Supporting Information

Highly efficient, enantioselective syntheses of (*S*)-(+)- and (*R*)-(-)-dapoxetine starting with 3-phenyl-1-propanol

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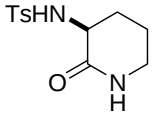
General: All commercial reagents were used as obtained commercially unless otherwise noted. Reactions were performed using oven dried glassware under an atmosphere of nitrogen. Dichloromethane (DCM) was dried with CaH and distilled prior to use. Flash column chromatography was carried out on Fuji Chromatorex silica gel (38-75 μm). Analytical thin layer chromatography (TLC) was performed on Merck silica gel 60 F_{254} plates. Visualization of the developed chromatogram was accomplished with UV light and by staining with ethanolic phosphomolybdic acid (PMA) solution followed by heating.

Nuclear magnetic resonance (NMR) spectra were recorded using Bruker 500 MHz NMR instrument (^{1}H NMR at 500 MHz and ^{13}C NMR at 125 MHz) and Bruker 300 MHz NMR instrument (^{1}H NMR at 300 MHz and ^{13}C NMR at 75 MHz). ^{1}H NMR data are reported as follows: chemical shift (δ, ppm), multiplicity (s = singlet, d = doublet, t = triplet, q = quartet, m = multiplet, br = broad), integration, coupling constants (Hz). Data for ^{13}C NMR are reported in terms of chemical shift (δ, ppm). High performance liquid chromatography (HPLC) was carried out on a Perkin Elmer series 200 HPLC equipped with a Chiralcel OD-H column. Specific rotations were measured on a Rudolph Autopol IV (Automatic polarimeter). High-resolution mass spectra were obtained from the center for chemical analysis in Korea Research Institute of Chemical Technology. Sulfamate ester **3** was prepared from the alcohol **2** according to a protocol reported by Du Bois and coworkers.[a] Preparation of Rh_2(*S*-nap)$_4$ catalyst was reported by Du Bois and coworkers.[b] Rh_2(*R*-nap)$_4$ catalyst was prepared by reaction between $Rh_2(OAc)_4$ and (*R*)-3-tosylamino-valerolactam, which is obtained from unnatural D-(-)-ornithine hydrochloride in a manner that is similar to the procedure employed for the preparation of Rh_2(*S*-nap)$_4$ catalyst from L-(+)-ornithine hydrochloride.[b,c]

(*S*)-4-Methyl-*N*-(2-oxo-piperidin-3-yl)-benzenesulfonamide.



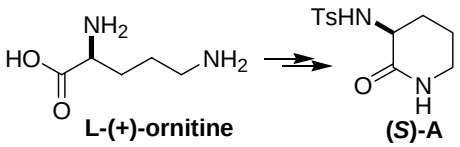
Prepared from L-(+)-ornithine hydrochloride according to the procedure of Du Bois and coworkers.[b]

Acetyl chloride (5.3 mL, 74.1 mmol) was slowly added over a 5 min period to an ice-cold suspension of L-(+)-ornithine hydrochloride (5 g, 29.7 mmol) in 120 mL of MeOH. The mixture was stirred at 0 ^{o}C for 10 min, the flask was then fitted with a reflux condenser, and the contents heated at 65 ^{o}C for

12 h. The clear, colorless solution was cooled to room temperature and concentrated under reduced pressure to give clear oil. This material was allowed to stand under high vacuum for 4 h prior to subsequent use; during this time the compound solidified. The solid mass was dissolved in 120 mL of MeOH to which Et_3N (12.4 mL, 89.1 mmol) was then added. The reaction mixture was stirred at 65 ^oC for 2 h. Following this time, the solution was concentrated under reduced pressure and the isolated solid was placed under high vacuum for 3 h. The off-white mass was suspended in 100 mL of DCM and to this mixture was added pyridine (4.8 mL, 59.4 mmol). The flask was set in an ice bath and charged with *p*-toluenesulfonyl chloride (6.8 g, 35.6 mmol). The mixture was warmed slowly to room temperature, stirred for 8 h, and then concentrated under reduced pressure to an orange solid. This material was transferred to a separatory funnel with 200 mL of warm EtOAc and washed with 80 mL of saturated aqueous NH_4Cl (3 times). The organic layer was collected, dried over anhydrous $MgSO_4$, filtered, and concentrated under reduced pressure to a white solid. Recrystallization of this material using hot EtOAc furnished the desired lactam as colorless needles (2.1 g, 26% overall).

$[\alpha]_D^{32}$= +50.7 (c 1.08, DMSO), $[\alpha]_D^{28}$= +121.8 (c 1.09, $CHCl_3$); ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.78 (d, 2H, *J* = 8.1 Hz), 7.30 (d, 2H, *J* = 8.1 Hz), 6.26 (br s, 1H), 5.95 (br, s, 1H), 3.47-3.50 (m, 1H), 3.25-3.28 (m, 2H), 2.45-2.48 (m, 1H), 2.42 (s, 3H), 1.66-2.05 (m, 3H).; ^{13}C NMR (75 MHz, $CDCl_3$) δ 169.9, 143.6, 136.0, 129.7, 127.4, 53.3, 41.9, 28.5, 21.5, 20.8.; HRMS (EI): *m*/*z* Calcd for $C_{12}H_{16}N_2O_3S$ 268.0882, found 268.0880.

The sign and magnitude of the optical rotation of **(*S*)-4-methyl-N-(2-oxo-piperidin-3-yl)-benzenesulfonamide** ligand (**A**: $[\alpha]_D^{25}$ = -91.1 (*c* 1.1, DMSO)), prepared from L-(+)-ornithine by the Du Bois group,[b] is greatly different from those reported in the literature[c] [$[\alpha]_D^{22}$ = +128 (*c* 1.05, $CHCl_3$)] and ours [$[\alpha]_D^{32}$ = +50.7 (*c* 1.08, DMSO), $[\alpha]_D^{28}$ = +121.8 (*c* 1.09, $CHCl_3$)].

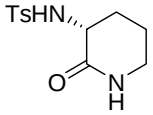


(a) Espino, C. G.; Wehn, P. M.; Chow, J.; Du Bois, J. *J. Am. Chem. Soc.* **2001,** *123*, 6935

(b) Zalatan, D. N.; Du Bois, J. *J. Am. Chem. Soc.* **2008,** *130*, 9220.

(c) Maguire, M. P.; Feldman, P. L.; Rapoport, H. *J. Org. Chem.* **1990**, *55*, 948.

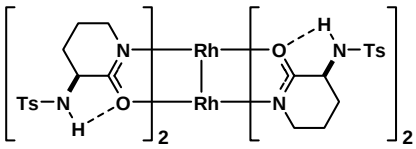
(*R*)-4-Methyl-N-(2-oxo-piperidin-3-yl)-benzenesulfonamide.



Prepared from D-(-)-ornithine hydrochloride as colorless needles (28% overall) by using a manner identical to (*S*)-4-methyl-N-(2-oxo-piperidin-3-yl)-benzenesulfonamide.

$[\alpha]_D^{29}$= -50.9 (c 1.01, DMSO), $[\alpha]_D^{29}$= -123.8 (c 0.95, $CHCl_3$); ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.79 (d, 2H, *J* = 8.4 Hz), 7.31 (d, 2H, *J* = 7.8 Hz), 5.99 (br s, 1H), 5.89 (br, s, 1H), 3.47-3.50 (m, 1H), 3.27-3.28 (m, 2H), 2.47-2.50 (m, 1H), 2.42 (s, 3H), 1.69-1.96 (m, 3H).; ^{13}C NMR (75 MHz, $CDCl_3$) δ 169.8, 143.7, 135.9, 129.8, 127.4, 53.3, 42.0, 28.5, 21.6, 20.8.; HRMS (EI): *m*/*z* Calcd for $C_{12}H_{16}N_2O_3S$ 268.0882, found 268.0882.

Rh_2(*S*-nap)$_4$.



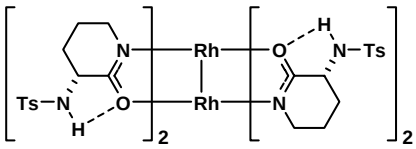
Prepared from $Rh_2(OAc)_4$ and **(*S*)-4-methyl-N-(2-oxo-piperidin-3-yl)-benzenesulfonamide** according to the procedure of Zalatan, D. N.; Du Bois, J. *J. Am. Chem. Soc.* **2008,** *130*, 9220.

yield: 82%; $[\alpha]_D^{27}$= +71.5 (c 0.2, $CHCl_3$); ^{1}H NMR (500 MHz, CD_3CN) δ 7.76 (d, 4H, *J* = 8.5 Hz), 7.67 (d, 4H, J = 8.5 Hz), 7.40 (d, 4H, J = 8.0 Hz), 7.32 (d, 4H, J = 8.0 Hz), 5.75-5.87 (m, 4H), 3.22-3.35 (m, 6H), 2.94 (m, 6H), 2.43 (s, 6H), 2.39 (s, 6H), 1.98-2.02 (m, 2H), 1.25-1.63(m, 14H).; HRMS (ESI): *m*/*z* Calcd for $C_{48}H_{60}N_8O_{12}Rh_2S_4$ 1274.1324, found 1274.1309.

