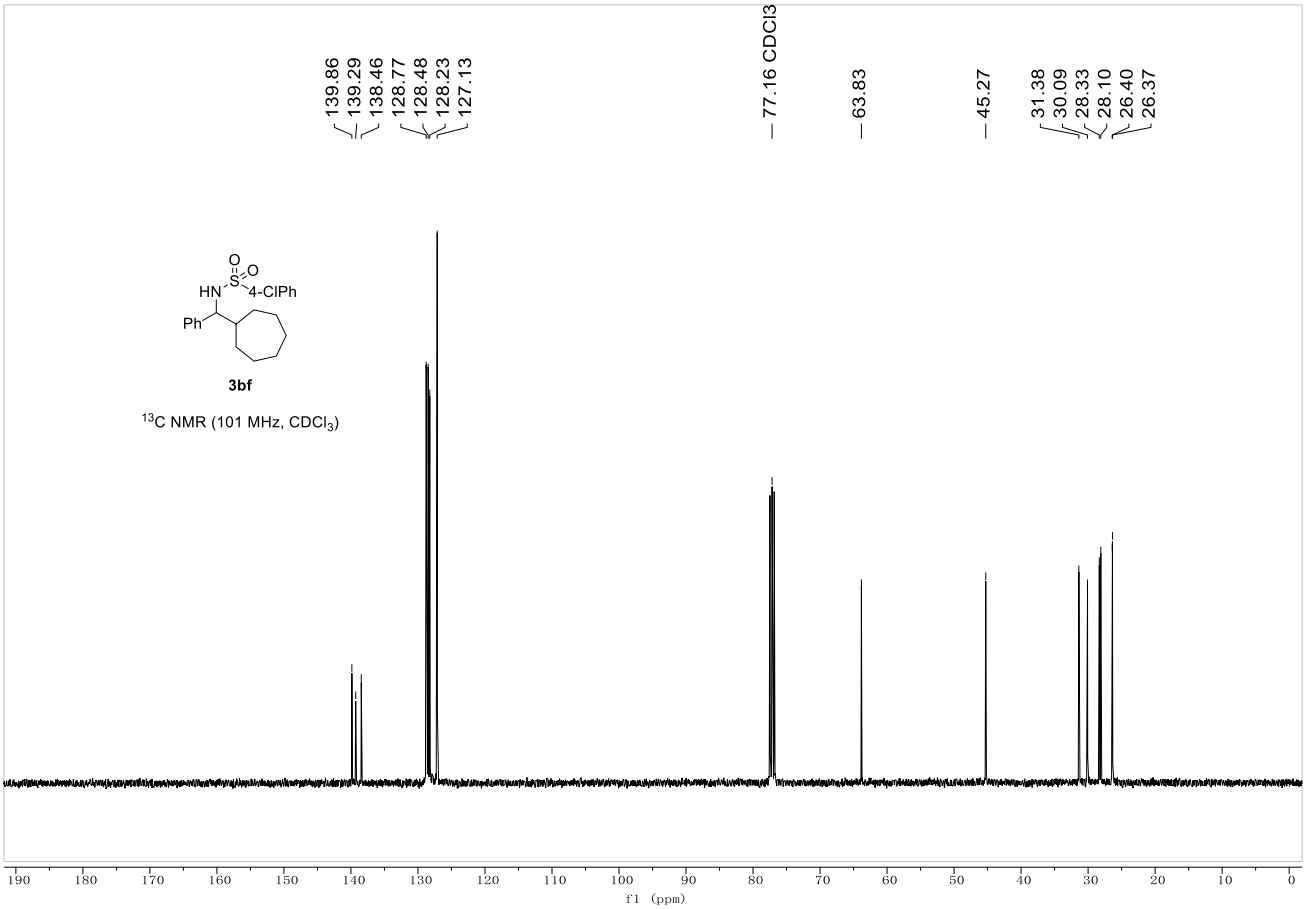
128.82
127.80
127.25
77.16 CDCl3
63.55
43.73
41.78
30.02
29.71
26.26
26.00
25.97
HN
S
O
O
Me
Ph
Cy
3ag
13C NMR (101 MHz, CDCl3)
f1 (ppm)


7.50 7.48 7.17 7.15 7.08 7.07 6.91 6.89 6.89 5.78 5.76 4.14 4.12 4.10 1.91 1.90 1.89 1.88 1.87 1.86 1.80 1.79 1.78 1.77 1.63 1.62 1.61 1.60 1.54 1.54 1.52 1.51 1.50 1.49 1.48 1.47 1.46 1.45 1.45 1.43 1.42 1.40 1.38 1.38 1.37 1.36 1.35 1.34 1.31 1.29 1.28 1.27 1.26 1.24 1.23 1.09 1.08 1.05
HN
S
O
O
4-ClPh
Ph
3bf
1H NMR (400 MHz, CDCl3)
2.03 2.02 3.17 2.00 1.01 1.01 0.96 1.05 1.04 9.44 1.07
f1 (ppm)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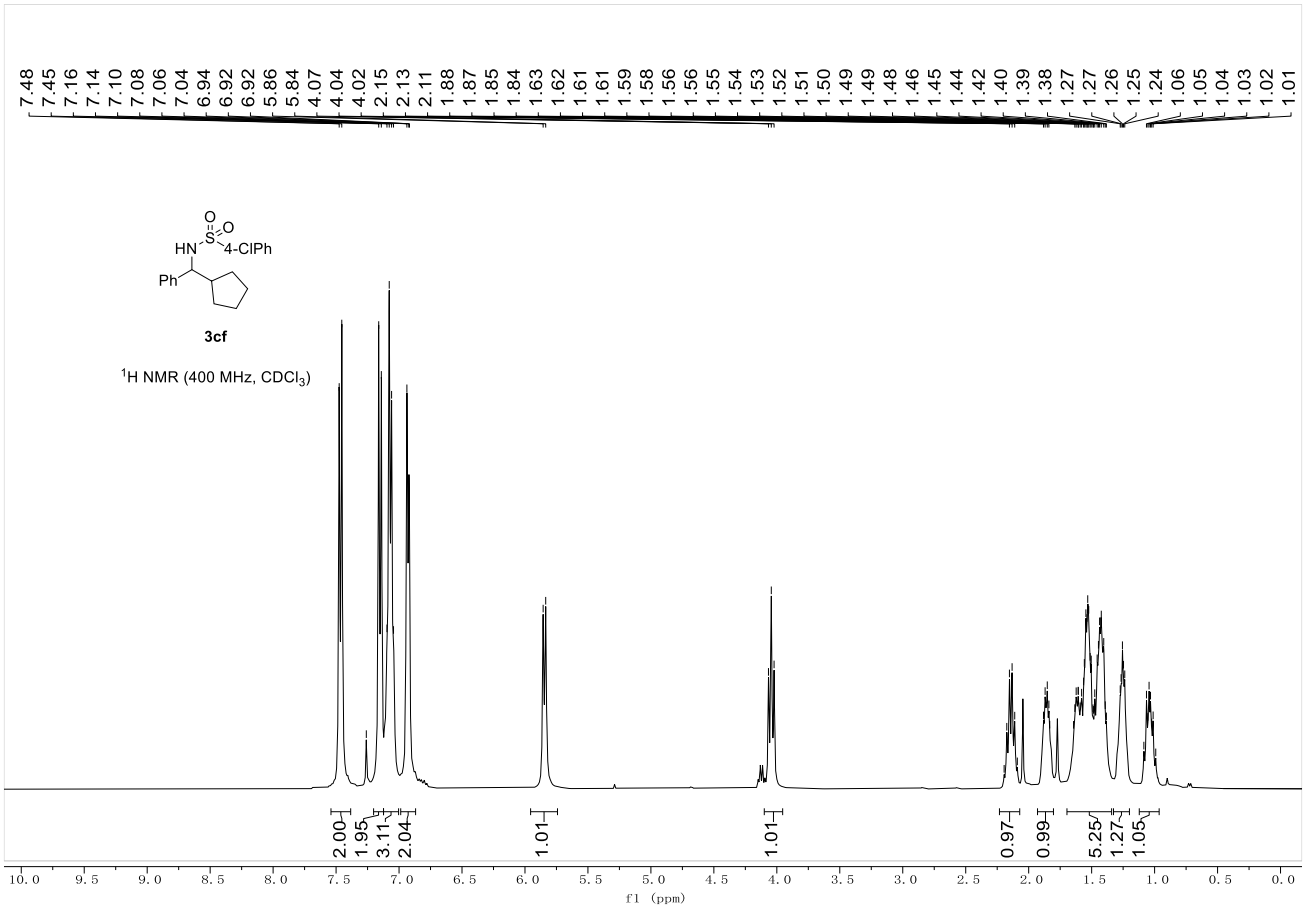
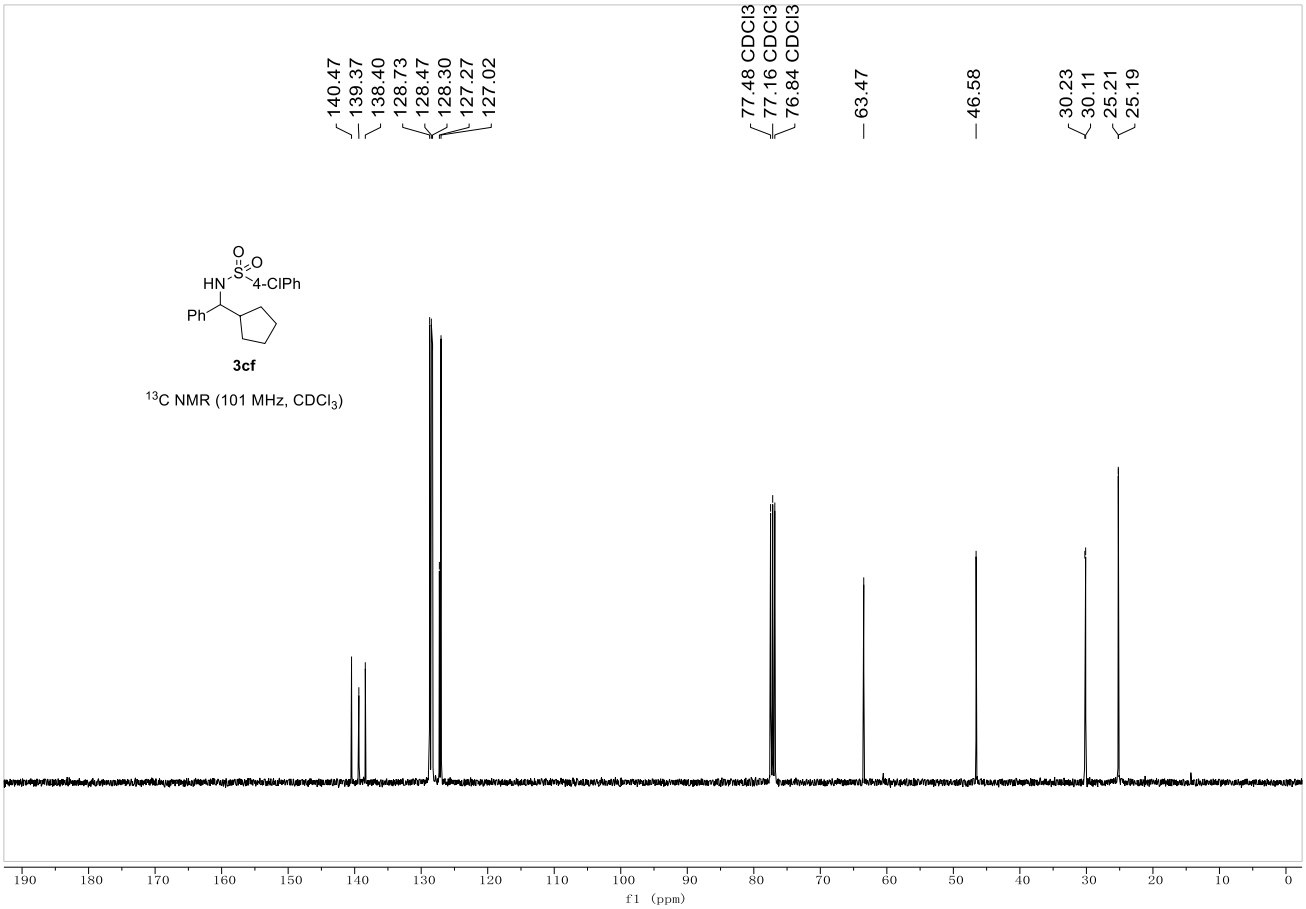
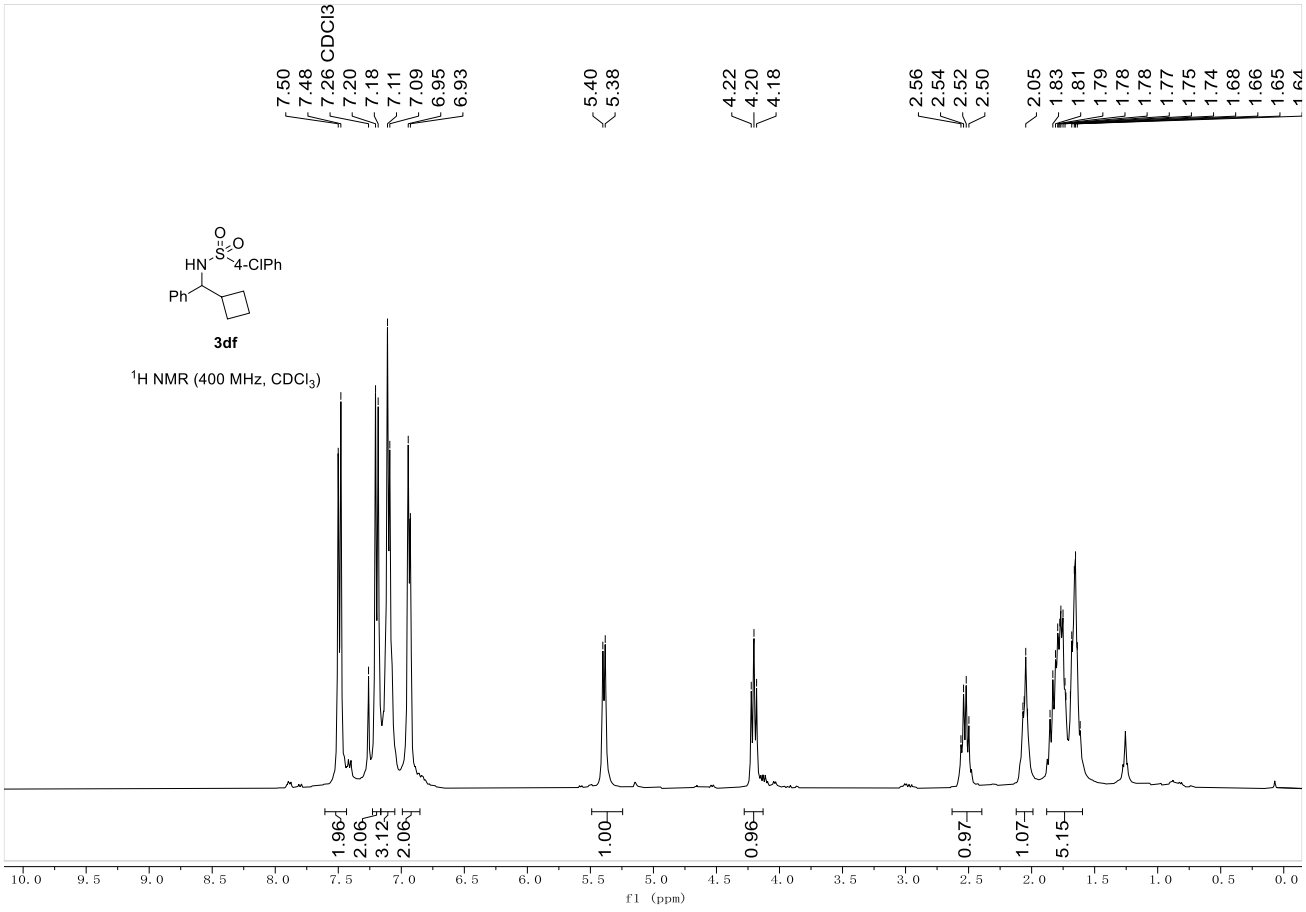
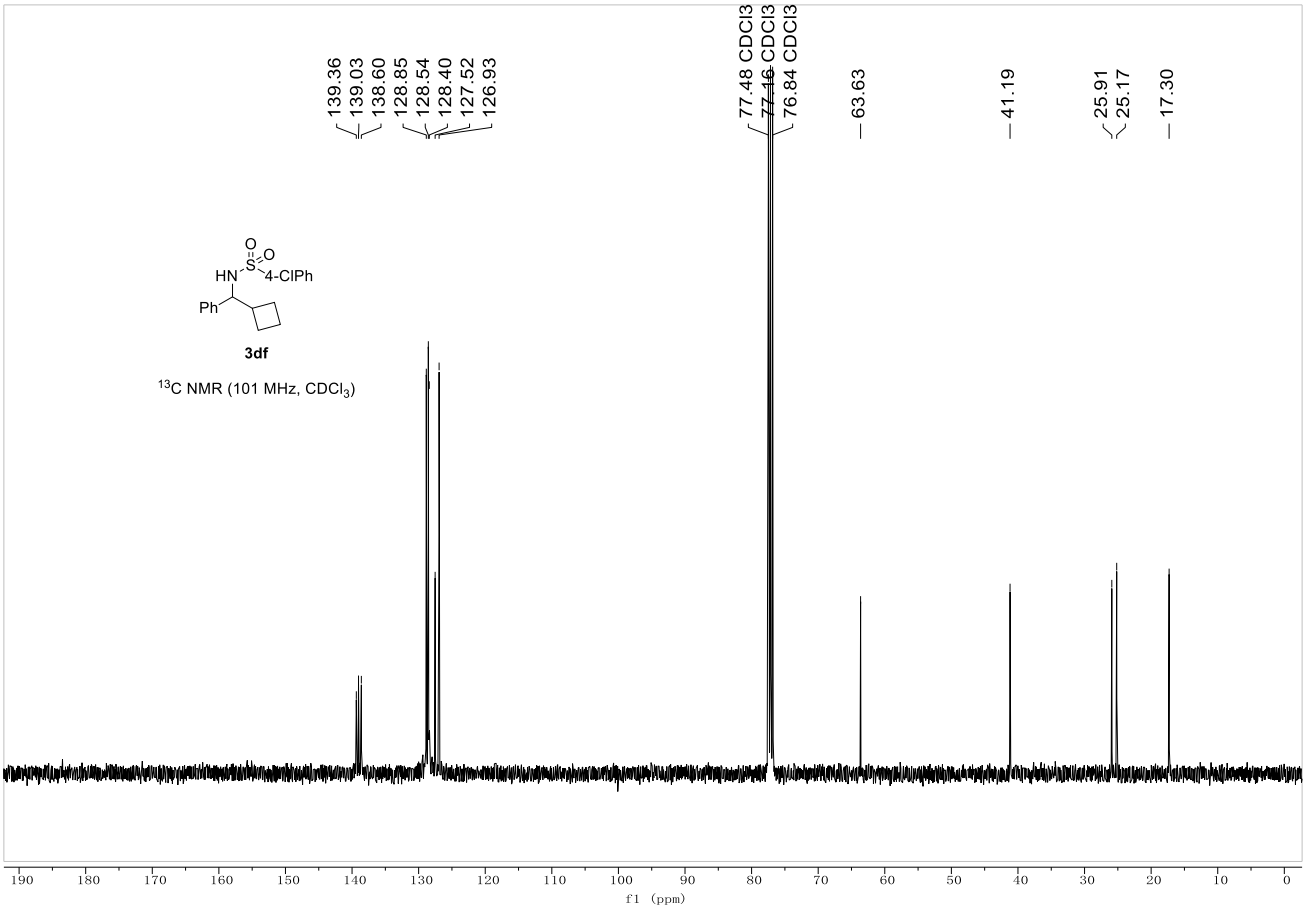
77.16 CDCl3
63.83
45.27
31.38 30.09 28.33 28.10 26.40 26.37
HN
S
O
O
4-ClPh
Ph
3bf
13C NMR (101 MHz, CDCl3)
f1 (ppm)


7.48 7.45 7.16 7.14 7.10 7.08 7.06 7.04 6.94 6.92 6.92 5.86 5.84 4.07 4.04 4.02 2.15 2.13 2.11 1.88 1.87 1.85 1.84 1.63 1.62 1.61 1.61 1.59 1.58 1.56 1.56 1.55 1.54 1.53 1.52 1.51 1.50 1.49 1.49 1.48 1.46 1.45 1.44 1.42 1.40 1.39 1.38 1.27 1.27 1.26 1.25 1.24 1.06 1.05 1.04 1.03 1.02 1.01
HN
O
O
S
4-ClPh
Ph
3cf
1H NMR (400 MHz, CDCl3)
2.00 1.95 3.11 2.04 1.01 1.01 0.97 0.99 5.25 1.27 1.05
f1 (ppm)


140.47 139.37 138.40 128.73 128.47 128.30 127.27 127.02
77.48 CDCl3 77.16 CDCl3 76.84 CDCl3
63.47
46.58
30.23 30.11 25.21 25.19
HN
O
O
S
4-ClPh
Ph
3cf
13C NMR (101 MHz, CDCl3)
f1 (ppm)


7.50
7.48
7.26 CDCl3
7.20
7.18
7.11
7.09
6.95
6.93
5.40
5.38
4.22
4.20
4.18
2.56
2.54
2.52
2.50
2.05
1.83
1.81
1.79
1.78
1.78
1.77
1.75
1.74
1.68
1.66
1.65
HN
S
O
O
4-ClPh
Ph
3df
1H NMR (400 MHz, CDCl3)
1.96
2.06
3.12
2.06
1.00
0.96
0.97
1.07
5.15
f1 (ppm)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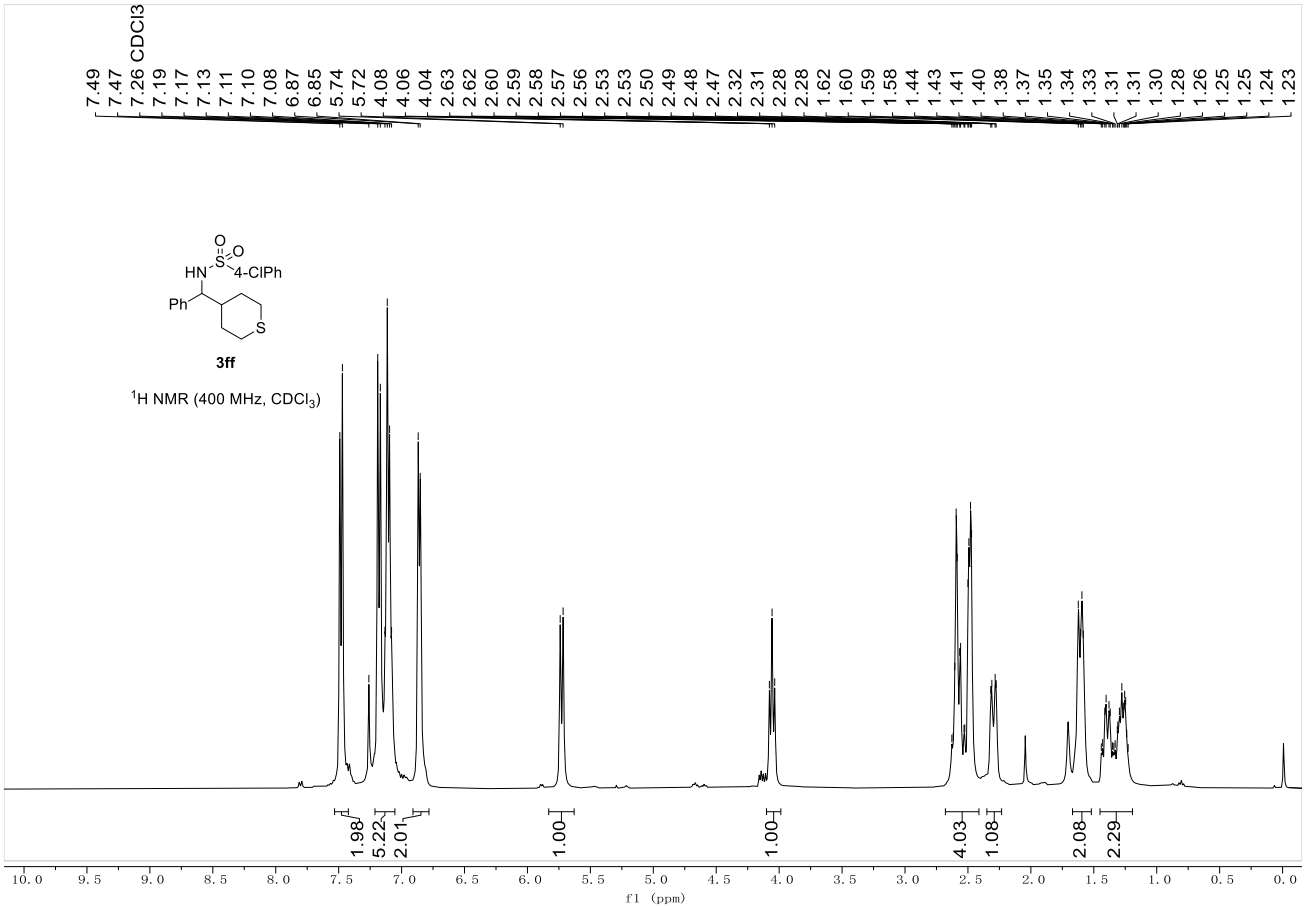
139.03
138.60
128.85
128.54
128.40
127.52
126.93
77.48 CDCl3
77.16 CDCl3
76.84 CDCl3
63.63
41.19
25.91
25.17
17.30
HN
S
O
O
4-ClPh
Ph
3df
13C NMR (101 MHz, CDCl3)
f1 (ppm)


7.49 7.47 7.26 CDCl3 7.19 7.17 7.13 7.11 7.10 7.08 6.87 6.85 5.74 5.72 4.08 4.06 4.04 2.63 2.62 2.60 2.59 2.58 2.57 2.56 2.53 2.53 2.50 2.49 2.48 2.47 2.32 2.31 2.28 2.28 1.62 1.60 1.59 1.58 1.44 1.43 1.41 1.40 1.38 1.37 1.35 1.34 1.33 1.31 1.31 1.30 1.28 1.26 1.25 1.25 1.24 1.23
HN
S
O
O
4-ClPh
Ph
S
3ff
1H NMR (400 MHz, CDCl3)
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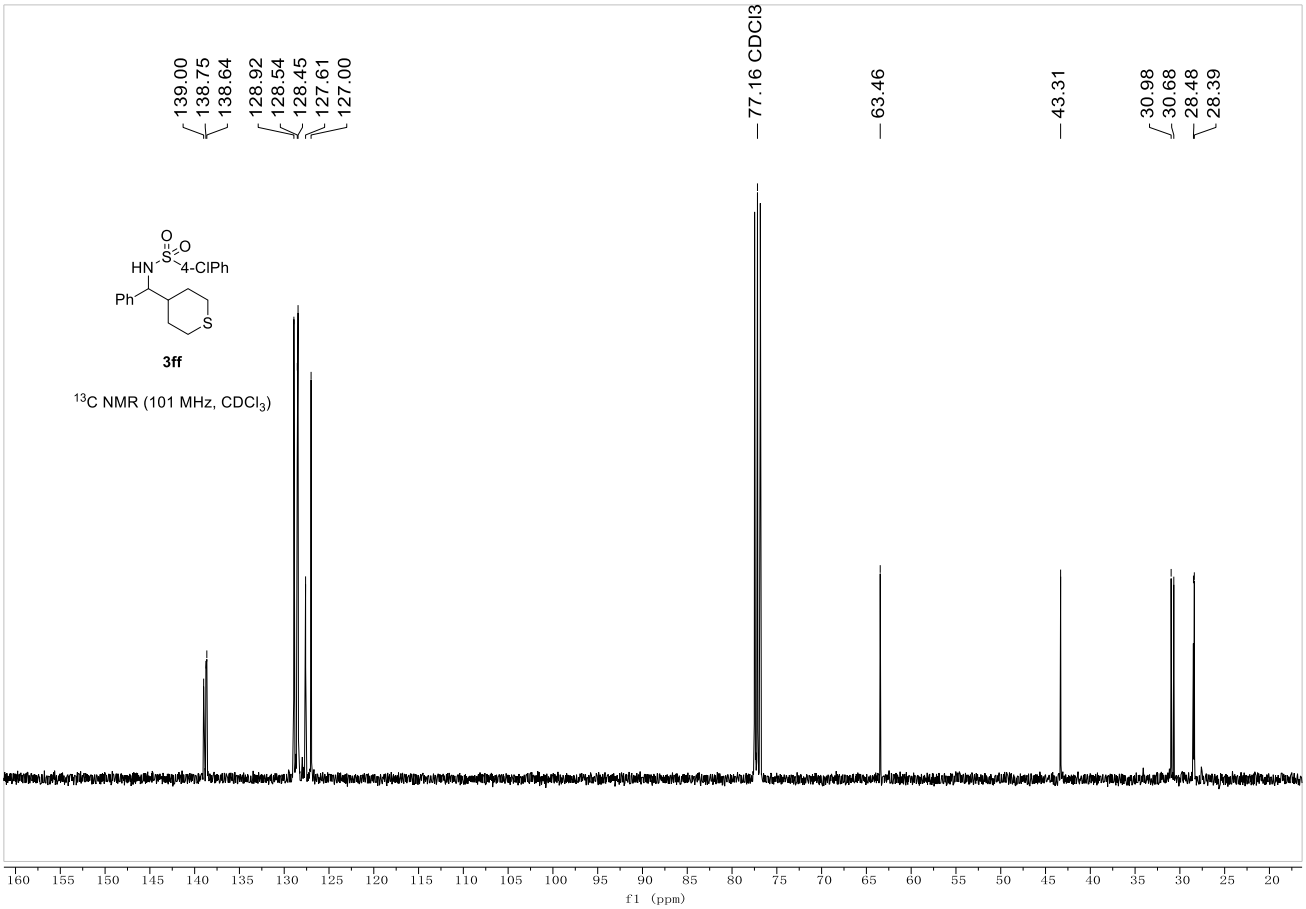
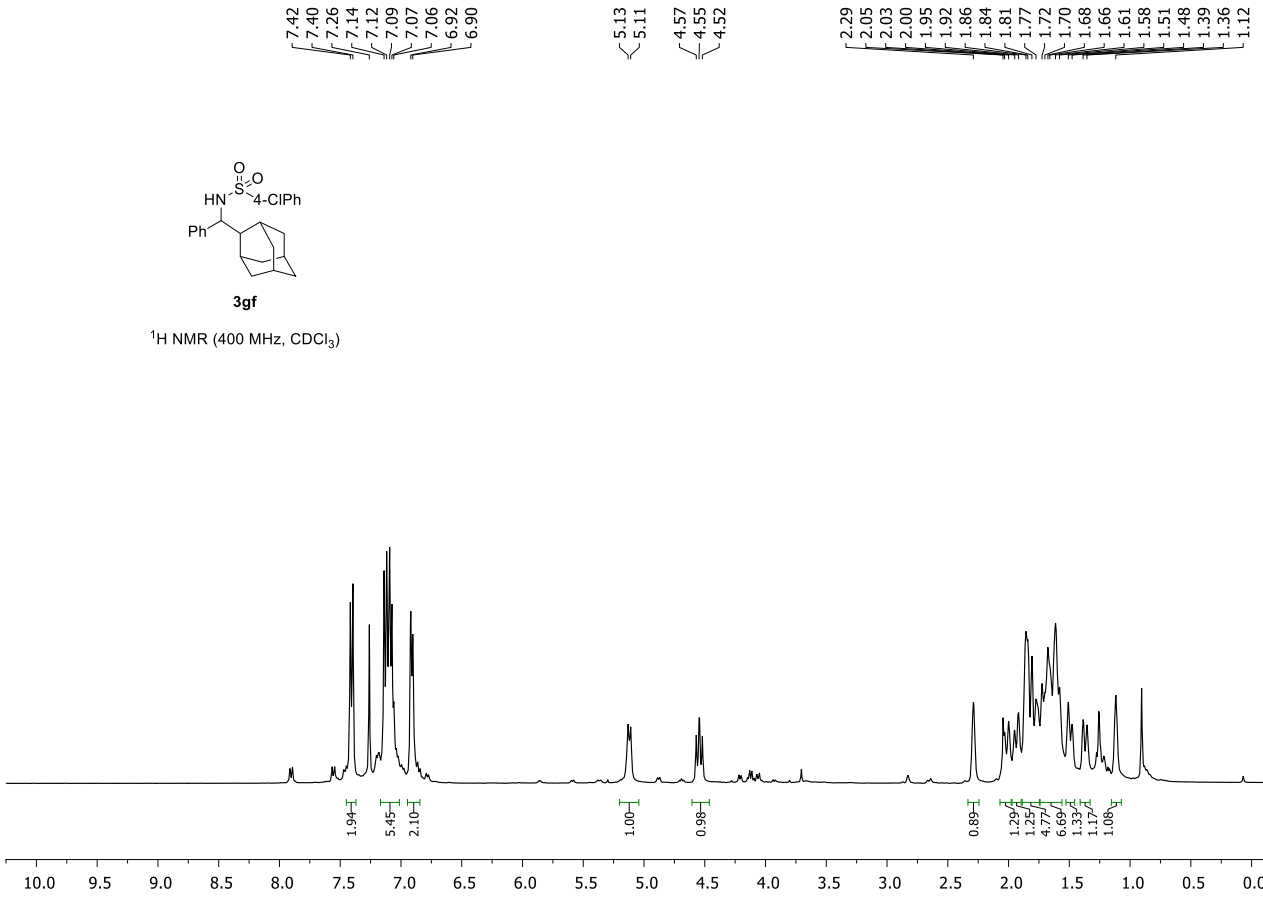
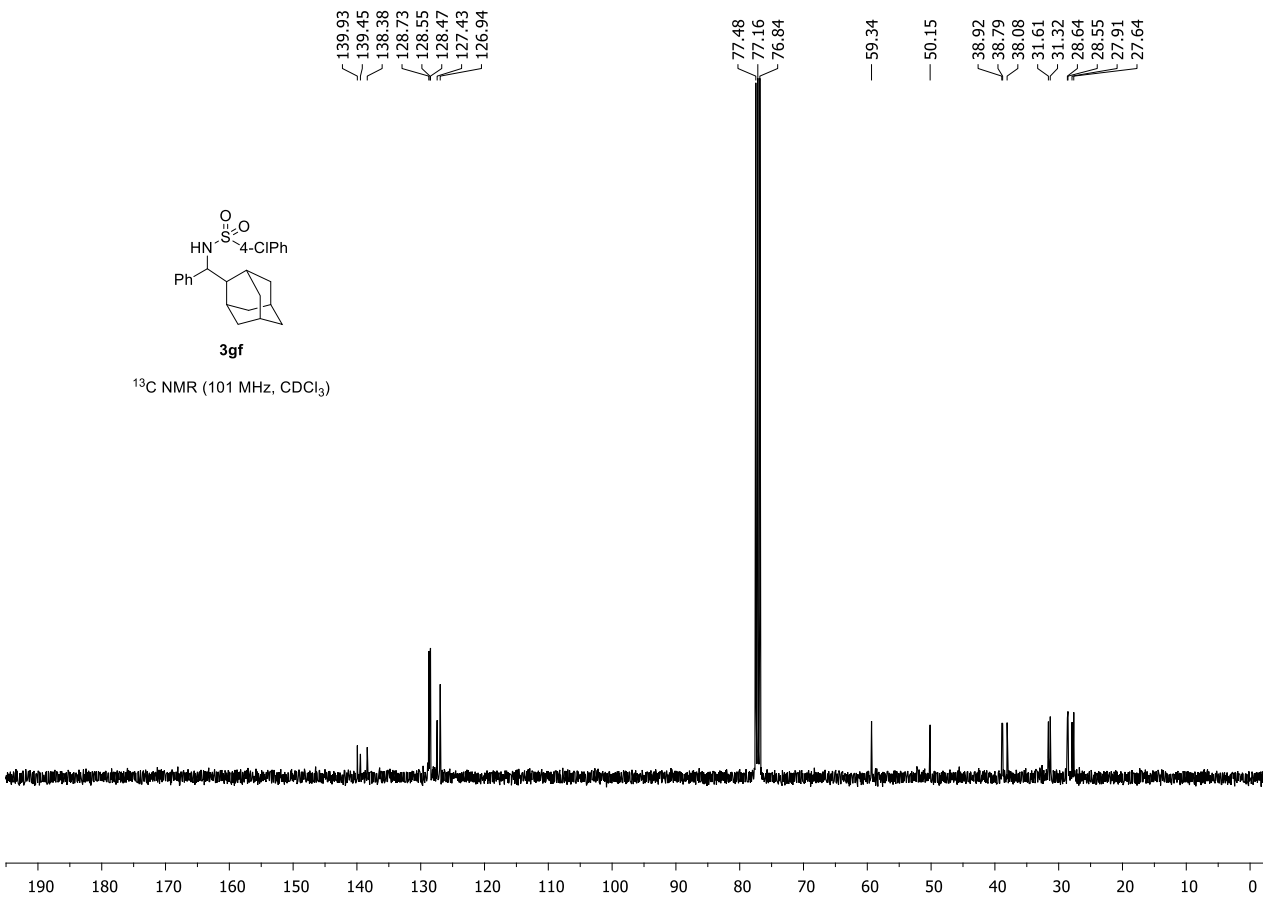
5.22
2.01
1.00
1.00
4.03
1.08
2.08
2.29
f1 (ppm)


139.00 138.75 138.64 128.92 128.54 128.45 127.61 127.00 77.16 CDCl3 63.46 43.31 30.98 30.68 28.48 28.39
HN
S
O
O
4-ClPh
Ph
S
3ff
13C NMR (101 MHz, CDCl3)
f1 (ppm)



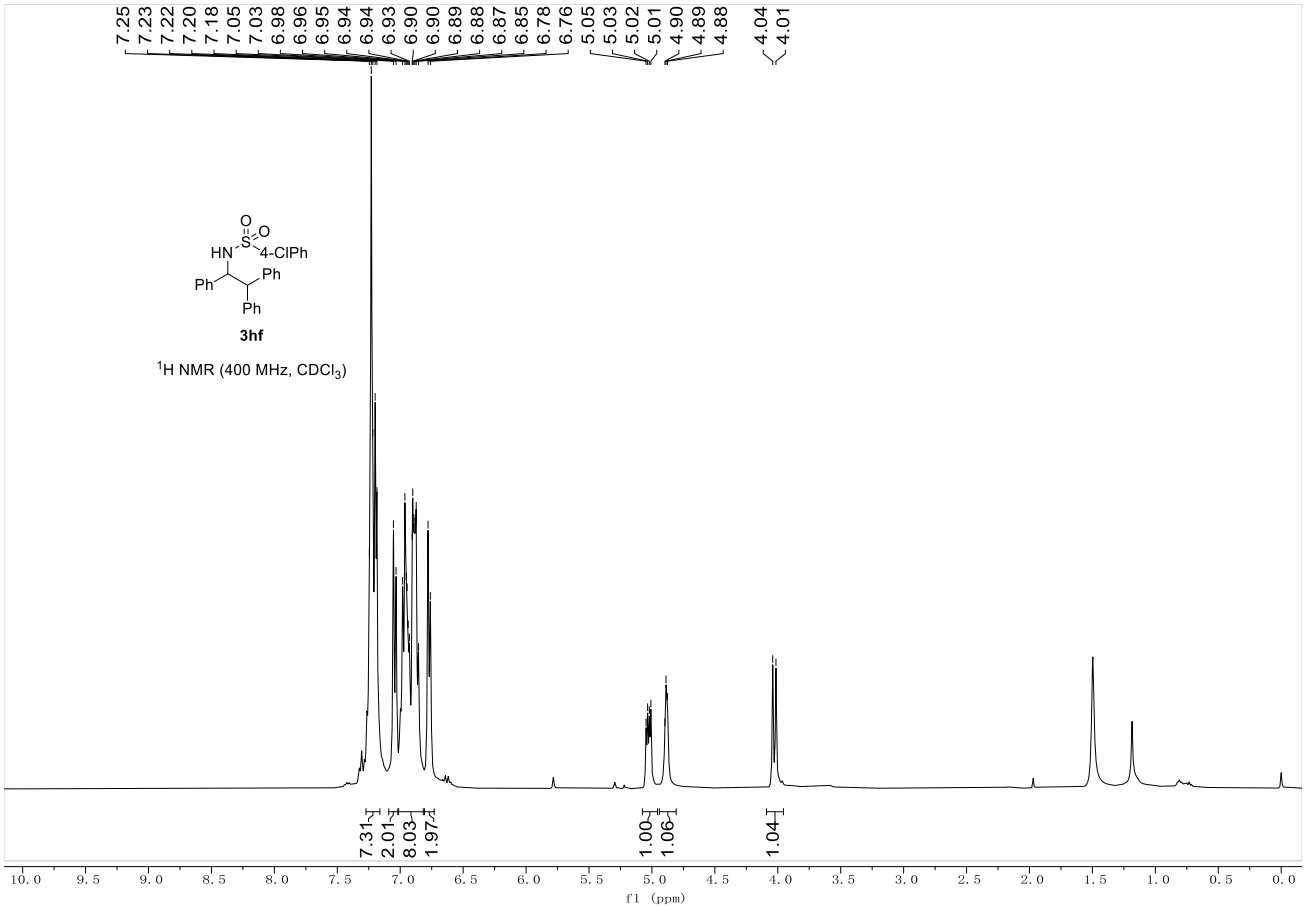
3gf

^{1}H NMR (400 MHz, $CDCl_3$)