The sign and magnitude of the optical rotation of **Rh_2(*S*-nap)$_4$** reported by the Du Bois group ($[\alpha]_D^{25}$ = -19.5 (*c* 1.0, $CHCl_3$))[a] are greatly different from those of ours ($[\alpha]_D^{27}$= +71.5 (c 0.2, $CHCl_3$)).

(a) Zalatan, D. N.; Du Bois, J. *J. Am. Chem. Soc.* **2008,** *130*, 9220.

Rh_2(*R*-nap)$_4$.

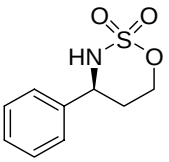


Prepared from $Rh_2(OAc)_4$ and **(*R*)-4-methyl-N-(2-oxo-piperidin-3-yl)-benzenesulfonamide** by using a manner identical to the procedure of Zalatan, D. N.; Du Bois, J. *J. Am. Chem. Soc.* **2008,** *130*, 9220.

A 10 mL round bottom flask was charged with $Rh_2(OAc)_4$ (43.3 mg, 0.1 mmol), (*R*)-4-methyl-N-(2-oxo-piperidin-3-yl)-benzenesulfonamide (201 mg, 0.8 mmol), and 4 mL of chlorobenzene. The flask was fitted with a short-path distillation head and a 10 mL receiving flask. Chlorobenzene was slowly distilled under nitrogen until ~1 mL of solvent remained. The reaction was cooled and the receiving flask was emptied. The reaction flask was recharged with another 4 mL of chlorobenzene and the distillation procedure was performed a second time. After repeating this cycle two additional times, the supernatant (~1 mL) of the resulting dark purple suspension was load onto a silica gel column and purified by flash chromatography (dichloromethane : acetonitrile = 4:1). The isolated material was dissolved in 1.5 mL of acetone and concentrated under reduced pressure. The blue solid was allowed to stand under high vacuum at 80 ^{0}C for 12h to afford the desired product as a blue-green solid (95.1 mg, 76%).

$[\alpha]_D^{29}$= -70.5 (c 0.2, $CHCl_3$); ^{1}H NMR (500 MHz, CD_3CN) δ 7.77 (d, 4H, *J* = 8.5 Hz), 7.68 (d, 4H, *J* = 8.5 Hz), 7.40 (d, 4H, *J* = 8.0 Hz), 7.32 (d, 4H, *J* = 8.0 Hz), 5.79-5.87 (m, 4H), 3.19-3.35 (m, 6H), 2.94-2.97 (m, 6H), 2.43 (s, 6H), 2.39 (s, 6H), 1.97-1.99 (m, 2H), 1.26-1.59(m, 14H).; HRMS (ESI): *m*/*z* Calcd for $C_{48}H_{60}N_8O_{12}Rh_2S_4$ 1274.1324, found 1274.1300.

(*S*)-4-Phenyl-[1,2,3]oxathiazinane 2,2-dioxide: (*S*)-4.

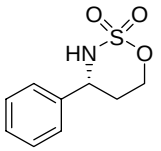


A mixture of sulfamate **3** (200 mg, 0.9 mmol), Rh_2(*R*-nap)$_4$ (24 mg, 0.02 mmol), and powdered 4Å molecular sieves (500 mg) was suspended in dry dichloromethane (2.0 mL). A single portion of PhI=O (240 mg, 1.1 mmol) was then added and the reaction mixture was stirred at room temperature for 2 h. The reaction mixture was loaded directly onto silica gel and purified by flash chromatography (*n*-hexane: ethyl acetate = 4:1) to afford desired product (168 mg, 85%) as a white crystal.

91.7% ee (Chiralcel OD-H, 8% isopropanol/hexanes, 1.0 mL/min, 210 nm, t_r(major) = 27.9 min,

t_r(minor) = 33.9 min); $[\alpha]_D^{36}$= -6.0 (*c* 1.0, $CHCl_3$); ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.33-7.44 (m, 5H), 4.82-4.90 (m, 2H), 4.62-4.68 (m, 1H), 4.40 (br d, 1H, *J* = 9.2 Hz), 2.18-2.33 (m, 1H), 1.98-2.05 (m, 1H).; ^{13}C NMR (75 MHz, $CDCl_3$) δ 138.0, 129.2, 128.9, 126.3, 71.9, 59.0, 30.2.; HRMS (EI) *m*/*z* Calcd for $C_9H_{11}NO_3S$ 213.0460, found 213.0462.

(*R*)-4-Phenyl-[1,2,3]oxathiazinane 2,2-dioxide: (*R*)-4.



Prepared from sulfamate **3** (332 mg, 1.54 mmol) and Rh_2(*S*-nap)$_4$ catalyst (40.0 mg, 0.03 mmol) similar to the procedure for (*S*)-**4**. Purified by flash chromatography (*n*-hexane: ethyl acetate = 4:1) to afford desired product (263 mg, 80%) as a white crystal.

92.6% ee (Chiralcel OD-H, 8% isopropanol/hexanes, 1.0 mL/min, 210 nm, t_r(minor) = 28.6 min, t_r(major) = 33.2 min); $[\alpha]_D^{27}$= +6.14 (c 1.0, $CHCl_3$); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.34-7.43 (m, 5H), 4.84-4.89 (m, 2H), 4.64-4.67 (m, 1H), 4.39 (br d, 1H, *J* = 9.0 Hz), 2.21-2.30 (m, 1H), 2.00-2.04 (m, 1H).; ^{13}C NMR (125 MHz, $CDCl_3$) δ 138.1, 129.3, 129.1, 126.4, 72.0, 59.1, 30.3.; HRMS (EI): *m*/*z* Calcd for $C_9H_{11}NO_3S$ 213.0460, found 213.0457.

Crystal structure data for absolute structure determination of oxathiazinane **(*R*)-4: (4r)**.

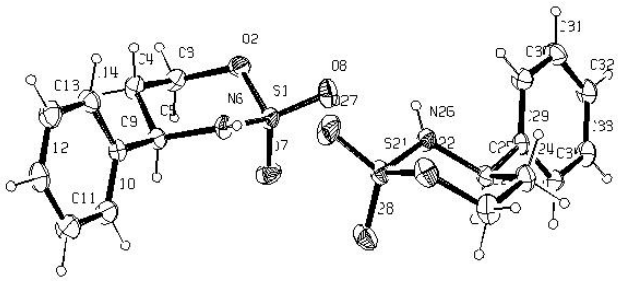


Table 1. Crystal data and structure refinement for KSY-090528.

Identification code	20090601a_0m	
Empirical formula	C9 H11 N O3 S	
Formula weight	213.25	
Temperature	296(2) K	
Wavelength	0.71073 Å	
Crystal system	Triclinic	
Space group	P1	
Unit cell dimensions	a = 5.89850(10) Å	α= 107.7300(10)°.
	b = 9.6146(2) Å	β= 103.1540(10)°.
	c = 10.1578(2) Å	γ = 107.3550(10)°.
Volume	490.553(16) $Å^3$	
Z	2	
Density (calculated)	1.444 Mg/m^3	
Absorption coefficient	0.310 mm^{-1}	
F(000)	224	
Crystal size	0.28 x 0.22 x 0.13 mm^3	
Theta range for data collection	2.25 to 28.35°	
Index ranges	-7<=h<=7, -12<=k<=12, -13<=l<=13	
Reflections collected	8143	
Independent reflections	3944 [R(int) = 0.0237]	
Completeness to theta = 28.35°	96.7 %	
Absorption correction	Multi-scan	
Max. and min. transmission	0.9609 and 0.9183	
Refinement method	Full-matrix least-squares on F^2	
Data / restraints / parameters	3944 / 3 / 254	
Goodness-of-fit on F^2	1.068	
Final R indices [I>2sigma(I)]	R1 = 0.0385, wR2 = 0.0904	
R indices (all data)	R1 = 0.0498, wR2 = 0.0965	
Absolute structure parameter	0.02(6)	
Extinction coefficient	0.006(4)	
Largest diff. peak and hole	0.252 and -0.302 $e.Å^{-3}$	