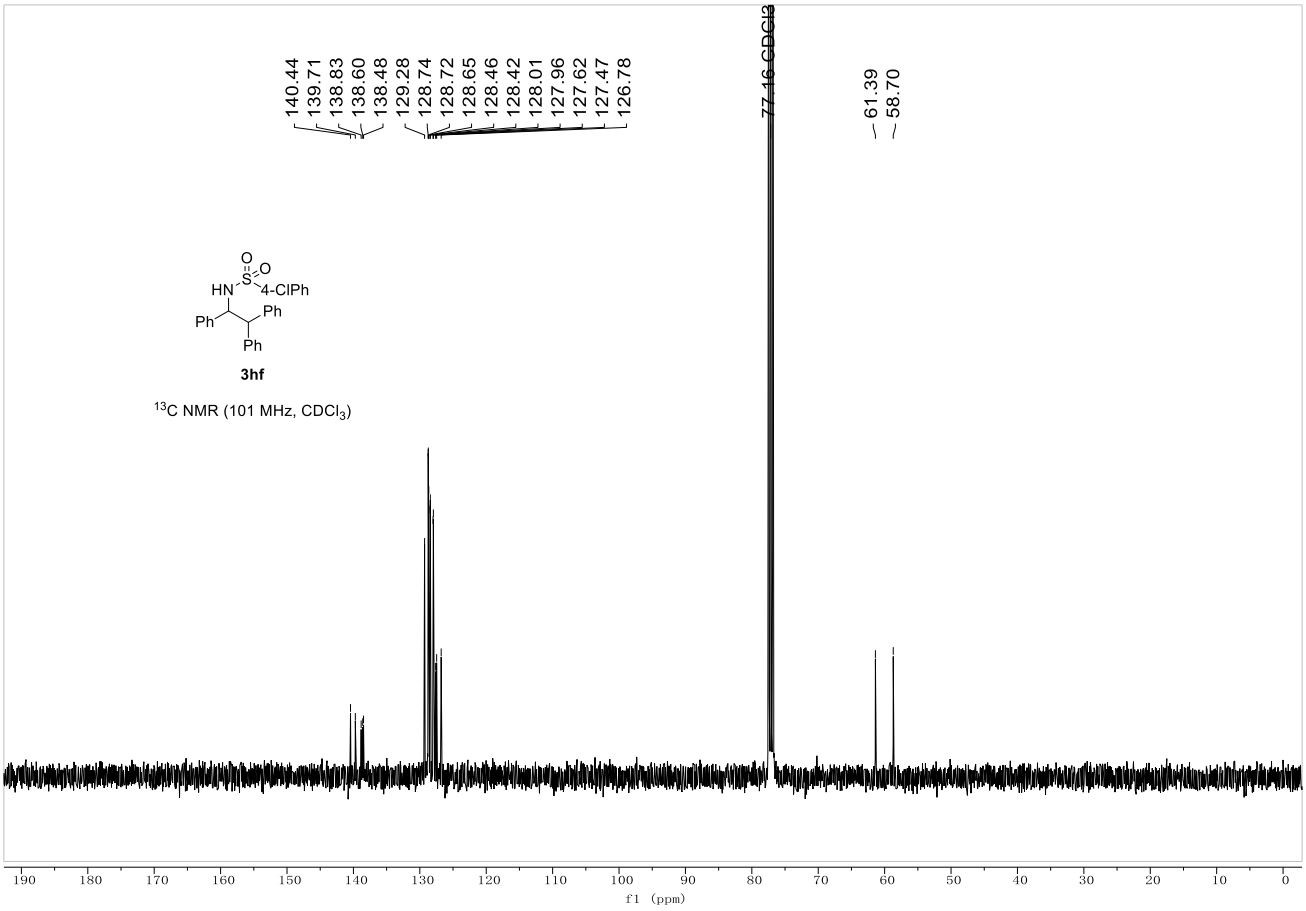


3gf

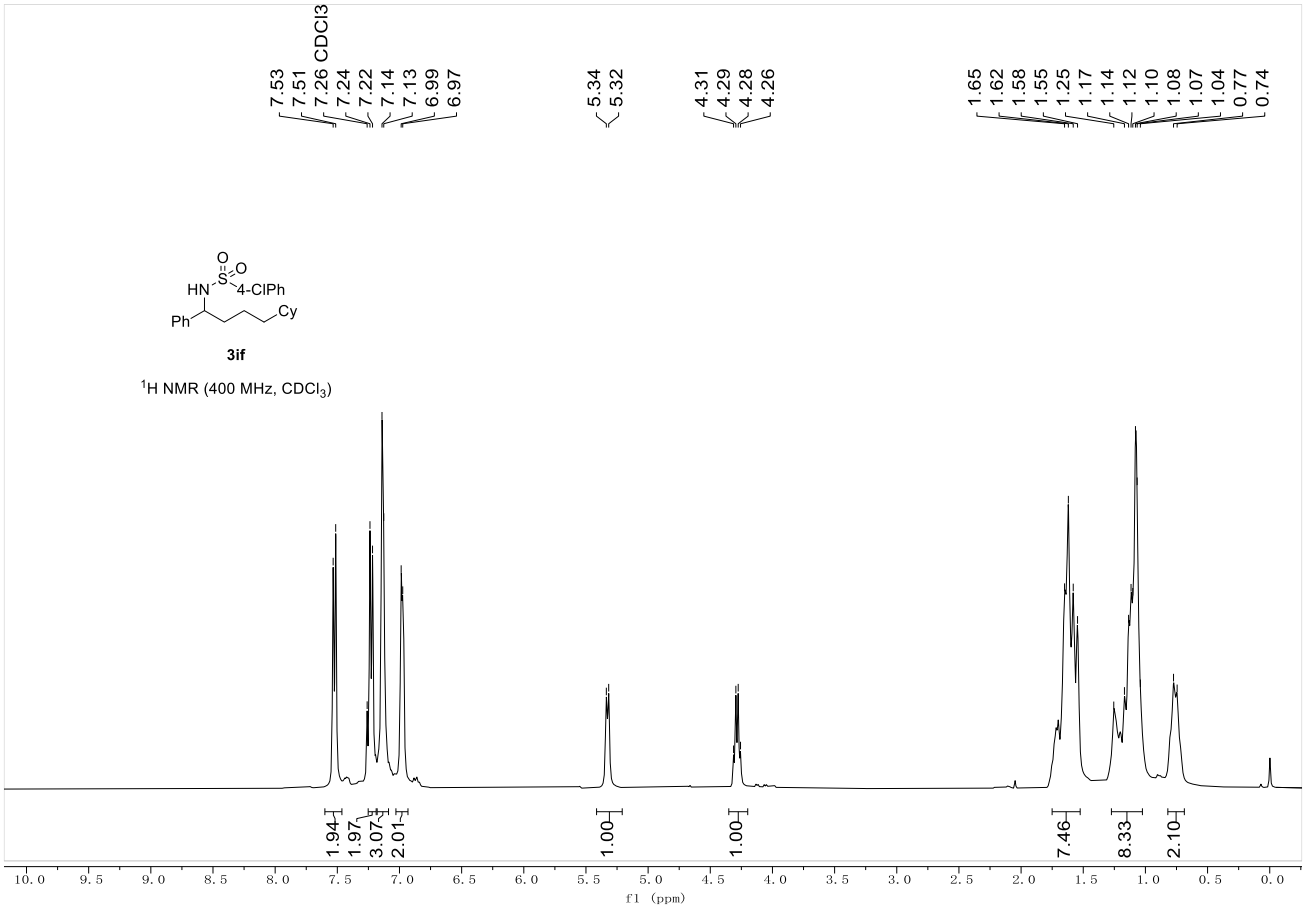
^{13}C NMR (101 MHz, $CDCl_3$)



^{1}H NMR (400 MHz, $CDCl_3$)



^{13}C NMR (101 MHz, $CDCl_3$)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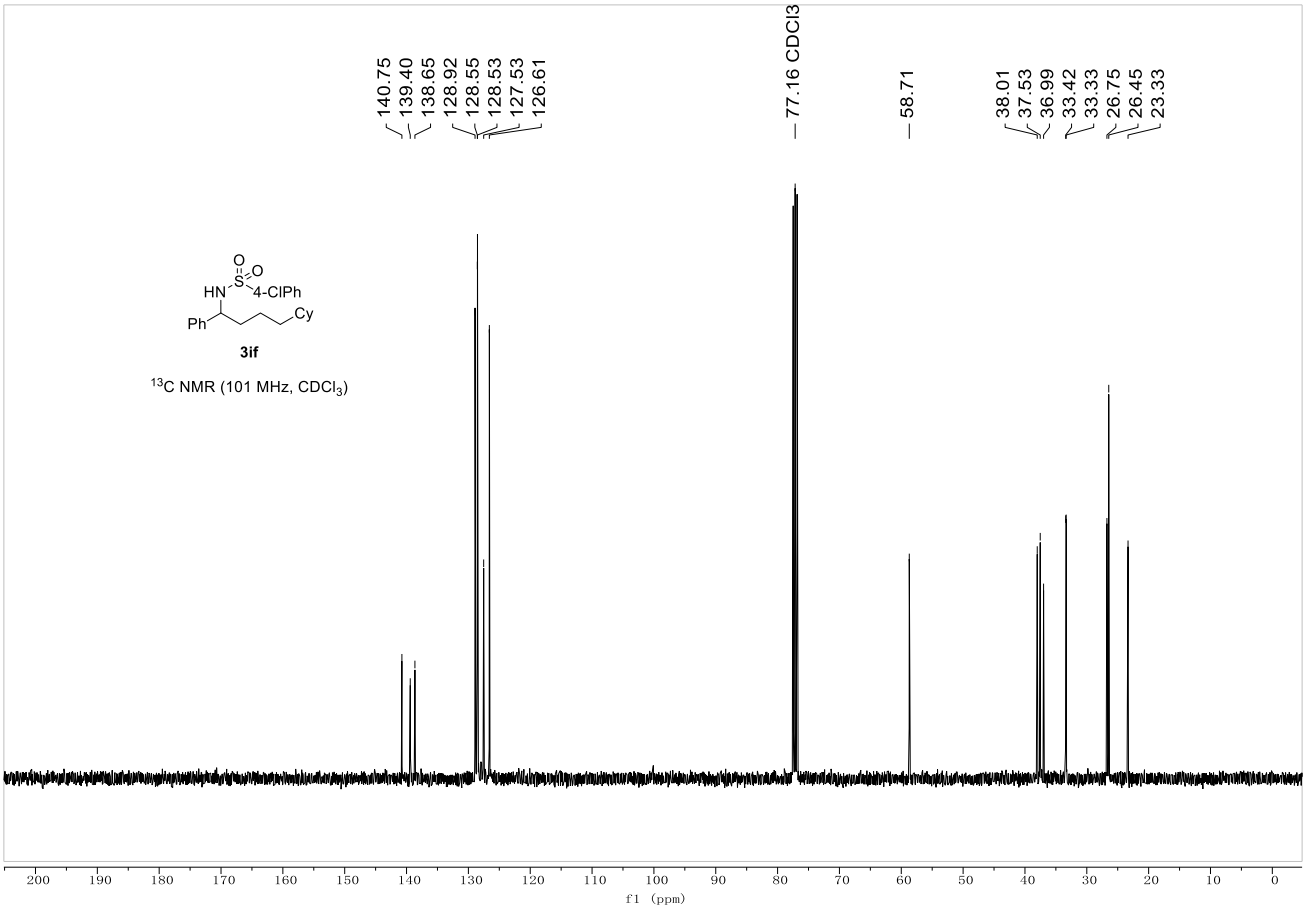
7.51
7.26 CDCl3
7.24
7.22
7.14
7.13
6.99
6.97
5.34
5.32
4.31
4.29
4.28
4.26
1.65
1.62
1.58
1.55
1.25
1.17
1.14
1.12
1.10
1.08
1.07
1.04
0.77
0.74
HN
S
O
O
4-ClPh
Ph
Cy
3if
1H NMR (400 MHz, CDCl3)
1.94
1.97
3.07
2.01
1.00
1.00
7.46
8.33
2.10
f1 (ppm)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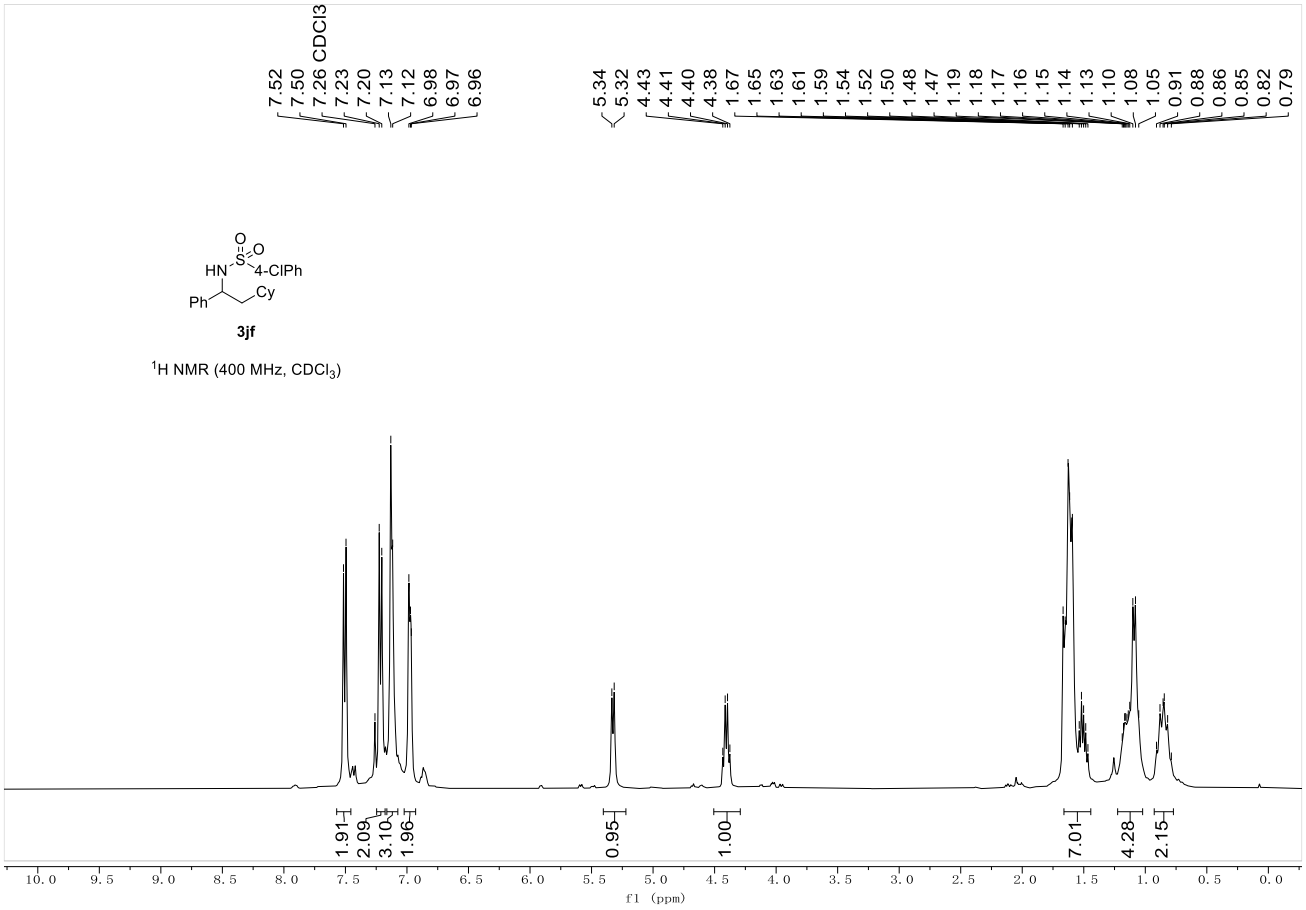
139.40
138.65
128.92
128.55
128.53
127.53
126.61
77.16 CDCl3
58.71
38.01
37.53
36.99
33.42
33.33
26.75
26.45
23.33
HN
S
O
O
4-ClPh
Ph
Cy
3if
13C NMR (101 MHz, CDCl3)
f1 (ppm)


7.52
7.50
7.26 CDCl3
7.23
7.20
7.13
7.12
6.98
6.97
6.96
5.34
5.32
4.43
4.41
4.40
4.38
1.67
1.65
1.63
1.61
1.59
1.54
1.52
1.50
1.48
1.47
1.19
1.18
1.17
1.16
1.15
1.14
1.13
1.10
1.08
1.05
0.91
0.88
0.86
0.85
0.82
0.79
HN
S
O
O
4-ClPh
Ph
Cy
3jf
1H NMR (400 MHz, CDCl3)
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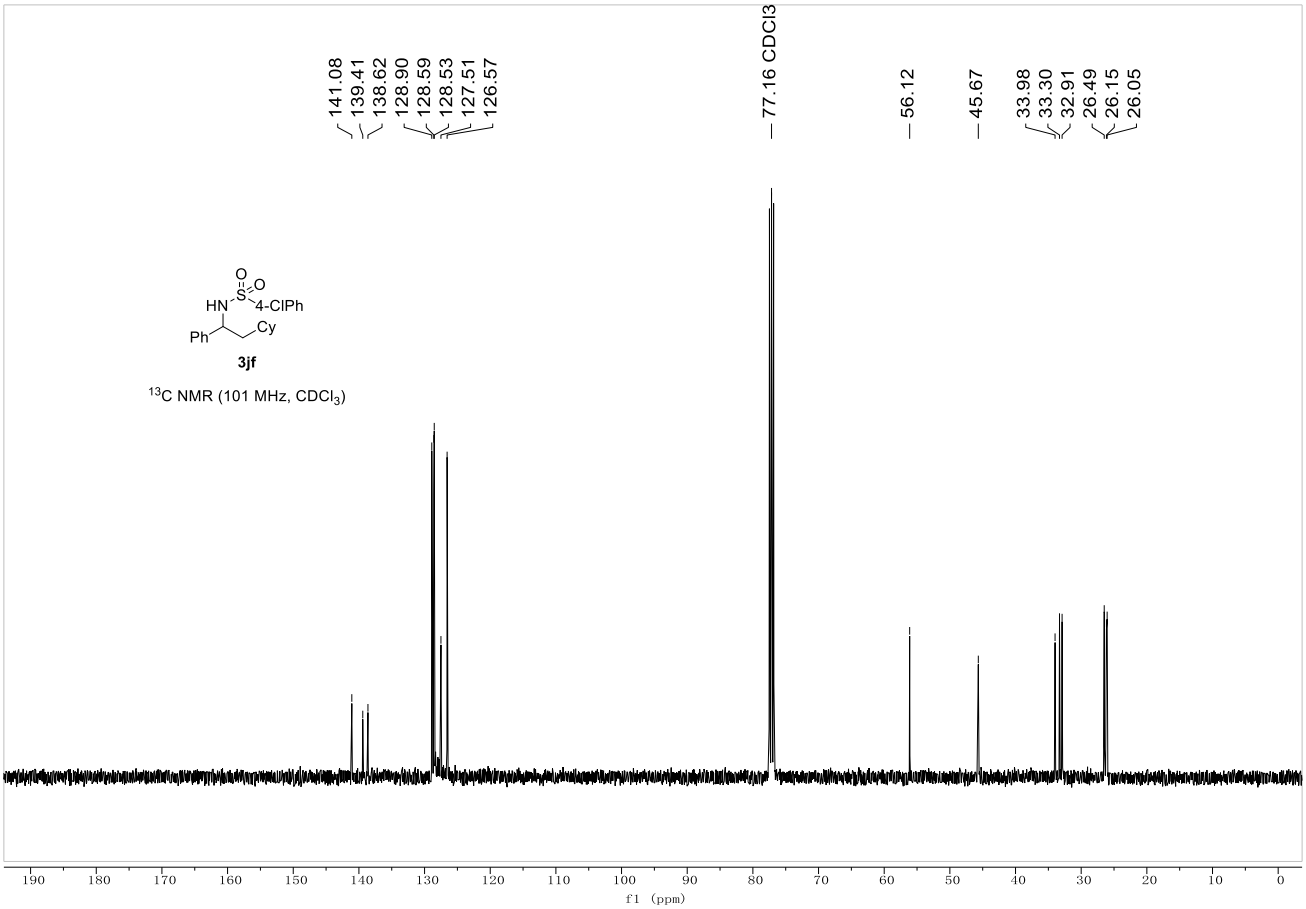
2.09
3.10
1.96
0.95
1.00
7.01
4.28
2.15
f1 (ppm)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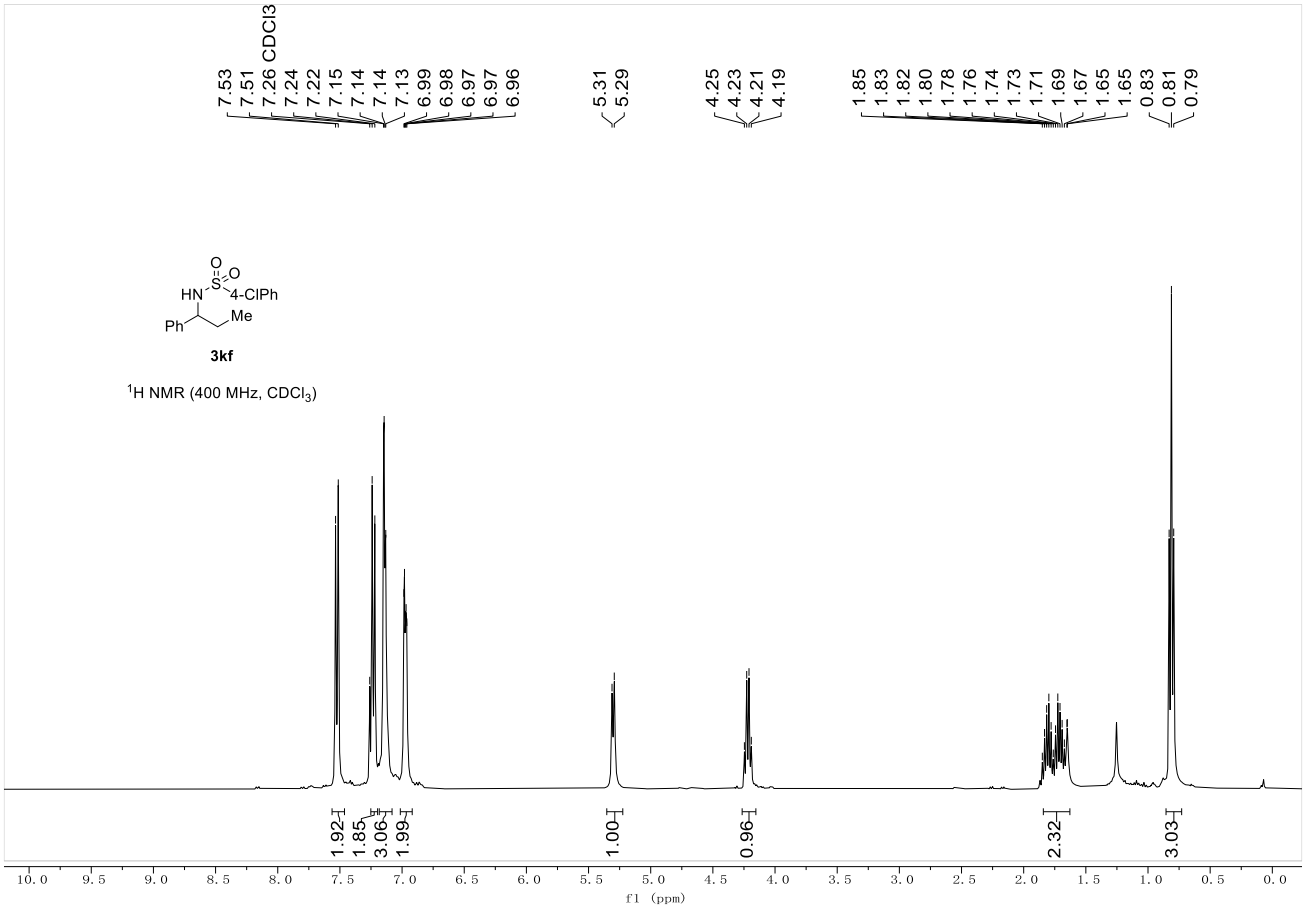
139.41
138.62
128.90
128.59
128.53
127.51
126.57
77.16 CDCl3
56.12
45.67
33.98
33.30
32.91
26.49
26.15
26.05
HN
S
O
O
4-ClPh
Ph
Cy
3jf
13C NMR (101 MHz, CDCl3)
f1 (ppm)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7.51
7.26 CDCl3
7.24
7.22
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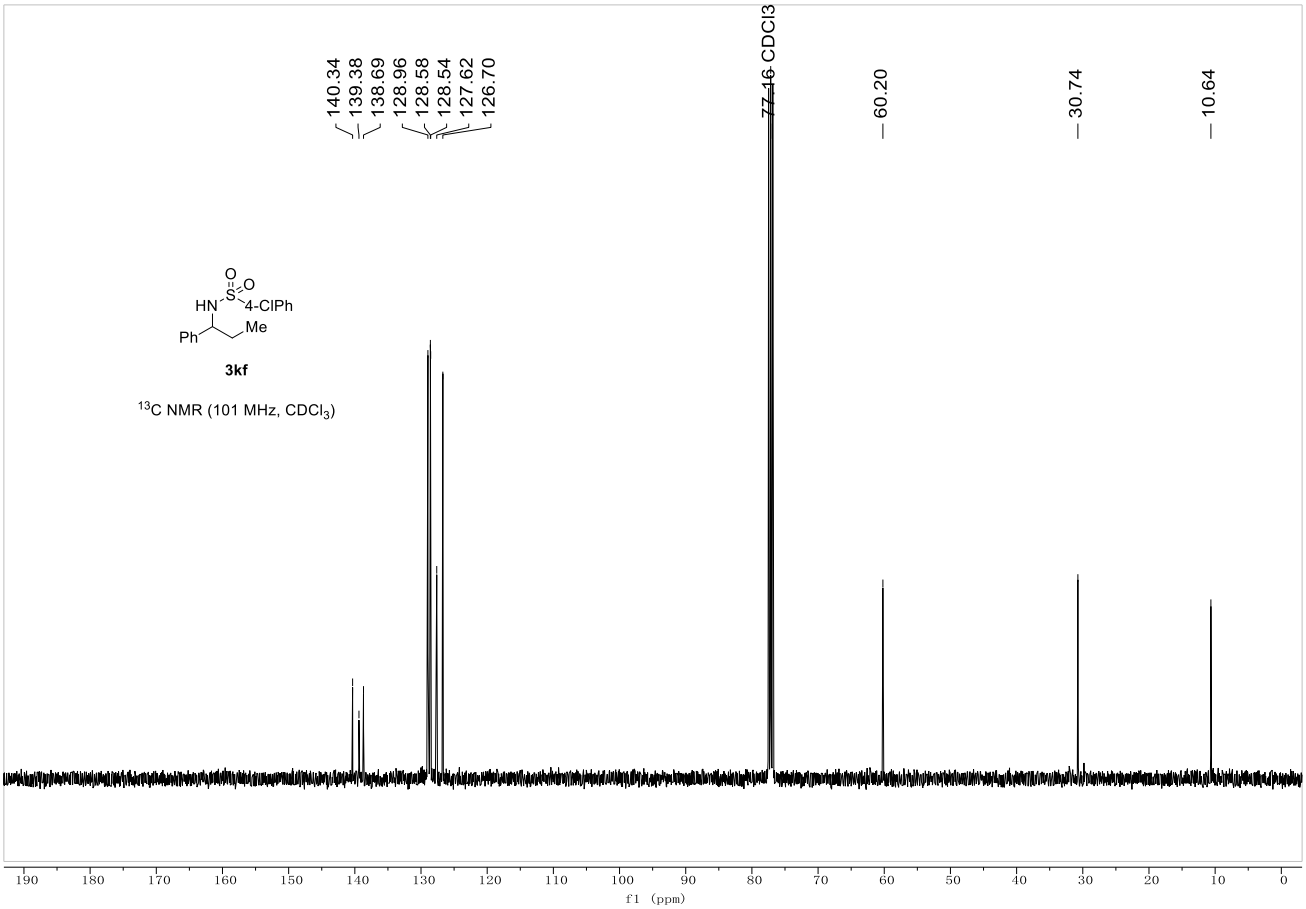
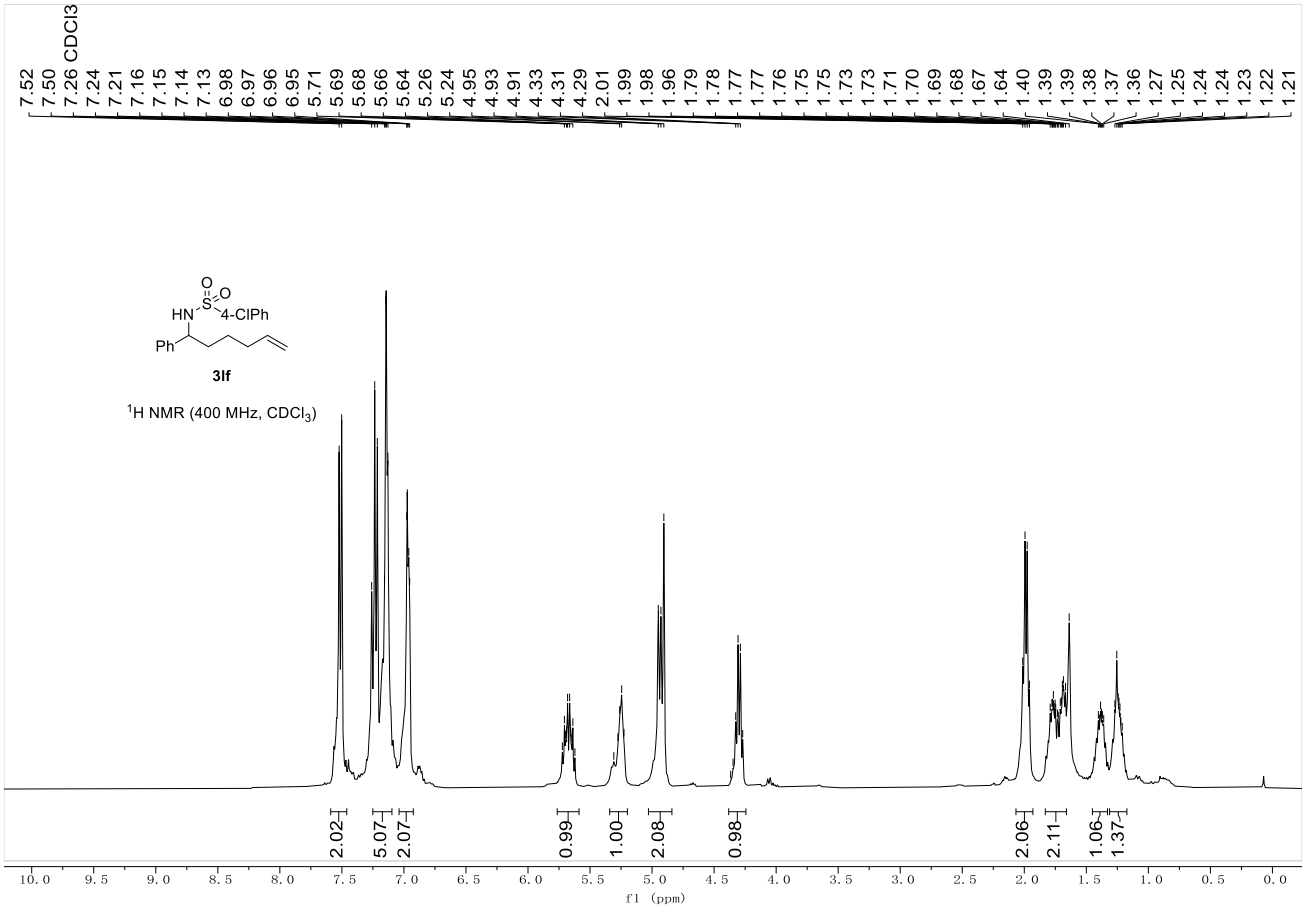
7.13
6.99
6.98
6.97
6.97
6.96
5.31
5.29
4.25
4.23
4.21
4.19
1.85
1.83
1.82
1.80
1.78
1.76
1.74
1.73
1.71
1.69
1.67
1.65
0.83
0.81
0.79
HN
S
O
O
4-ClPh
Ph
Me
3kf
1H NMR (400 MHz, CDCl3)
1.92
1.85
3.06
1.99
1.00
0.96
2.32
3.03
f1 (ppm)


140.34
139.38
138.69
128.96
128.58
128.54
127.62
126.70
77.16 CDCl3
60.20
30.74
10.64
HN
S
O
O
4-ClPh
Ph
Me
3kf
13C NMR (101 MHz, CDCl3)
f1 (ppm)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7.50
7.26 CDCl3
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7.21
7.16
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7.13
6.98
6.97
6.96
6.95
5.71
5.69
5.68
5.66
5.64
5.26
5.24
4.95
4.93
4.91
4.33
4.31
4.29
2.01
1.99
1.98
1.96
1.79
1.78
1.77
1.77
1.76
1.75
1.75
1.73
1.73
1.71
1.70
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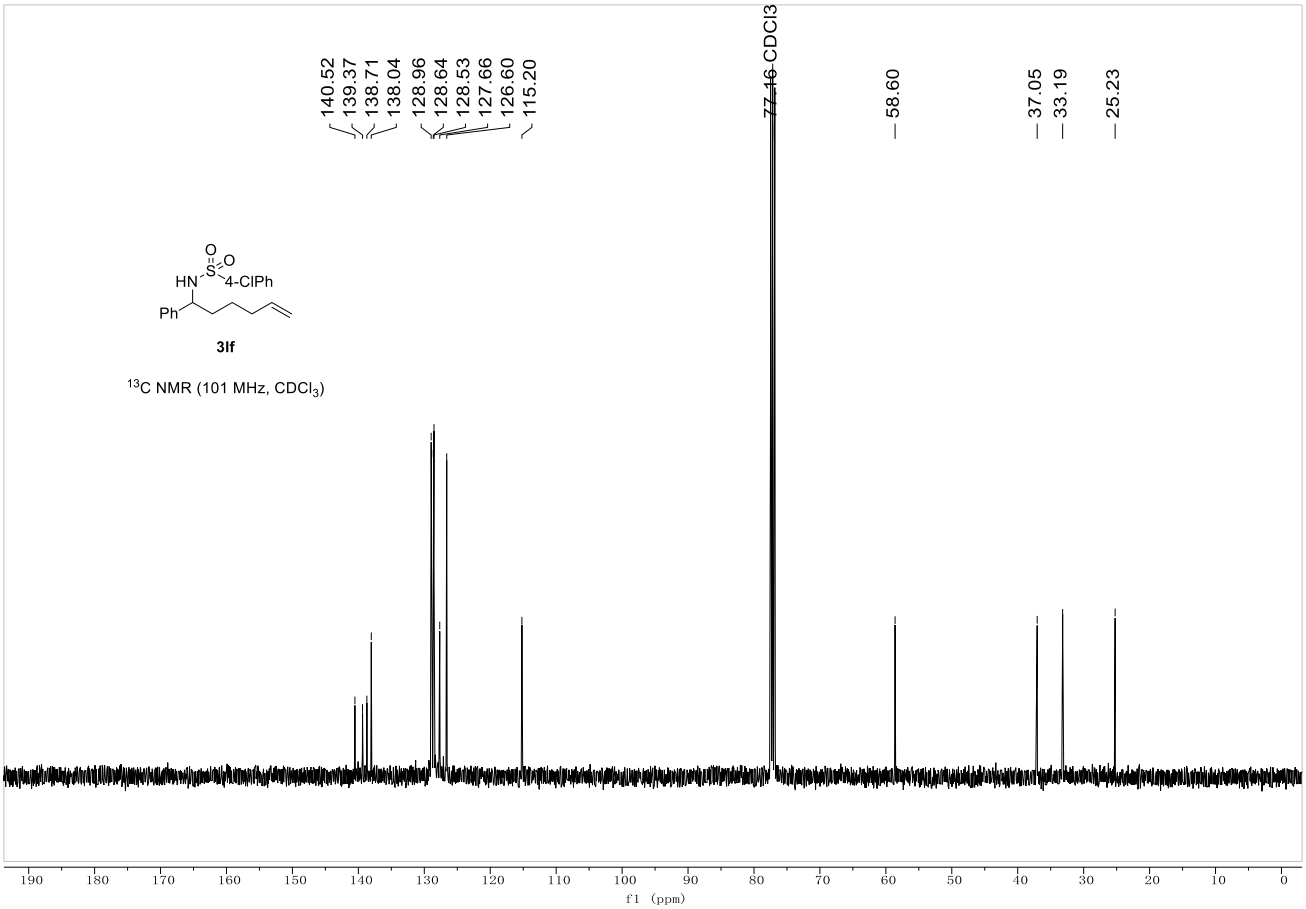
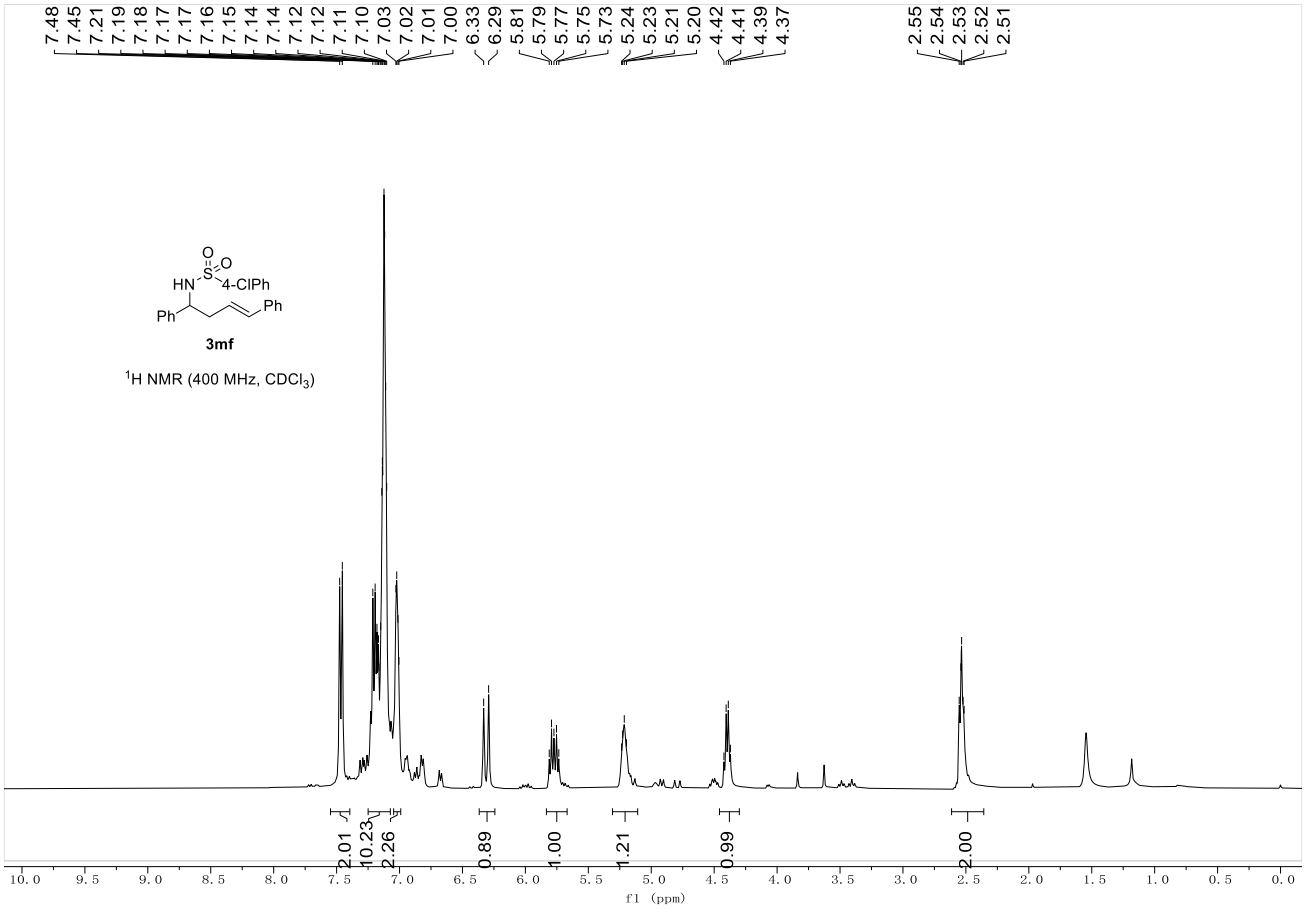
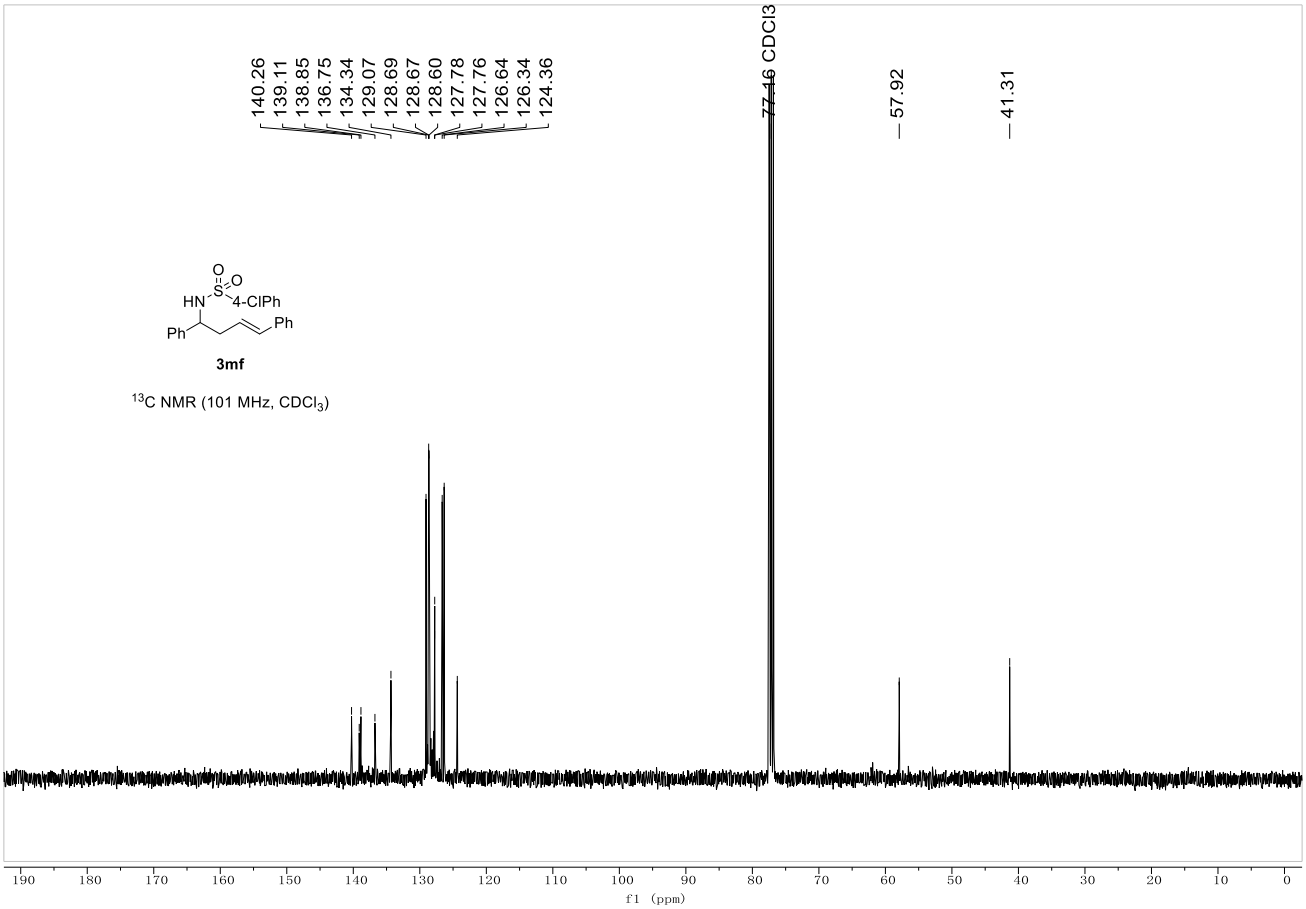
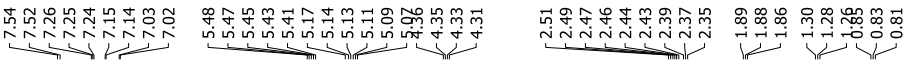
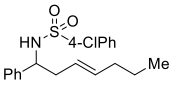
1.68
1.67
1.64
1.40
1.39
1.39
1.38
1.37
1.36
1.27
1.25
1.24
1.24
1.23
1.22
1.21
HN
S
O
O
4-ClPh
Ph
3lf
1H NMR (400 MHz, CDCl3)
2.02
5.07
2.07
0.99
1.00
2.08
0.98
2.06
2.11
1.06
1.37
f1 (ppm)


140.52
139.37
138.71
138.04
128.96
128.64
128.53
127.66
126.60
115.20
77.16-CDCl3
58.60
37.05
33.19
25.23
HN
S
O
O
4-ClPh
Ph
3lf
13C NMR (101 MHz, CDCl3)
f1 (ppm)


7.48
7.45
7.21
7.19
7.18
7.17
7.17
7.16
7.15
7.14
7.14
7.12
7.12
7.11
7.10
7.03
7.02
7.01
7.00
6.33
6.29
5.81
5.79
5.77
5.75
5.73
5.24
5.23
5.21
5.20
4.42
4.41
4.39
4.37
2.55
2.54
2.53
2.52
2.51
HN
S
O
O
4-ClPh
Ph
Ph
3mf
1H NMR (400 MHz, CDCl3)
2.01
10.23
2.26
0.89
1.00
1.21
0.99
2.00
f1 (ppm)

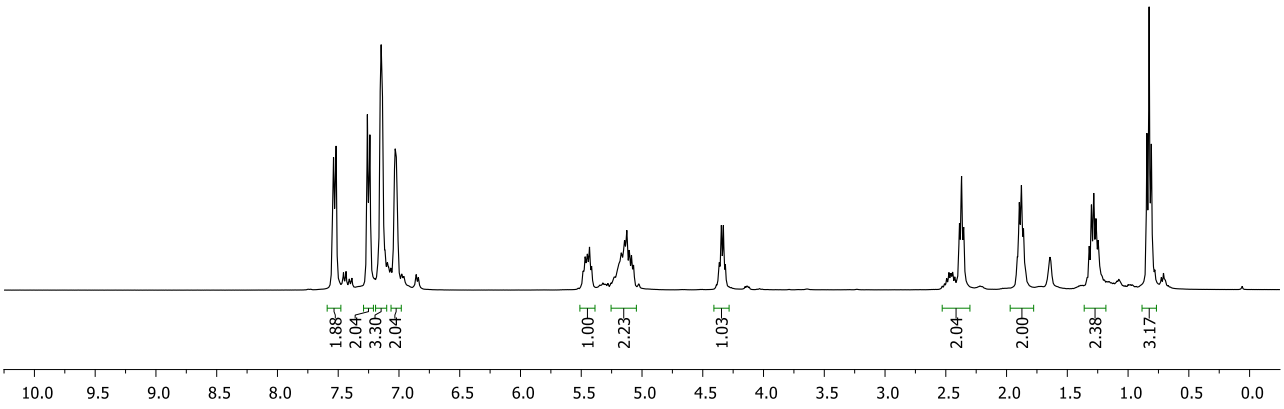

140.26
139.11
138.85
136.75
134.34
129.07
128.69
128.67
128.60
127.78
127.76
126.64
126.34
124.36
77.16 CDCl3
57.92
41.31
HN
S
O
O
4-ClPh
Ph
Ph
3mf
13C NMR (101 MHz, CDCl3)
f1 (ppm)

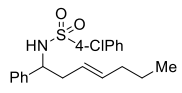




3nf

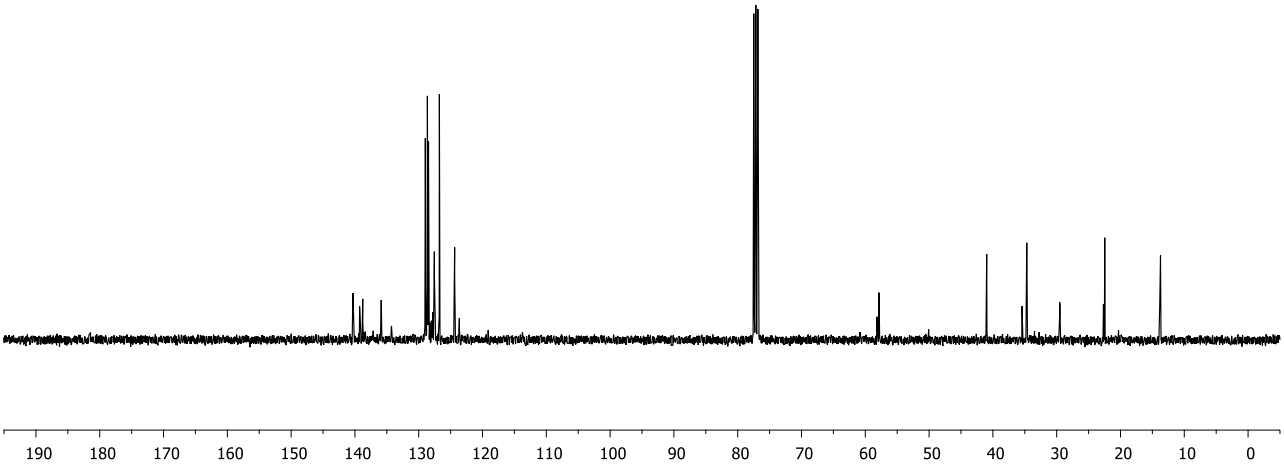
^{1}H NMR (400 MHz, $CDCl_3$)

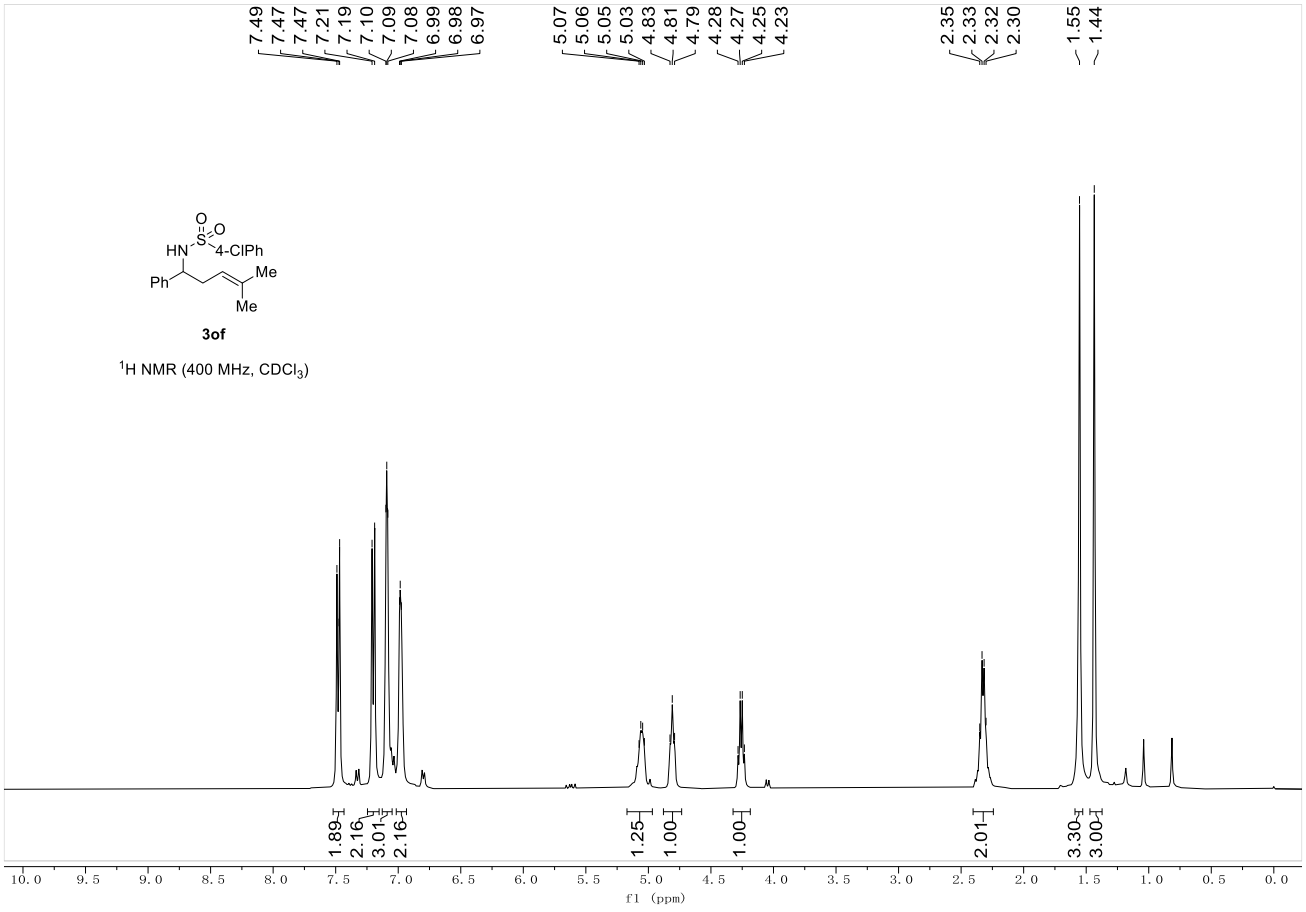


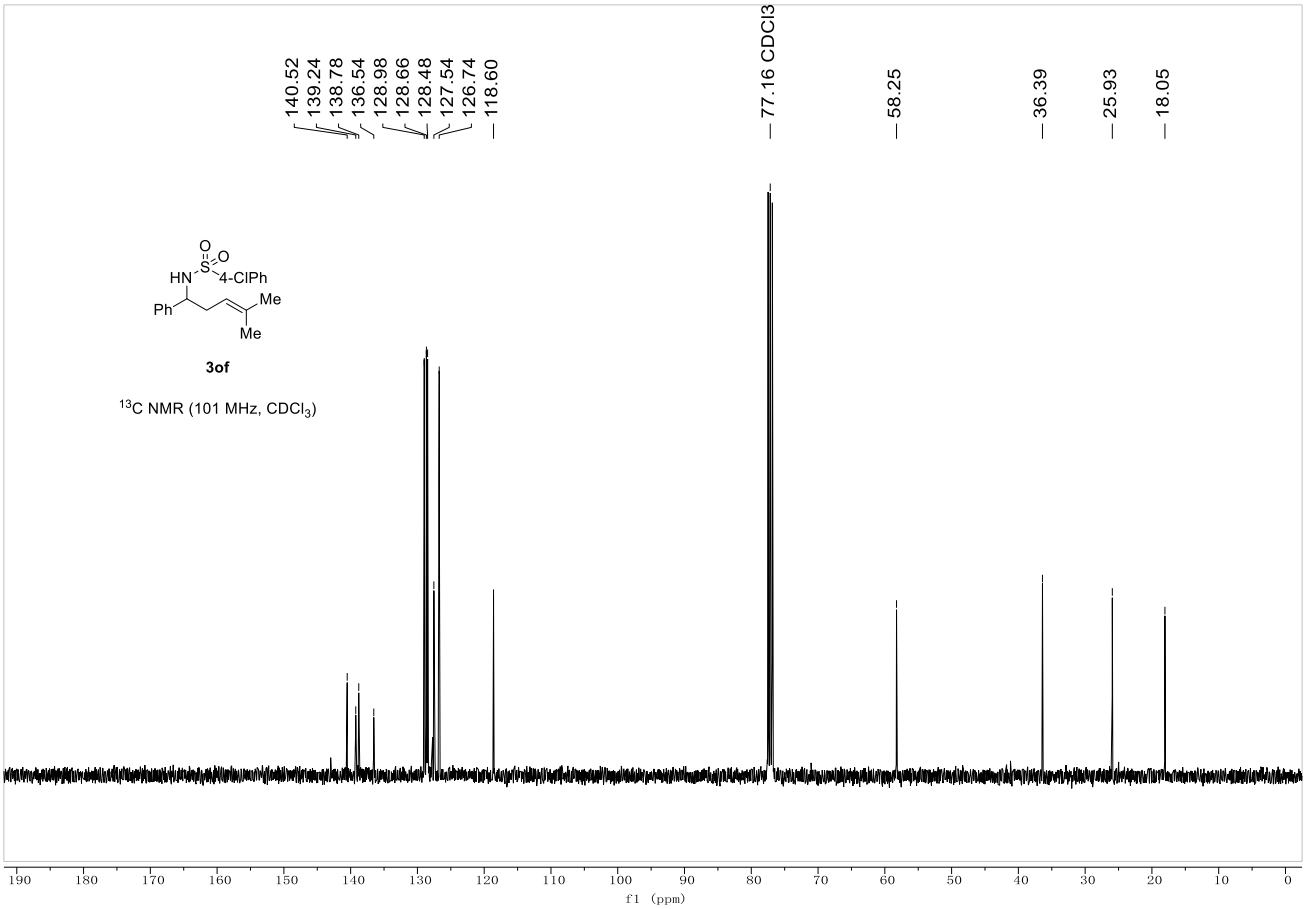


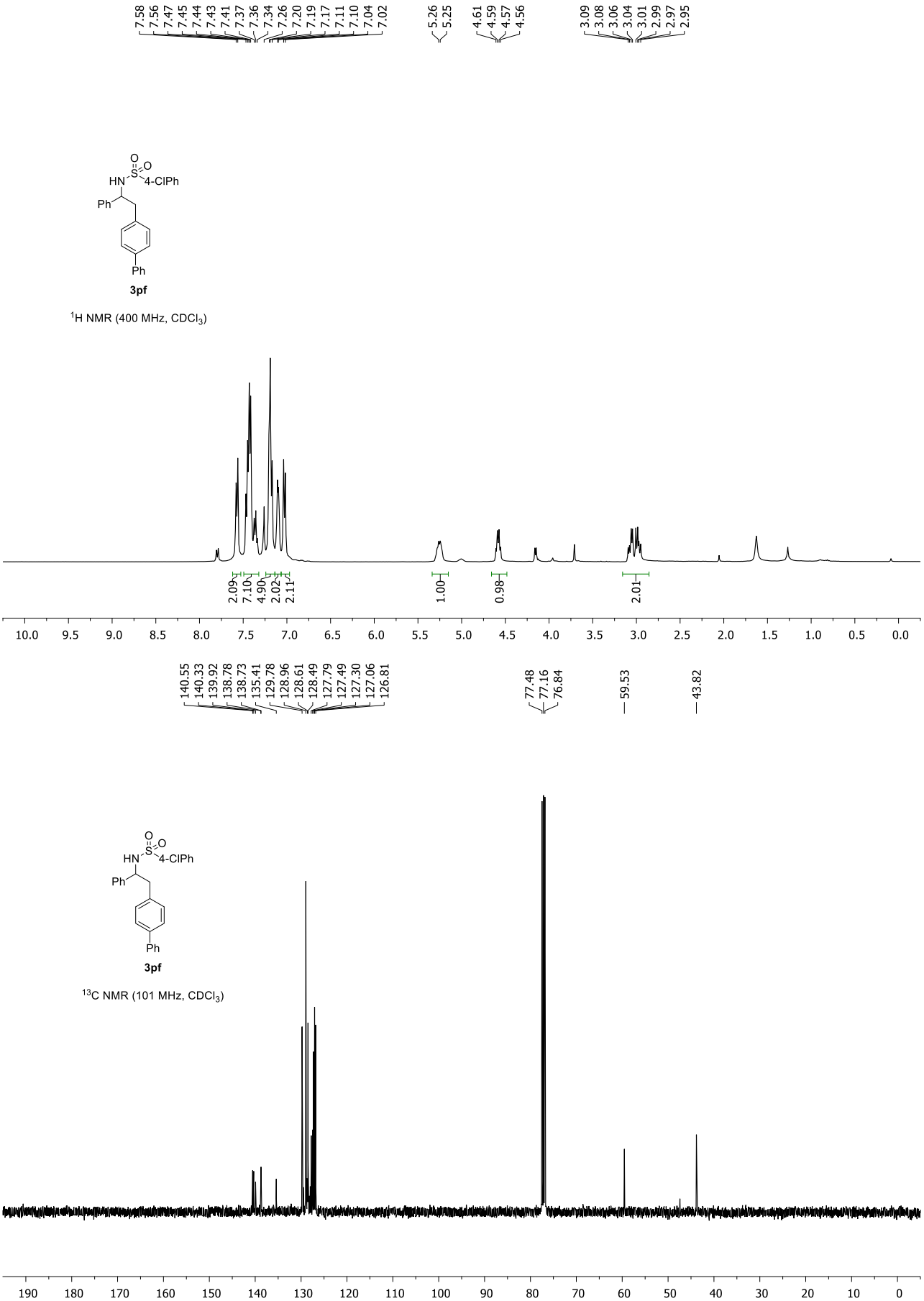
3nf

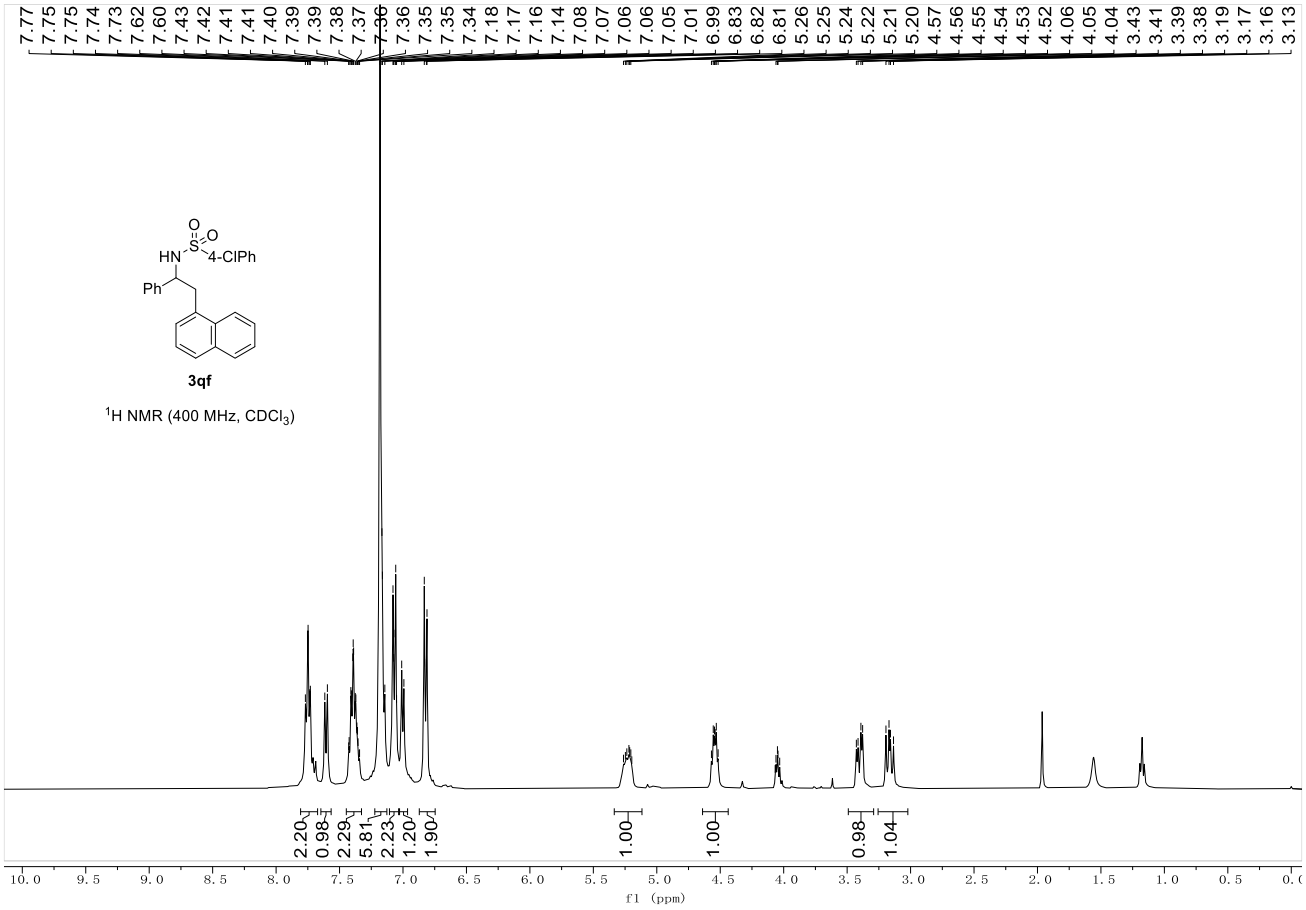
^{13}C NMR (101 MHz, $CDCl_3$)

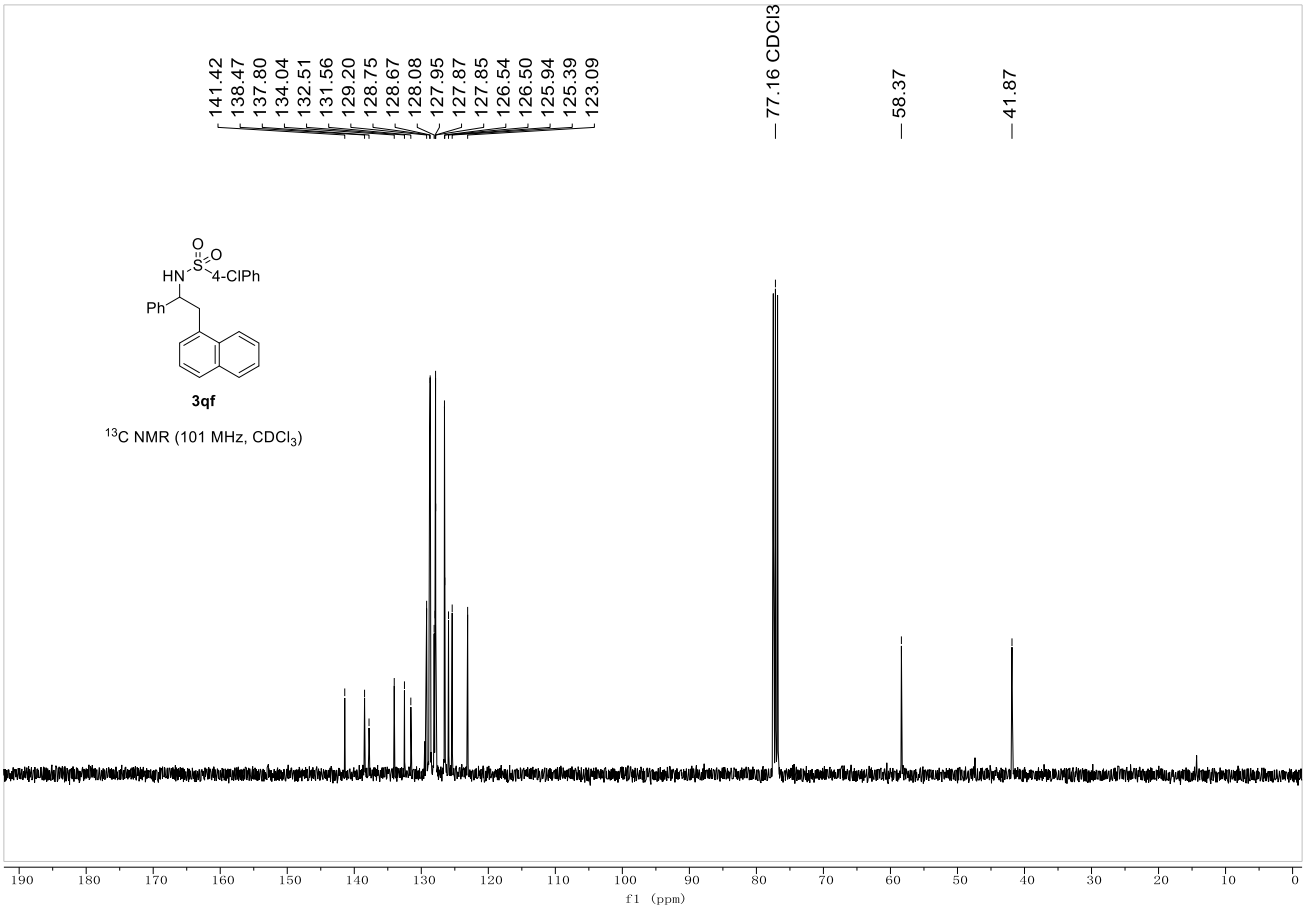


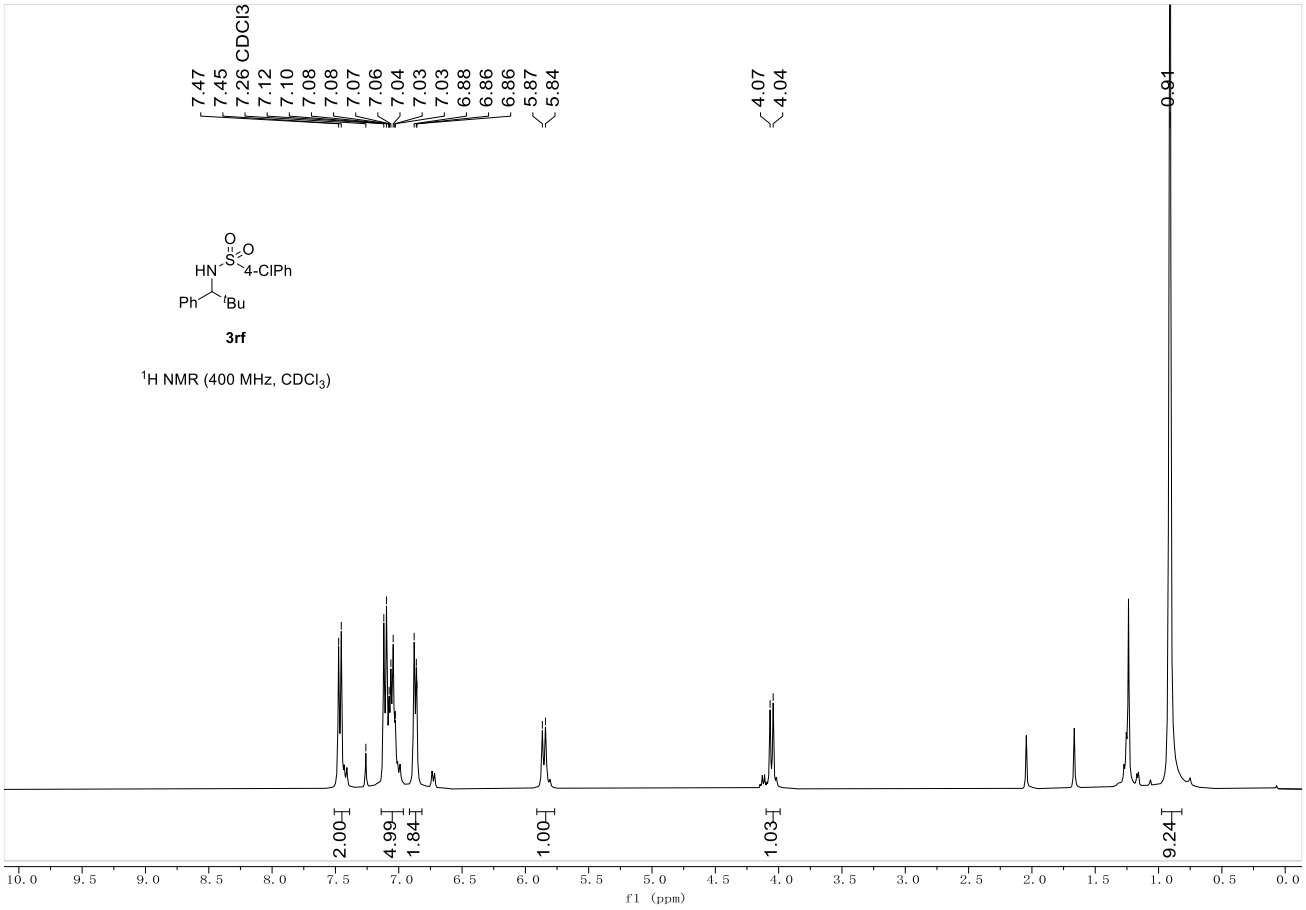

7.49
7.47
7.47
7.21
7.19
7.10
7.09
7.08
6.99
6.98
6.97
5.07
5.06
5.05
5.03
4.83
4.81
4.79
4.28
4.27
4.25
4.23
2.35
2.33
2.32
2.30
1.55
1.44
HN
O
O
S
4-ClPh
Ph
Me
Me
3of
1H NMR (400 MHz, CDCl3)
1.89
2.16
3.01
2.16
1.25
1.00
1.00
2.01
3.30
3.00
f1 (ppm)


140.52
139.24
138.78
136.54
128.98
128.66
128.48
127.54
126.74
118.60
77.16 CDCl3
58.25
36.39
25.93
18.05
HN
O
O
S
4-ClPh
Ph
Me
Me
3of
13C NMR (101 MHz, CDCl3)
f1 (ppm)


7.58
7.56
7.47
7.45
7.44
7.43
7.41
7.37
7.36
7.34
7.26
7.20
7.19
7.17
7.11
7.10
7.04
7.02
5.26
5.25
4.61
4.59
4.57
4.56
3.09
3.08
3.06
3.04
3.01
2.99
2.97
2.95
HN
S
O
O
4-ClPh
Ph
Ph
3pf
1H NMR (400 MHz, CDCl3)
2.09
7.10
4.90
2.02
2.11
1.00
0.98
2.01
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
140.55
140.33
139.92
138.78
138.73
135.41
129.78
128.96
128.61
128.49
127.79
127.49
127.30
127.06
126.81
77.48
77.16
76.84
59.53
43.82
HN
S
O
O
4-ClPh
Ph
Ph
3pf
13C NMR (101 MHz, CDCl3)
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0

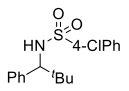

7.77 7.75 7.75 7.74 7.73 7.62 7.60 7.43 7.42 7.41 7.41 7.40 7.39 7.39 7.38 7.37 7.36 7.36 7.35 7.35 7.34 7.18 7.17 7.16 7.14 7.08 7.07 7.06 7.06 7.05 7.01 6.99 6.83 6.82 6.81 5.26 5.25 5.24 5.22 5.21 5.20 4.57 4.56 4.55 4.54 4.53 4.52 4.06 4.05 4.04 3.43 3.41 3.39 3.38 3.19 3.17 3.16 3.13
O
O
HN
S
4-ClPh
Ph
3qf
1H NMR (400 MHz, CDCl3)
2.20 0.98 2.29 5.81 2.23 1.20 1.90 1.00 1.00 0.98 1.04
f1 (ppm)


141.42 138.47 137.80 134.04 132.51 131.56 129.20 128.75 128.67 128.08 127.95 127.87 127.85 126.54 126.50 125.94 125.39 123.09
77.16 CDCl3
58.37
41.87
O
O
HN
S
4-ClPh
Ph
3qf
13C NMR (101 MHz, CDCl3)
f1 (ppm)



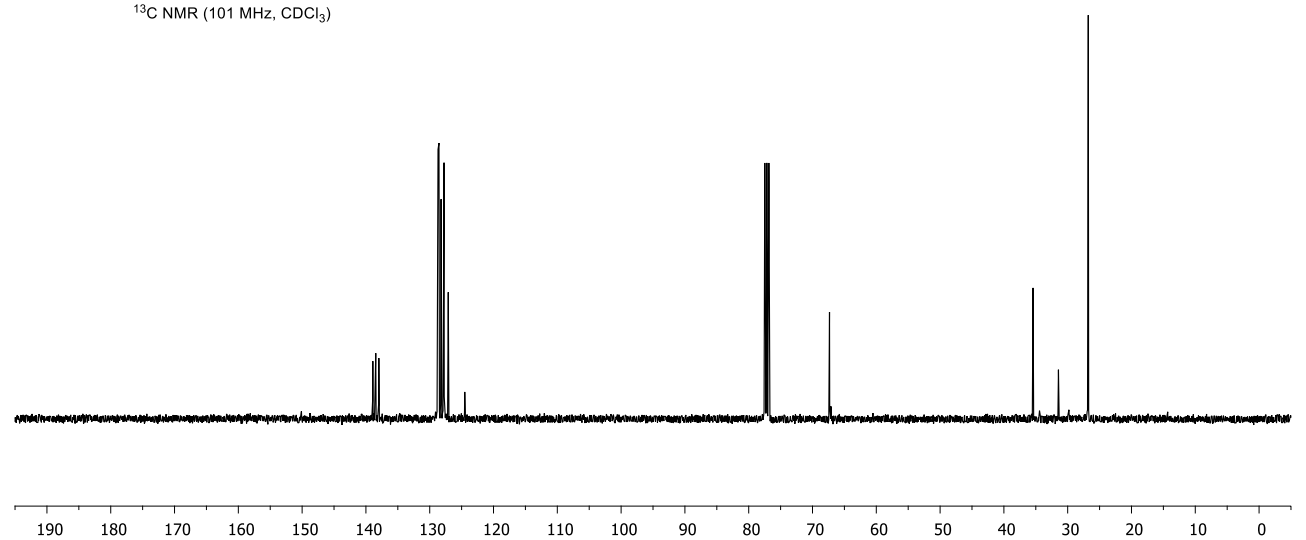
3rf

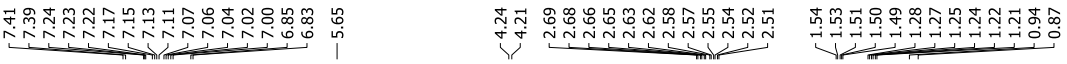
^{1}H NMR (400 MHz, $CDCl_3$)

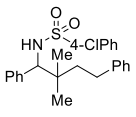


3rf

^{13}C NMR (101 MHz, $CDCl_3$)

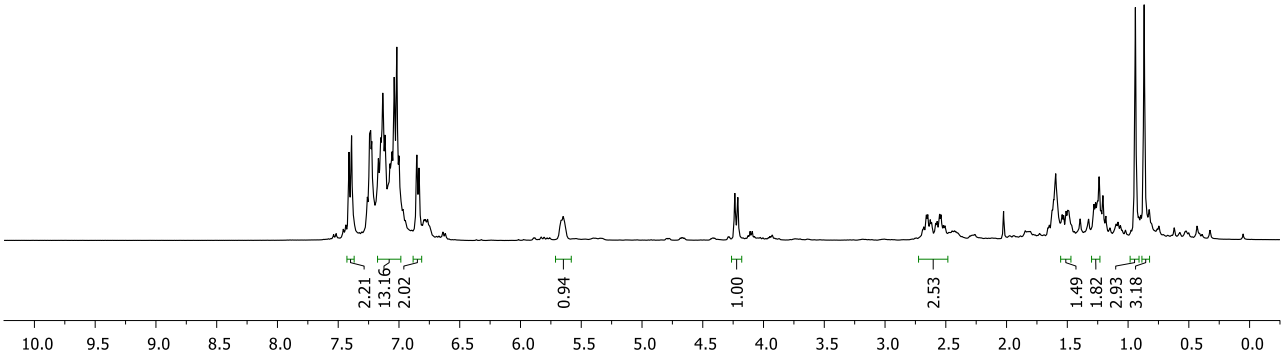


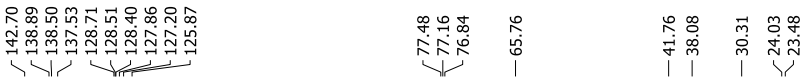


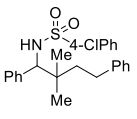


3sf

^{1}H NMR (400 MHz, $CDCl_3$)