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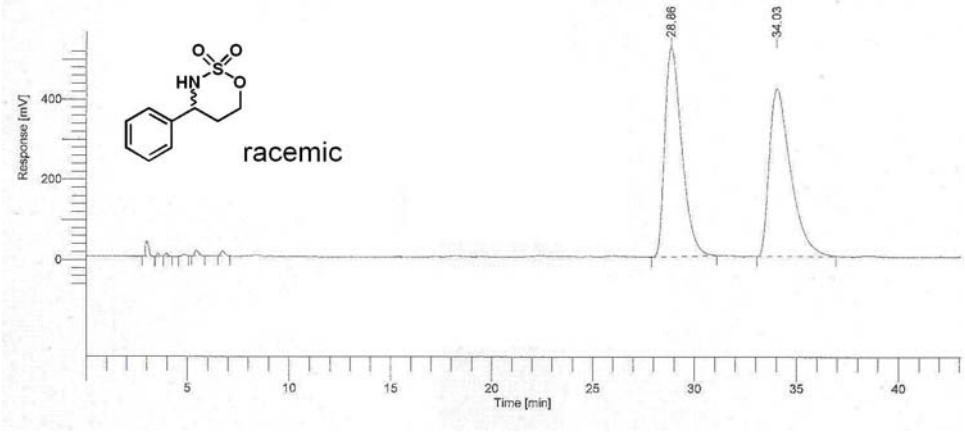

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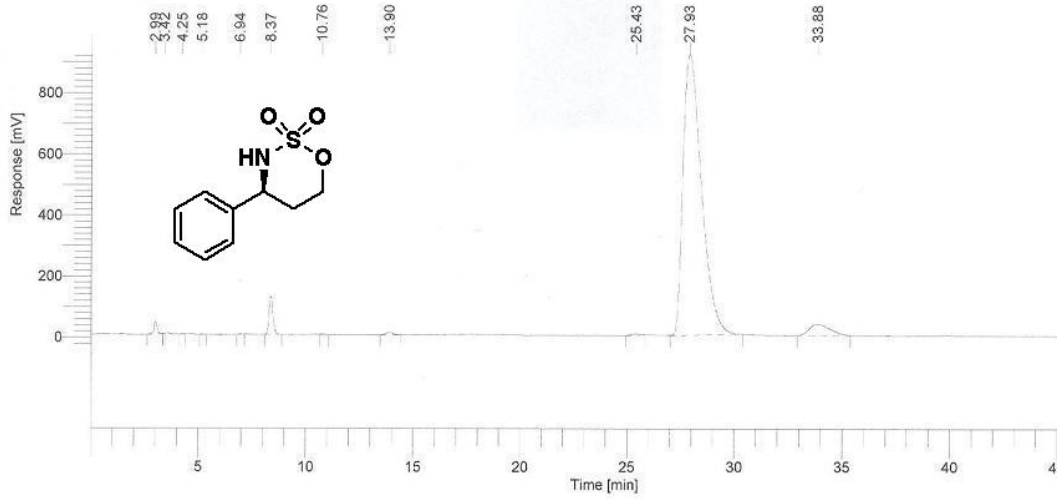

DEFAULT REPORT

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2	3.421	4014.30	1060.56	0.01	BB	0.0040
3	4.254	6956.55	958.18	0.01	BB	0.0070
4	5.182	13411.67	1774.95	0.02	BB	0.0134
5	6.943	27831.98	2711.30	0.05	BB	0.0278
6	8.372	1572046.08	125173.21	2.63	BB	1.5720
7	10.758	26889.04	2403.15	0.04	BB	0.0269
8	13.897	212790.36	8769.50	0.36	BB	0.2128
9	25.432	93958.40	3330.76	0.16	BB	0.0940
10	27.930	55078771.07	916601.42	92.07	BB	55.0788
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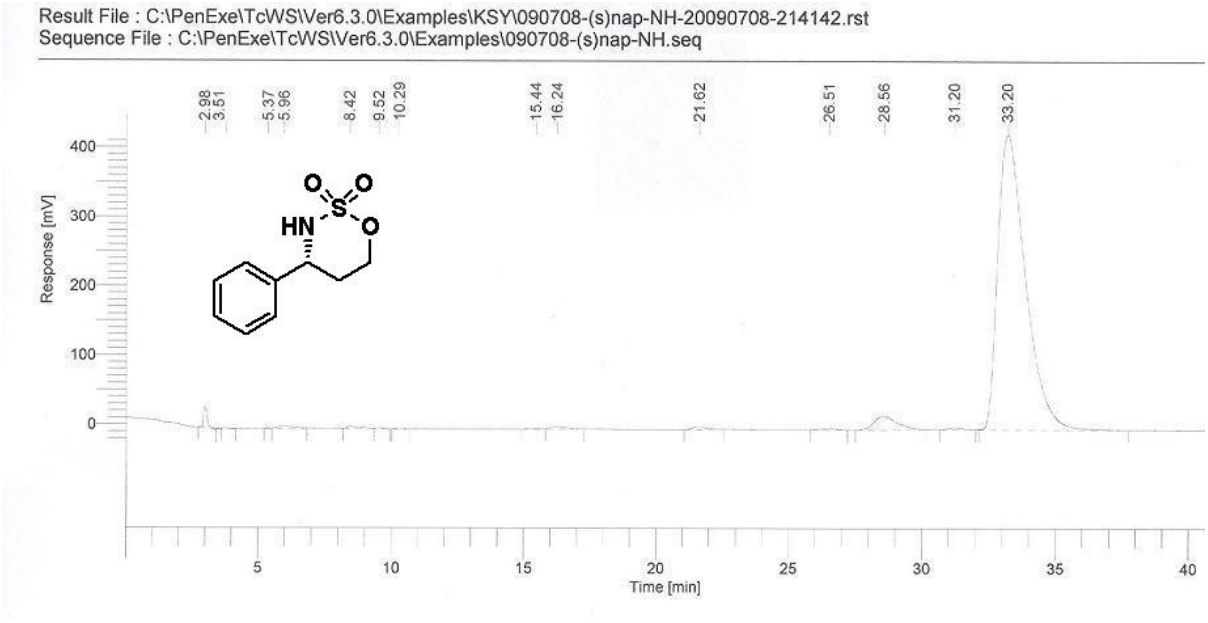

DEFAULT REPORT

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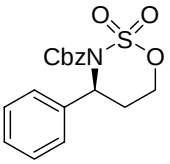
2	3.510	10296.57	1455.60	0.03	BV	0.0103
3	3.754	23408.40	1156.35	0.07	VB	0.0234
4	5.368	7027.96	718.50	0.02	BV	0.0070
5	5.959	132701.34	3553.28	0.40	VB	0.1327
6	8.423	126860.59	3824.58	0.38	BV	0.1269
7	9.523	32360.81	1676.50	0.10	VB	0.0324
8	10.292	8945.54	443.22	0.03	BB	0.0089
9	15.441	44524.53	1426.57	0.13	BV	0.0445
10	16.242	152176.53	3873.25	0.46	VB	0.1522
11	21.618	147843.23	4034.24	0.45	BB	0.1478
12	26.506	76615.55	2004.32	0.23	BB	0.0766
13	28.564	1176540.77	20133.78	3.54	BB	1.1765
14	31.197	129215.92	3394.00	0.39	BV	0.1292
15	33.201	30817180.22	425242.48	92.85	VB	30.8172
		33192008.03	503857.88	100.00		33.1920

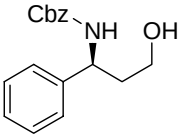
3-*Cbz*-4-phenyl-[1,2,3]oxathiazinane 2,2-dioxide: (*S*)-7.



Oxathiazinane (*S*)-**4s** (50 mg, 0.24 mmol) was added to a solution of NaO^{t}Bu (36 mg, 0.36 mmol) in DME (2.0 mL) at room temperature. The resulting suspension was stirred vigorously for 1.5 h following which time benzylchloroformate (71 μL, 0.60 mmol) was added. After 10 h, the reaction was quenched by the addition of 1.0 mL of H_2O. The biphasic solution was extracted with EtOAc (3 times). The combined organic layer was washed successively with brine, and dried over anhydrous $MgSO_4$ and concentrated *in vacuo* to give a residue which was subjected to flash chromatography on silica gel (*n*-hexane: ethyl acetate = 3:1) to afford desired product (75.6 mg, 91%) as a colorless oil.