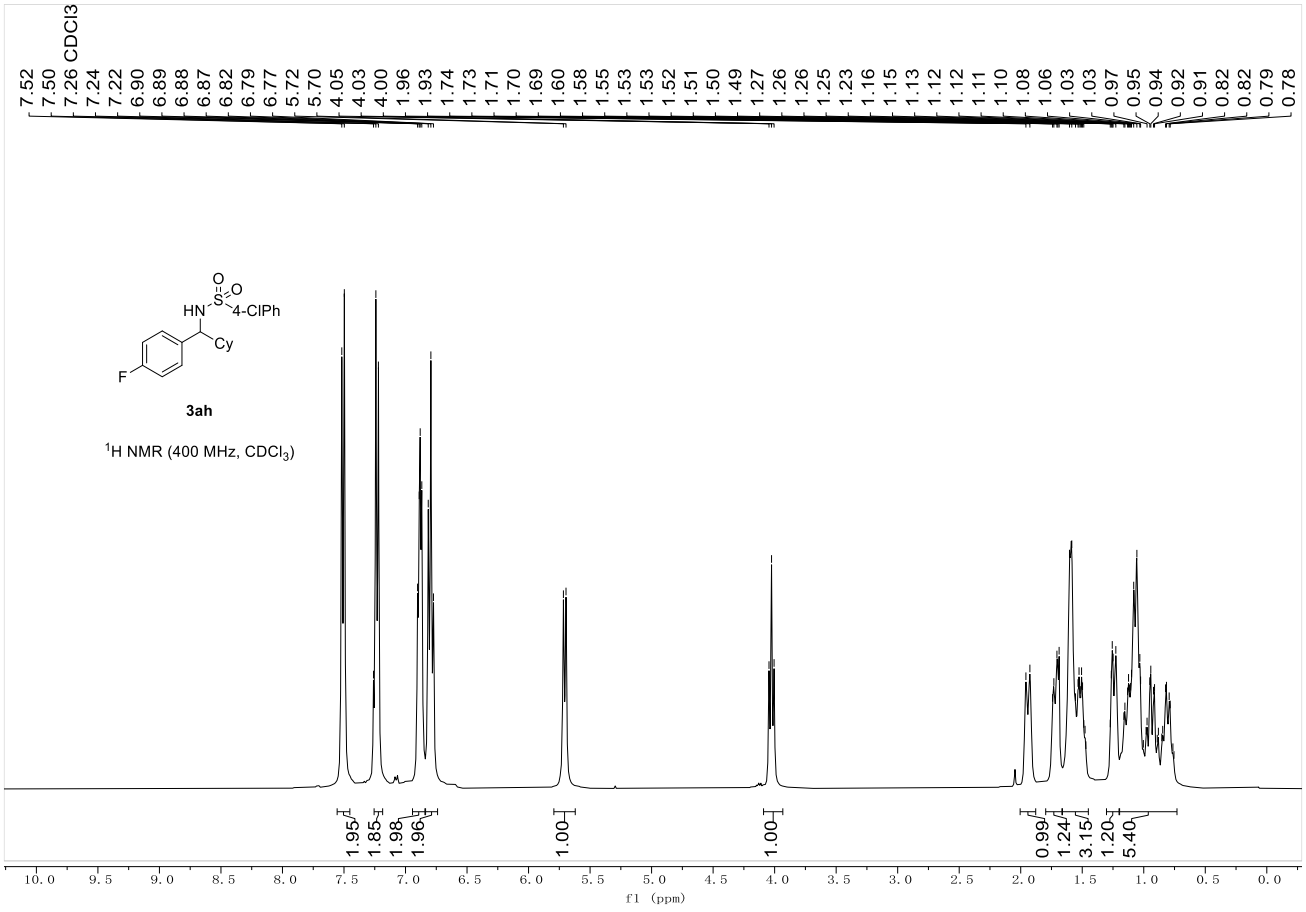


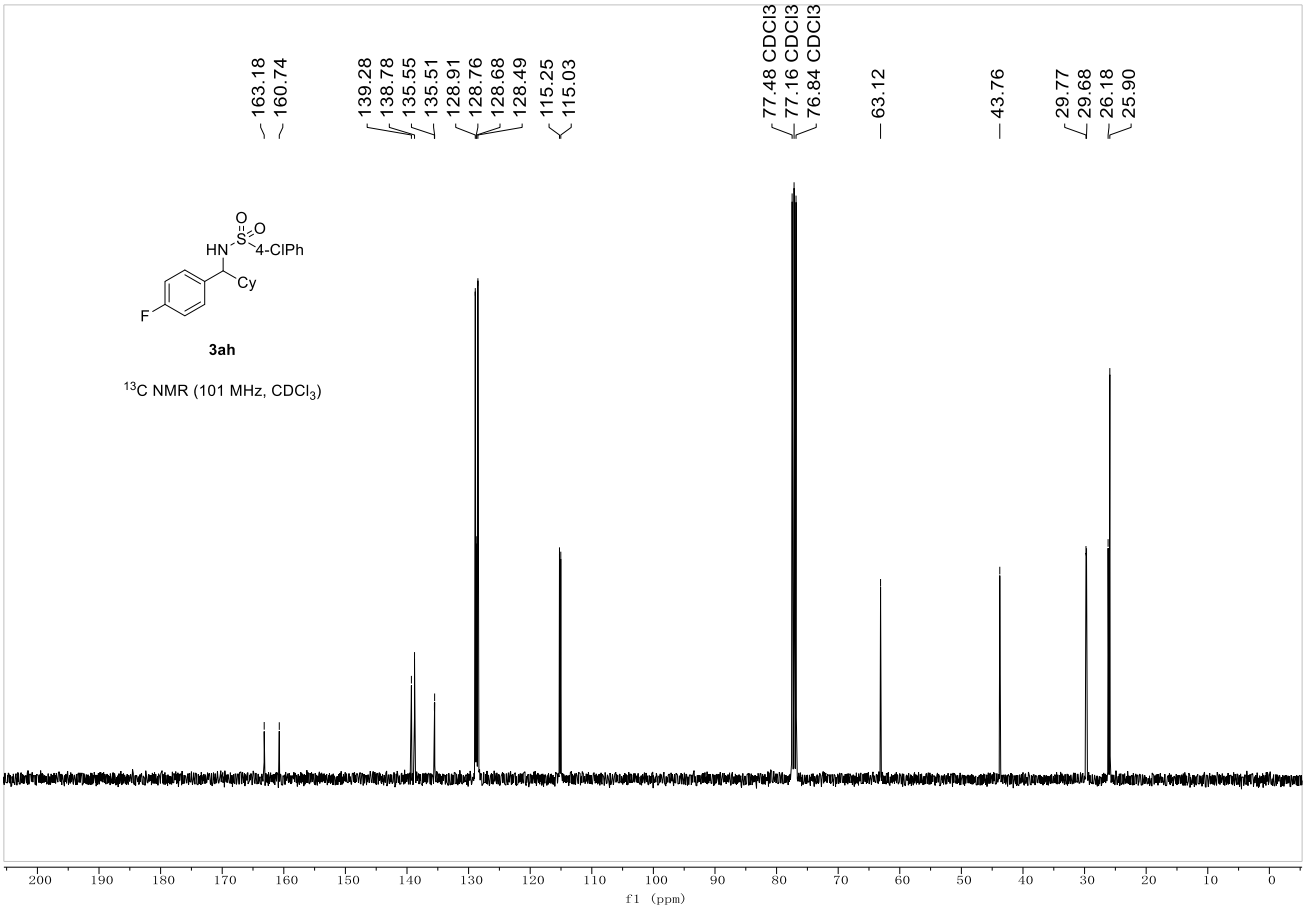


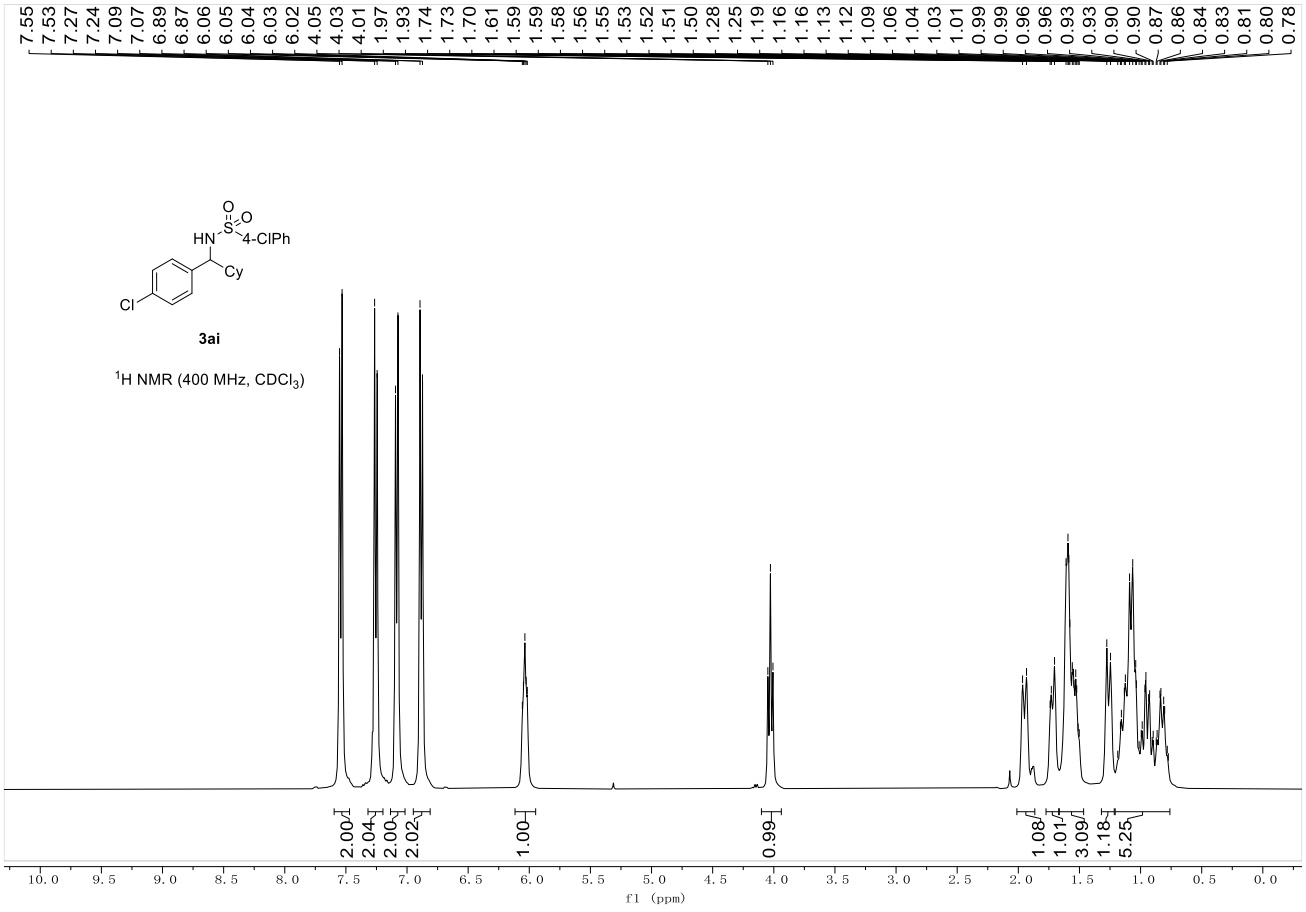


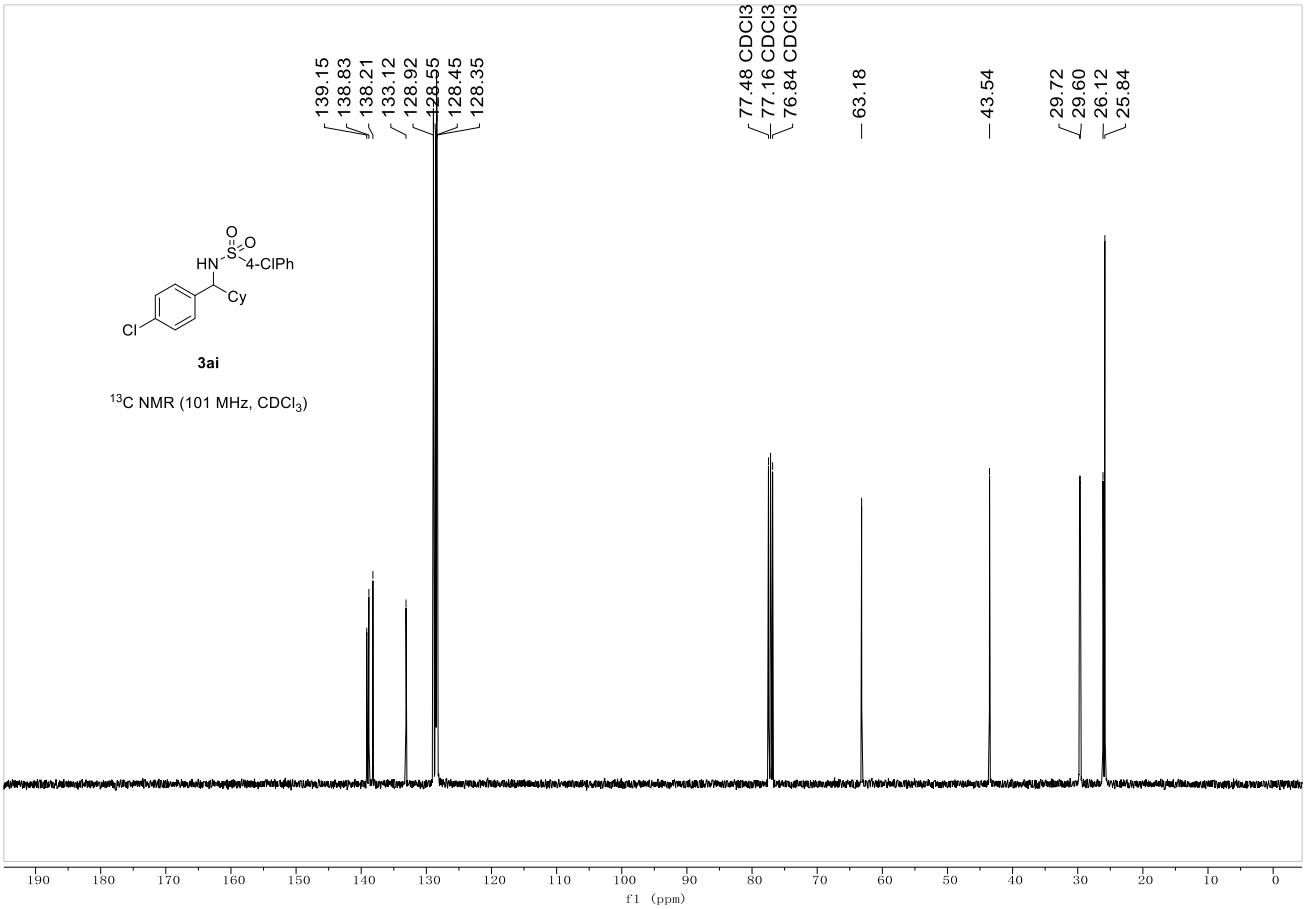
3sf

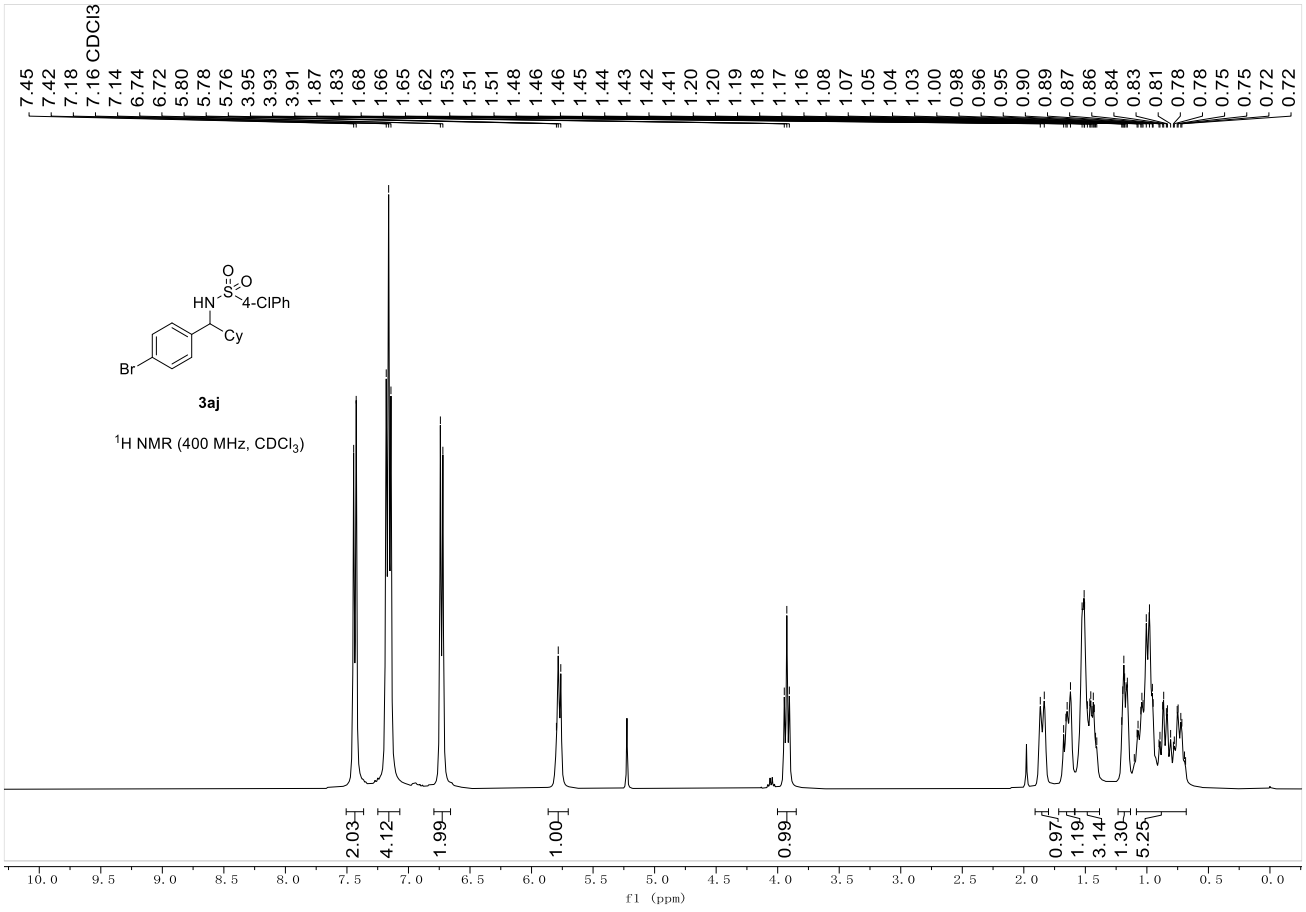
^{13}C NMR (101 MHz, $CDCl_3$)

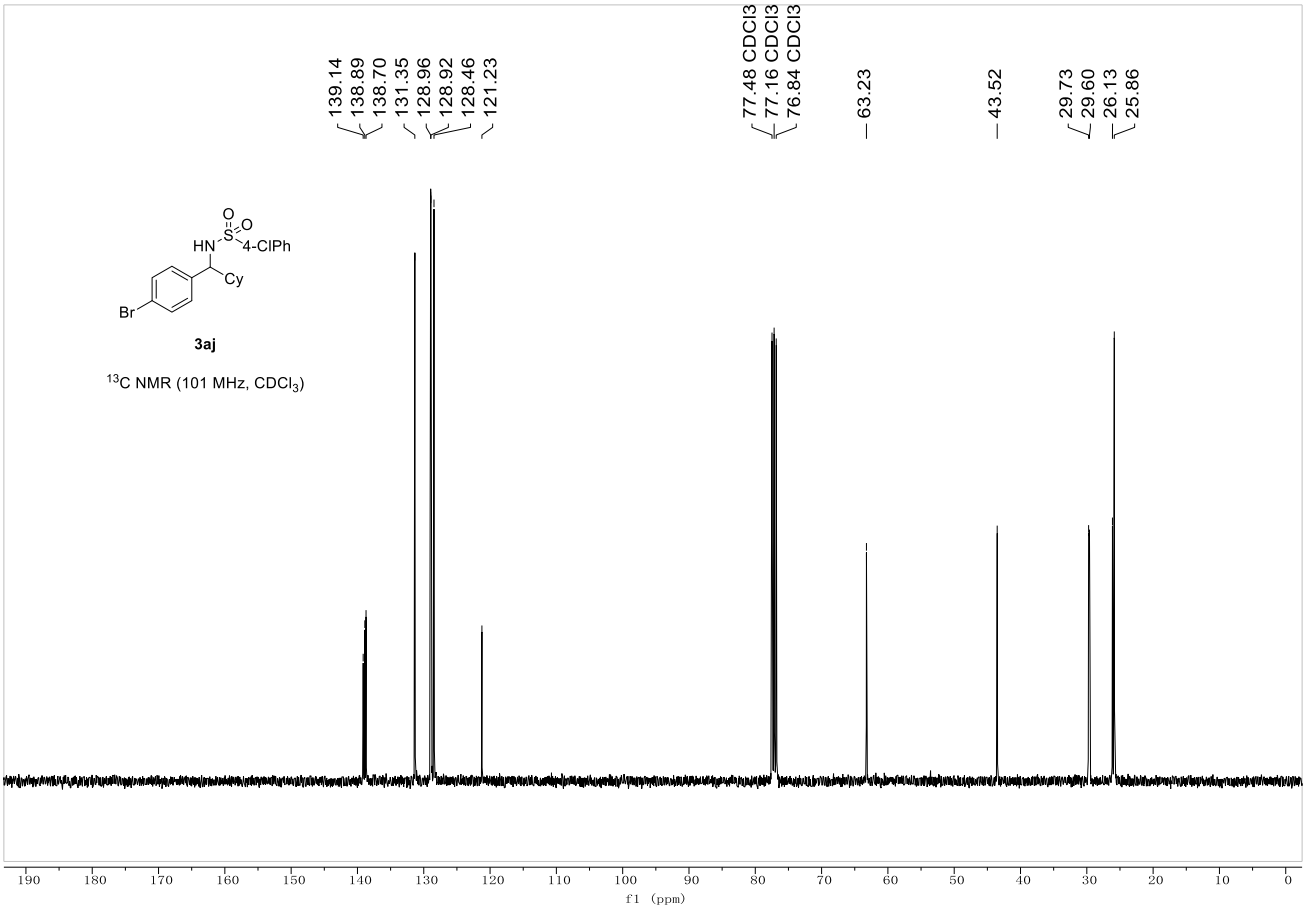

7.52
7.50
7.26 CDCl3
7.24
7.22
6.90
6.89
6.88
6.87
6.82
6.79
6.77
5.72
5.70
4.05
4.03
4.00
1.96
1.93
1.74
1.73
1.71
1.70
1.69
1.60
1.58
1.55
1.53
1.53
1.52
1.51
1.50
1.49
1.27
1.26
1.26
1.25
1.23
1.16
1.15
1.13
1.12
1.12
1.11
1.10
1.08
1.06
1.03
1.03
0.97
0.95
0.94
0.92
0.91
0.82
0.82
0.79
0.78
HN
S
O
O
4-ClPh
Cy
F
3ah
1H NMR (400 MHz, CDCl3)
1.95
1.85
1.98
1.96
1.00
1.00
0.99
1.24
3.15
1.20
5.40
f1 (ppm)

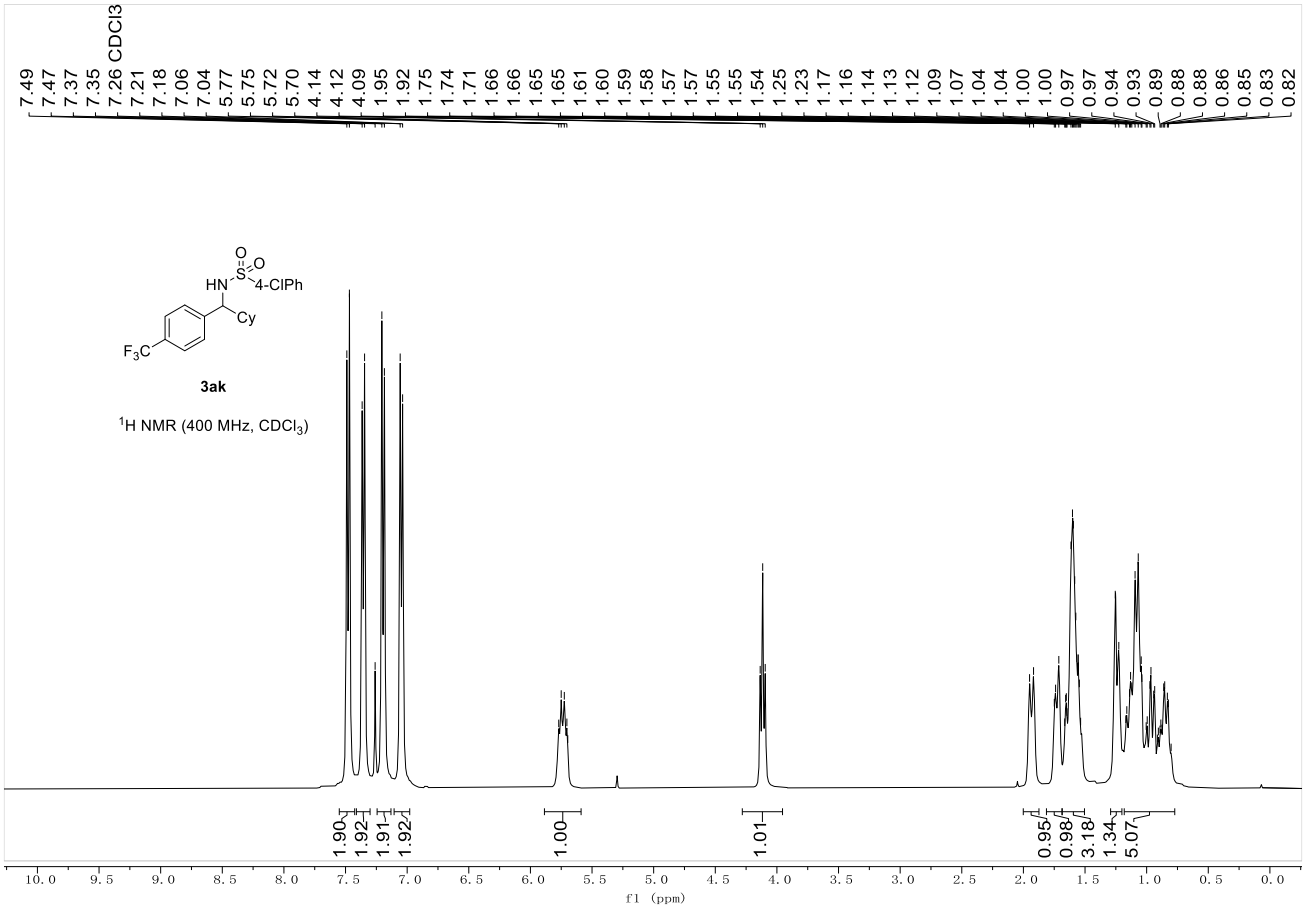

163.18
160.74
139.28
138.78
135.55
135.51
128.91
128.76
128.68
128.49
115.25
115.03
77.48 CDCl3
77.16 CDCl3
76.84 CDCl3
63.12
43.76
29.77
29.68
26.18
25.90
HN
S
O
O
4-ClPh
Cy
F
3ah
13C NMR (101 MHz, CDCl3)
f1 (ppm)

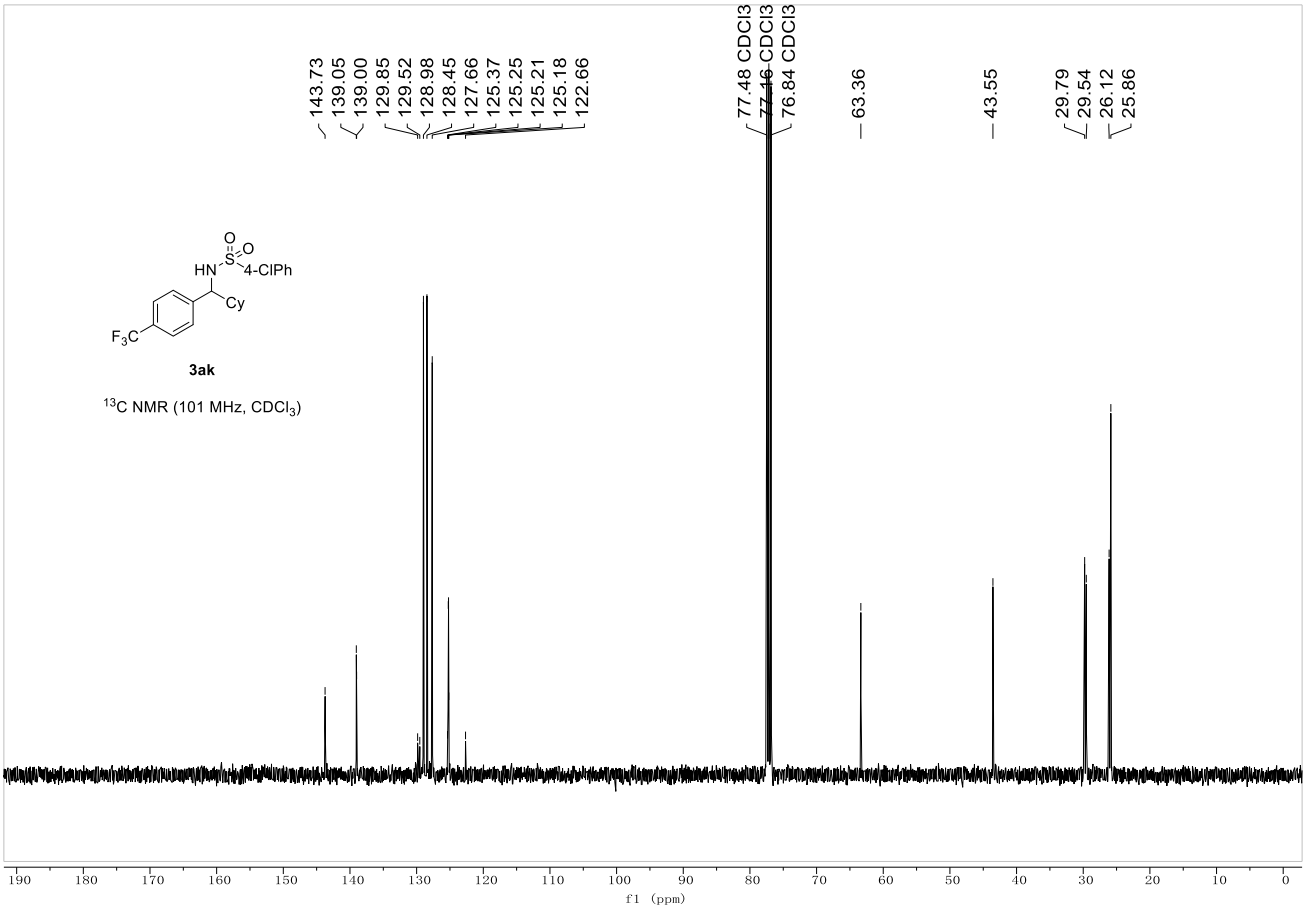

7.55 7.53 7.27 7.24 7.09 7.07 6.89 6.87 6.06 6.05 6.04 6.03 6.02 4.05 4.03 4.01 1.97 1.93 1.74 1.73 1.70 1.61 1.59 1.59 1.58 1.56 1.55 1.53 1.52 1.51 1.50 1.28 1.25 1.19 1.16 1.16 1.13 1.12 1.09 1.06 1.04 1.03 1.01 0.99 0.99 0.96 0.96 0.93 0.93 0.90 0.90 0.87 0.86 0.84 0.83 0.81 0.80 0.78
HN
S
O
O
4-ClPh
Cy
Cl
3ai
1H NMR (400 MHz, CDCl3)
2.00 2.04 2.00 2.02 1.00 0.99 1.08 1.01 3.09 1.18 5.25
f1 (ppm)

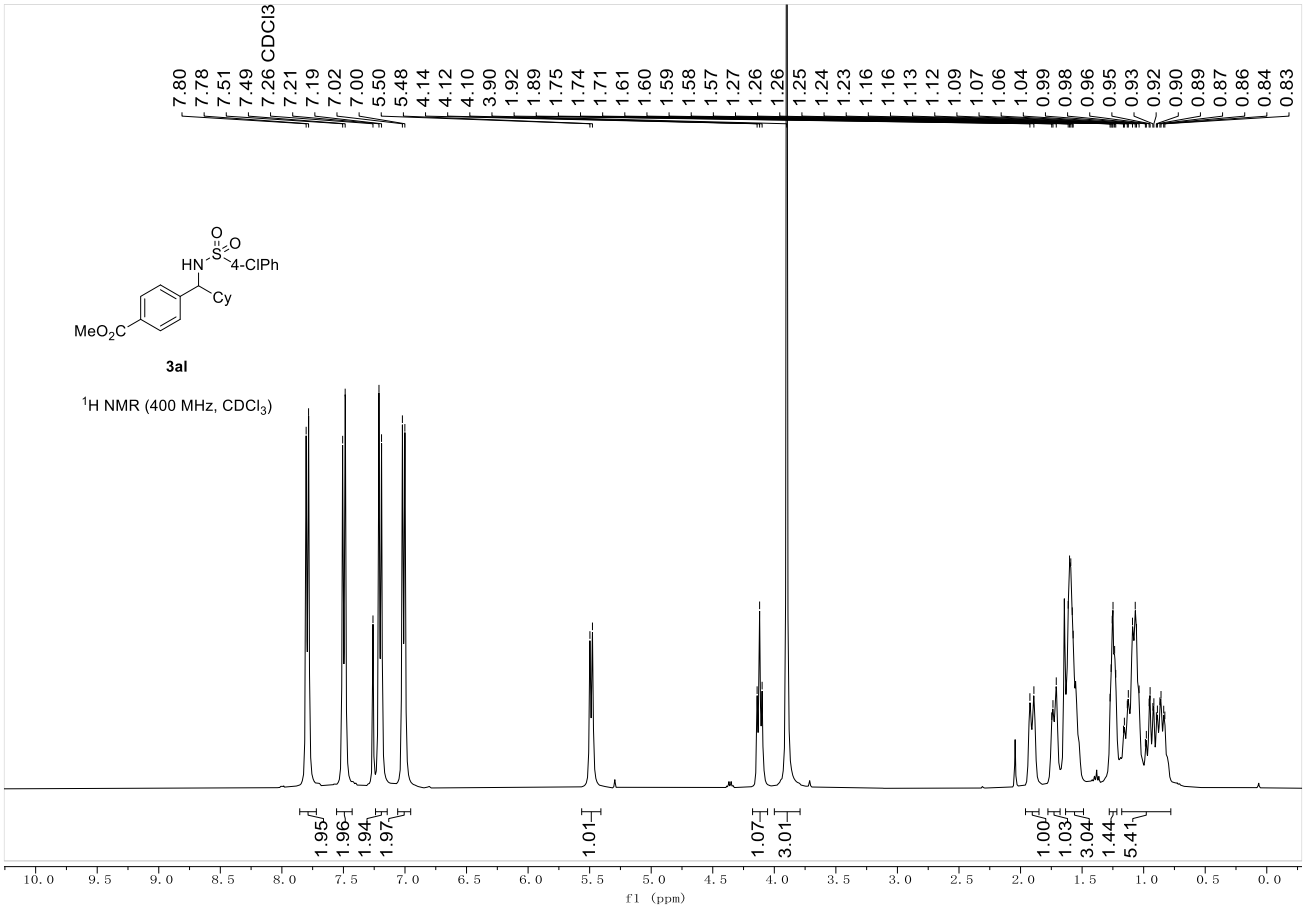

139.15 138.83 138.21 133.12 128.92 128.55 128.45 128.35
77.48 CDCl3 77.16 CDCl3 76.84 CDCl3
63.18
43.54
29.72 29.60 26.12 25.84
HN
S
O
O
4-ClPh
Cy
Cl
3ai
13C NMR (101 MHz, CDCl3)
f1 (ppm)

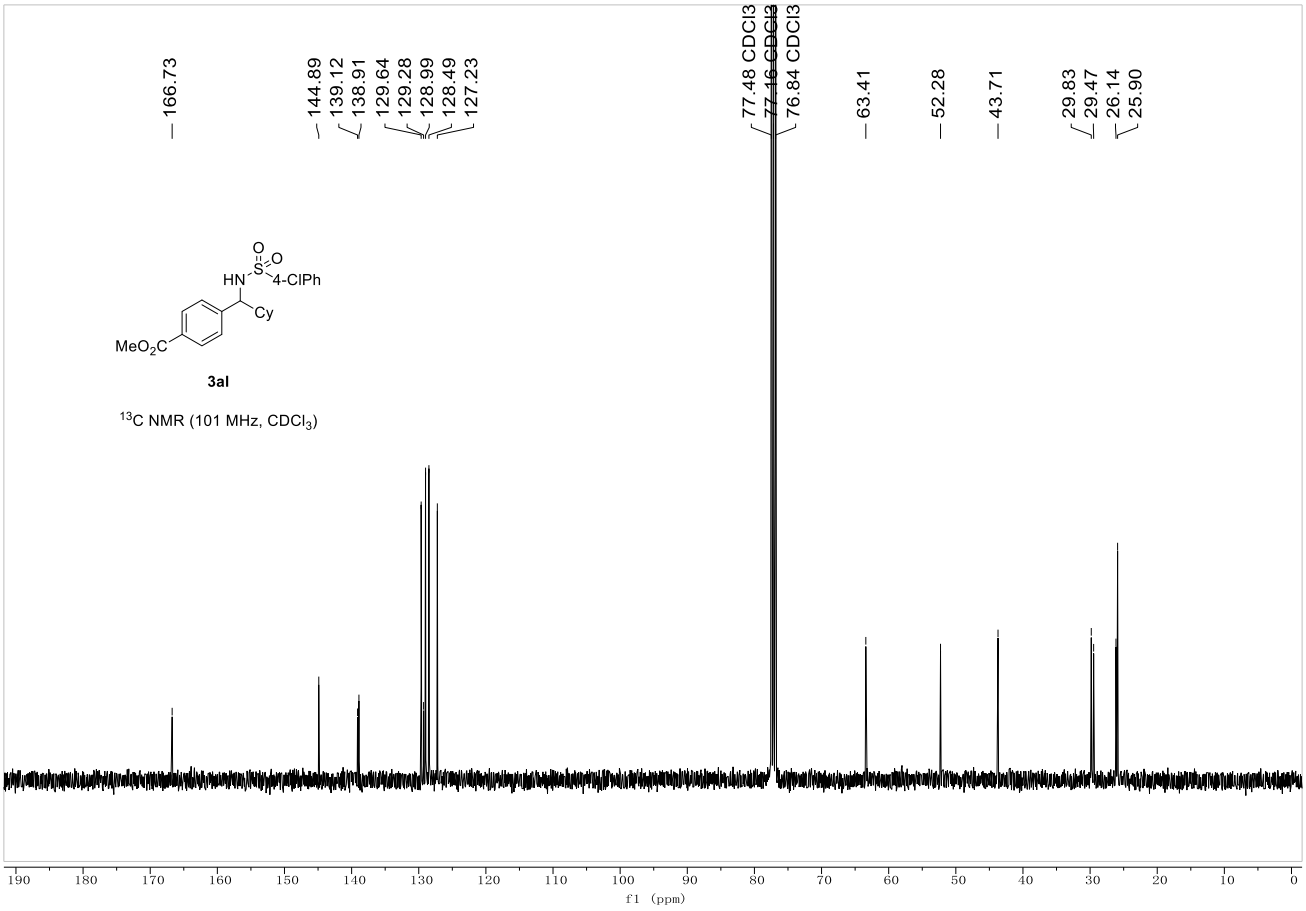

7.45
7.42
7.18
7.16 CDCl3
7.14
6.74
6.72
5.80
5.78
5.76
3.95
3.93
3.91
1.87
1.83
1.68
1.66
1.65
1.62
1.53
1.51
1.51
1.48
1.46
1.46
1.45
1.44
1.43
1.42
1.41
1.20
1.20
1.19
1.18
1.17
1.16
1.08
1.07
1.05
1.04
1.03
1.00
0.98
0.96
0.95
0.90
0.89
0.87
0.86
0.84
0.83
0.81
0.78
0.78
0.75
0.75
0.72
0.72
HN
S
O
O
4-ClPh
Cy
Br
3aj
1H NMR (400 MHz, CDCl3)
2.03
4.12
1.99
1.00
0.99
0.97
1.19
3.14
1.30
5.25
f1 (ppm)

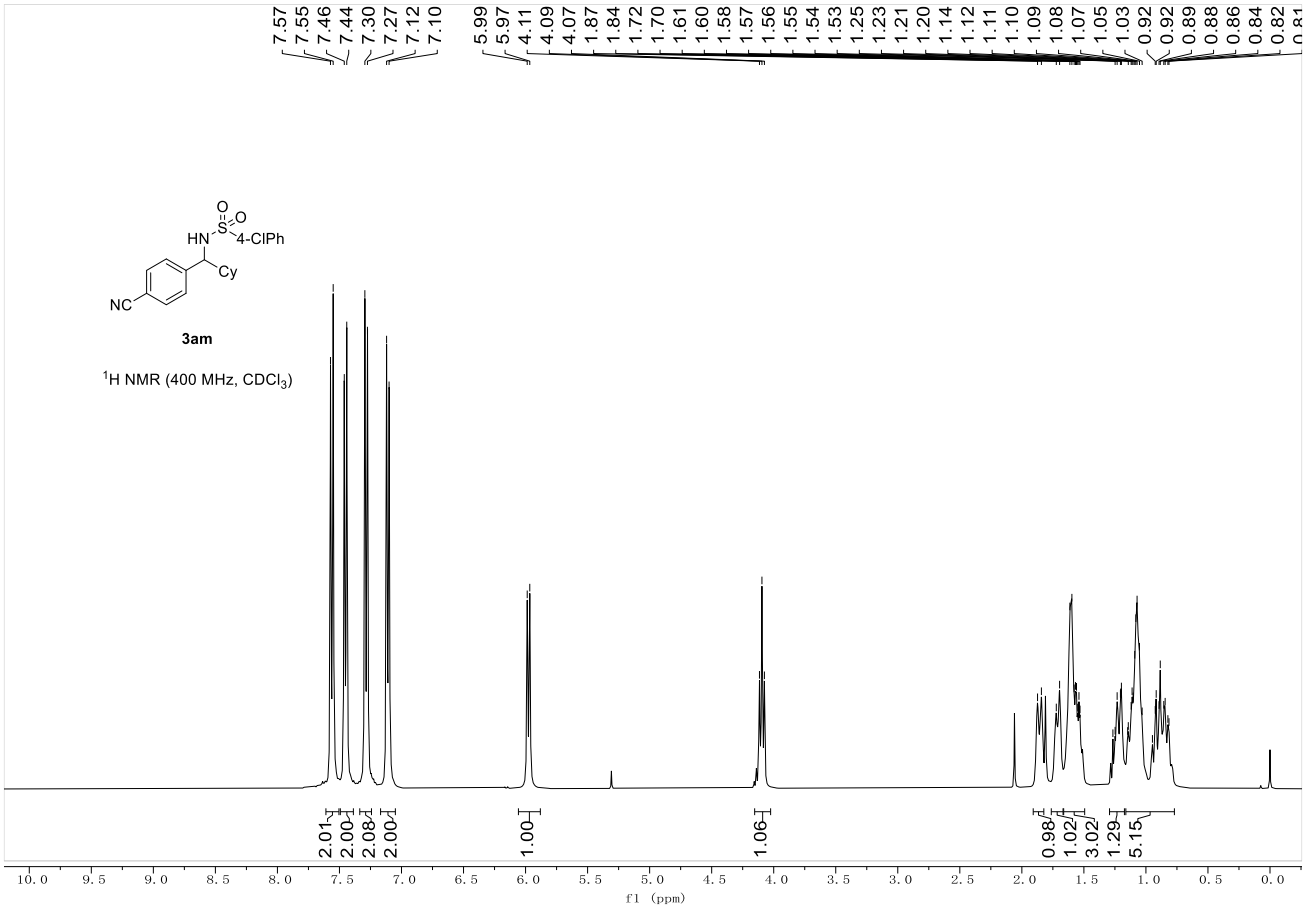

139.14
138.89
138.70
131.35
128.96
128.92
128.46
121.23
77.48 CDCl3
77.16 CDCl3
76.84 CDCl3
63.23
43.52
29.73
29.60
26.13
25.86
HN
S
O
O
4-ClPh
Cy
Br
3aj
13C NMR (101 MHz, CDCl3)
f1 (ppm)

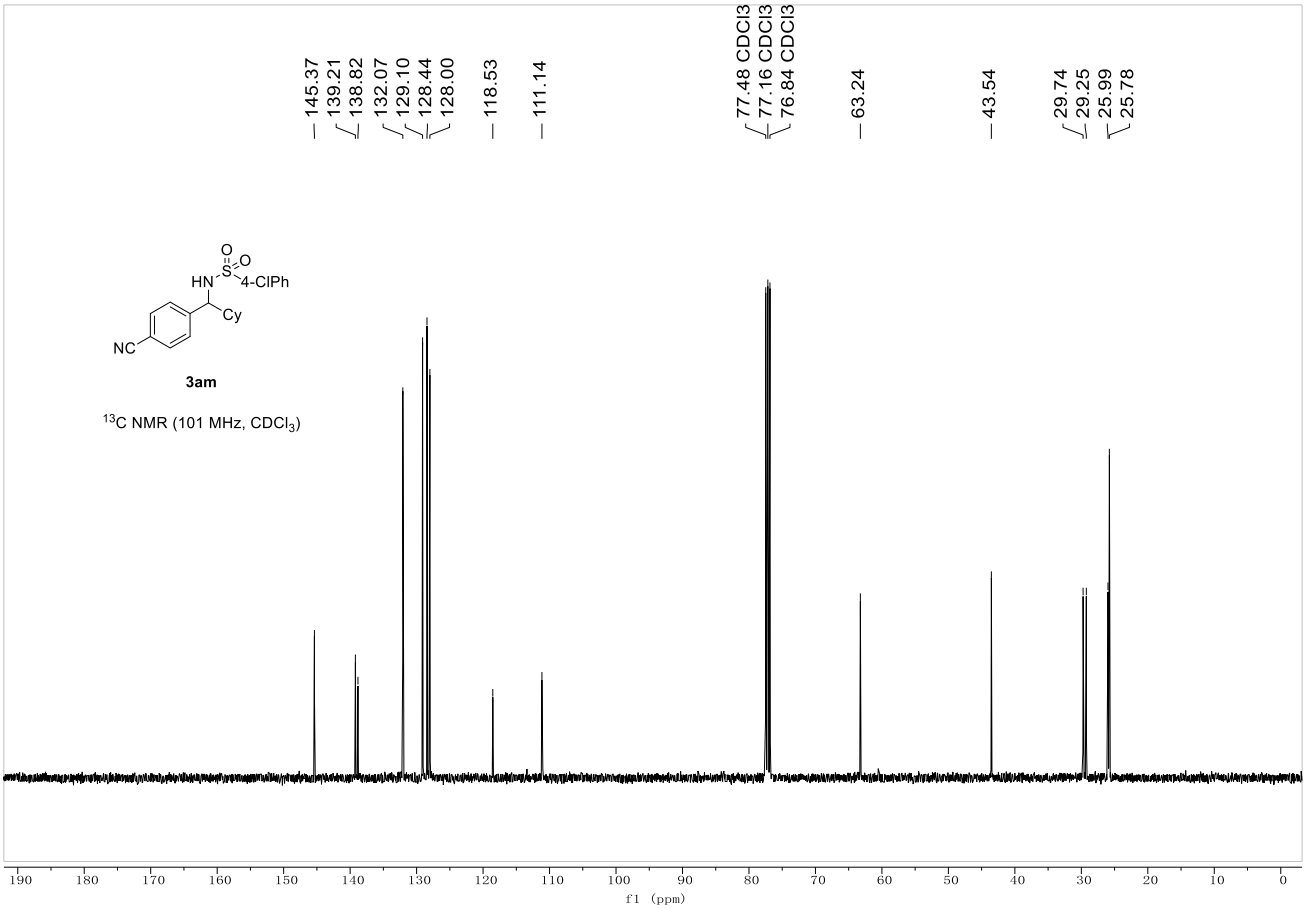

7.49 7.47 7.37 7.35 7.26 CDCl3 7.21 7.18 7.06 7.04 5.77 5.75 5.72 5.70 4.14 4.12 4.09 1.95 1.92 1.75 1.74 1.71 1.66 1.66 1.65 1.65 1.61 1.60 1.59 1.58 1.57 1.57 1.55 1.55 1.54 1.25 1.23 1.17 1.16 1.14 1.13 1.12 1.09 1.07 1.04 1.04 1.00 1.00 0.97 0.97 0.94 0.93 0.89 0.88 0.88 0.86 0.85 0.83 0.82
HN
S
O
O
4-ClPh
Cy
F3C
3ak
1H NMR (400 MHz, CDCl3)
1.90 1.92 1.91 1.92 1.00 1.01 0.95 0.98 3.18 1.34 5.07
f1 (ppm)

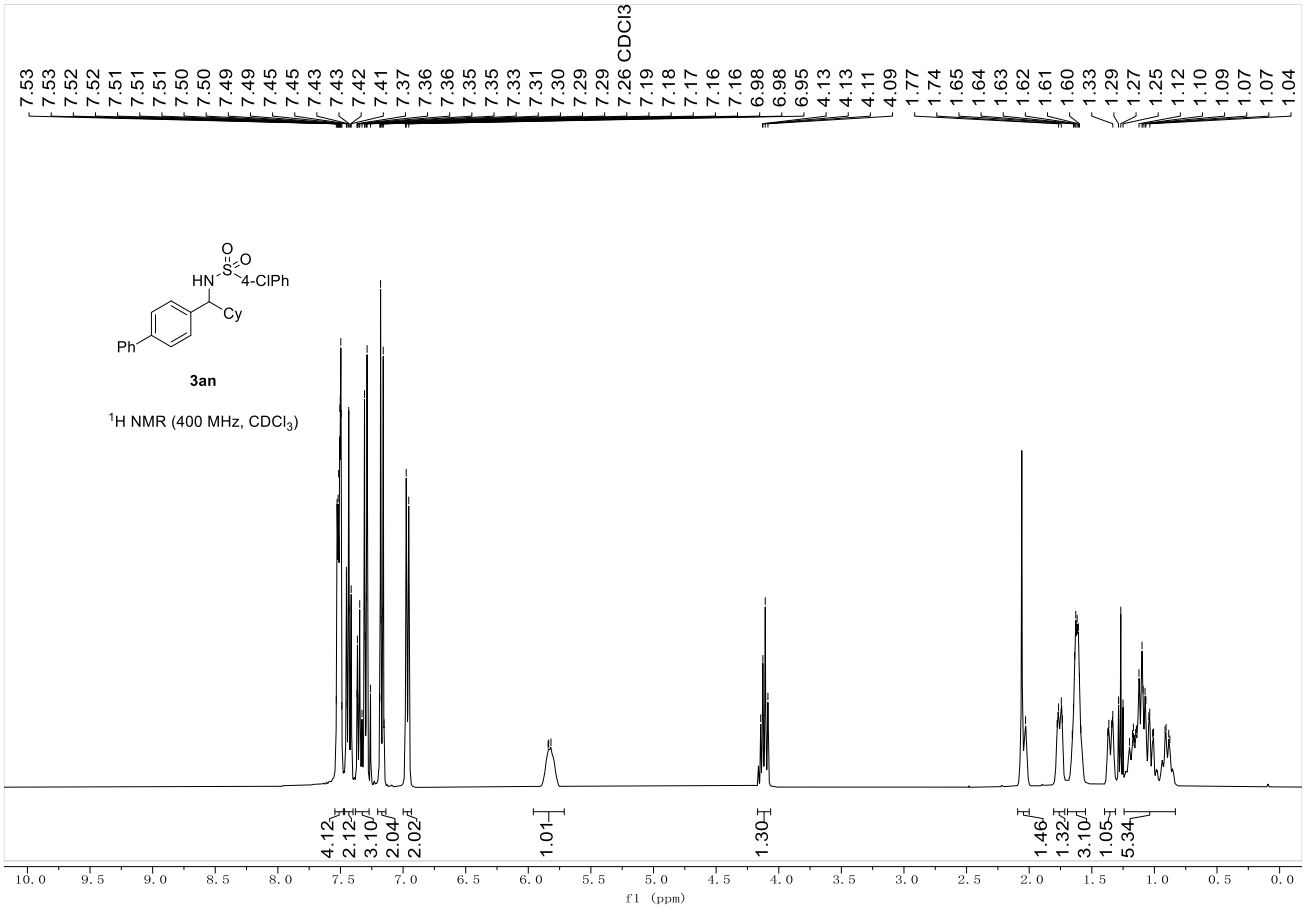

143.73 139.05 139.00 129.85 129.52 128.98 128.45 127.66 125.37 125.25 125.21 125.18 122.66
77.48 CDCl3 77.16 CDCl3 76.84 CDCl3
63.36
43.55
29.79 29.54 26.12 25.86
HN
S
O
O
4-ClPh
Cy
F3C
3ak
13C NMR (101 MHz, CDCl3)
f1 (ppm)

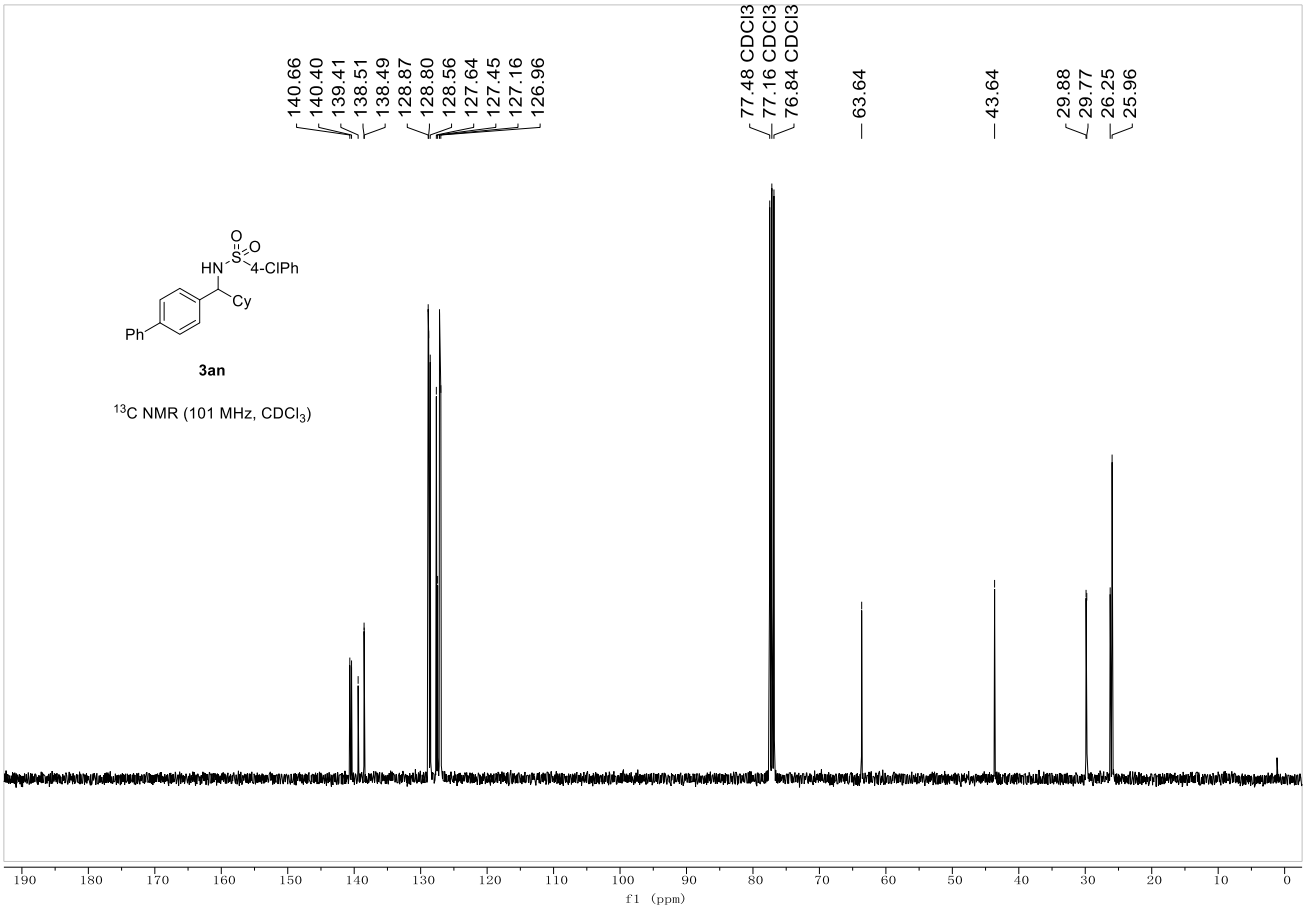

7.80
7.78
7.51
7.49
7.26 CDCl3
7.21
7.19
7.02
7.00
5.50
5.48
4.14
4.12
4.10
3.90
1.92
1.89
1.75
1.74
1.71
1.61
1.60
1.59
1.58
1.57
1.27
1.26
1.26
1.25
1.24
1.23
1.16
1.16
1.13
1.12
1.09
1.07
1.06
1.04
0.99
0.98
0.96
0.95
0.93
0.92
0.90
0.89
0.87
0.86
0.84
0.83
HN
O
S
O
4-ClPh
Cy
MeO2C
3al
1H NMR (400 MHz, CDCl3)
1.95
1.96
1.94
1.97
1.01
1.07
3.01
1.00
1.03
3.04
1.44
5.41
f1 (ppm)

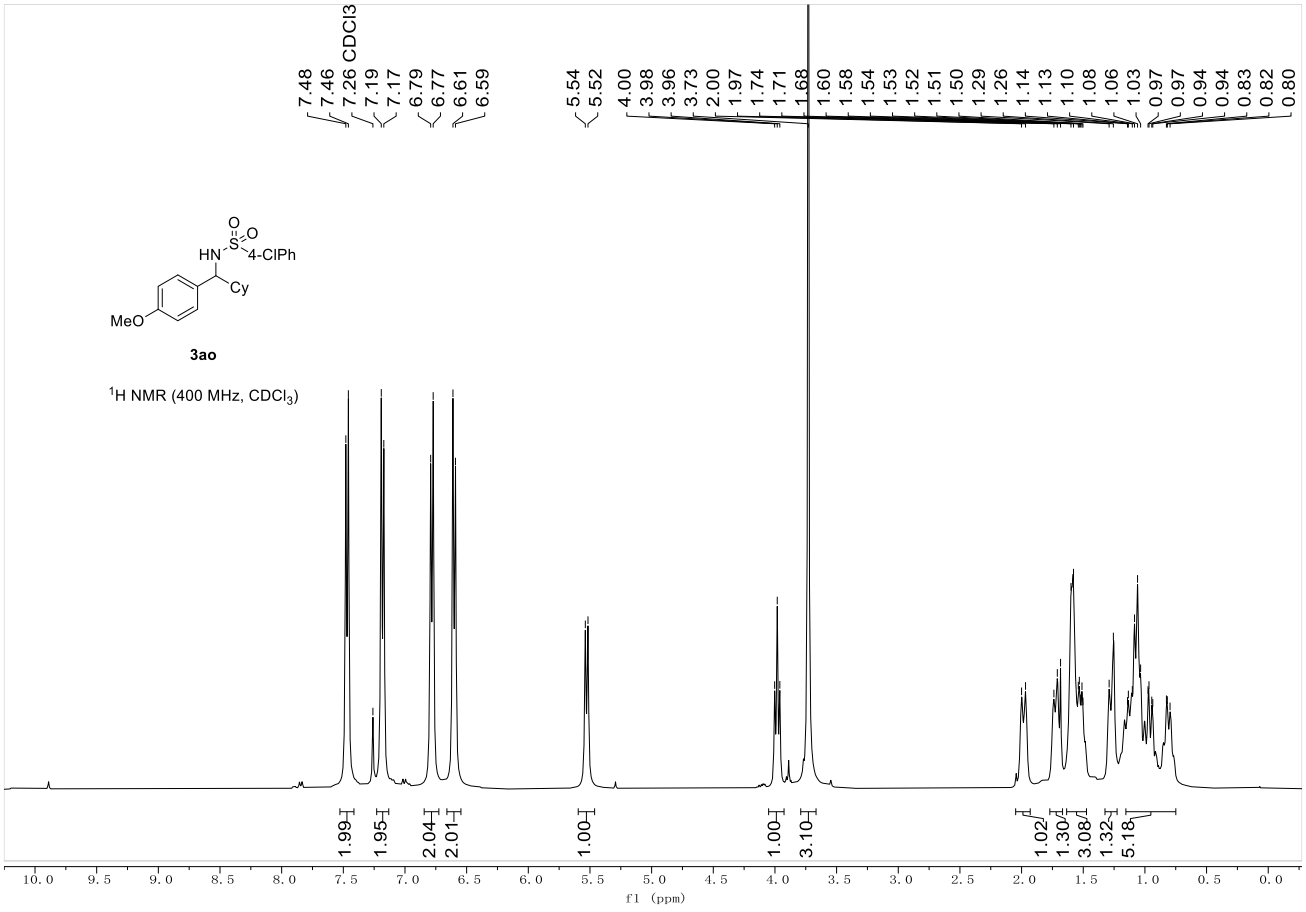

166.73
144.89
139.12
138.91
129.64
129.28
128.99
128.49
127.23
77.48 CDCl3
77.16 CDCl3
76.84 CDCl3
63.41
52.28
43.71
29.83
29.47
26.14
25.90
HN
O
S
O
4-ClPh
Cy
MeO2C
3al
13C NMR (101 MHz, CDCl3)
f1 (ppm)

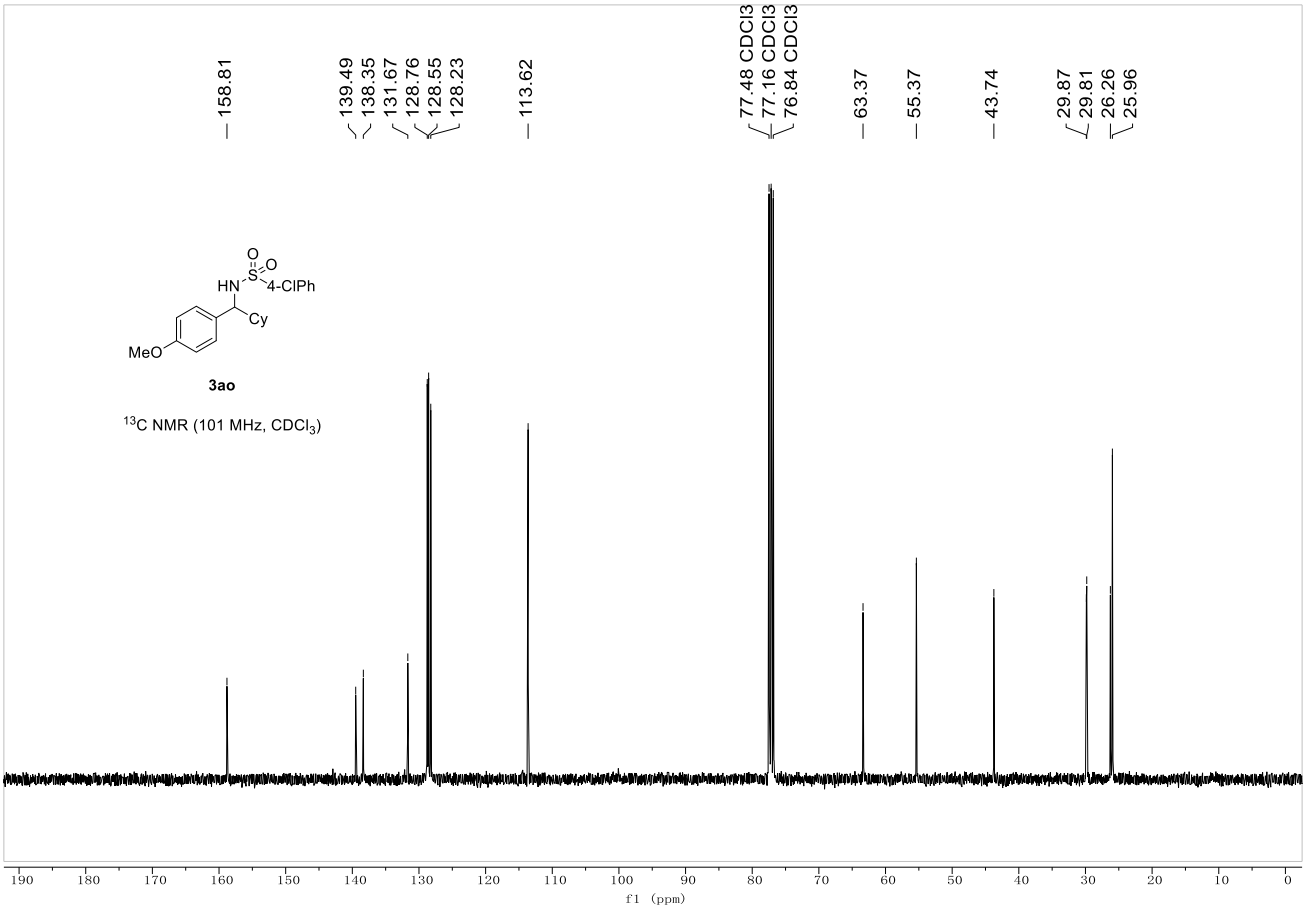

7.57
7.55
7.46
7.44
7.30
7.27
7.12
7.10
5.99
5.97
4.11
4.09
4.07
1.87
1.84
1.72
1.70
1.61
1.60
1.58
1.57
1.56
1.55
1.54
1.53
1.25
1.23
1.21
1.20
1.14
1.12
1.11
1.10
1.09
1.08
1.07
1.05
1.03
0.92
0.92
0.89
0.88
0.86
0.84
0.82
HN
S
O
O
4-ClPh
Cy
NC
3am
1H NMR (400 MHz, CDCl3)
2.01
2.00
2.08
2.00
1.00
1.06
0.98
1.02
3.02
1.29
5.15
f1 (ppm)

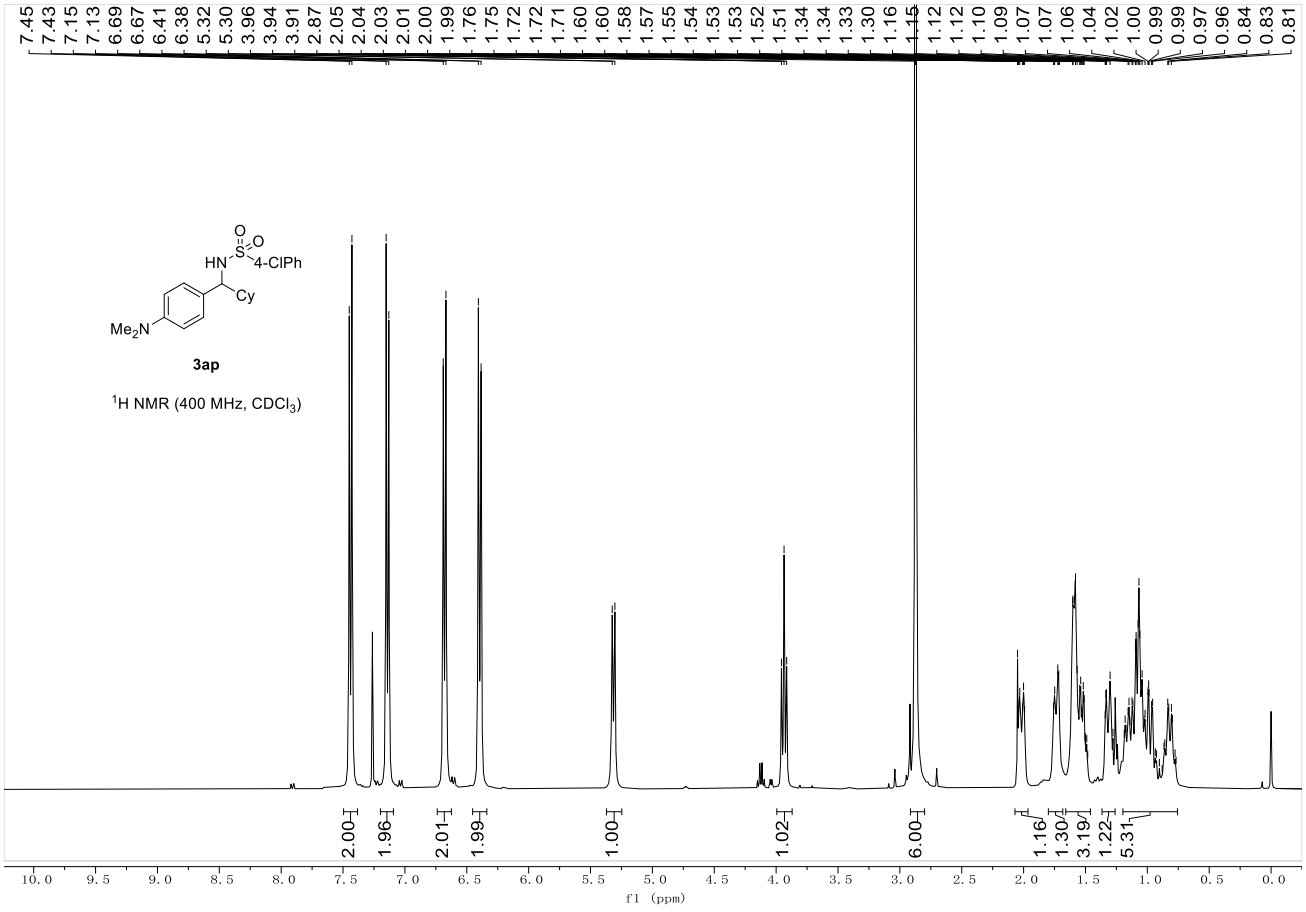

145.37
139.21
138.82
132.07
129.10
128.44
128.00
118.53
111.14
77.48 CDCl3
77.16 CDCl3
76.84 CDCl3
63.24
43.54
29.74
29.25
25.99
25.78
HN
S
O
O
4-ClPh
Cy
NC
3am
13C NMR (101 MHz, CDCl3)
f1 (ppm)

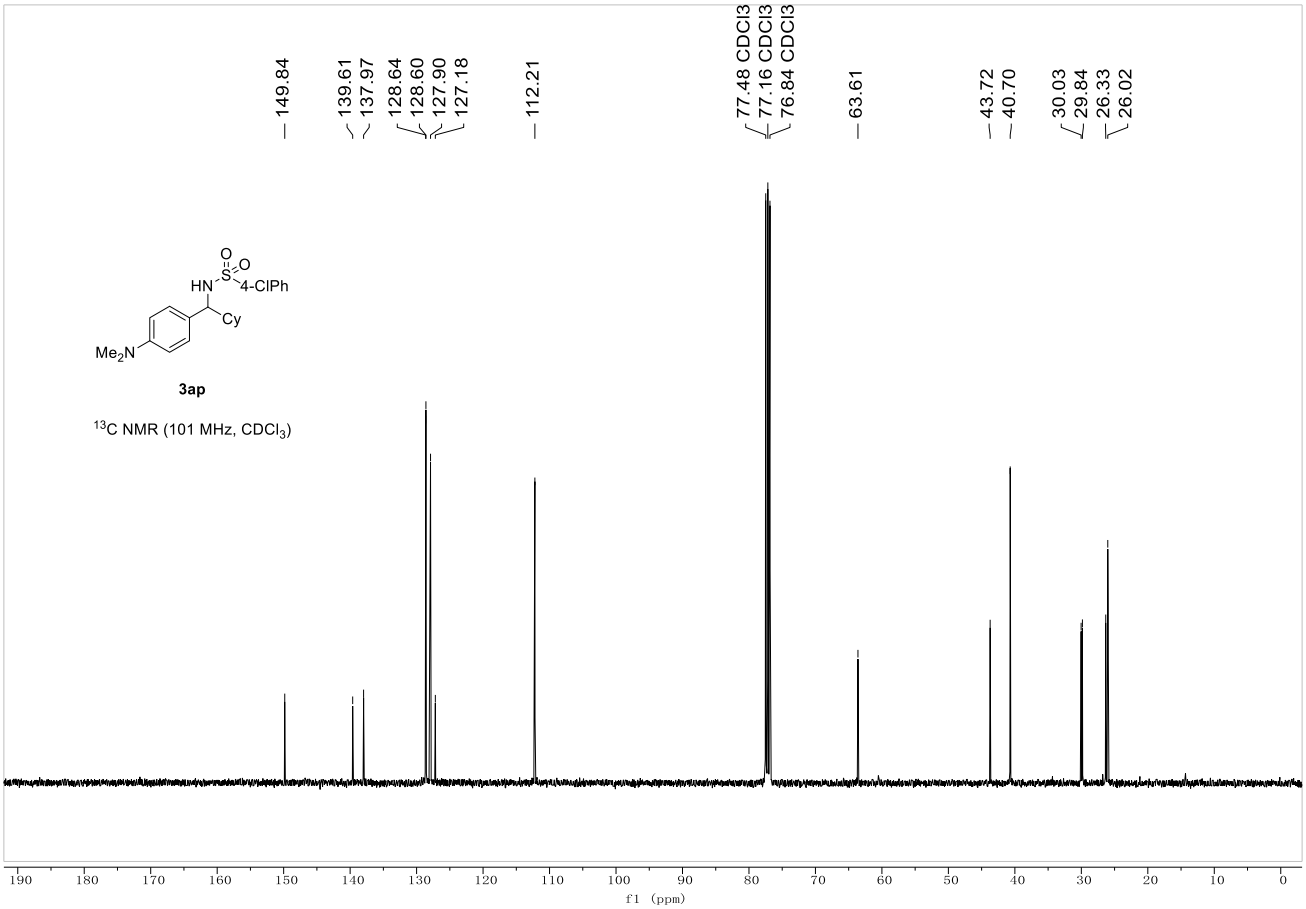

7.53 7.53 7.52 7.52 7.51 7.51 7.51 7.50 7.50 7.49 7.49 7.45 7.45 7.43 7.43 7.42 7.41 7.37 7.36 7.36 7.35 7.35 7.33 7.31 7.30 7.29 7.29 7.26 CDCl3 7.19 7.18 7.17 7.16 7.16 6.98 6.98 6.95 4.13 4.11 4.09 1.77 1.74 1.65 1.64 1.63 1.62 1.61 1.60 1.33 1.29 1.27 1.25 1.12 1.10 1.09 1.07 1.07 1.04
HN
S
O
O
4-ClPh
Cy
Ph
3an
1H NMR (400 MHz, CDCl3)
4.12 2.12 3.10 2.04 2.02 1.01 1.30 1.46 1.32 3.10 1.05 5.34
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)

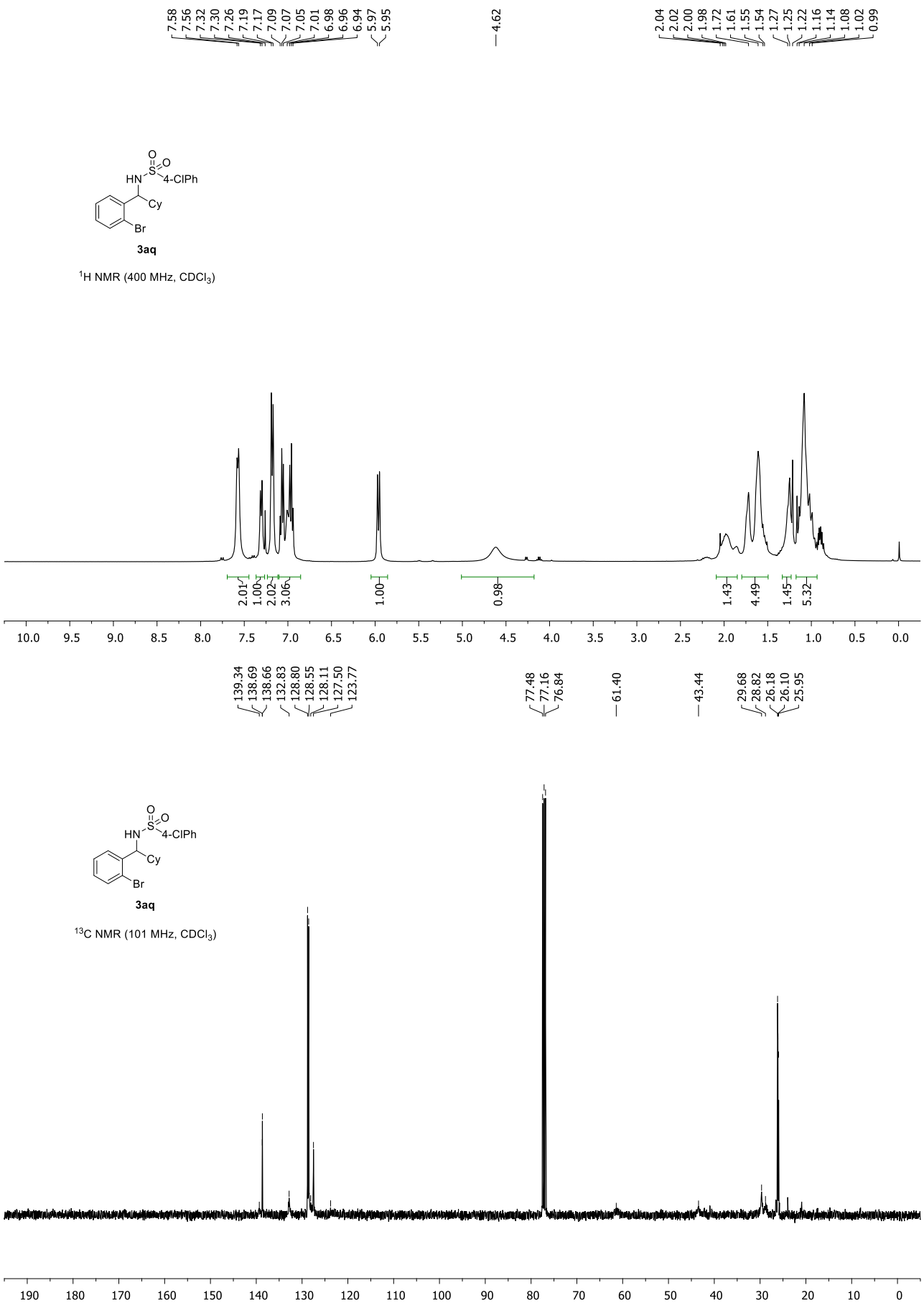

140.66 140.40 139.41 138.51 138.49 128.87 128.80 128.56 127.64 127.45 127.16 126.96
77.48 CDCl3 77.16 CDCl3 76.84 CDCl3
63.64
43.64
29.88 29.77 26.25 25.96
HN
S
O
O
4-ClPh
Cy
Ph
3an
13C NMR (101 MHz, CDCl3)
190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

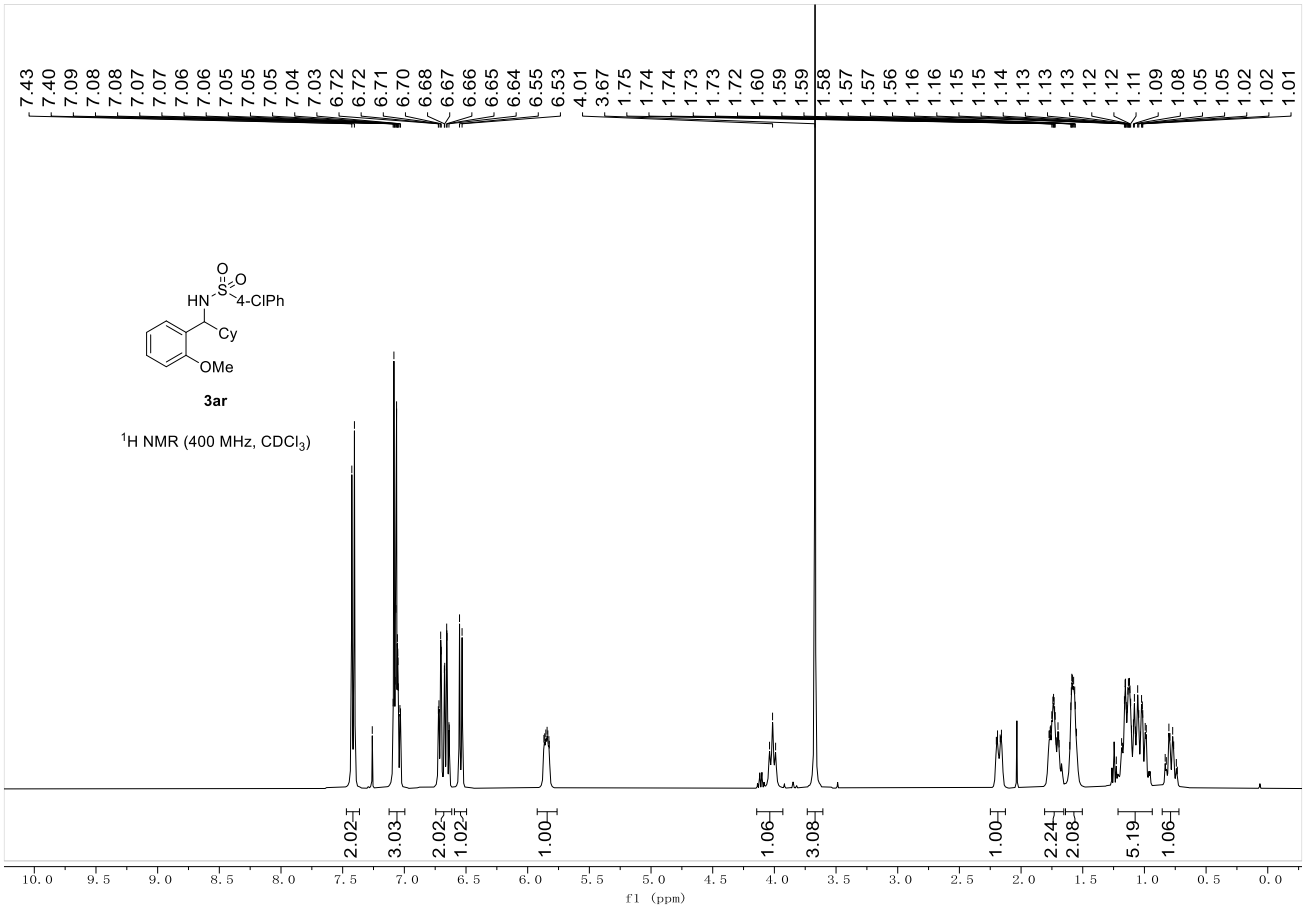

7.48
7.46
7.26 CDCl3
7.19
7.17
6.79
6.77
6.61
6.59
5.54
5.52
4.00
3.98
3.96
3.73
2.00
1.97
1.74
1.71
1.68
1.60
1.58
1.54
1.53
1.52
1.51
1.50
1.29
1.26
1.14
1.13
1.10
1.08
1.06
1.03
0.97
0.97
0.94
0.94
0.83
0.82
0.80
HN
S
O
O
4-ClPh
Cy
MeO
3ao
1H NMR (400 MHz, CDCl3)
1.99
1.95
2.04
2.01
1.00
1.00
3.10
1.02
1.30
3.08
1.32
5.18
f1 (ppm)

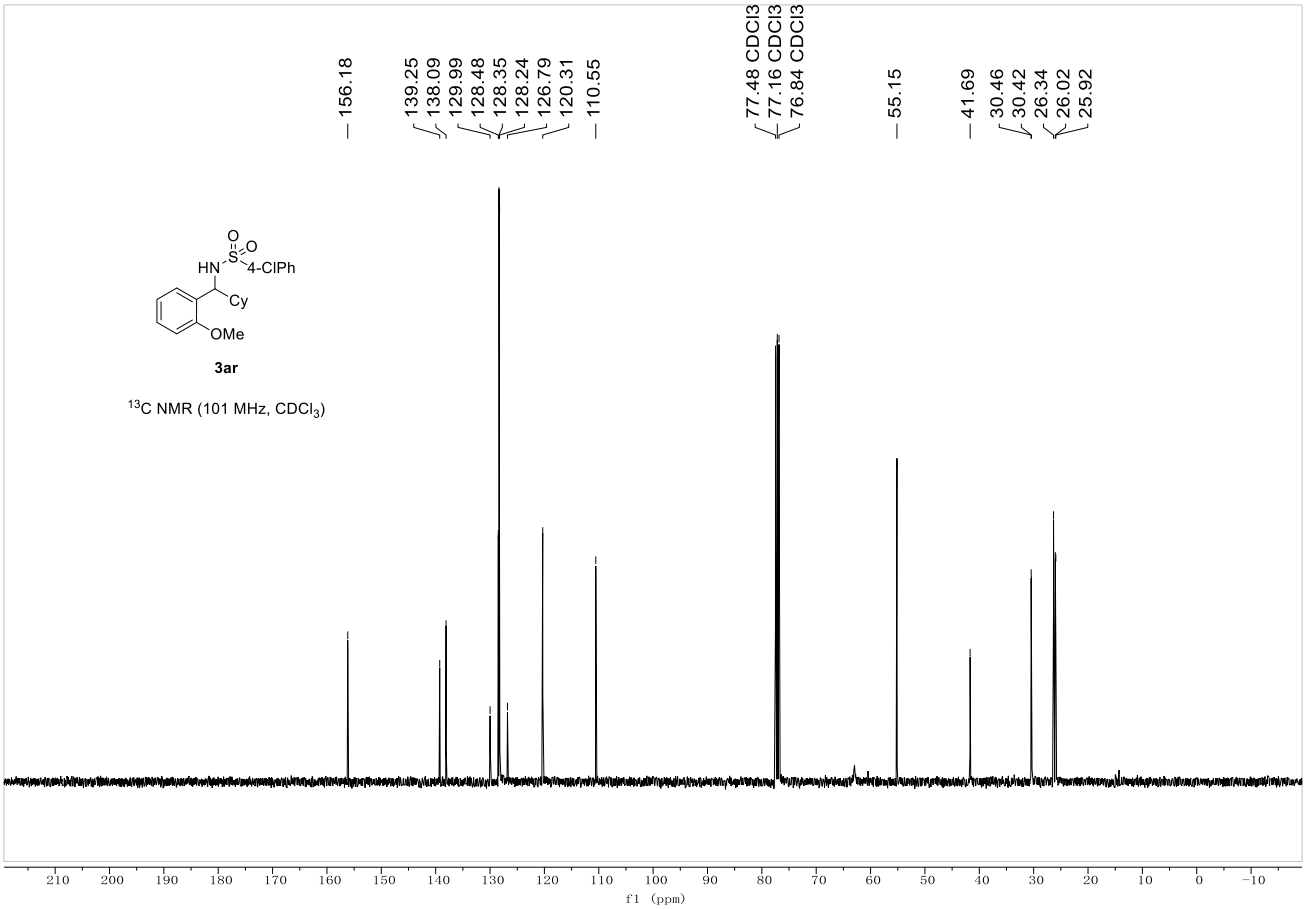

158.81
139.49
138.35
131.67
128.76
128.55
128.23
113.62
77.48 CDCl3
77.16 CDCl3
76.84 CDCl3
63.37
55.37
43.74
29.87
29.81
26.26
25.96
HN
S
O
O
4-ClPh
Cy
MeO
3ao
13C NMR (101 MHz, CDCl3)
f1 (ppm)

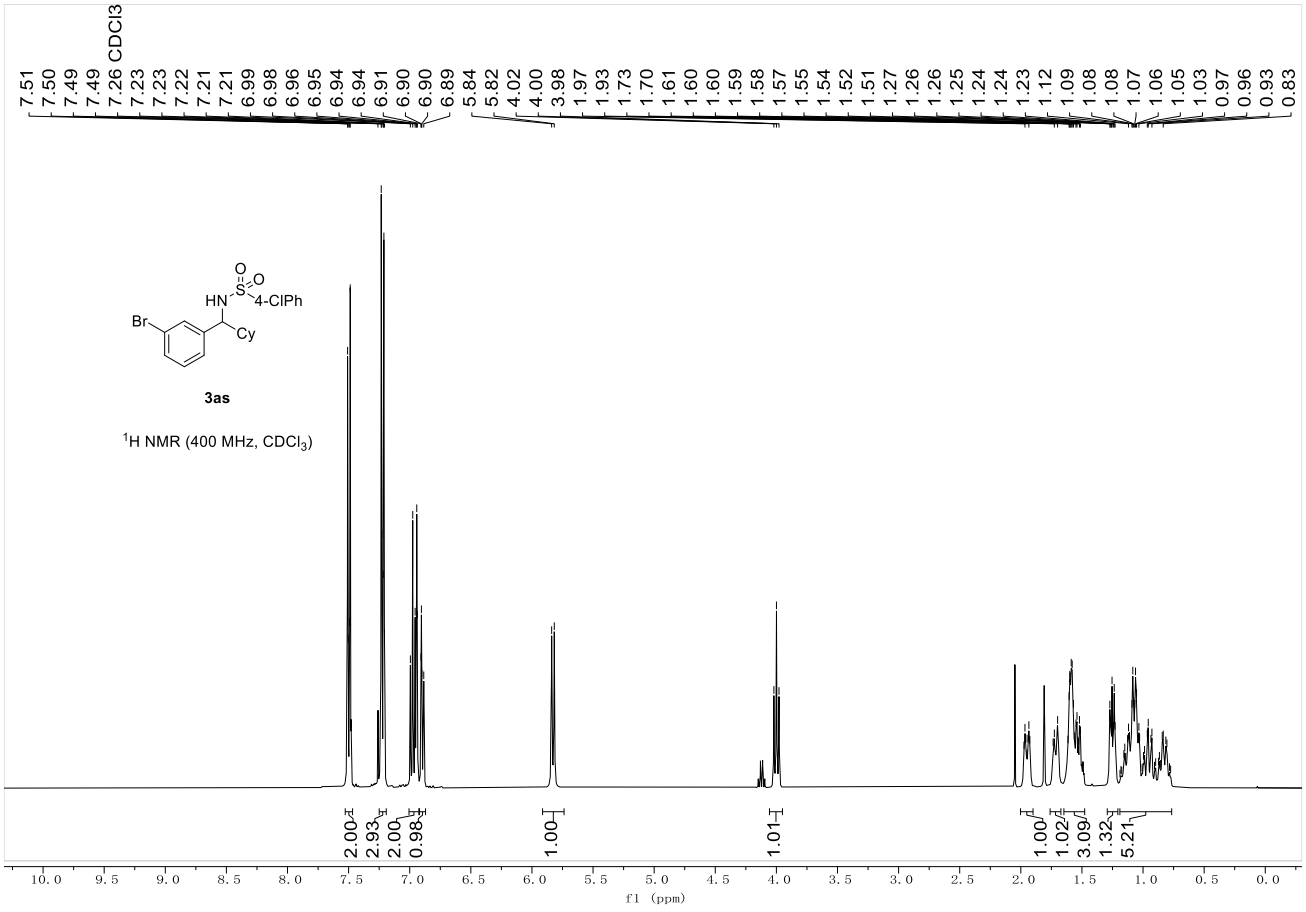

7.45 7.43 7.15 7.13 6.69 6.67 6.41 6.38 5.32 5.30 3.96 3.94 3.91 2.87 2.05 2.04 2.03 2.01 2.00 1.99 1.76 1.75 1.72 1.72 1.71 1.60 1.60 1.58 1.57 1.55 1.54 1.53 1.53 1.52 1.51 1.34 1.34 1.33 1.30 1.16 1.15 1.12 1.12 1.10 1.09 1.07 1.07 1.06 1.04 1.02 1.00 0.99 0.99 0.97 0.96 0.84 0.83 0.81
HN
O
S
O
4-ClPh
Cy
Me2N
3ap
1H NMR (400 MHz, CDCl3)
2.00 1.96 2.01 1.99 1.00 1.02 6.00 1.16 1.30 3.19 1.22 5.31
f1 (ppm)

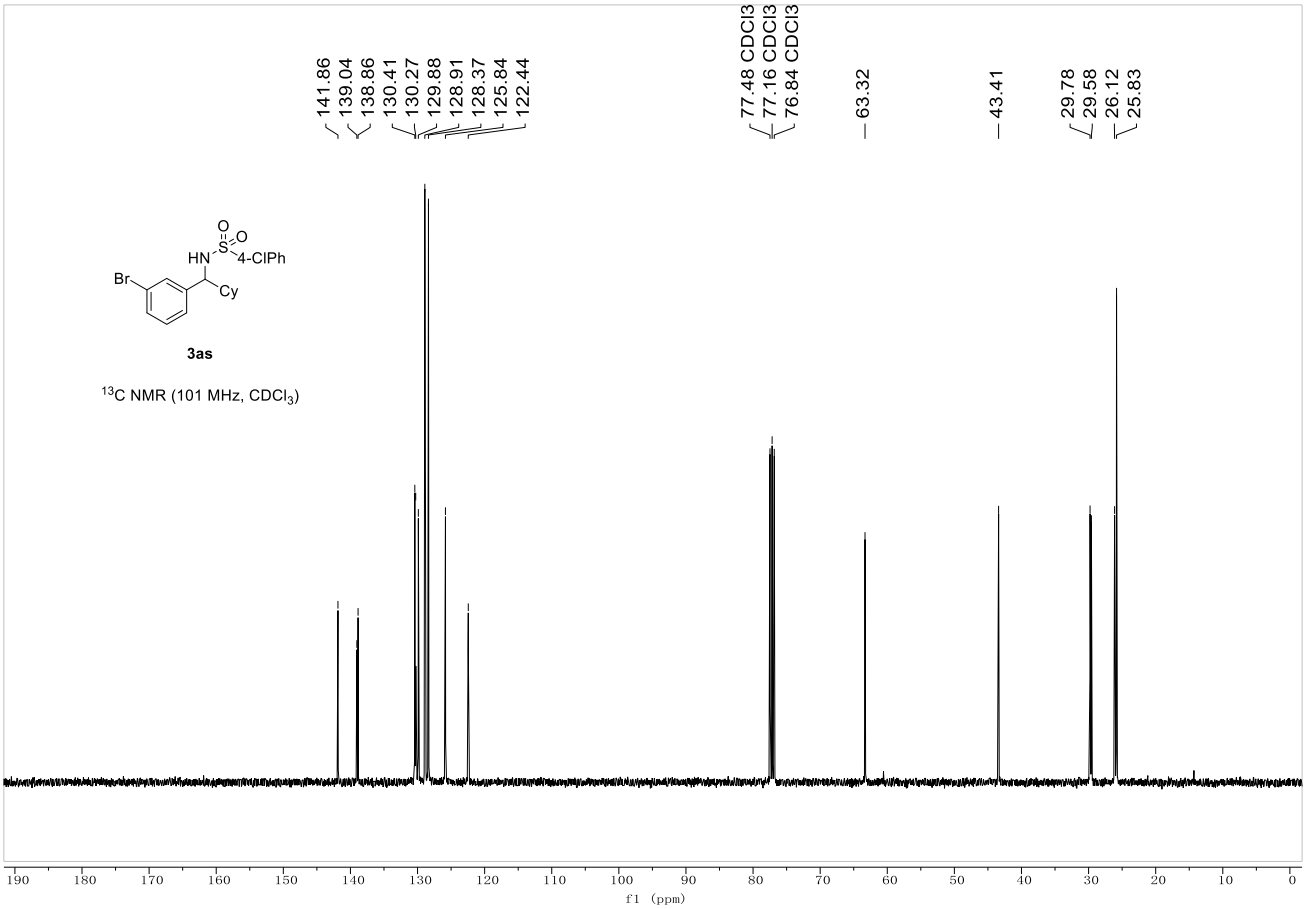

149.84
139.61
137.97
128.64
128.60
127.90
127.18
112.21
77.48 CDCl3
77.16 CDCl3
76.84 CDCl3
63.61
43.72
40.70
30.03
29.84
26.33
26.02
HN
O
S
O
4-ClPh
Cy
Me2N
3ap
13C NMR (101 MHz, CDCl3)
f1 (ppm)