$[\alpha]_D^{28}$= -25.4 (c 0.52, $CHCl_3$); ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.29-7.41 (m, 10H), 5.75 (t, 1H, *J* = 4.2 Hz), 5.31 (s, 2H), 4.66-4.72 (m, 1H), 4.35-4.44 (m, 1H), 2.90-3.02 (m, 1H), 2.43-2.51 (m, 1H).; ^{13}C NMR (75 MHz, $CDCl_3$) δ 152.1, 137.6, 134.7, 129.0, 128.6, 128.4, 127.9, 127.8, 125.5, 70.1, 69.5, 60.7, 28.2.; HRMS (EI): *m*/*z* Calcd for $C_{17}H_{17}NO_5S$ 347.0827, found 347.0832.

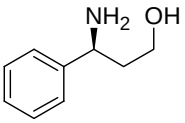
(*S*)-3-(*N-Cbz*-amino)-3-phenylpropan-1-ol: (S)-8.



A solution of *N-Cbz*-oxathiazinane (*S*)-**7** (60 mg, 0.17 mmol) in 2.0 mL of CH_3CN and 1.5 mL of H_2O was stirred vigorously at 75 ^oC for 24 h. After cooling the solution of room temperature, the mixture of 1 mL of 1M HCl and 1 mL of EtOAc was added and stirred at rt for 1 h, then basified with 1M NaOH. The biphasic solution was extracted with EtOAc (3 times). The combined organic layer was washed successively with brine, and dried over anhydrous $MgSO_4$ and concentrated *in vacuo* to give a residue which was subjected to flash chromatography on silica gel (*n*-hexane: ethyl acetate = 3:1) to afford desired product (40.4 mg, 83%) as a white solid.

$[\alpha]_D^{31}$= -37.2 (c 0.4, CH_2Cl_2); ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.28-7.35 (m, 10H), 5.32 (m, 1H), 5.14 (d, 1H, *J* = 12.0 Hz), 5.07 (d, 1H, *J* = 12.0 Hz), 3.69 (m, 2H), 2.61 (m, 1H), 2.05-2.11 (m, 1H), 1.85-1.93 (m, 1H).; ^{13}C NMR (75 MHz, $CDCl_3$) δ 156.6, 141.7, 136.3, 128.8, 128.5, 128.2, 127.6, 126.4, 67.0, 59.2, 52.6, 39.0.; HRMS (EI): *m*/*z* Calcd for $C_{17}H_{19}NO_3$ 285.1365, found 285.1363.

(*S*)-3-Amino-3-phenyl-propan-1-ol: (*S*)-9.

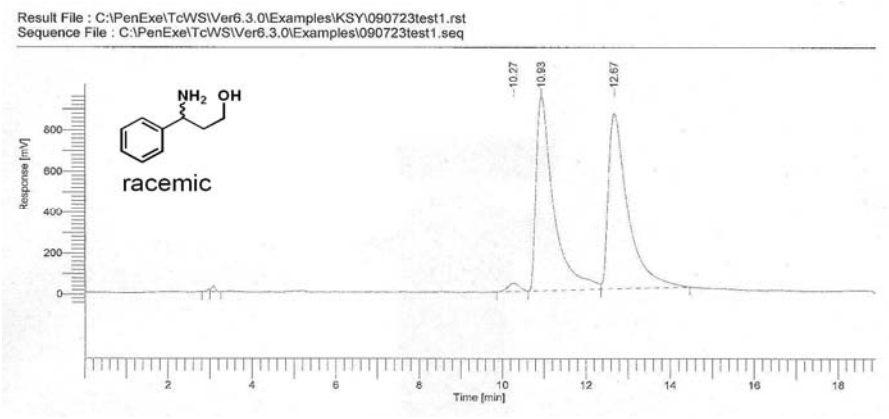


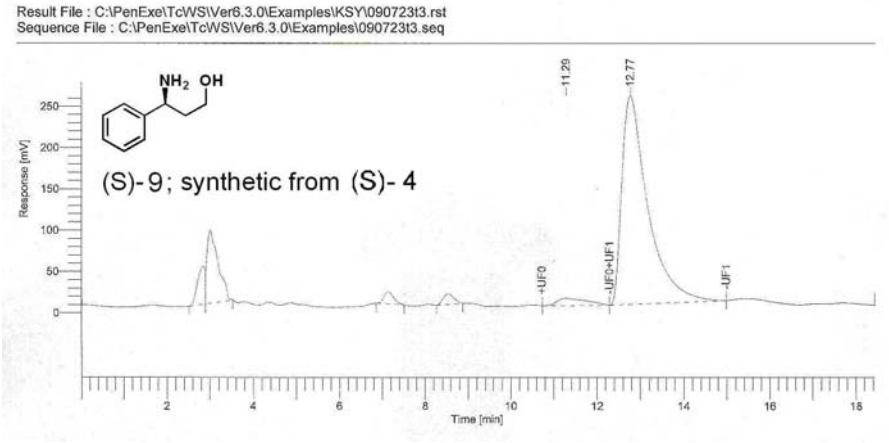
Catalytic Pd/C was added to a solution of *N-Cbz* amino alcohol (*S*)-**8** (40.4 mg, 0.14 mmol) in EtOAc (3 mL). The reaction mixture was stirred at room temperature under H_2 atmosphere (1 atm) for 10 h. The Pd/C was removed by celite filtration and washed with dichloromethane. The combined organic layer was concentrated *in vacuo* to give a residue which was subjected to flash chromatography on silica gel (methanol only) to afford desired product (18.0 mg, 84%) as a colorless solid.

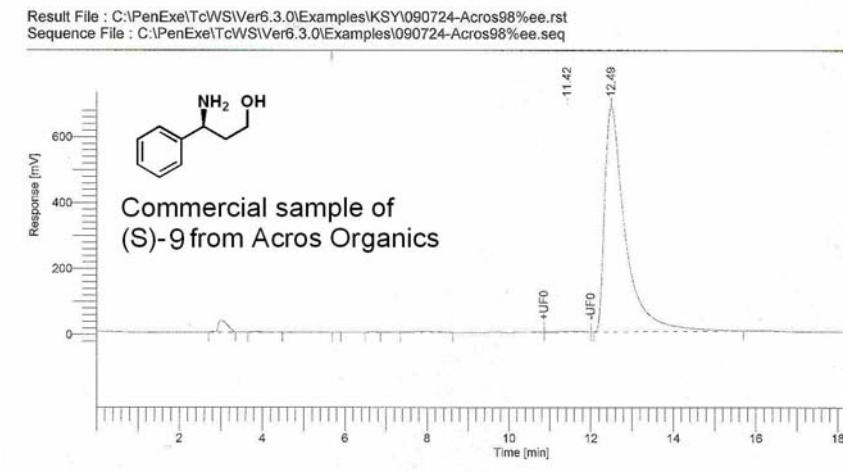
93% ee (Chiralcel OD-H, 10% isopropanol/hexanes, 1.0 mL/min, 210 nm, t_r(minor) = 11.3 min, t_r(major) = 12.8 min); $[\alpha]_D^{28}$= -20.4 (c 0.44, $CHCl_3$); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.25-7.37 (m, 5H), 4.13 (dd, 1H, *J* = 4.5, 9.0 Hz), 3.78-3.85 (m, 2H), 2.63 (br s, 3H), 1.85-1.95 (m, 2H).; ^{13}C NMR (125 MHz, $CDCl_3$) δ 146.2, 128.9, 127.3, 125.8, 62.4, 56.7, 39.6.; HRMS (EI): *m*/*z* Calcd for $C_9H_{13}NO$ 151.0997, found 151.0979.

Commercial sample of (*S*)-9 from Acros Organics

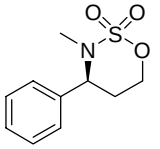
$[\alpha]_D^{27}$= -22.0 (*c* 0.40, $CHCl_3$); ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.24-7.38 (m, 5H), 4.13 (dd, 1H, *J* = 5.1, 7.8 Hz), 3.77-3.89 (m, 2H), 2.46 (br s, 3H), 1.84-1.94 (m, 2H).; ^{13}C NMR (75 MHz, $CDCl_3$) δ 146.2, 128.7, 127.2, 125.7, 62.4, 56.7, 39.5.







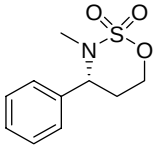
(*S*)-3-Methyl-4-phenyl-[1,2,3]oxathiazinane 2,2-dioxide: (*S*)-5.



To a solution of (*S*)-**4** (154 mg, 0.72 mmol) in DMF (3 mL) were added CH_3I (93 μL, 1.5 mmol), K_2CO_3 (122 mg, 0.88 mmol) and a catalytic amount of *n*-Bu_4NI at 0 °C and the mixture was stirred at rt for 6h. The reaction mixture was diluted with ethyl acetate (30 mL) and H_2O (15 mL). The biphasic solution was extracted with ethyl acetate (3 times). The combined organic layer was washed successively with water and brine, and dried over anhydrous $MgSO_4$ and concentrated *in vacuo* to give a residue which was subjected to flash chromatography on silica gel (*n*-hexane: ethyl acetate = 10:1) to afford desired product (81%) as a white crystal.