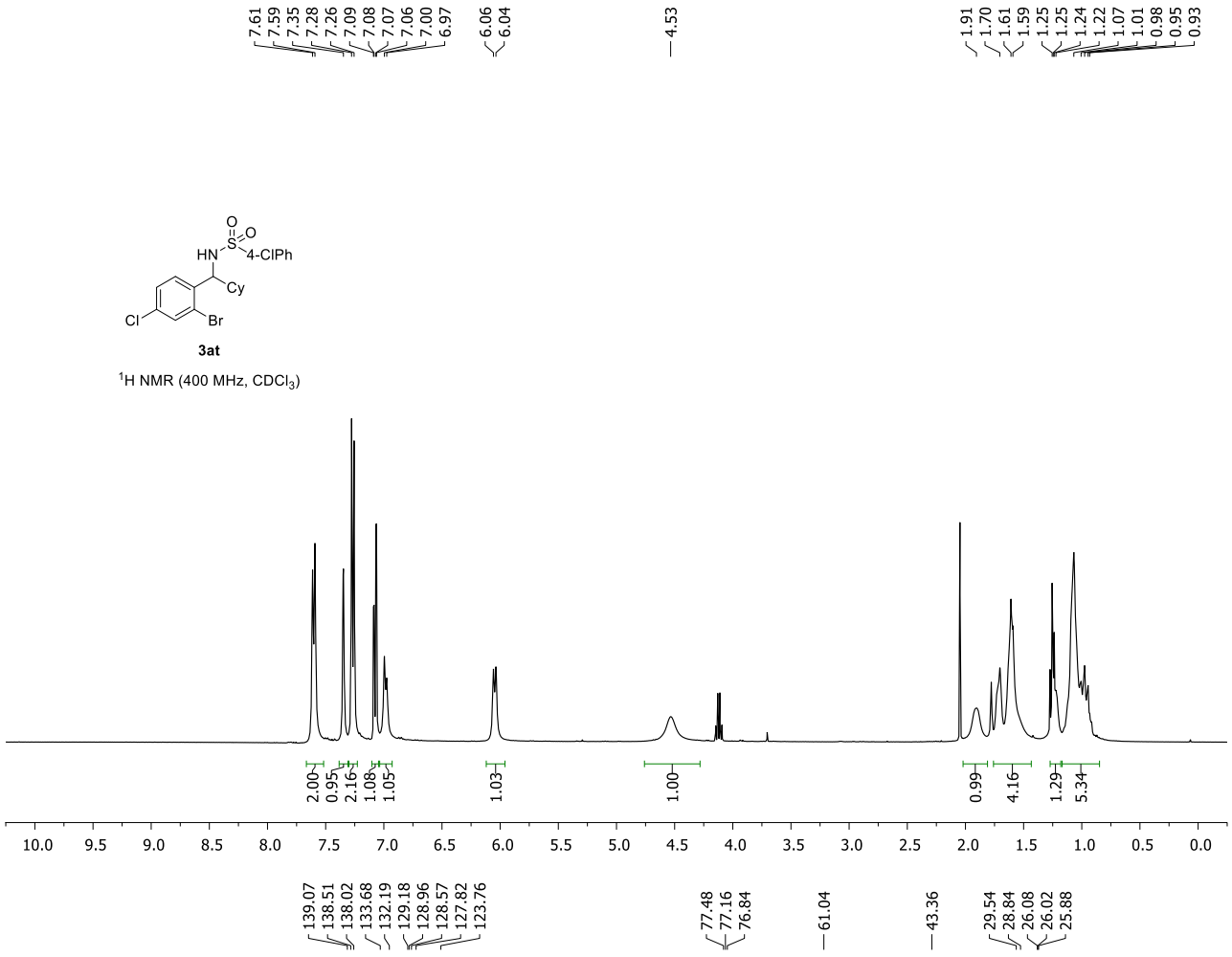

7.58
7.56
7.32
7.30
7.26
7.19
7.17
7.09
7.07
7.05
7.01
6.98
6.96
6.94
5.97
5.95
4.62
2.04
2.02
2.00
1.98
1.72
1.61
1.55
1.54
1.27
1.25
1.22
1.16
1.14
1.08
1.02
0.99
HN
S
O
O
4-ClPh
Cy
Br
3aq
1H NMR (400 MHz, CDCl3)
2.01
1.00
2.02
3.06
1.00
0.98
1.43
4.49
1.45
5.32
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
139.34
138.69
138.66
132.83
128.80
128.55
128.11
127.50
123.77
77.48
77.16
76.84
61.40
43.44
29.68
28.82
26.18
26.10
25.95
HN
S
O
O
4-ClPh
Cy
Br
3aq
13C NMR (101 MHz, CDCl3)
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0

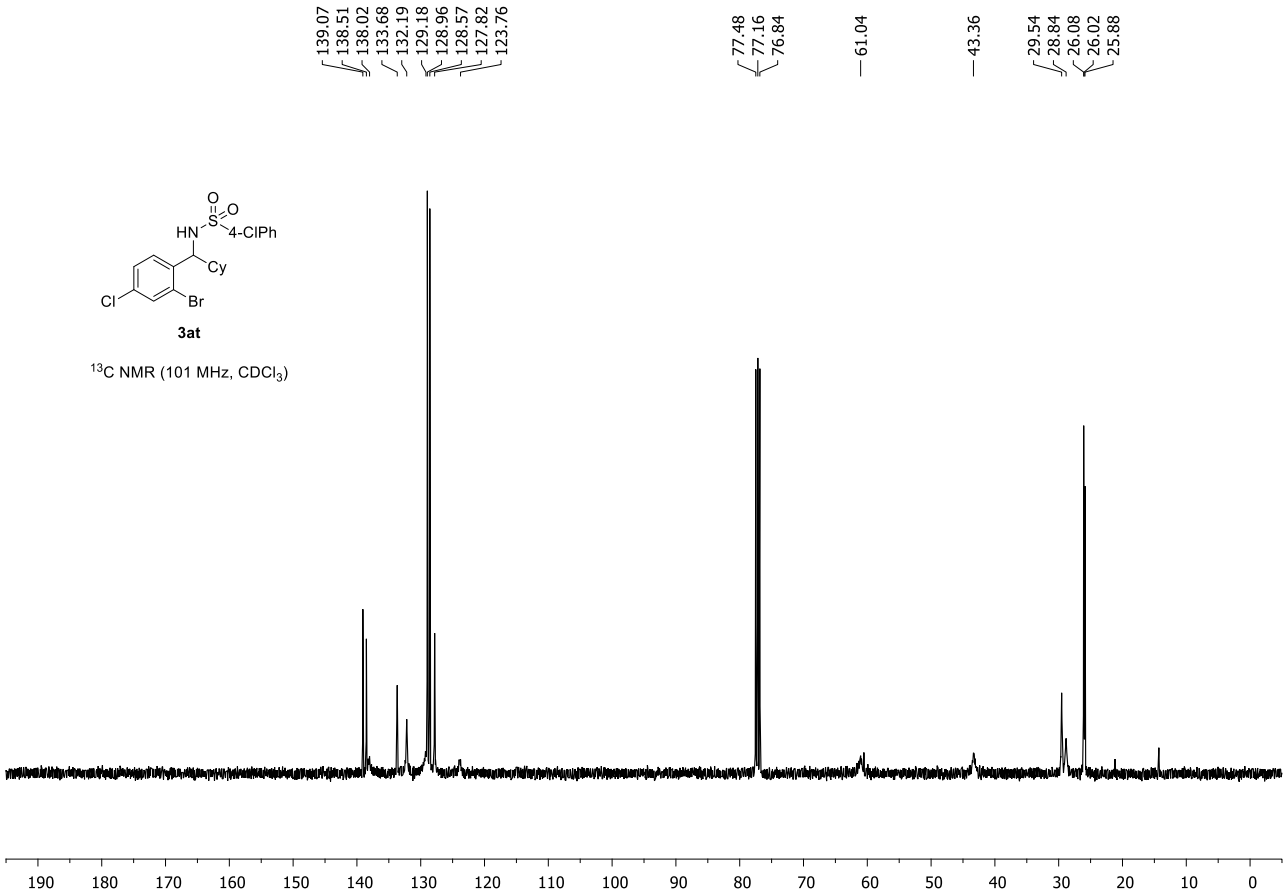

7.43 7.40 7.09 7.08 7.08 7.07 7.07 7.06 7.06 7.05 7.05 7.05 7.04 7.03 6.72 6.72 6.71 6.70 6.68 6.67 6.66 6.65 6.64 6.55 6.53 4.01 3.67 1.75 1.74 1.74 1.73 1.73 1.72 1.60 1.59 1.59 1.58 1.57 1.57 1.56 1.16 1.16 1.15 1.15 1.14 1.13 1.13 1.13 1.12 1.12 1.11 1.09 1.08 1.05 1.05 1.02 1.02 1.01
HN
S
O
O
4-ClPh
Cy
OMe
3ar
1H NMR (400 MHz, CDCl3)
2.02 3.03 2.02 1.02 1.00 1.06 3.08 1.00 2.24 2.08 5.19 1.06
f1 (ppm)

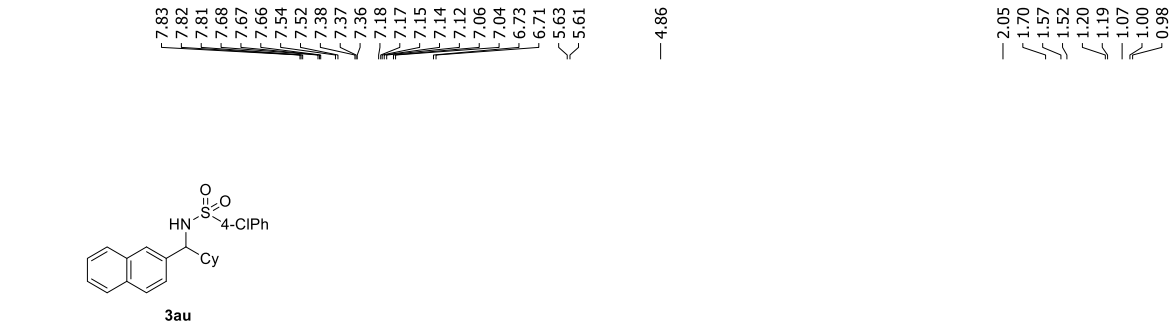

156.18 139.25 138.09 129.99 128.48 128.35 128.24 126.79 120.31 110.55 77.48 CDCl3 77.16 CDCl3 76.84 CDCl3 55.15 41.69 30.46 30.42 26.34 26.02 25.92
HN
S
O
O
4-ClPh
Cy
OMe
3ar
13C NMR (101 MHz, CDCl3)
f1 (ppm)


7.51 7.50 7.49 7.49 7.26 CDCl3 7.23 7.23 7.22 7.21 7.21 6.99 6.98 6.96 6.95 6.94 6.94 6.91 6.90 6.90 6.89 5.84 5.82 4.02 4.00 3.98 1.97 1.93 1.73 1.70 1.61 1.60 1.60 1.59 1.58 1.57 1.55 1.54 1.52 1.51 1.27 1.26 1.26 1.25 1.24 1.24 1.23 1.12 1.09 1.08 1.08 1.07 1.06 1.05 1.03 0.97 0.96 0.93 0.83
HN
S
O
O
4-ClPh
Br
Cy
3as
1H NMR (400 MHz, CDCl3)
2.00 2.93 2.00 0.98 1.00 1.01 1.00 1.02 3.09 1.32 5.21
f1 (ppm)


141.86 139.04 138.86 130.41 130.27 129.88 128.91 128.37 125.84 122.44
77.48 CDCl3 77.16 CDCl3 76.84 CDCl3
63.32
43.41
29.78 29.58 26.12 25.83
HN
S
O
O
4-ClPh
Br
Cy
3as
13C NMR (101 MHz, CDCl3)
f1 (ppm)

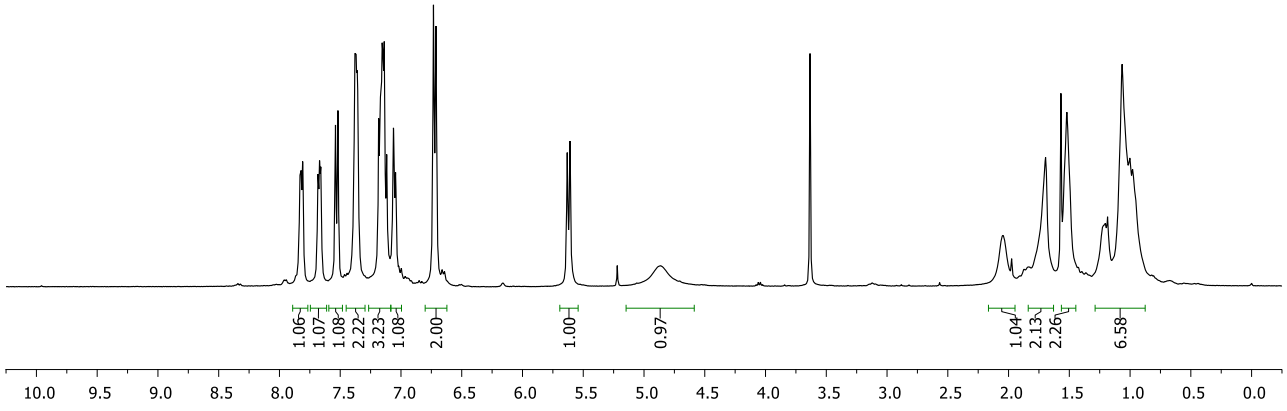

7.61
7.59
7.35
7.28
7.26
7.09
7.08
7.07
7.06
7.00
6.97
6.06
6.04
4.53
1.91
1.70
1.61
1.59
1.25
1.25
1.24
1.22
1.07
1.01
0.98
0.95
0.93
O
S
O
HN
4-ClPh
Cy
Cl
Br
3at
^{1}H NMR (400 MHz, $CDCl_3$)
2.00
0.95
2.16
1.08
1.05
1.03
1.00
0.99
4.16
1.29
5.34
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0

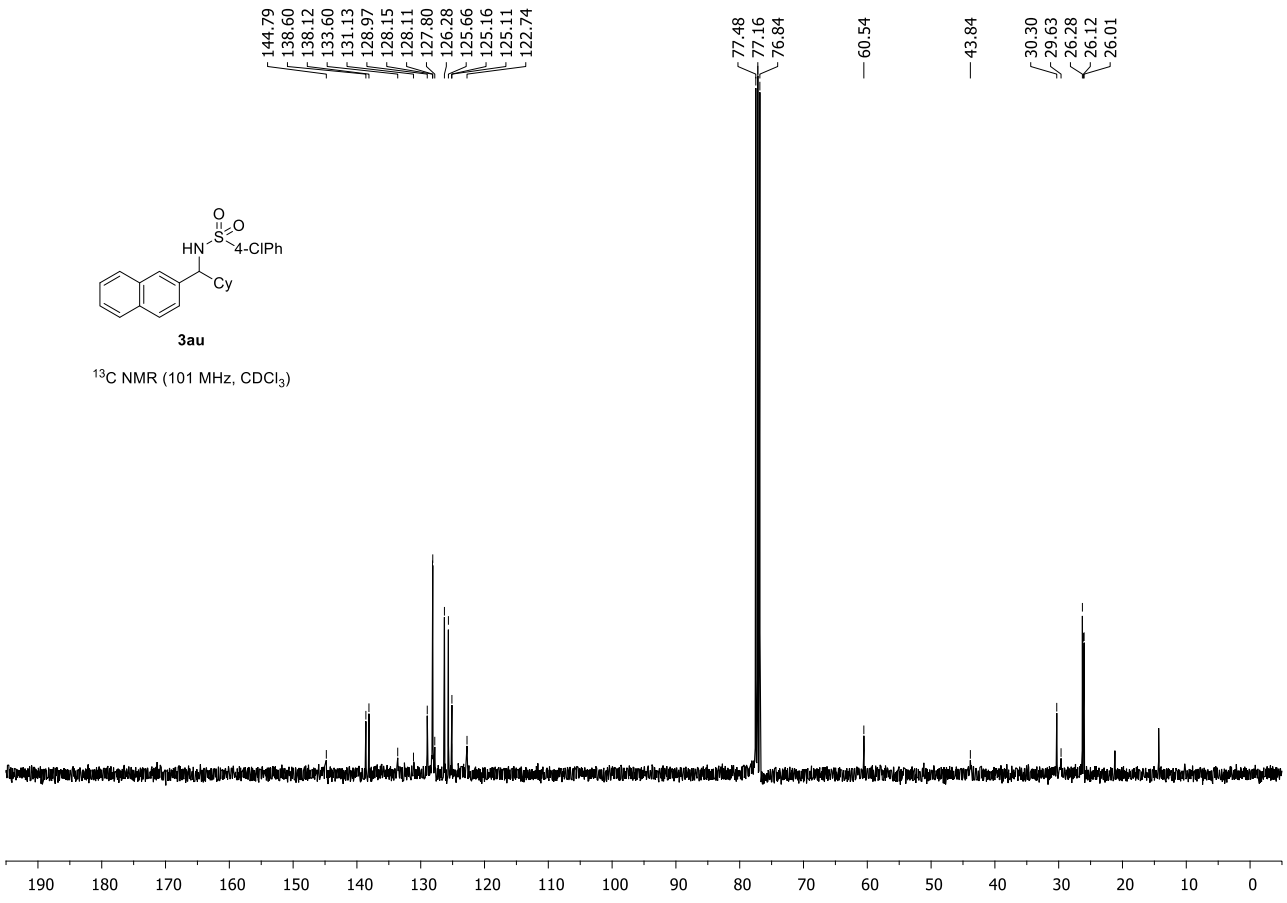

139.07
138.51
138.02
133.68
132.19
129.18
128.96
128.57
127.82
123.76
77.48
77.16
76.84
61.04
43.36
29.54
28.84
26.08
26.02
25.88
O
S
O
HN
4-ClPh
Cy
Cl
Br
3at
^{13}C NMR (101 MHz, $CDCl_3$)
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0



3au

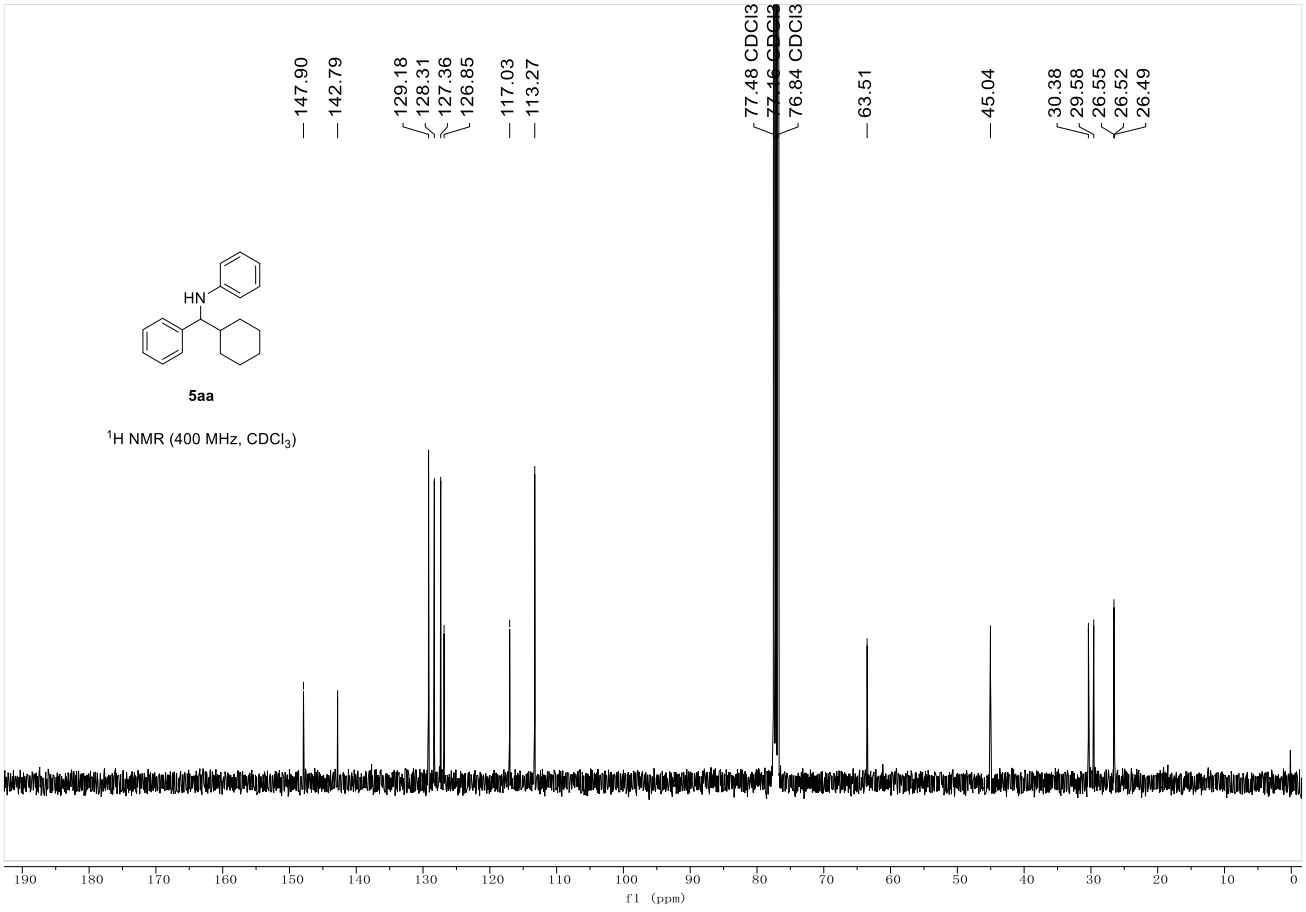
^{1}H NMR (400 MHz, $CDCl_3$)

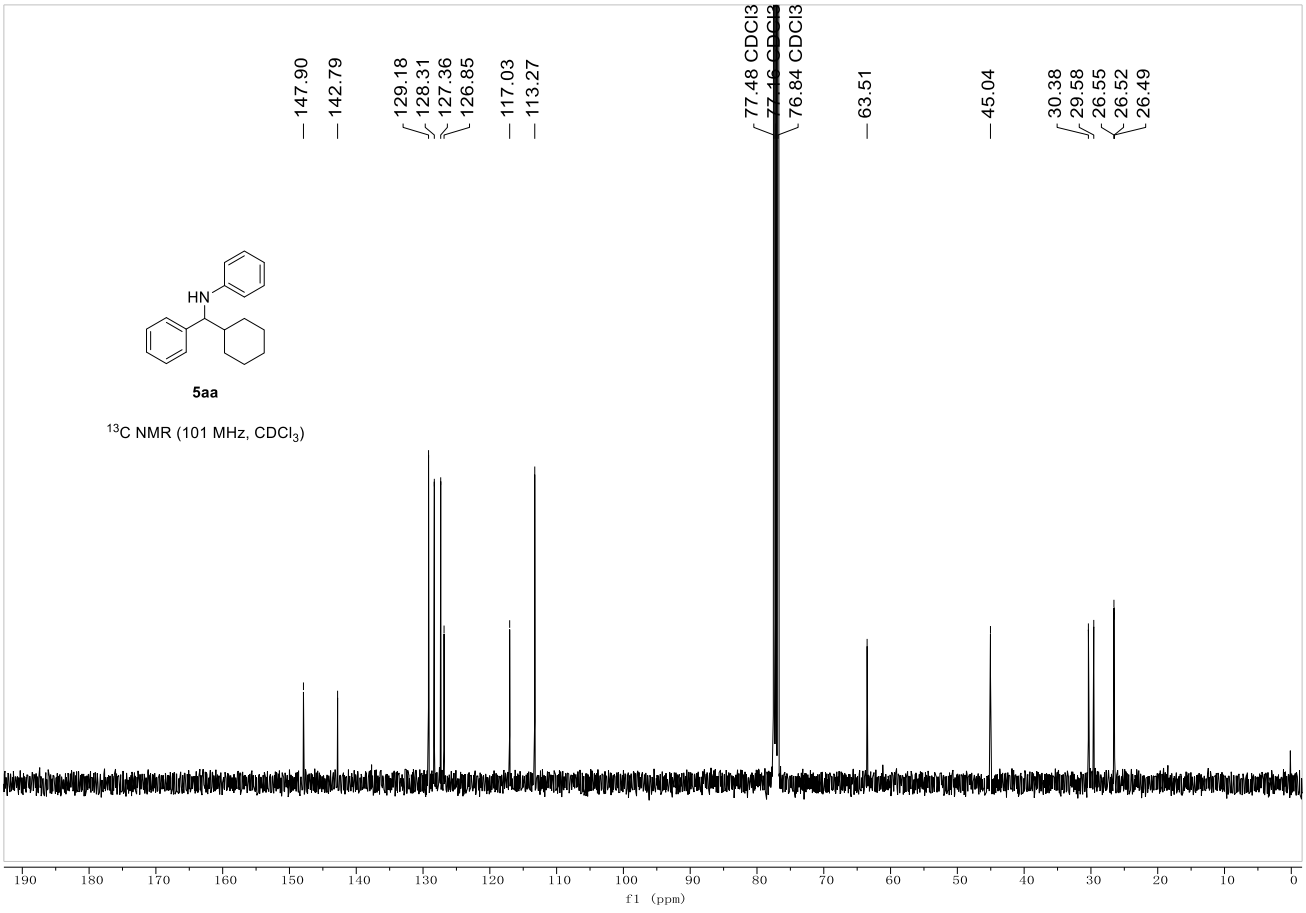


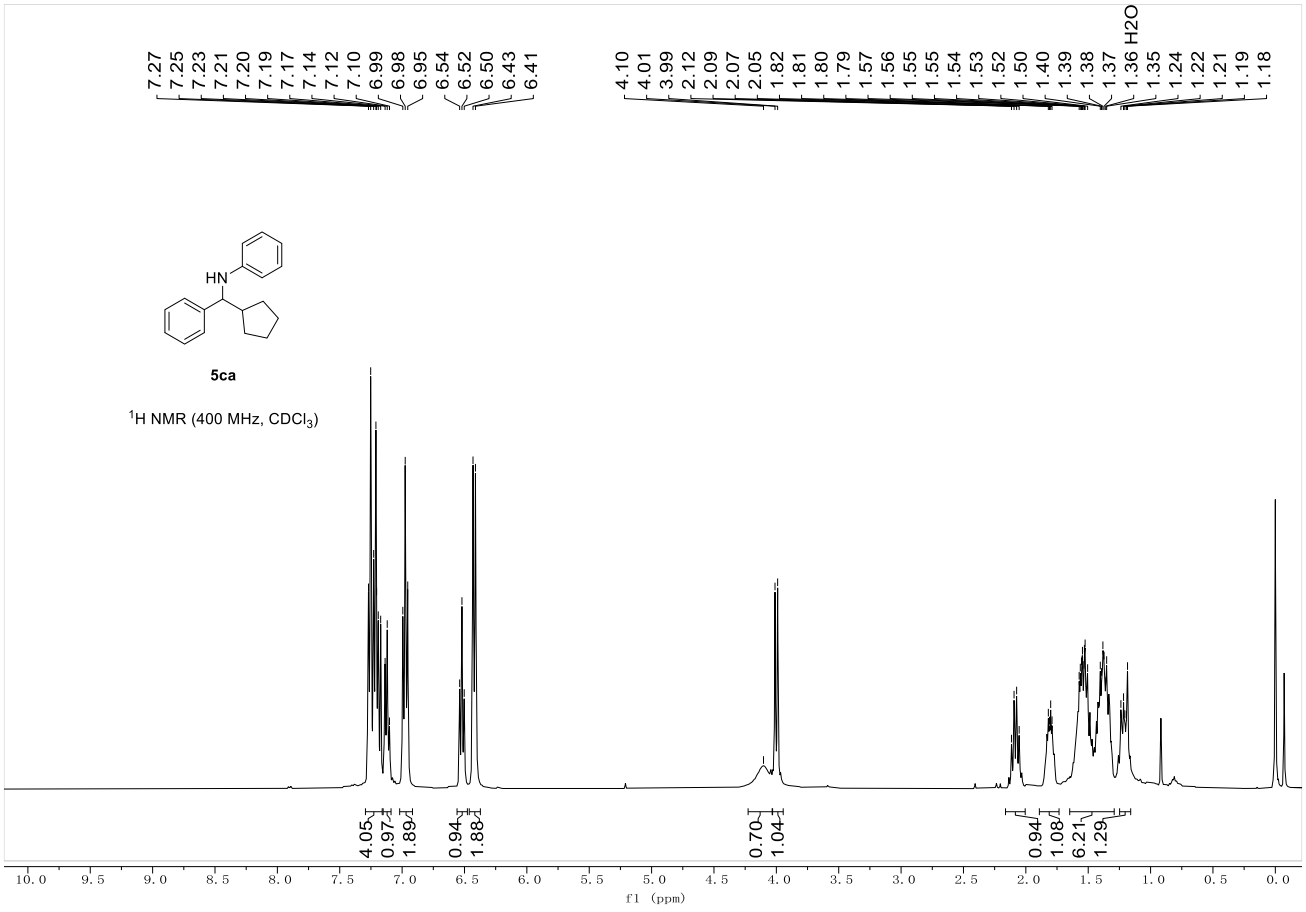


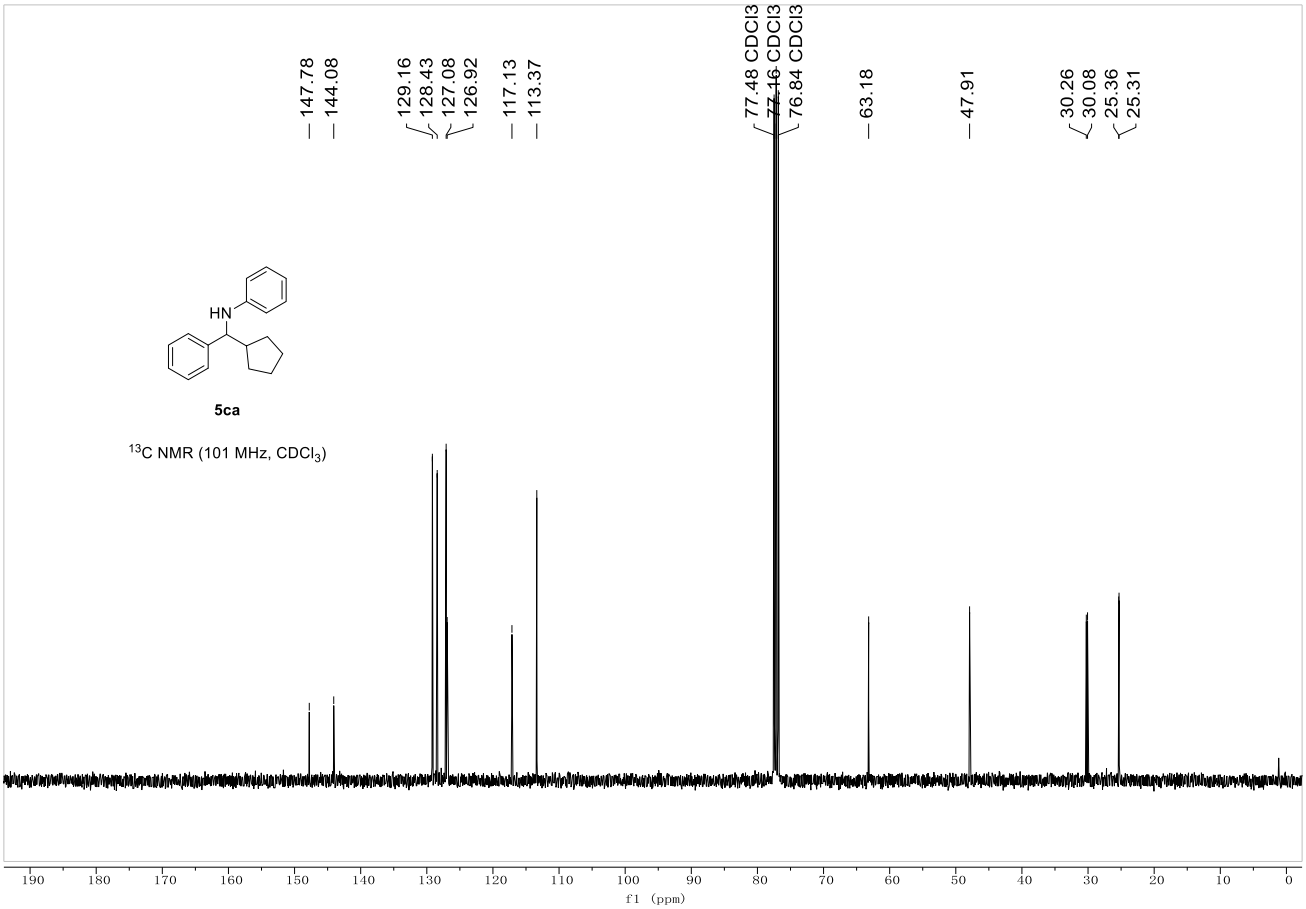
3au

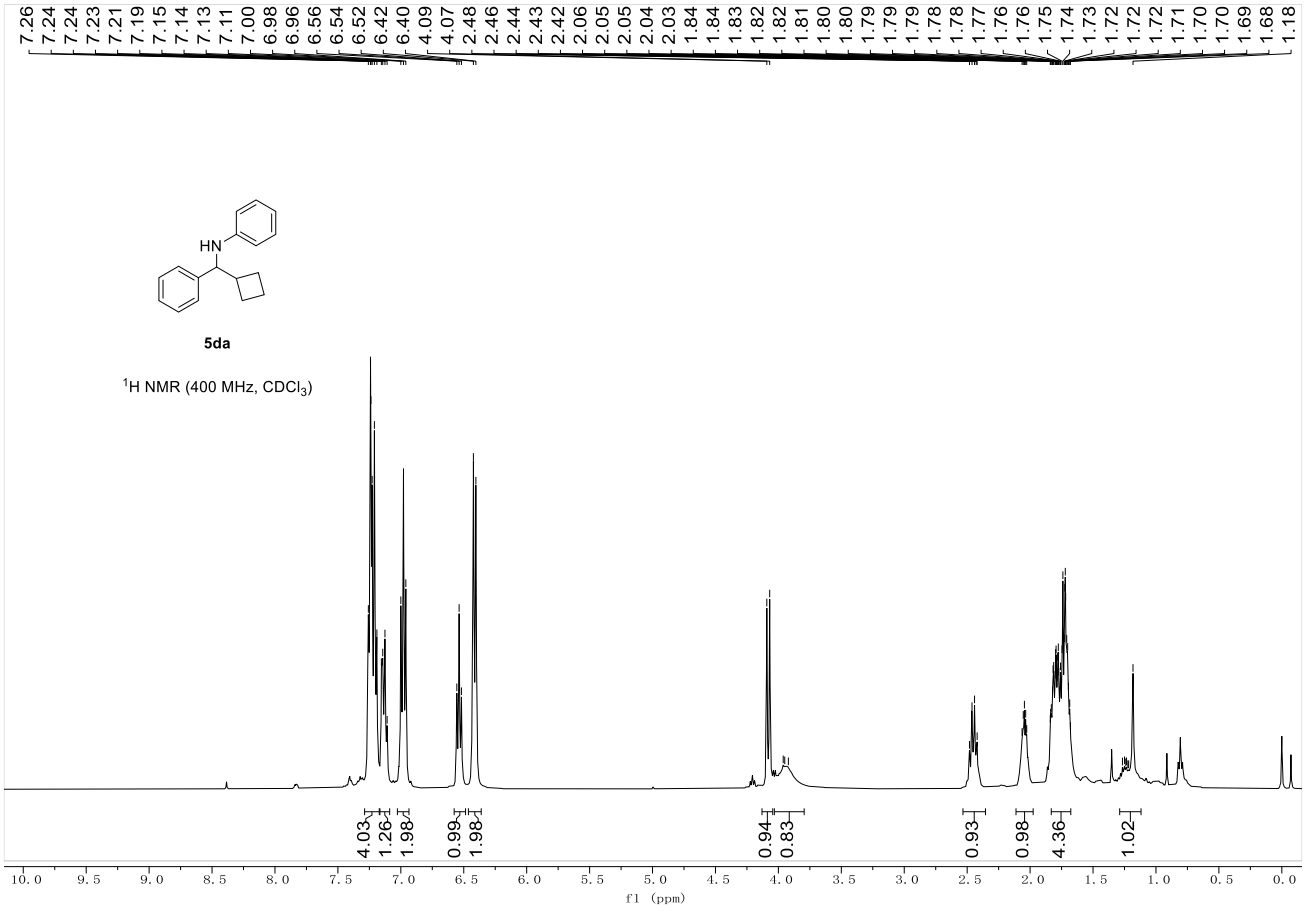
^{13}C NMR (101 MHz, $CDCl_3$)

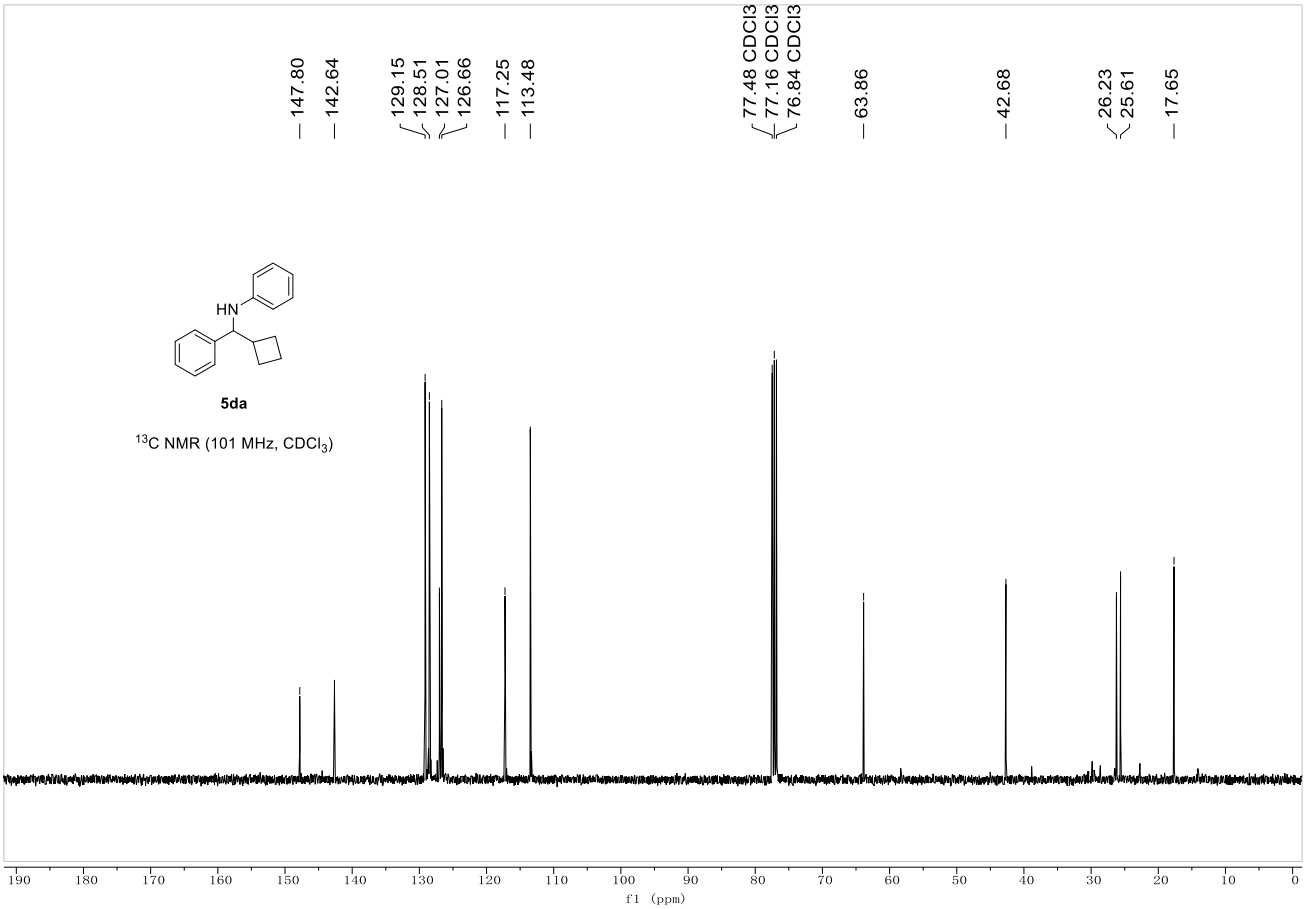

147.90
142.79
129.18
128.31
127.36
126.85
117.03
113.27
77.48 CDCl3
77.16 CDCl3
76.84 CDCl3
63.51
45.04
30.38
29.58
26.55
26.52
26.49
HN
5aa
^{1}H NMR (400 MHz, $CDCl_3$)
f1 (ppm)