92.0% ee (Chiralcel OD-H, 10% isopropanol/hexanes, 1.2 mL/min, 210 nm, t_r(major) = 18.5 min, t_r(minor) = 15.6 min); $[\alpha]_D^{28}$= -3.0 (c 0.3, $CHCl_3$); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.35-7.41 (m, 5H), 4.76-4.85 (m, 2H), 4.55-4.58 (m, 1H), 2.46-2.55 (m, 1H), 2.49 (s, 3H), 1.88-1.91 (m, 1H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 137.5, 129.3, 129.0, 127.6, 71.7, 64.3, 32.5, 28.1; HRMS (EI): *m*/*z* Calcd for $C_{10}H_{13}NO_3S$: 227.0616 found: 227.0611.

(*R*)-3-Methyl-4-phenyl-[1,2,3]oxathiazinane 2,2-dioxide: (*R*)-5.



Prepared from (*R*)-**4** (201.2 mg, 0.95 mmol) and CH_3I (118 μL, 1.9 mmol) similar to the procedure for (*S*)-**5**. Purified by flash chromatography (*n*-hexane: ethyl acetate = 10:1) to afford desired product (180 mg, 83%) as a white crystal.

91.1% ee (Chiralcel OD-H, 10% isopropanol/hexanes, 1.2 mL/min, 210nm, t_r(major) = 18.5 min, t_r(minor) = 15.6 min); $[\alpha]_D^{28}$= +3.2 (c 0.3, $CHCl_3$); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.34-7.42 (m, 5H), 4.76-4.85 (m, 2H), 4.55-4.58 (m, 1H), 2.46-2.55 (m, 1H), 2.49 (s, 3H), 1.87-1.91 (m, 1H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 137.5, 129.2, 128.9, 127.6, 71.7, 64.2, 32.5, 28.0; HRMS (EI): *m*/*z* Calcd for $C_{10}H_{13}NO_3S$: 227.0616 found: 227.0612.

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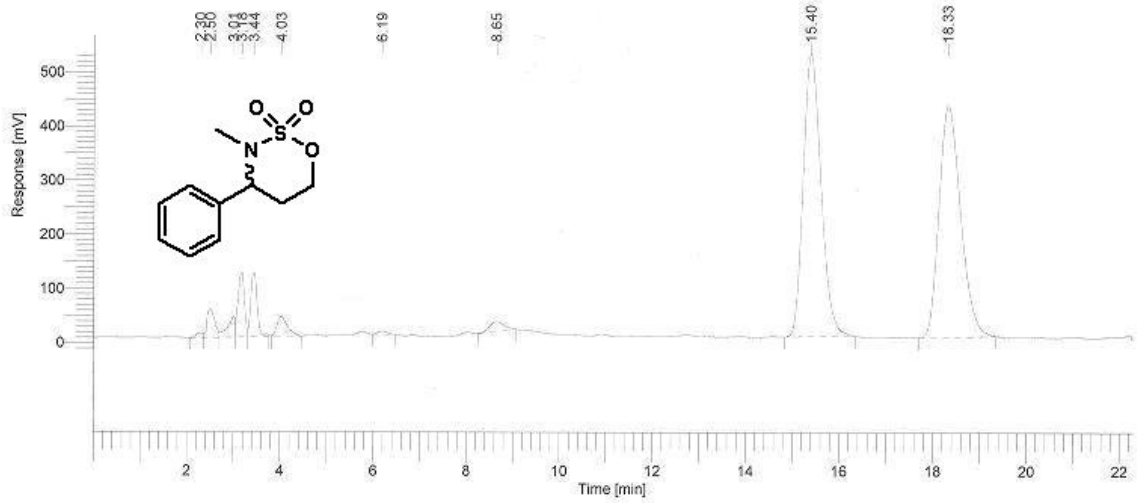

DEFAULT REPORT

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2	2.502	611725.92	52019.57	1.91	VV	0.6117
3	3.007	416060.76	38394.79	1.30	VV	0.4161
4	3.182	1130233.77	121445.66	3.53	VV	1.1302
5	3.444	1148088.13	124270.29	3.59	VV	1.1481
6	4.027	575280.35	36376.91	1.80	VB	0.5753
7	6.186	87167.12	5870.78	0.27	BB	0.0872
8	8.646	396464.99	17938.23	1.24	BB	0.3965
9	15.396	13801227.72	520243.29	43.14	BB	13.8012
10	18.325	13737322.58	426298.96	42.94	BB	13.7373
		31990887.43	1.35e+06	100.00		31.9909

Result File : C:\PenExe\TcWS\Ver6.3.0\Examples\KSY\dapoxetine\(S)MeN.rst
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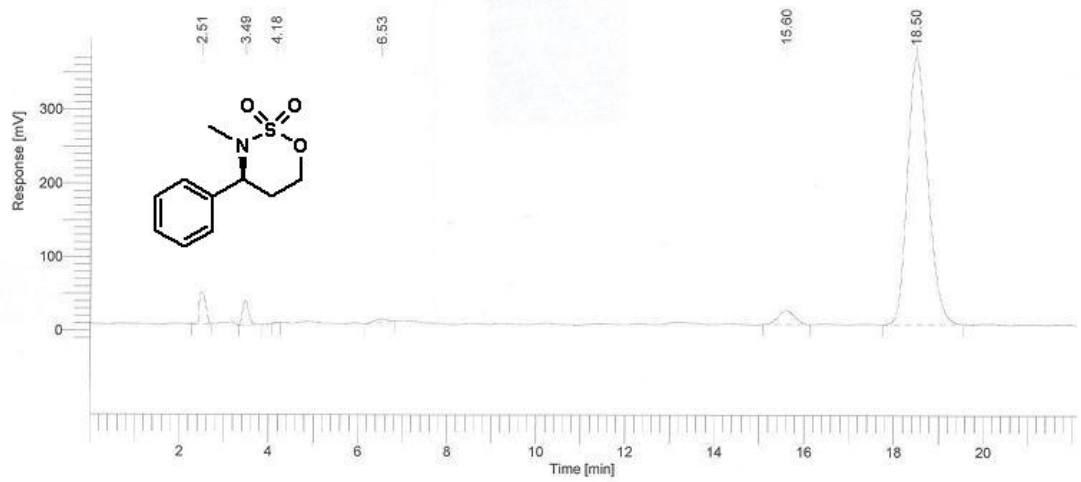

DEFAULT REPORT

Peak #	Time [min]	Area [μV·s]	Height [μV]	Area [%]	BL	Adjusted Amount
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2	3.487	323229.36	33849.45	2.51	BB	0.3232
3	4.175	7068.46	1072.58	0.05	BB	0.0071
4	6.527	85088.59	4313.86	0.66	BB	0.0851
5	15.599	484780.93	19014.61	3.76	BB	0.4848
6	18.496	11577228.60	363527.18	89.76	BB	11.5772
		12898668.42	464699.21	100.00		12.8987

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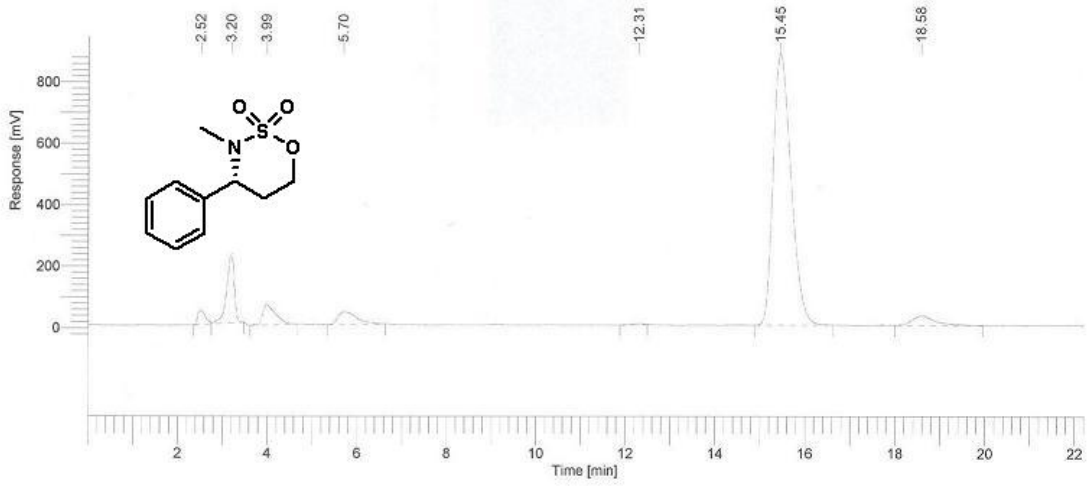

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Peak #	Time [min]	Area [μV·s]	Height [μV]	Area [%]	BL	Adjusted Amount
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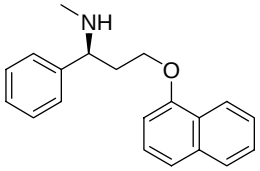
2	3.203	2635894.33	231063.25	8.45	VB	2.6359
3	3.991	1310409.62	64882.65	4.20	BB	1.3104
4	5.701	1164518.41	40212.35	3.73	BB	1.1645
5	12.306	38537.09	1669.96	0.12	BB	0.0385
6	15.454	24379029.50	881375.45	78.16	BB	24.3790
7	18.583	1141353.56	31251.40	3.66	BB	1.1414
		31191381.76	1.29e+06	100.00		31.1914

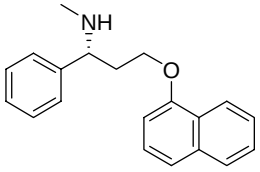
(*S*)-Methyl-[3-(naphthalen-1-yloxy)-1-phenyl-propyl]-amine: (*S*)-6.



The mixture of 1-naphtol (140 mg, 0.97 mmol) and NaH (42 mg, 0.97 mmol) in DMF (1 mL) was stirred at rt for 10 min. A solution of (*S*)-**5** (111 mg, 0.49 mmol) in DMF (1 mL) was added to a reaction mixture and stirred at rt for 1h. 1M HCl (1.5 mL, 5 eq) was added and stirred at rt for 2h, then basified with 2M NaOH. The reaction mixture was diluted with EA (10 mL) and H_2O (5 mL). The biphasic solution was extracted with ethyl acetate (3 times). The combined organic layer was washed successively with water and brine, and dried over anhydrous $MgSO_4$ and concentrated *in vacuo* to give a residue which was subjected to flash chromatography on silica gel (dichloromethane:methanol = 10:1) to afford desired product (120 mg, 84%) as orange oil.

91.2% ee (Chiralcel OD-H, 2% isopropanol/hexanes, 1.2 mL/min, 210nm, t_r(major) = 12.6 min, t_r(minor) = 10.0 min); $[\alpha]_D^{28}$= +60.3 (c 0.3, $CHCl_3$); ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.24-8.26 (m, 1H), 7.78-7.80 (m, 1H), 7.46-7.51 (m, 2H), 7.39-7.41 (m, 1H), 7.25-7.34 (m, 7H), 6.70 (d, 1H, *J* = 7.5 Hz), 4.13-4.17 (m, 1H), 3.97-4.02 (m, 1H), 3.90-3.92 (m, 1H), 2.41-2.47 (m, 1H), 2.33 (s, 3H), 2.17-2.2 3(m, 1H).; ^{13}C NMR (125 MHz, $CDCl_3$) δ 154.6, 134.6, 128.8, 127.59, 127.55, 127.5, 126.5, 126.1, 126.0, 125.8, 125.3, 122.1, 120.3, 104.7, 65.5, 62.8, 37.2, 34.4.; HRMS (EI): *m*/*z* Calcd for $C_{20}H_{21}NO$: 291.1623 found: 291.1622.

(*R*)-Methyl-[3-(naphthalen-1-yloxy)-1-phenyl-propyl]-amine: (*R*)-6.



Prepared from (*R*)-**5** (100 mg, 0.44 mmol) and 1-naphtol (127 mg, 0.88 mmol) similar to the procedure for (*S*)-**6**. Purified by flash chromatography (dichloromethane:methanol = 10:1) to afford desired product (111 mg, 87 %) as yellow oil.

92.5% ee (Chiralcel OD-H, 2% isopropanol/hexanes, 1.2 mL/min, 210nm, t_r(major) = 12.6 min, t_r(minor) = 10.0 min); $[\alpha]_D^{28}$= -61.5 (c 0.3, $CHCl_3$); ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.25-8.27 (m, 1H), 7.77-7.81 (m, 1H), 7.46-7.52 (m, 2H), 7.40-7.42 (m, 1H), 7.27-7.35 (m, 7H), 6.69 (d, 1H, *J* = 7.5 Hz), 4.12-4.16 (m, 1H), 3.92-4.00 (m, 2H), 2.44-2.50 (m, 1H), 2.34 (s, 3H), 2.19-2.25(m, 1H).; ^{13}C NMR (75 MHz, $CDCl_3$) δ 154.6, 134.5, 128.6, 127.5, 127.4, 127.3, 126.4, 125.9, 125.6, 125.2, 122.0, 120.2, 104.6, 65.4, 62.7, 37.2, 34.4.; HRMS (EI): *m*/*z* Calcd for $C_{20}H_{21}NO$: 291.1623 found: 291.1627.

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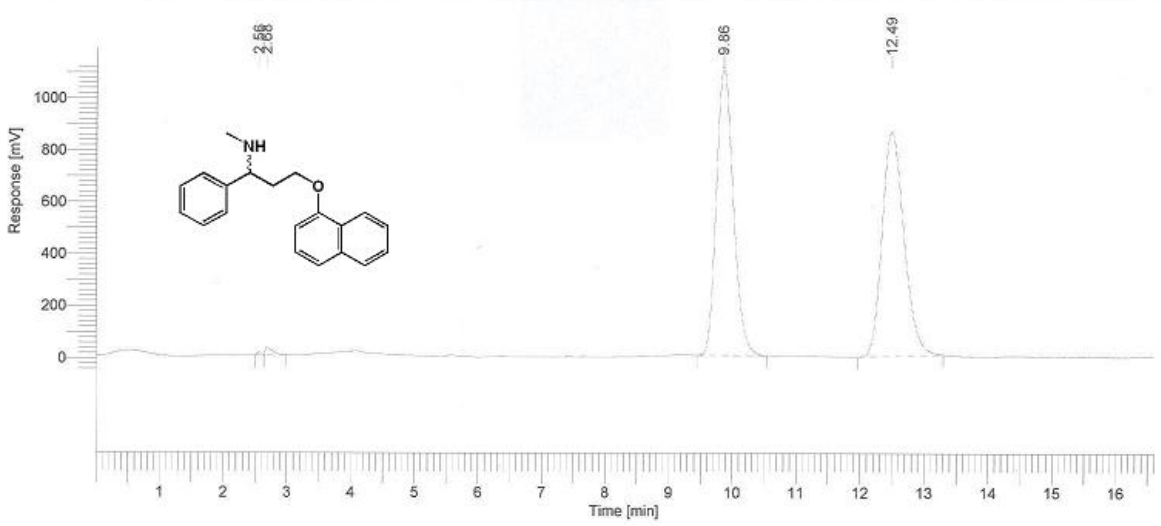

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2	2.677	230887.62	30128.61	0.56	VB	0.2309
3	9.862	20600403.63	1.11e+06	49.70	BB	20.6004
4	12.490	20574928.77	863335.22	49.63	BB	20.5749
		41452776.24	2.01e+06	100.00		41.4528

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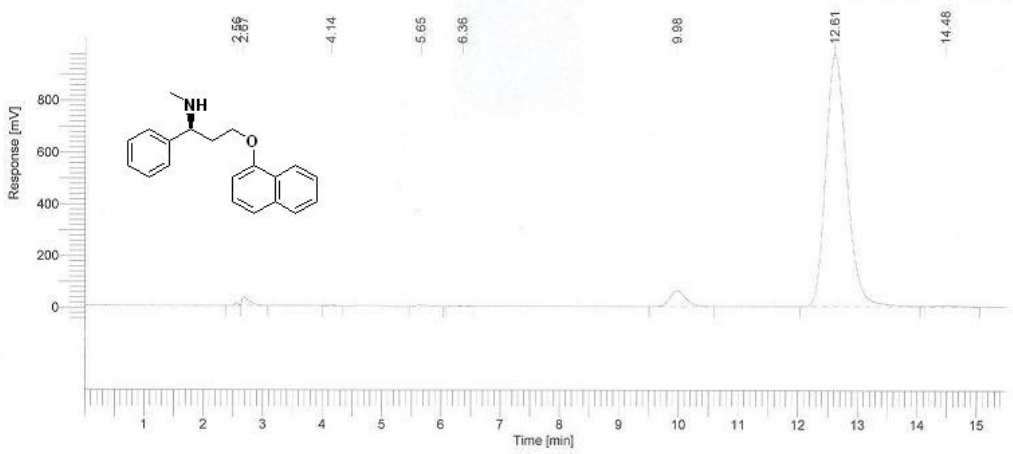