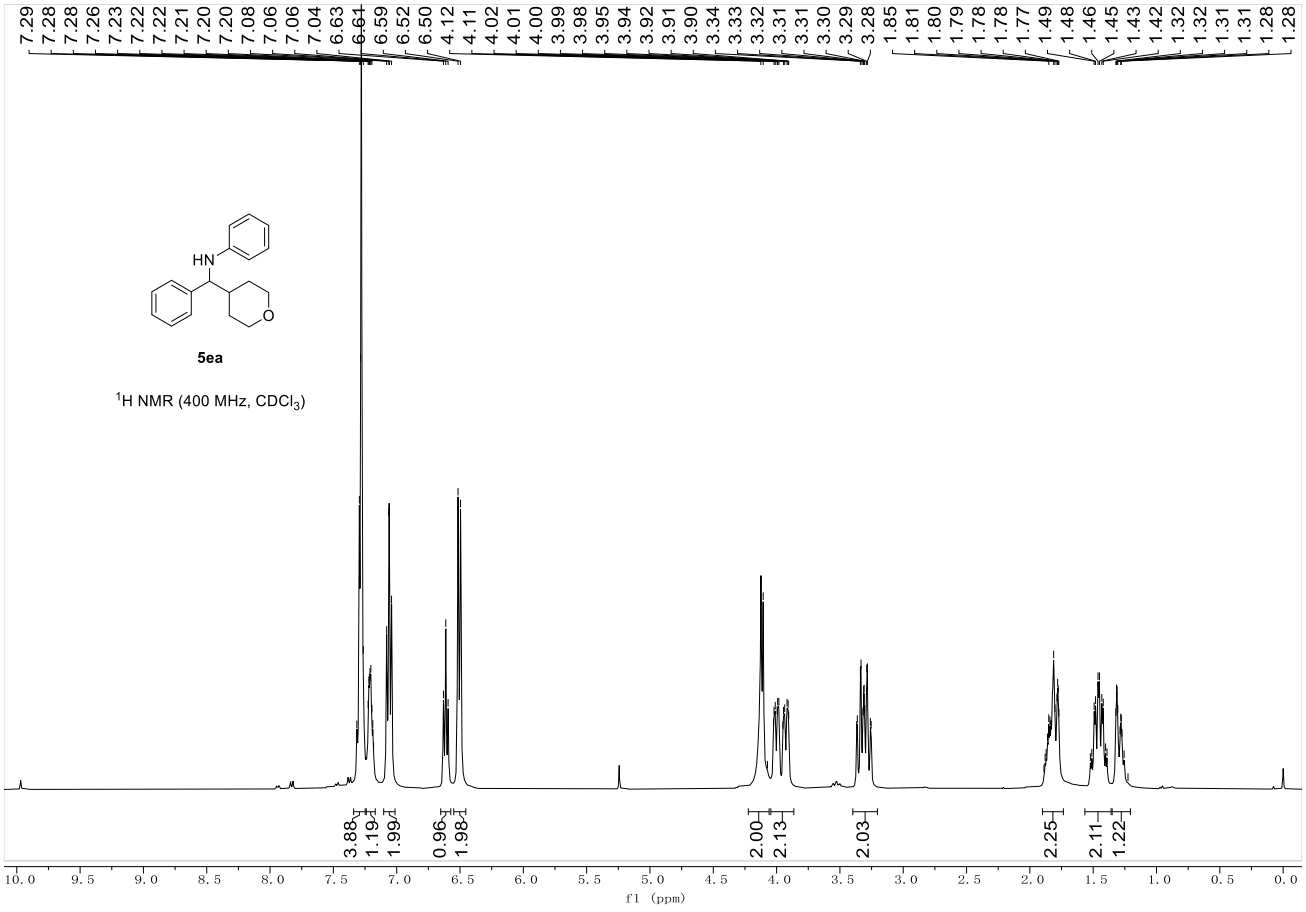

147.90
142.79
129.18
128.31
127.36
126.85
117.03
113.27
77.48 CDCl3
77.16 CDCl3
76.84 CDCl3
63.51
45.04
30.38
29.58
26.55
26.52
26.49
HN
5aa
^{13}C NMR (101 MHz, $CDCl_3$)
f1 (ppm)

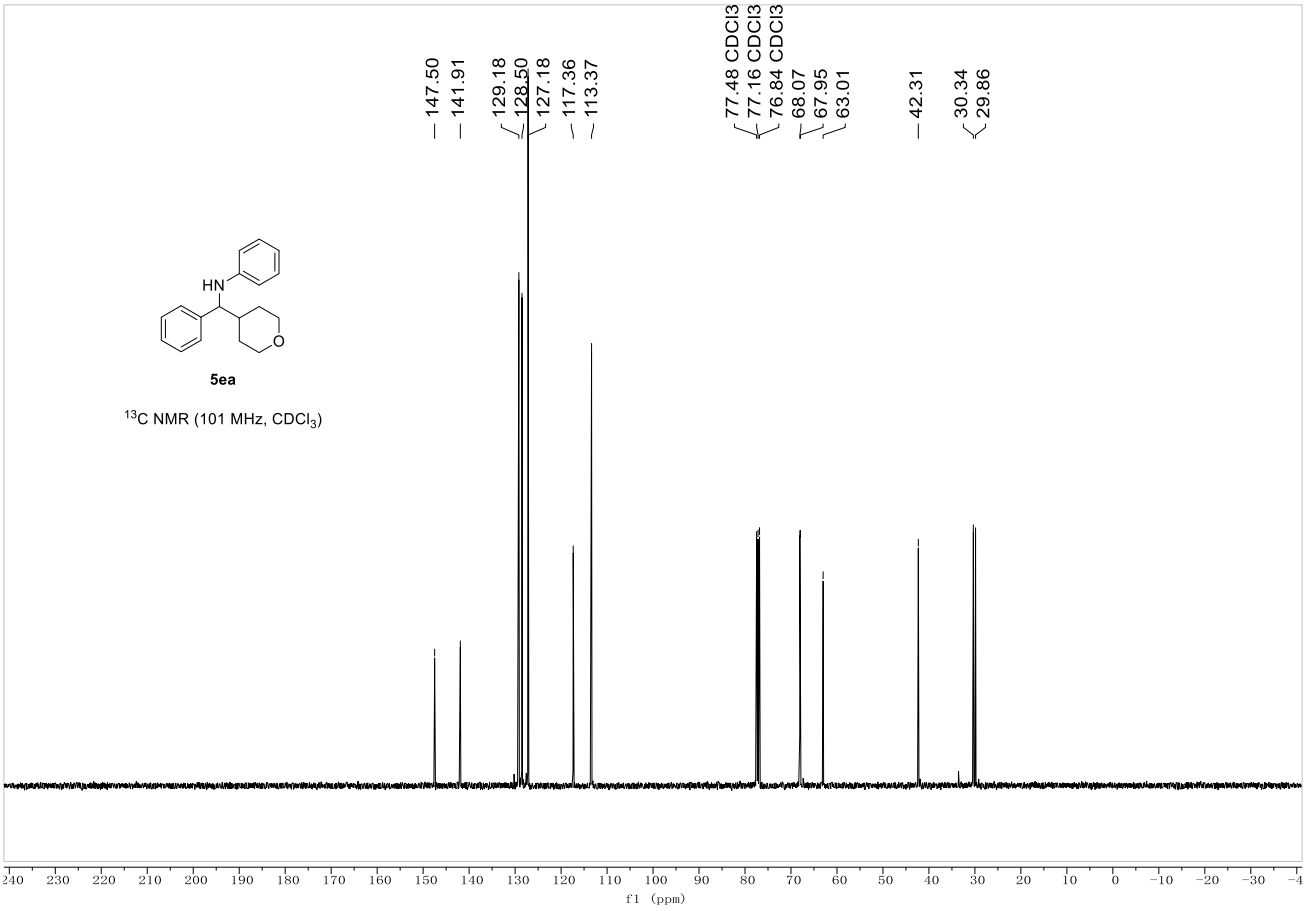

7.27
7.25
7.23
7.21
7.20
7.19
7.17
7.14
7.12
7.10
6.99
6.98
6.95
6.54
6.52
6.50
6.43
6.41
4.10
4.01
3.99
2.12
2.09
2.07
2.05
1.82
1.81
1.80
1.79
1.57
1.56
1.55
1.55
1.54
1.53
1.52
1.50
1.40
1.39
1.38
1.37
1.36 H2O
1.35
1.24
1.22
1.21
1.19
1.18
HN
5ca
1H NMR (400 MHz, CDCl3)
4.05
0.97
1.89
0.94
1.88
0.70
1.04
0.94
1.08
6.21
1.29
f1 (ppm)

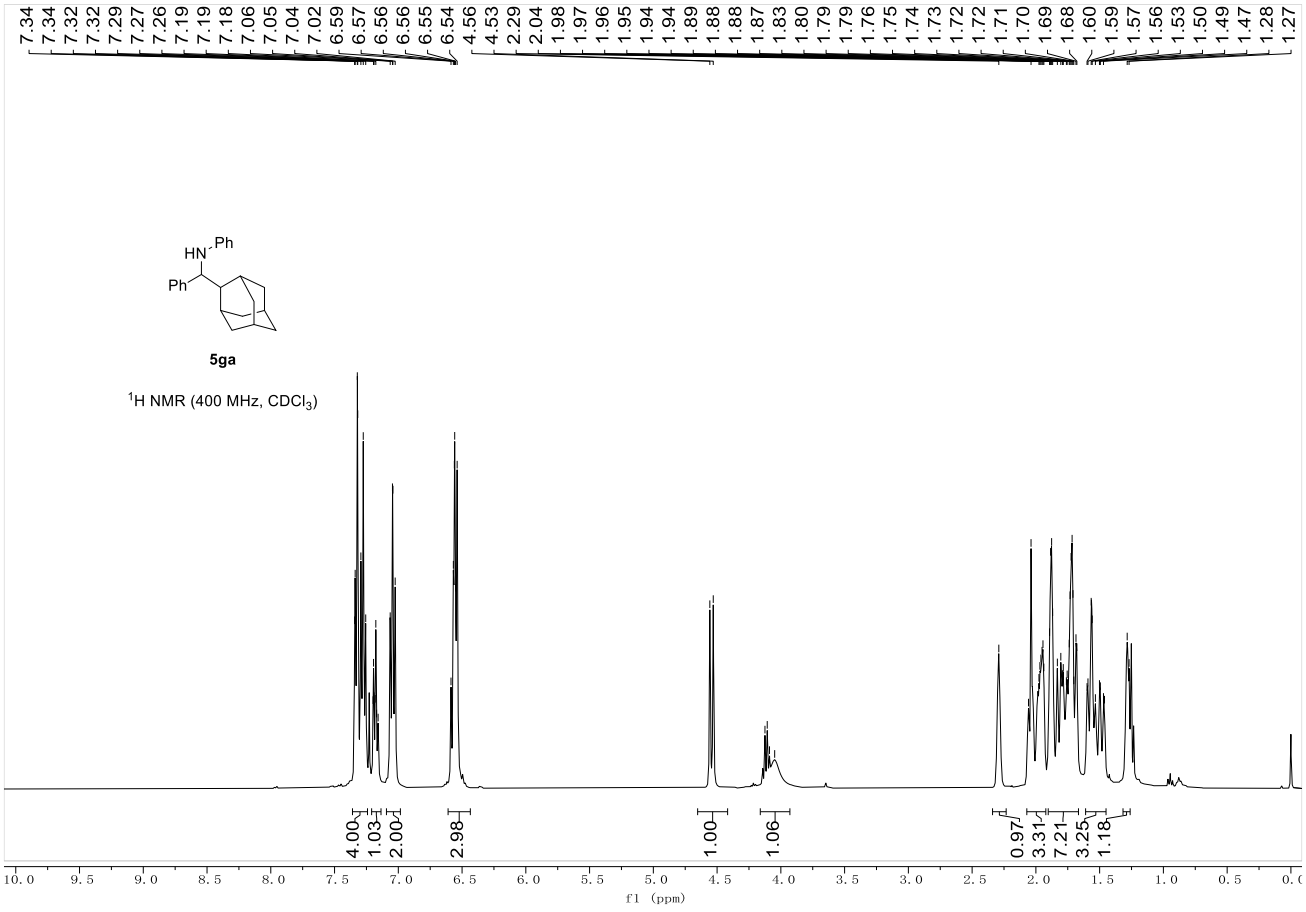

147.78
144.08
129.16
128.43
127.08
126.92
117.13
113.37
77.48 CDCl3
77.16 CDCl3
76.84 CDCl3
63.18
47.91
30.26
30.08
25.36
25.31
HN
5ca
13C NMR (101 MHz, CDCl3)
f1 (ppm)

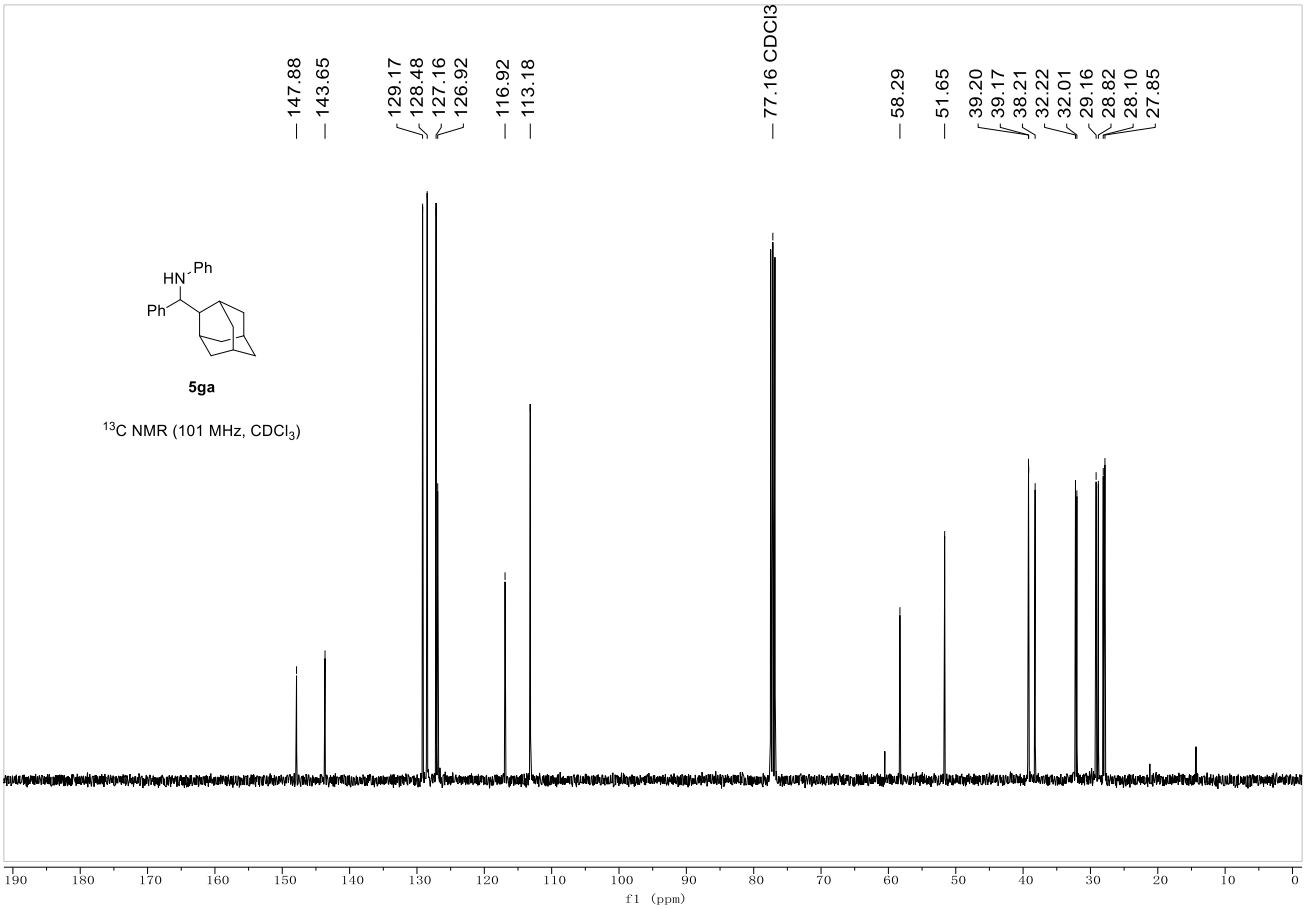

7.26 7.24 7.24 7.23 7.21 7.19 7.15 7.14 7.13 7.11 7.00 6.98 6.96 6.56 6.54 6.52 6.42 6.40 4.09 4.07 2.48 2.46 2.44 2.43 2.42 2.06 2.05 2.05 2.04 2.03 1.84 1.84 1.83 1.82 1.82 1.81 1.80 1.80 1.79 1.79 1.79 1.78 1.78 1.77 1.76 1.76 1.75 1.74 1.73 1.72 1.72 1.72 1.71 1.70 1.70 1.69 1.68 1.18
HN
5da
1H NMR (400 MHz, CDCl3)
4.03 1.26 1.98 0.99 1.98 0.94 0.83 0.93 0.98 4.36 1.02
f1 (ppm)

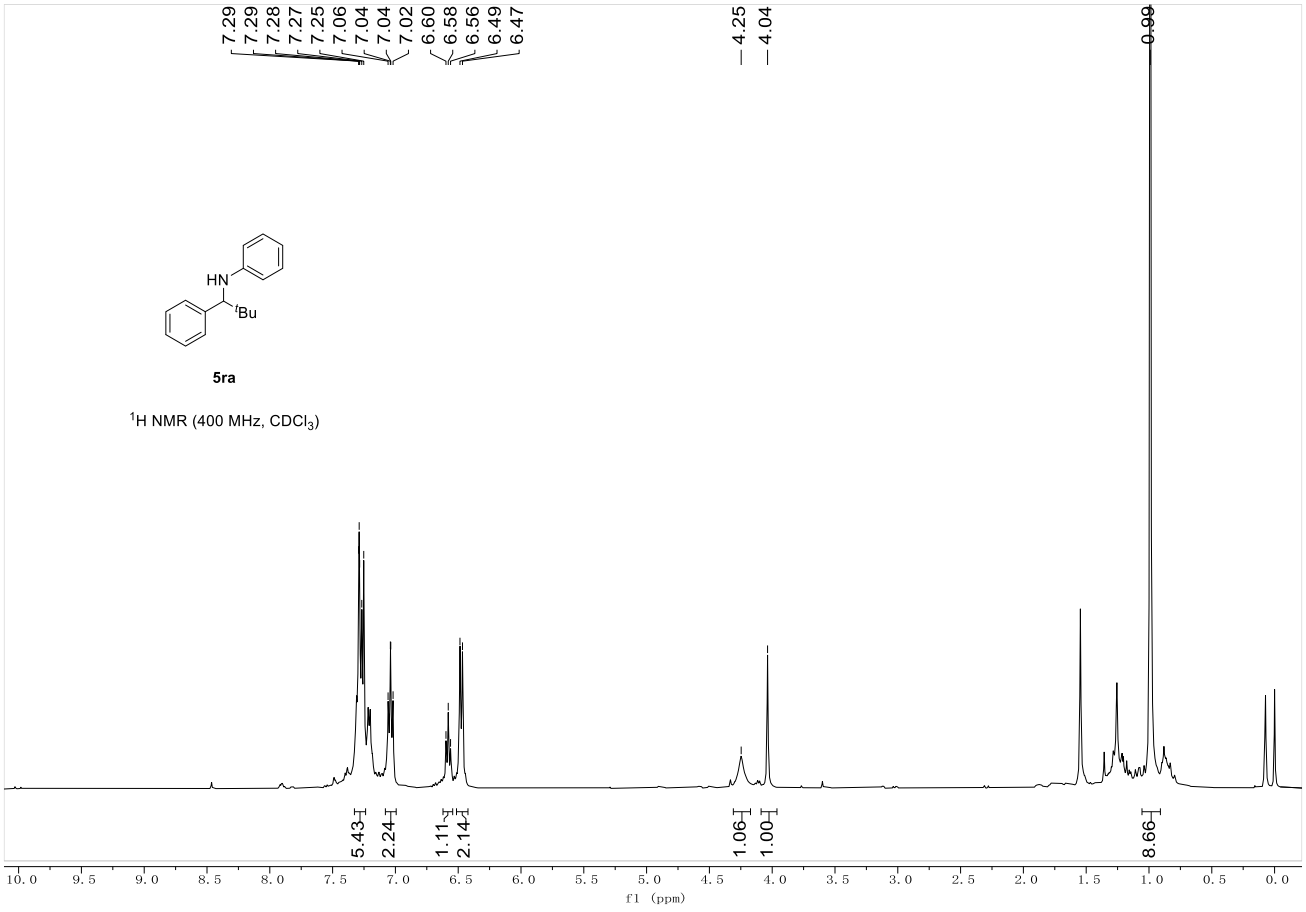

147.80 142.64 129.15 128.51 127.01 126.66 117.25 113.48 77.48 CDCl3 77.16 CDCl3 76.84 CDCl3 63.86 42.68 26.23 25.61 17.65
HN
5da
13C NMR (101 MHz, CDCl3)
f1 (ppm)

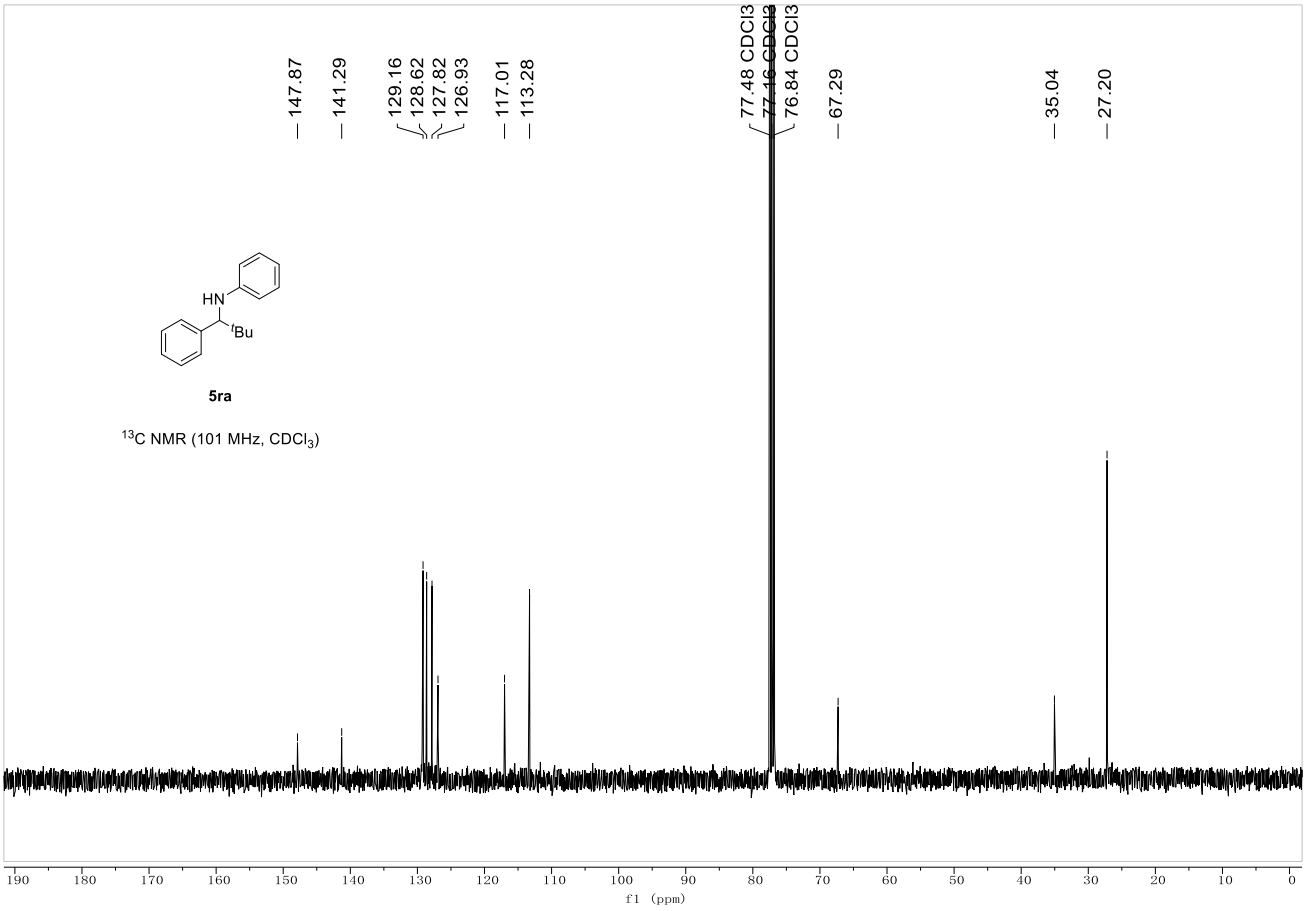

7.29 7.28 7.28 7.26 7.23 7.22 7.22 7.21 7.20 7.20 7.08 7.06 7.06 7.04 6.63 6.61 6.59 6.52 6.50 4.12 4.11 4.02 4.01 4.00 3.99 3.98 3.95 3.94 3.92 3.91 3.90 3.34 3.33 3.32 3.31 3.31 3.30 3.29 3.28 1.85 1.81 1.80 1.79 1.78 1.78 1.77 1.49 1.48 1.46 1.45 1.43 1.42 1.32 1.32 1.31 1.31 1.28 1.28
HN
O
5ea
1H NMR (400 MHz, CDCl3)
3.88 1.19 1.99 0.96 1.98 2.00 2.13 2.03 2.25 2.11 1.22
f1 (ppm)

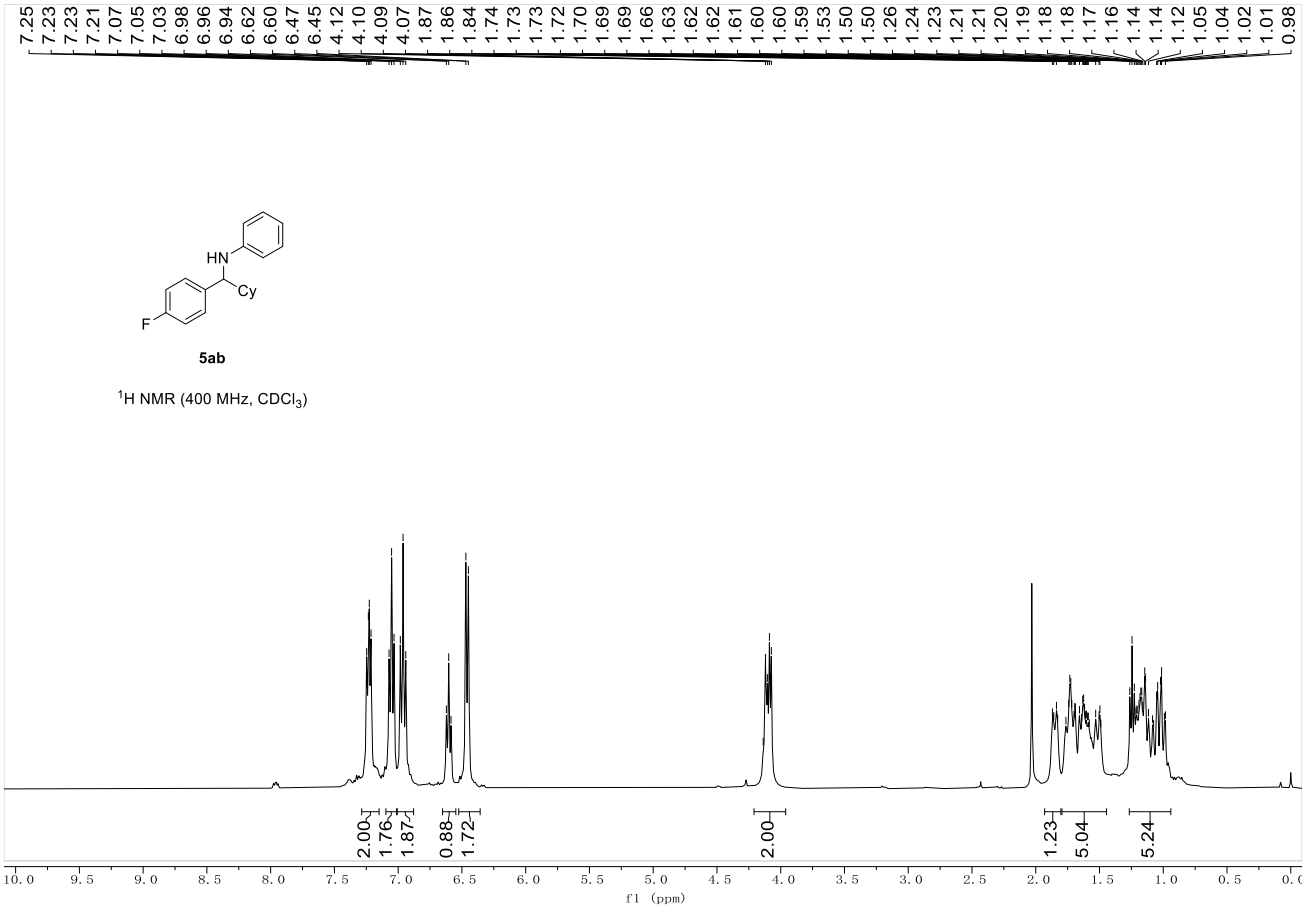

147.50 141.91 129.18 128.50 127.18 117.36 113.37
77.48 CDCl3 77.16 CDCl3 76.84 CDCl3 68.07 67.95 63.01
42.31 30.34 29.86
HN
O
5ea
13C NMR (101 MHz, CDCl3)
f1 (ppm)


7.34 7.34 7.32 7.32 7.29 7.27 7.26 7.19 7.18 7.06 7.05 7.04 7.02 6.59 6.57 6.56 6.56 6.55 6.54 4.56 4.53 2.29 2.04 1.98 1.97 1.96 1.95 1.94 1.94 1.89 1.88 1.88 1.87 1.83 1.80 1.79 1.79 1.76 1.75 1.74 1.73 1.72 1.72 1.71 1.70 1.69 1.68 1.60 1.59 1.57 1.56 1.53 1.50 1.49 1.47 1.28 1.27
HN Ph
Ph
5ga
1H NMR (400 MHz, CDCl3)
4.00 1.03 2.00 2.98 1.00 1.06 0.97 3.31 7.21 3.25 1.18
f1 (ppm)


147.88 143.65 129.17 128.48 127.16 126.92 116.92 113.18 77.16 CDCl3 58.29 51.65 39.20 39.17 38.21 32.22 32.01 29.16 28.82 28.10 27.85
HN Ph
Ph
5ga
13C NMR (101 MHz, CDCl3)
f1 (ppm)

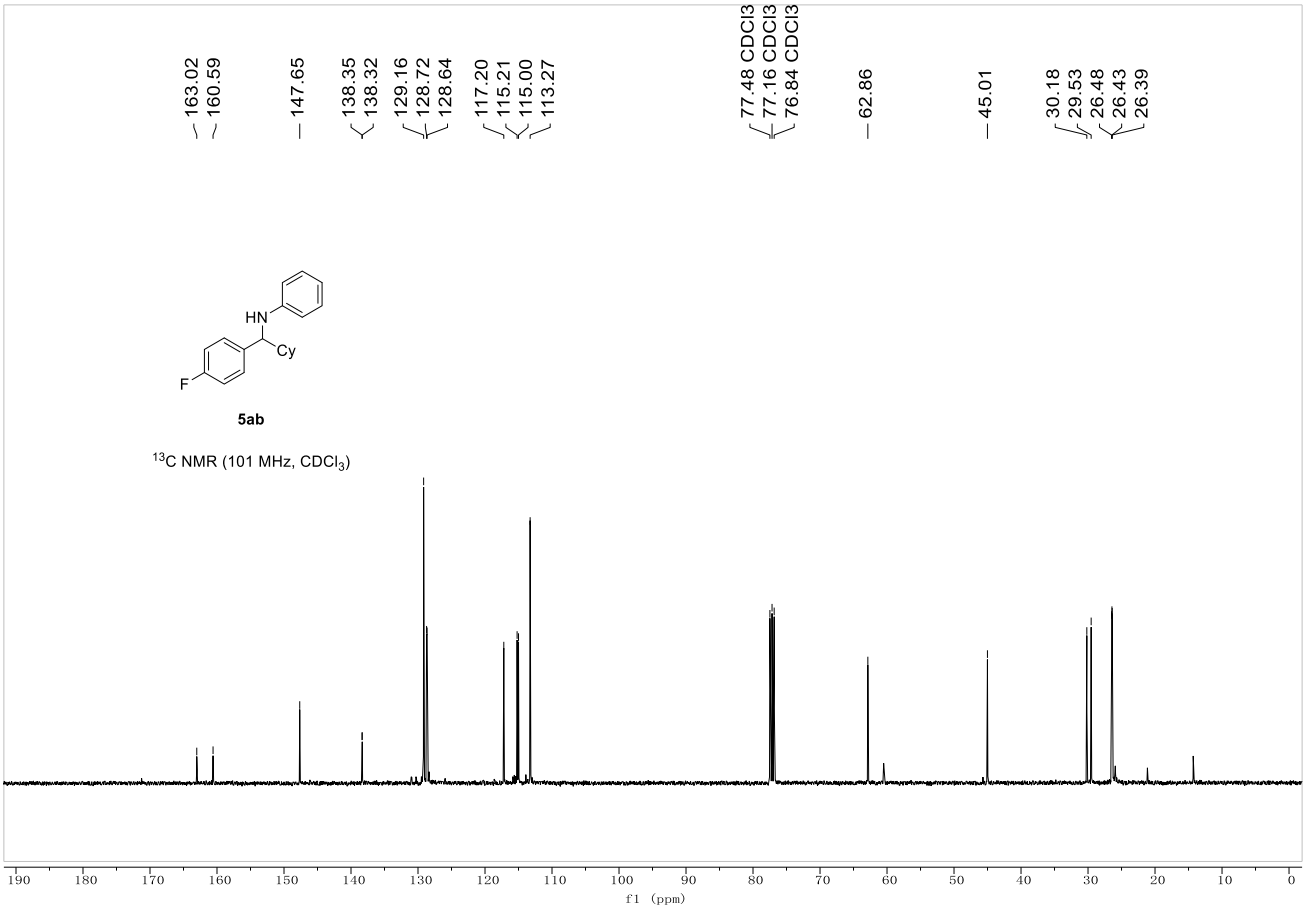

7.29
7.29
7.28
7.27
7.25
7.06
7.04
7.04
7.02
6.60
6.58
6.56
6.49
6.47
4.25
4.04
0.99
HN
tBu
5ra
1H NMR (400 MHz, CDCl3)
5.43
2.24
1.11
2.14
1.06
1.00
8.66
f1 (ppm)


147.87
141.29
129.16
128.62
127.82
126.93
117.01
113.28
77.48 CDCl3
77.16 CDCl3
76.84 CDCl3
67.29
35.04
27.20
HN
tBu
5ra
13C NMR (101 MHz, CDCl3)
f1 (ppm)



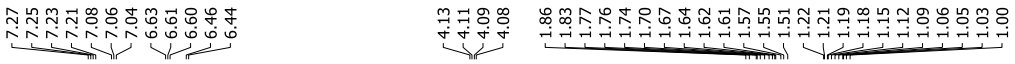
5ab

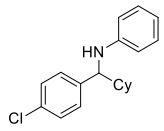
^{1}H NMR (400 MHz, $CDCl_3$)



5ab

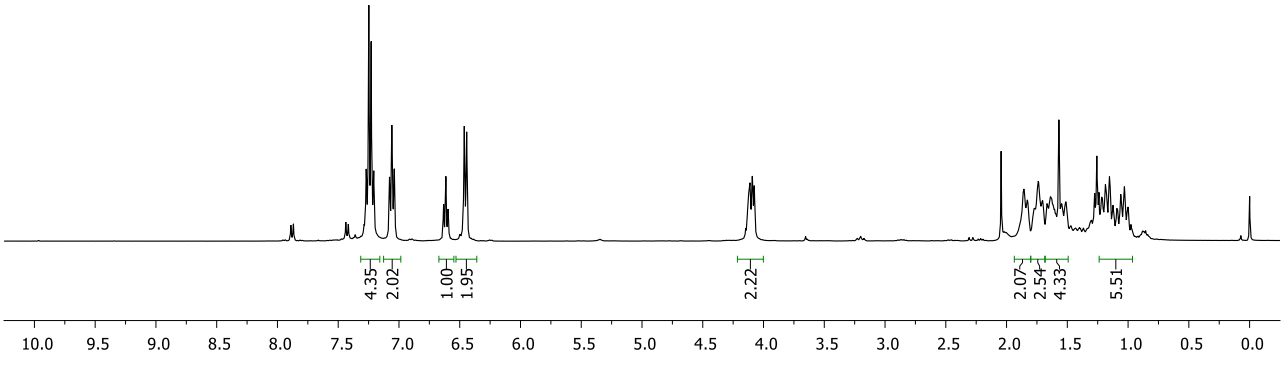
^{13}C NMR (101 MHz, $CDCl_3$)

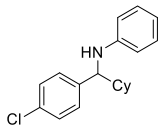




5ac

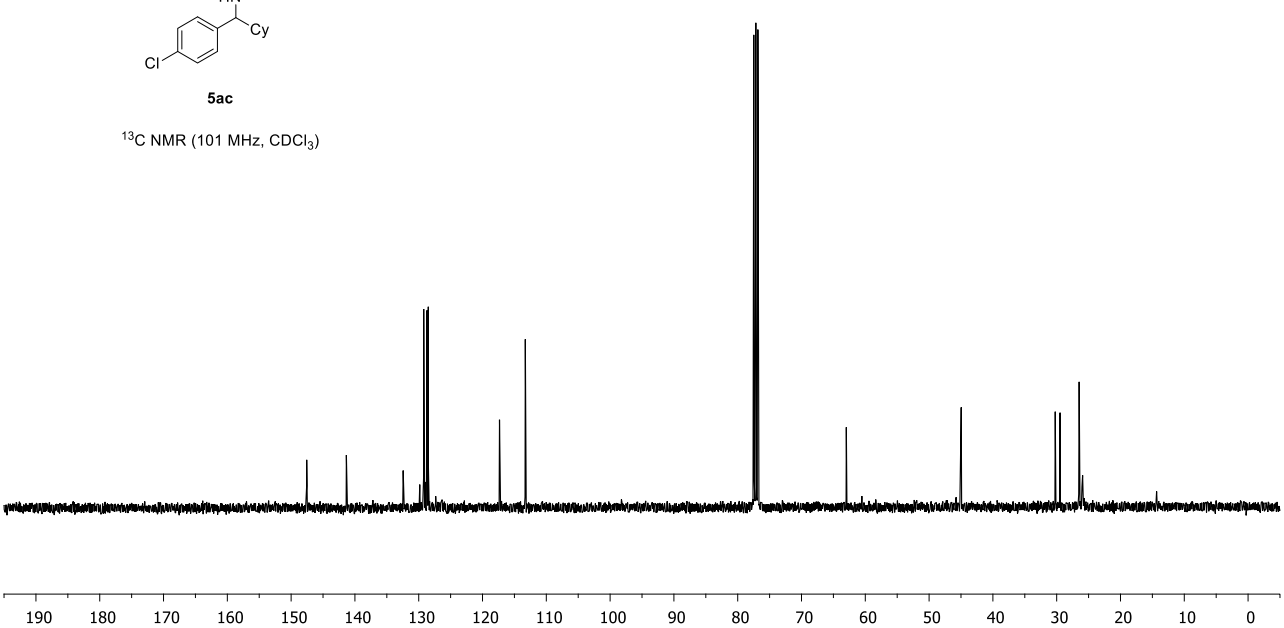
^{1}H NMR (400 MHz, $CDCl_3$)

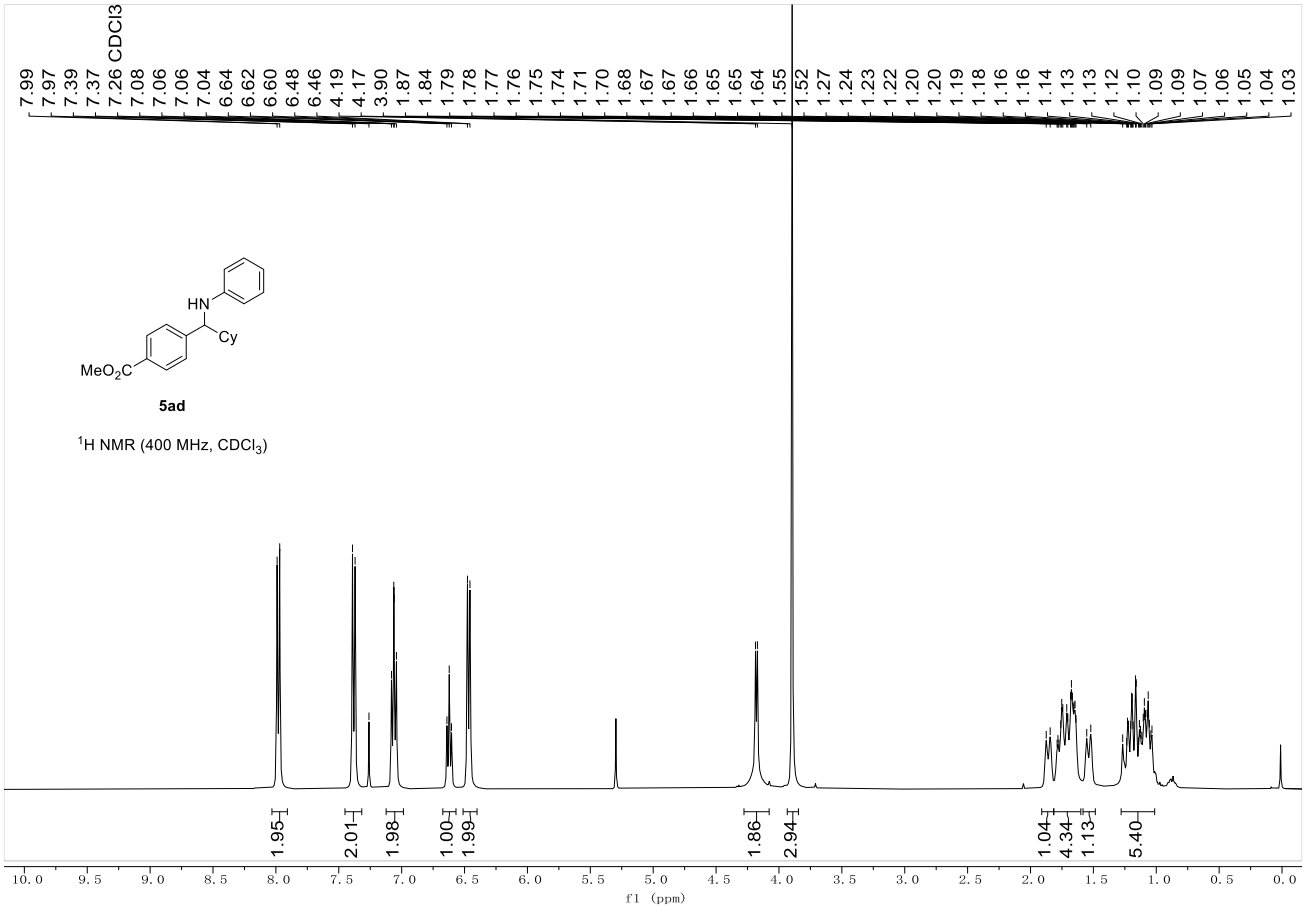




5ac

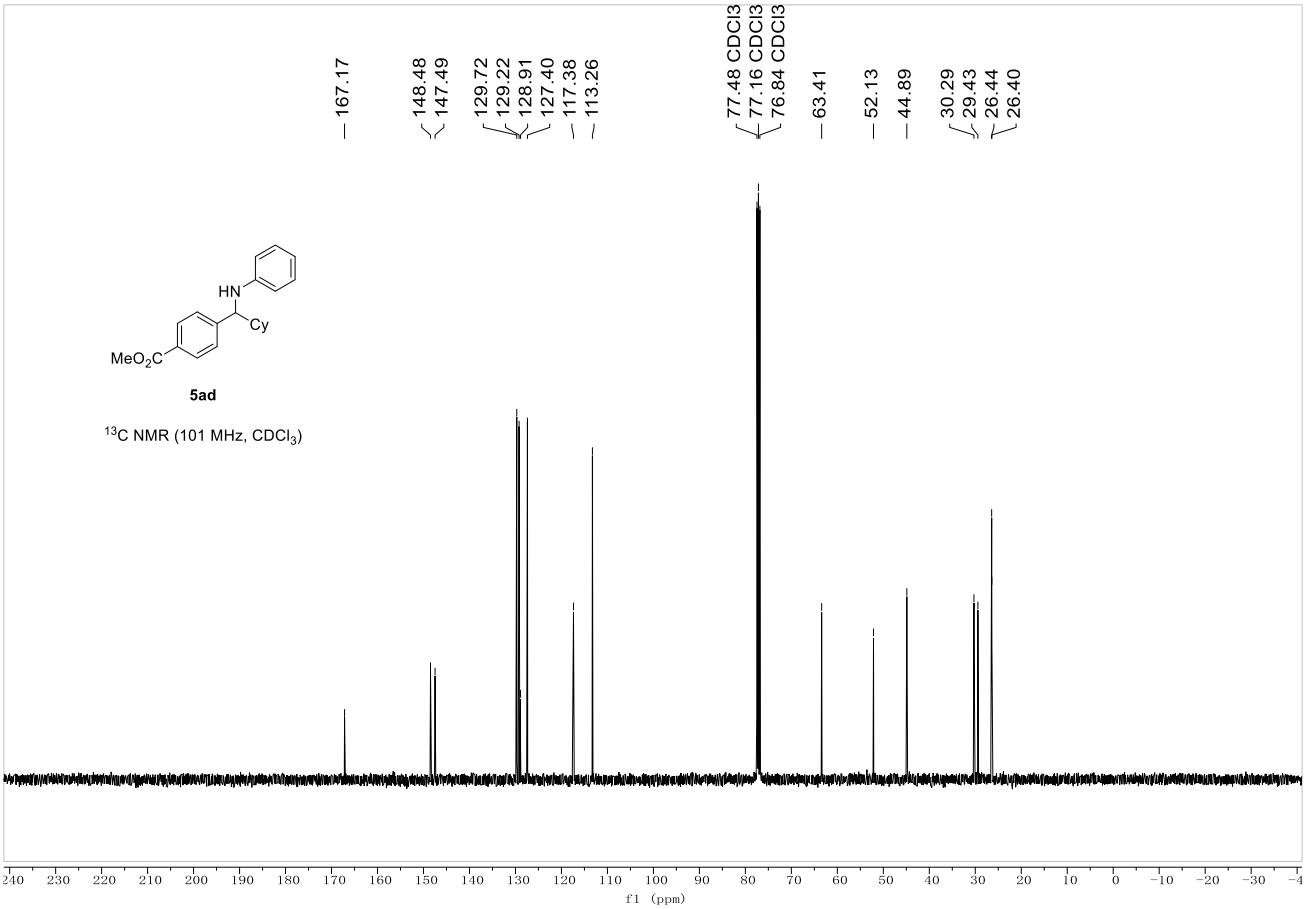
^{13}C NMR (101 MHz, $CDCl_3$)





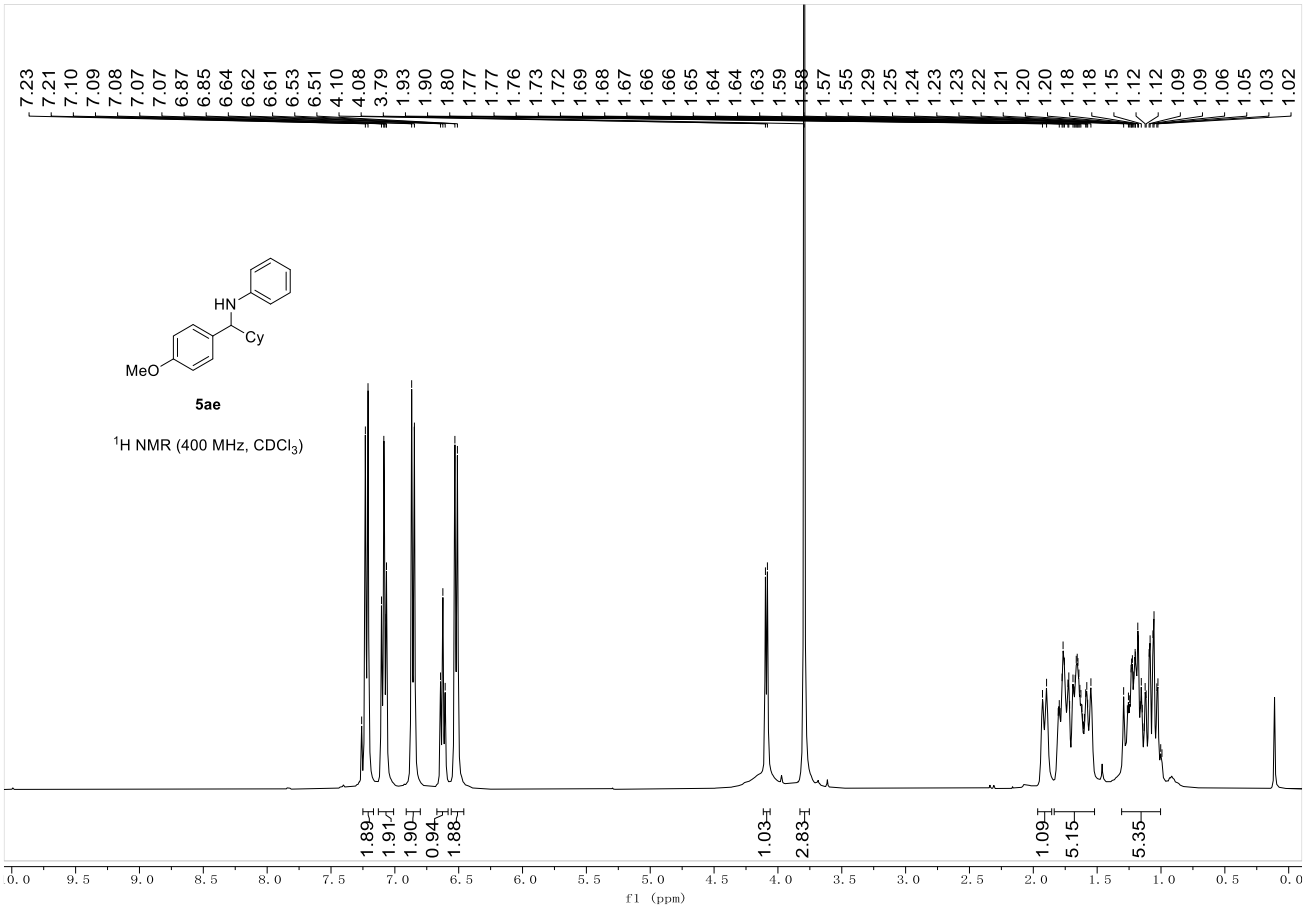
5ad

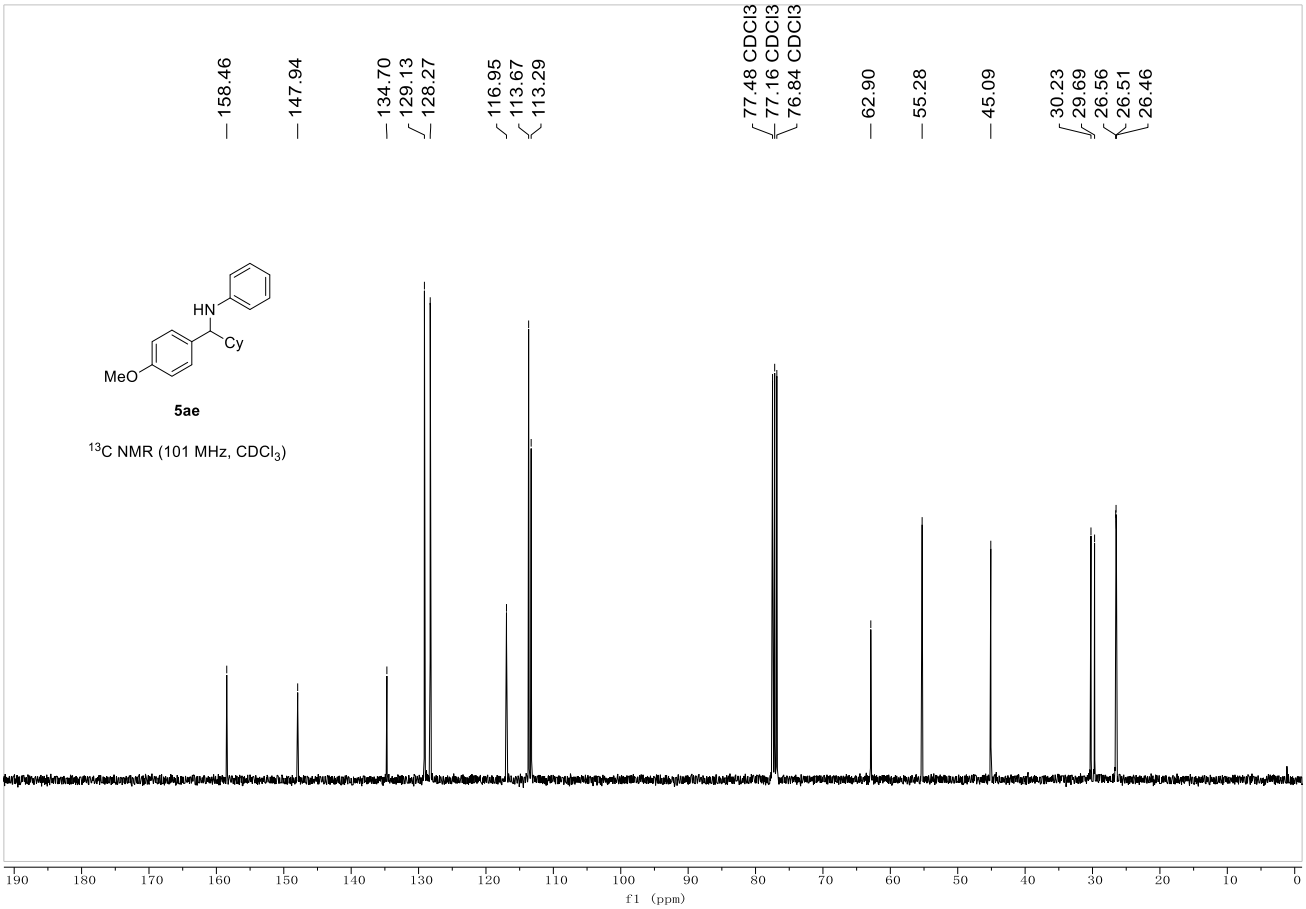
^{1}H NMR (400 MHz, $CDCl_3$)

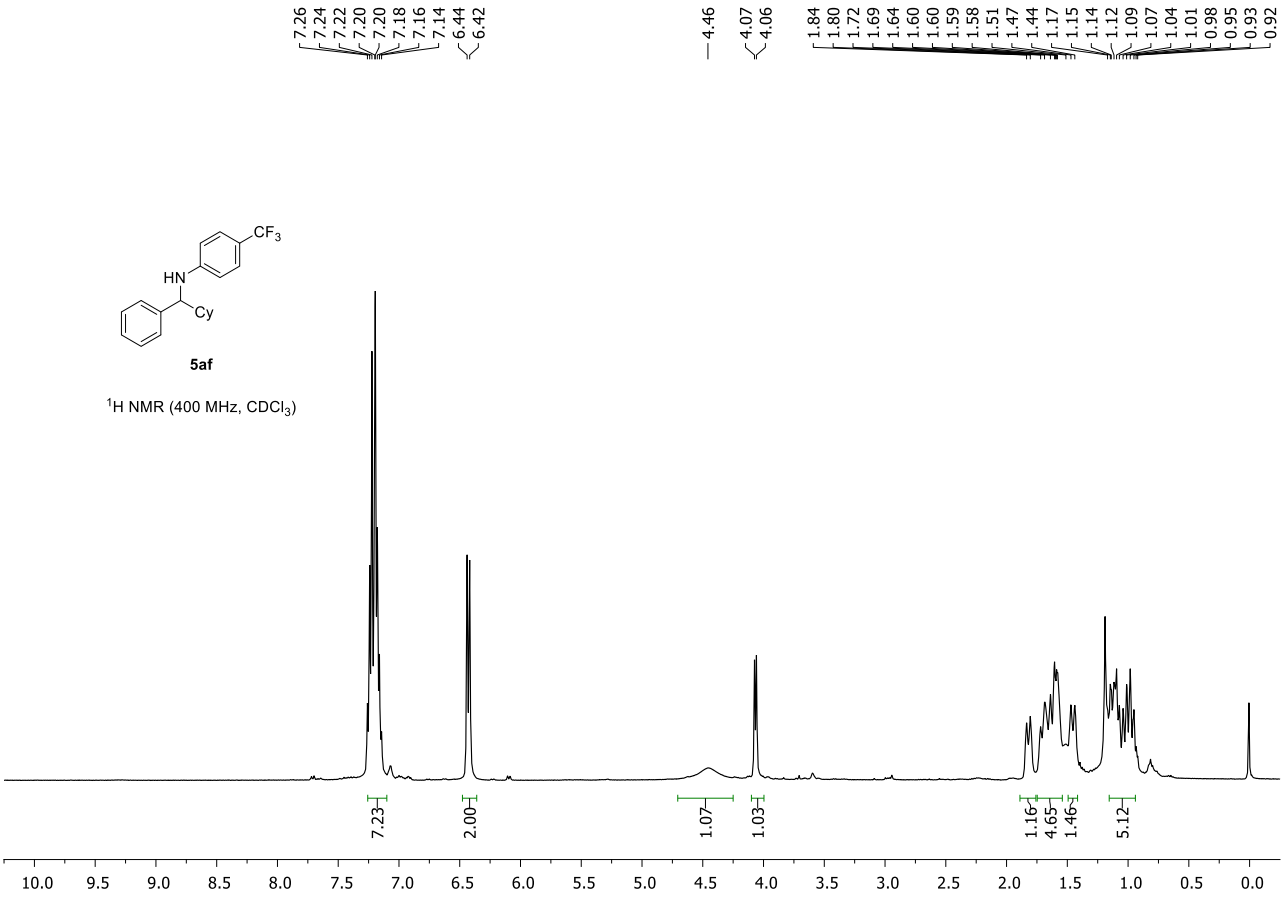


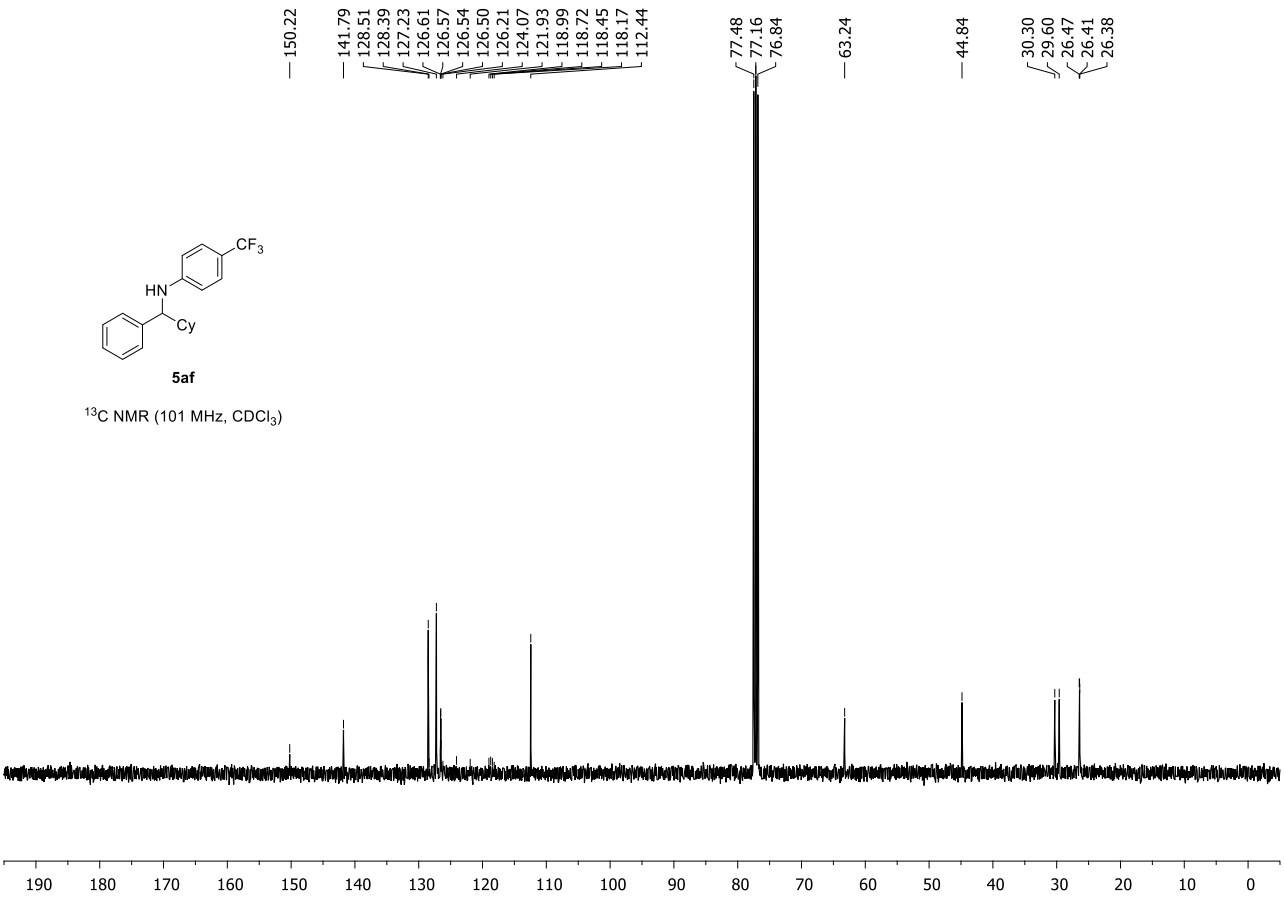
5ad

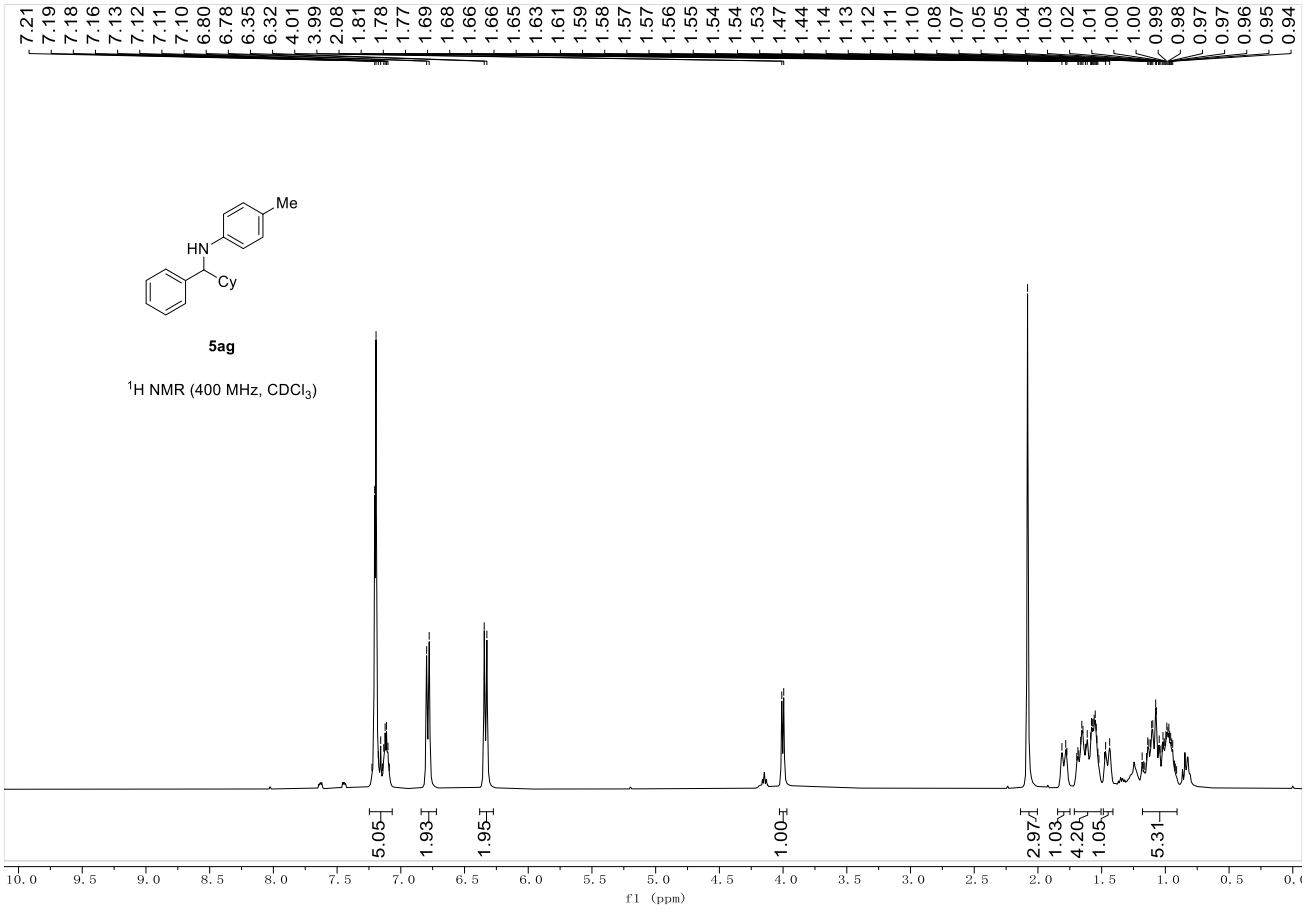
^{13}C NMR (101 MHz, $CDCl_3$)

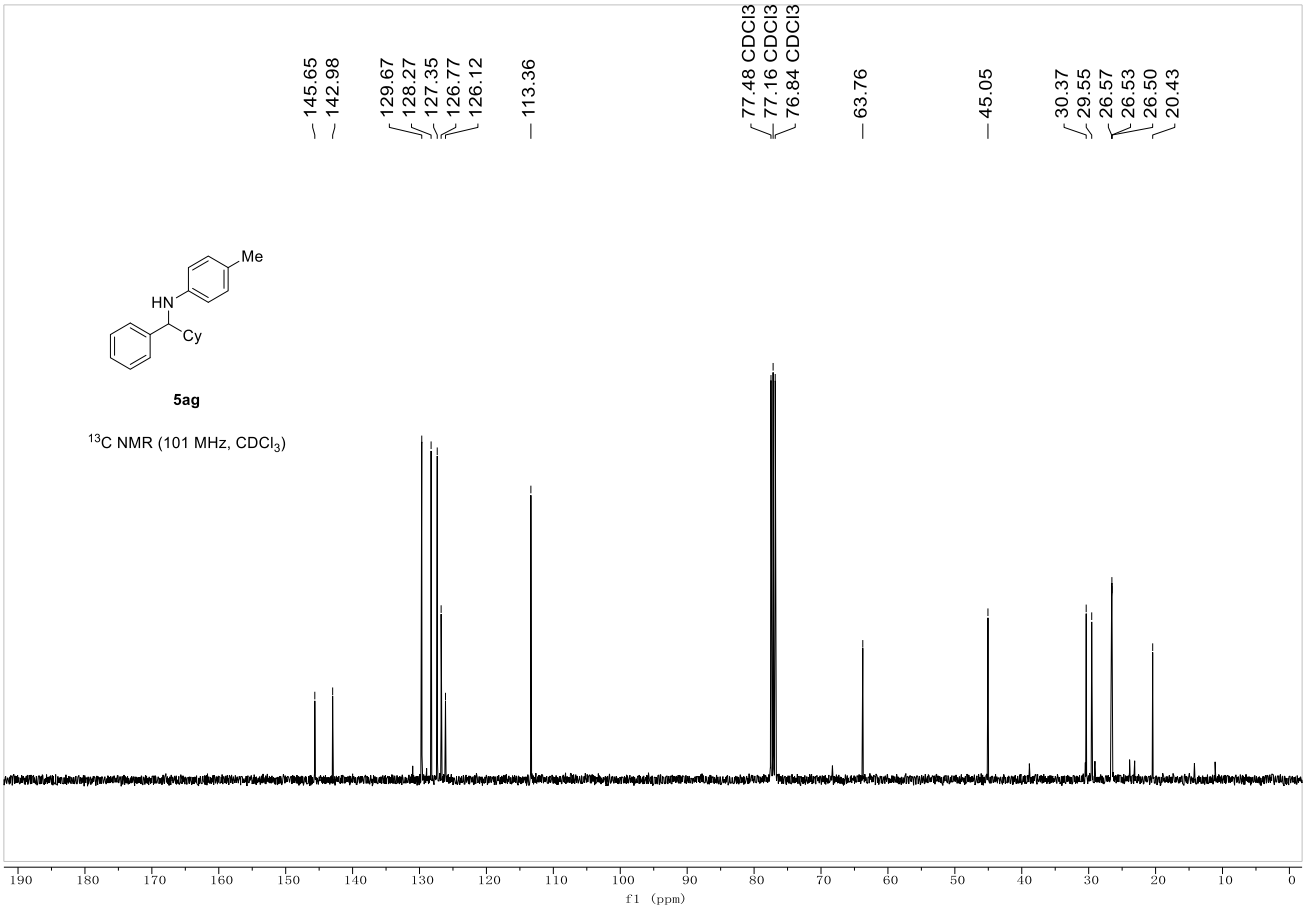

7.23 7.21 7.10 7.09 7.08 7.07 7.07 6.87 6.85 6.64 6.62 6.61 6.53 6.51 4.10 4.08 3.79 1.93 1.90 1.80 1.77 1.77 1.76 1.73 1.72 1.69 1.68 1.67 1.66 1.66 1.65 1.64 1.64 1.63 1.59 1.58 1.57 1.55 1.29 1.25 1.24 1.23 1.23 1.22 1.21 1.20 1.20 1.18 1.18 1.15 1.12 1.12 1.09 1.09 1.06 1.05 1.03 1.02
HN
Cy
MeO
5ae
1H NMR (400 MHz, CDCl3)
1.89 1.91 1.90 0.94 1.88 1.03 2.83 1.09 5.15 5.35
f1 (ppm)

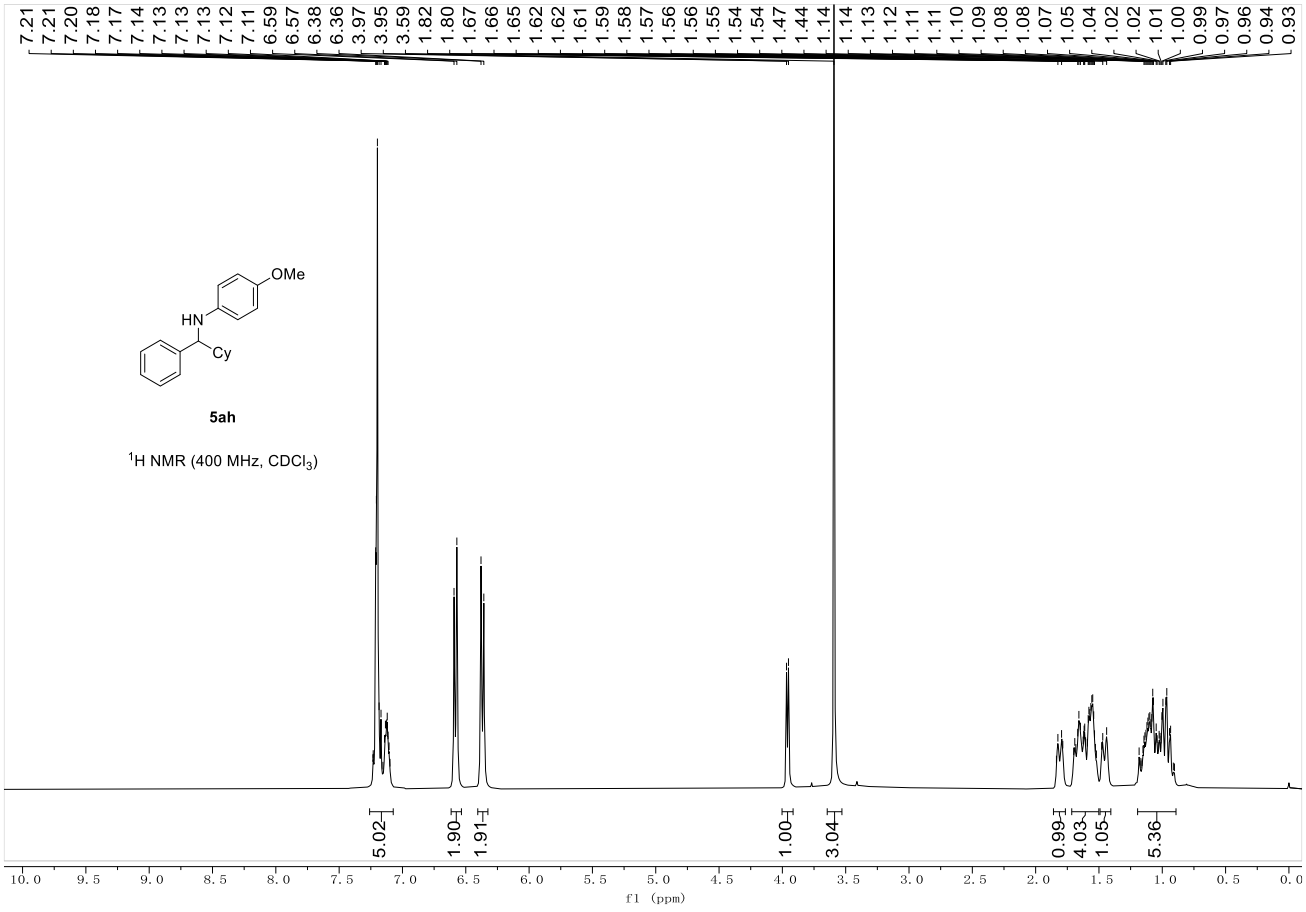

158.46 147.94 134.70 129.13 128.27 116.95 113.67 113.29 77.48 CDCl3 77.16 CDCl3 76.84 CDCl3 62.90 55.28 45.09 30.23 29.69 26.56 26.51 26.46
HN
Cy
MeO
5ae
13C NMR (101 MHz, CDCl3)
f1 (ppm)

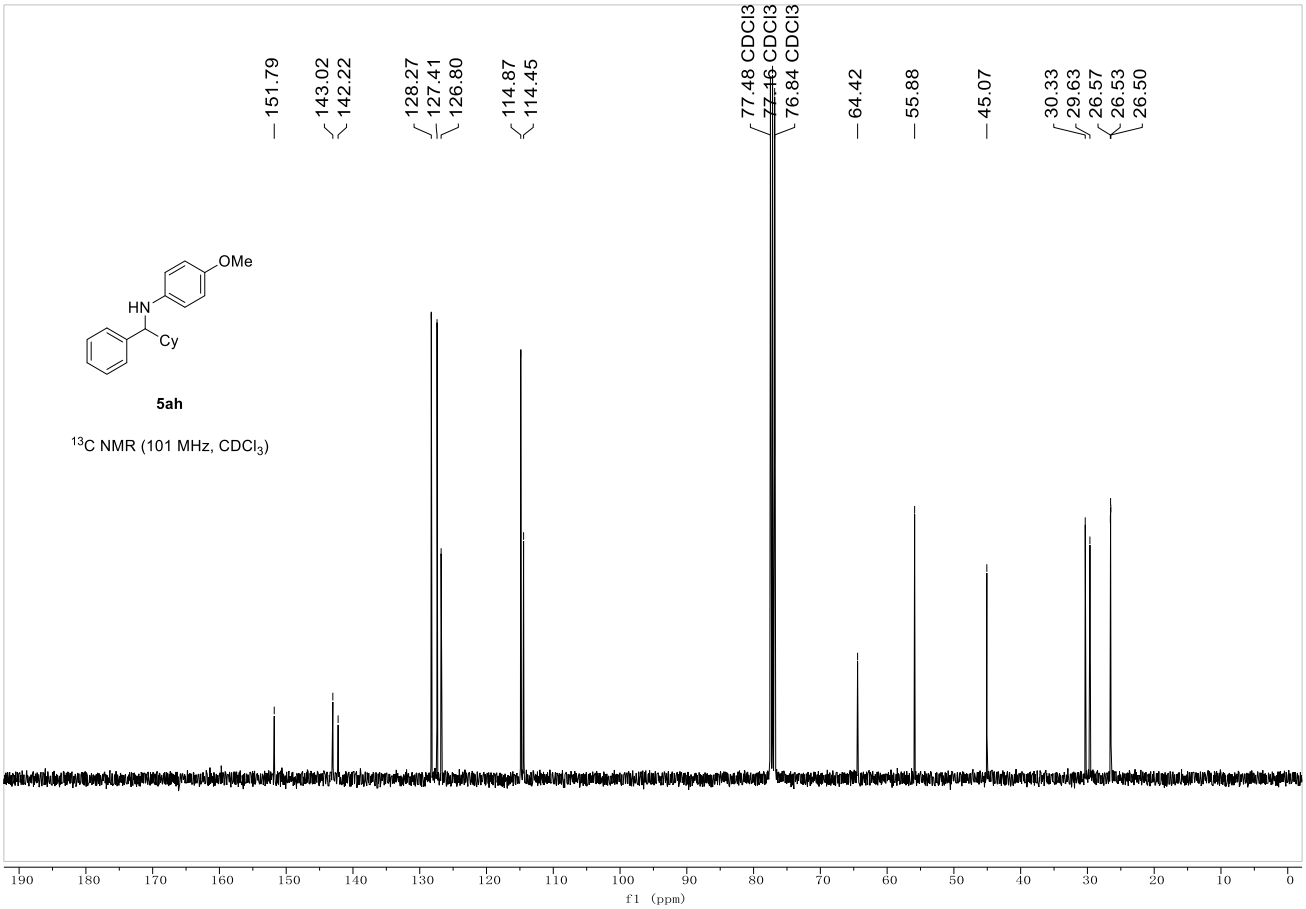

7.26
7.24
7.22
7.20
7.20
7.18
7.16
7.14
6.44
6.42
4.46
4.07
4.06
1.84
1.80
1.72
1.69
1.64
1.60
1.60
1.59
1.58
1.51
1.47
1.44
1.17
1.15
1.14
1.12
1.09
1.07
1.04
1.01
0.98
0.95
0.93
0.92
CF3
HN
Cy
5af
1H NMR (400 MHz, CDCl3)
7.23
2.00
1.07
1.03
1.16
4.65
1.46
5.12
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0

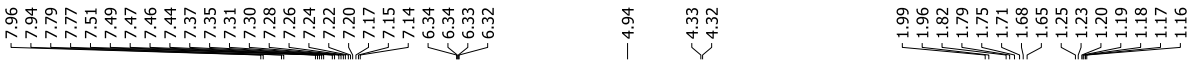

150.22
141.79
128.51
128.39
127.23
126.61
126.57
126.54
126.50
126.21
124.07
121.93
118.99
118.72
118.45
118.17
112.44
77.48
77.16
76.84
63.24
44.84
30.30
29.60
26.47
26.41
26.38
CF3
HN
Cy
5af
13C NMR (101 MHz, CDCl3)
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0

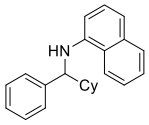

7.21 7.19 7.18 7.16 7.13 7.12 7.11 7.10 6.80 6.78 6.35 6.32 4.01 3.99 2.08 1.81 1.78 1.77 1.69 1.68 1.66 1.66 1.65 1.63 1.61 1.59 1.58 1.57 1.57 1.56 1.55 1.54 1.54 1.53 1.47 1.44 1.14 1.13 1.12 1.11 1.10 1.08 1.07 1.05 1.05 1.04 1.03 1.02 1.01 1.00 1.00 0.99 0.98 0.97 0.97 0.96 0.95 0.94
Me
HN
Cy
5ag
1H NMR (400 MHz, CDCl3)
5.05
1.93
1.95
1.00
2.97
1.03
4.20
1.05
5.31
f1 (ppm)


145.65
142.98
129.67
128.27
127.35
126.77
126.12
113.36
77.48 CDCl3
77.16 CDCl3
76.84 CDCl3
63.76
45.05
30.37
29.55
26.57
26.53
26.50
20.43
Me
HN
Cy
5ag
13C NMR (101 MHz, CDCl3)
f1 (ppm)


7.21 7.21 7.20 7.18 7.17 7.14 7.13 7.13 7.12 7.11 6.59 6.57 6.38 6.36 3.97 3.95 3.59 1.82 1.80 1.67 1.66 1.65 1.62 1.62 1.61 1.59 1.58 1.57 1.56 1.56 1.55 1.54 1.54 1.47 1.44 1.14 1.14 1.13 1.12 1.11 1.11 1.10 1.09 1.08 1.08 1.07 1.05 1.04 1.02 1.02 1.01 1.00 0.99 0.97 0.96 0.94 0.93
OMe
HN
Cy
5ah
1H NMR (400 MHz, CDCl3)
5.02 1.90 1.91 1.00 3.04 0.99 4.03 1.05 5.36
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)

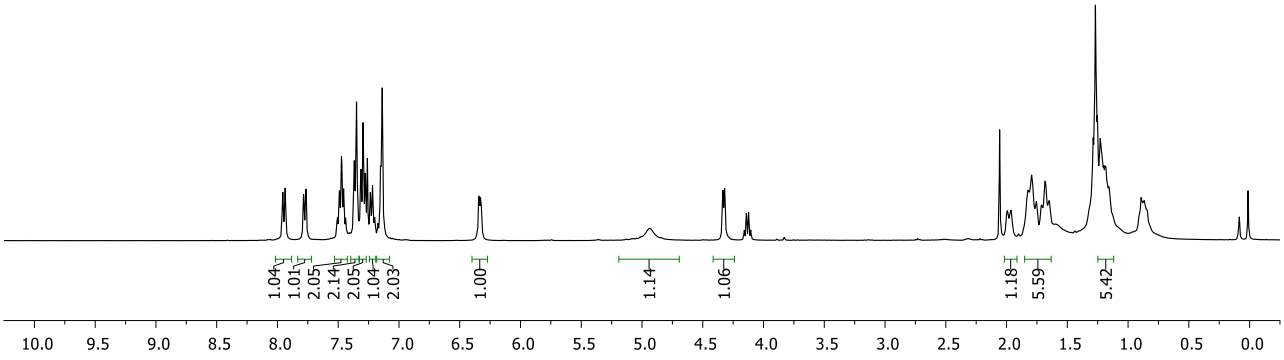

151.79
143.02 142.22
128.27 127.41 126.80
114.87 114.45
77.48 CDCl3 77.16 CDCl3 76.84 CDCl3
64.42
55.88
45.07
30.33 29.63 26.57 26.53 26.50
OMe
HN
Cy
5ah
13C NMR (101 MHz, CDCl3)
190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

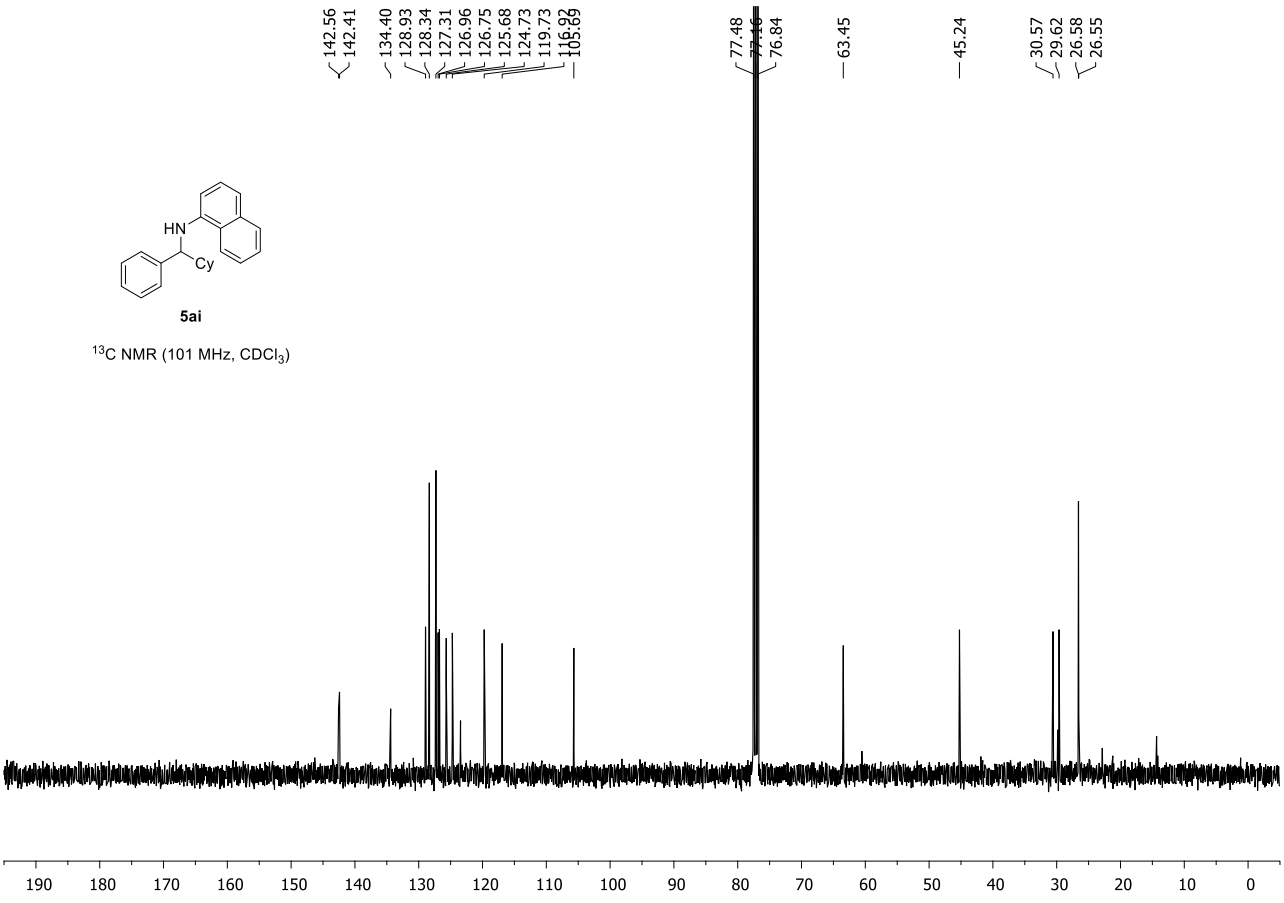




5ai

^{1}H NMR (400 MHz, $CDCl_3$)





5ai

^{13}C NMR (101 MHz, $CDCl_3$)