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1	2.556	42486.01	10688.94	0.17	BV	0.0425
2	2.667	283011.15	33672.88	1.10	VB	0.2830
3	4.139	13677.49	1929.50	0.05	BB	0.0137
4	5.654	107868.41	6929.80	0.42	BB	0.1079
5	6.358	24526.02	1120.56	0.10	BB	0.0245
6	9.975	1104328.39	60231.63	4.30	BB	1.1043
7	12.615	24004037.44	972475.75	93.44	BV	24.0040
8	14.478	109169.99	3469.59	0.42	VB	0.1092
		25689104.89	1.09e+06	100.00		25.6891

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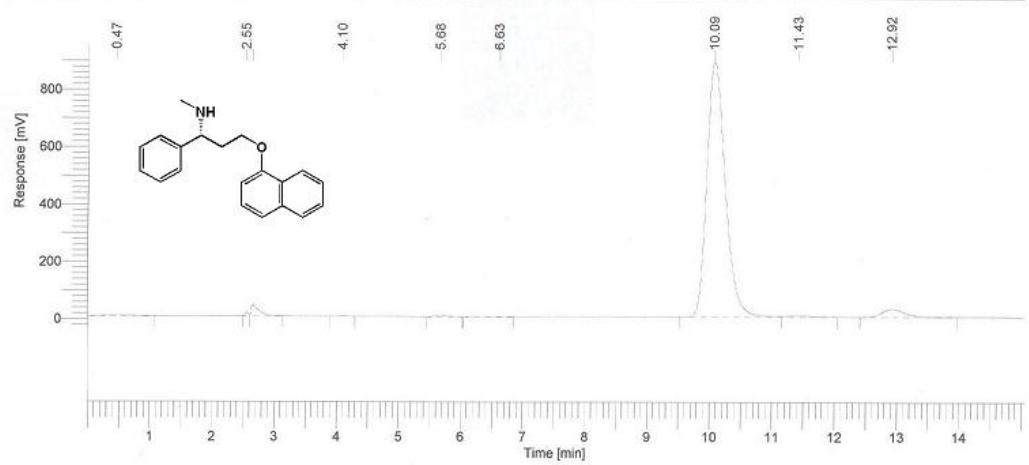

DEFAULT REPORT

Peak #	Time [min]	Area [μV·s]	Height [μV]	Area [%]	BL	Adjusted Amount
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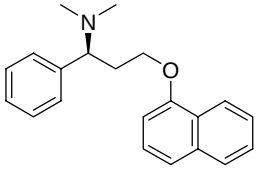
2	2.555	48210.26	12619.38	0.25	BV	0.0482
3	2.652	323445.25	39063.09	1.65	VB	0.3234
4	4.098	12892.96	1513.71	0.07	BB	0.0129
5	5.678	95456.59	6196.29	0.49	BB	0.0955
6	6.628	47710.95	875.31	0.24	BB	0.0477
7	10.086	18153535.76	890932.03	92.63	BV	18.1535
8	11.428	101006.03	3855.13	0.52	VB	0.1010
9	12.924	708818.58	26705.54	3.62	BB	0.7088
		19598523.96	985238.50	100.00		19.5985

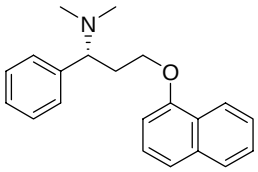
(*S*)-Dimethyl-[3-(naphthalen-1-yloxy)-1-phenyl-propyl]-amine: (*S*)-1.



To a solution of (*S*)-**9** (54 mg, 0.19 mmol) in formic acid (38 μL, 1.0 mmol) was added a 30% aqueous solution of formaldehyde (100 μL, 1.0 mmol) and the reaction mixture was refluxed for 8h. After this time the solution was acidified with conc. HCl until pH=1 and basified with 4N NaOH. The reaction mixture was diluted with ethyl acetate and washed with aqueous $NaHCO_3$ solution. The organic phase was separated and dried over $MgSO_4$. After evaporation of solvent the crude residue was purified by flash chromatography (*n*-Hexane: Ethyl acetate = 1:3) to afford desired product (42.5 mg, 75%) as colorless oil.

91.8% ee (Chiralcel OD-H, 2% isopropanol/hexanes, 0.7 mL/min, 210nm, t_r(major) = 10.1 min, t_r(minor) = 8.9 min); $[\alpha]_D^{28}$= +63.2 (c 0.3, $CHCl_3$); ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.26-8.28 (m, 1H), 7.79-7.81 (m,1H), 7.28-7.52 (m,10H), 6.67 (d, 1H, *J* = 7.5 Hz), 4.07-4.12 (m, 1H), 3.91-3.95 (m, 1H), 3.62-3.65 (m, 1H), 2.63-2.70 (m, 1H), 2.26-2.34 (m, 1H), 2.28 (s, 6H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 154.8, 139.7, 134.7, 128.8, 128.4, 127.6, 127.5, 126.5, 126.1, 125.9, 125.3, 122.2, 120.2, 104.8, 67.9 (1C, C_3), 65.8 (1C, C_1), 43.0 (2C, C_4 + $C_{4'}$), 33.2 (1C, C_2).; HRMS (EI): *m*/*z* Calcd for $C_{21}H_{23}NO$: 305.1780 found: 305.1765.

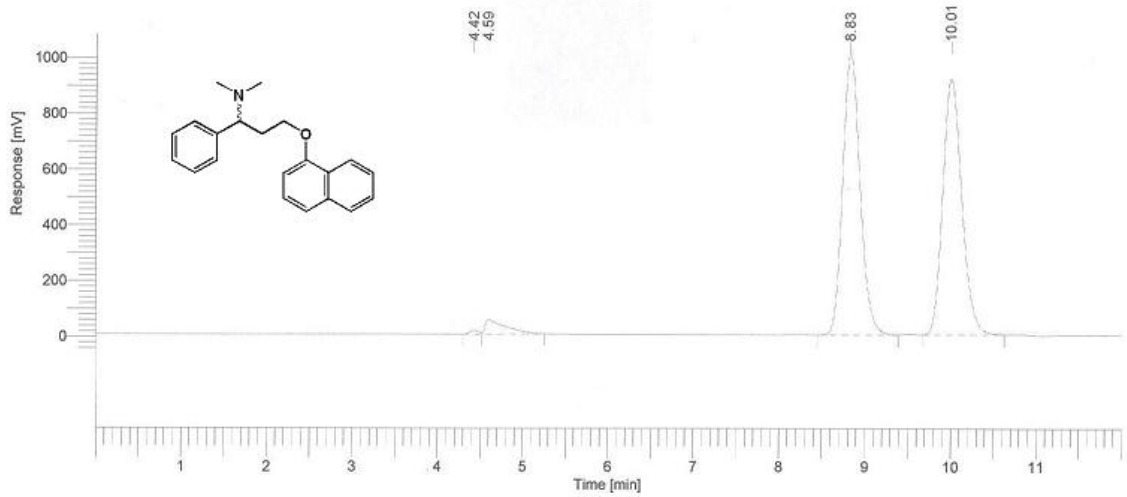
(*R*)-Dimethyl-[3-(naphthalen-1-yloxy)-1-phenyl-propyl]-amine: (*R*)-1.



Prepared from (*R*)-**9 (**52 mg, 0.18 mmol), formic acid (37 μL) and formaldehyde (84 μL) similar to the procedure for (*S*)-**1**. Purified by flash chromatography (dichloromethane:methanol = 10:1) to afford desired product (43 mg, 79%) as colorless oil.

91.2% ee (Chiralcel OD-H, 2% isopropanol/hexanes, 0.7 mL/min, 210 nm, t_r(major) = 10.1 min, t_r(minor) = 8.9 min); $[\alpha]_D^{28}$= -67.0 (c 0.3, $CHCl_3$); ^{1}H NMR (500 MHz, $CDCl_3$) δ ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.24-8.26 (m, 1H), 7.78-7.80 (m,1H), 7.27-7.51 (m,10H), 6.66 (d, 1H, *J* = 7.5 Hz), 4.07-4.11 (m, 1H), 3.89-3.94 (m, 1H), 3.64-3.66 (m, 1H), 2.63-2.70 (m, 1H), 2.27-2.35 (m, 1H), 2.29 (s, 6H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 154.8, 139.5, 134.7, 128.8, 128.5, 127.7, 127.6, 126.5, 126.1, 125.9, 125.3, 122.2, 120.2, 104.8, 67.9 (1C, C_3), 65.8 (1C, C_1), 42.9 (2C, C_4 + $C_{4'}$), 33.1 (1C, C_2).; HRMS (EI): *m*/*z* Calcd for $C_{21}H_{23}NO$: 305.1780 found: 305.1769.

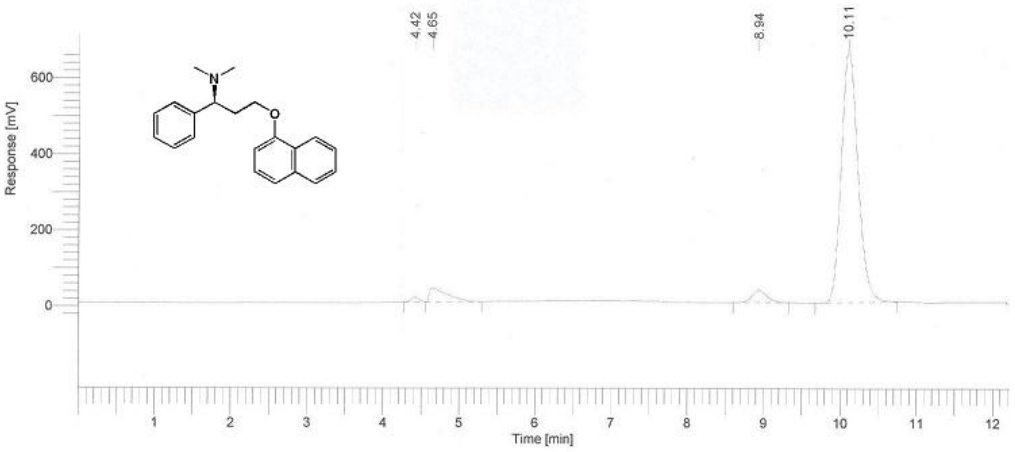
Result File : C:\PenExe\TcWS\Ver6.3.0\Examples\KSY\dapoxetine\(racemic)dapoxetine.rst
Sequence File : C:\PenExe\TcWS\Ver6.3.0\Examples\090911-6.seq



DEFAULT REPORT

Peak #	Time [min]	Area [μV·s]	Height [μV]	Area [%]	BL	Adjusted Amount
1	4.424	92946.93	12790.35	0.32	BV	0.0929
2	4.593	863841.54	51715.26	2.94	VB	0.8638
3	8.832	14183424.77	1.01e+06	48.35	BB	14.1834
4	10.005	14197220.36	919249.57	48.39	BB	14.1972
		29337433.60	1.99e+06	100.00		29.3374

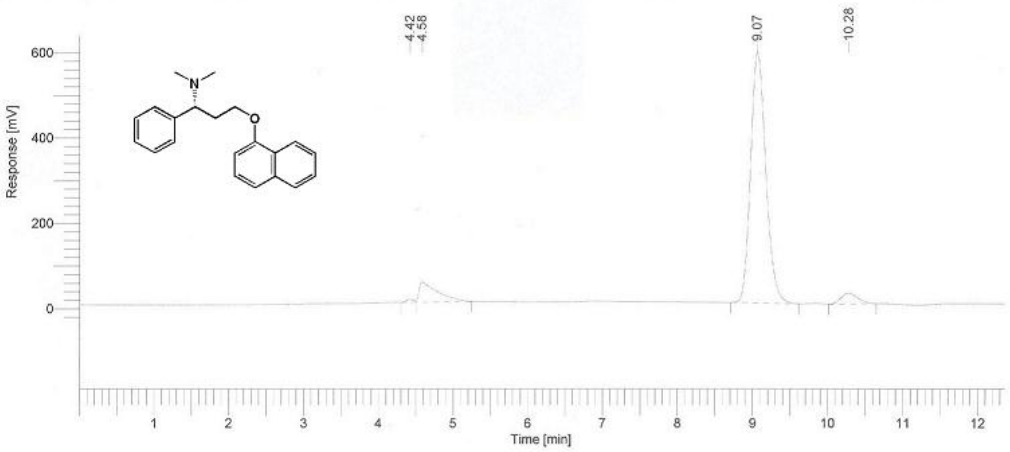
Result File : C:\PenExe\TcWS\Ver6.3.0\Examples\KSY\dapoxetine\(S)dapoxetine.rst
Sequence File : C:\PenExe\TcWS\Ver6.3.0\Examples\090911-5.seq



DEFAULT REPORT

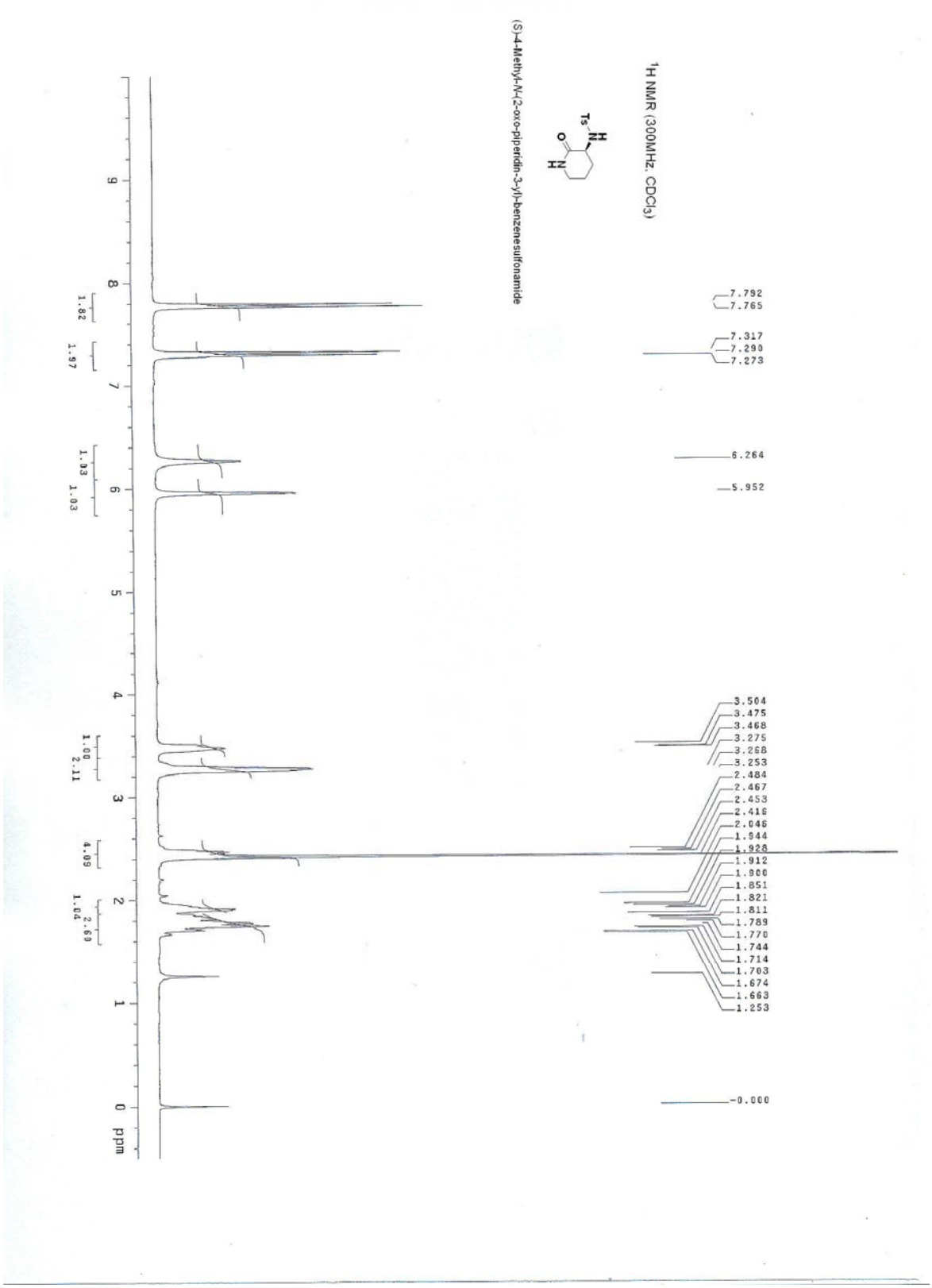
Peak #	Time [min]	Area [μV·s]	Height [μV]	Area [%]	BL	Adjusted Amount
1	4.422	90153.62	12844.14	0.80	BV	0.0902
2	4.648	609826.45	37336.66	5.44	VB	0.6098
3	8.939	431134.31	32065.00	3.85	BB	0.4311
4	10.108	10071191.13	664195.51	89.90	BB	10.0712
		11202305.52	746441.31	100.00		11.2023

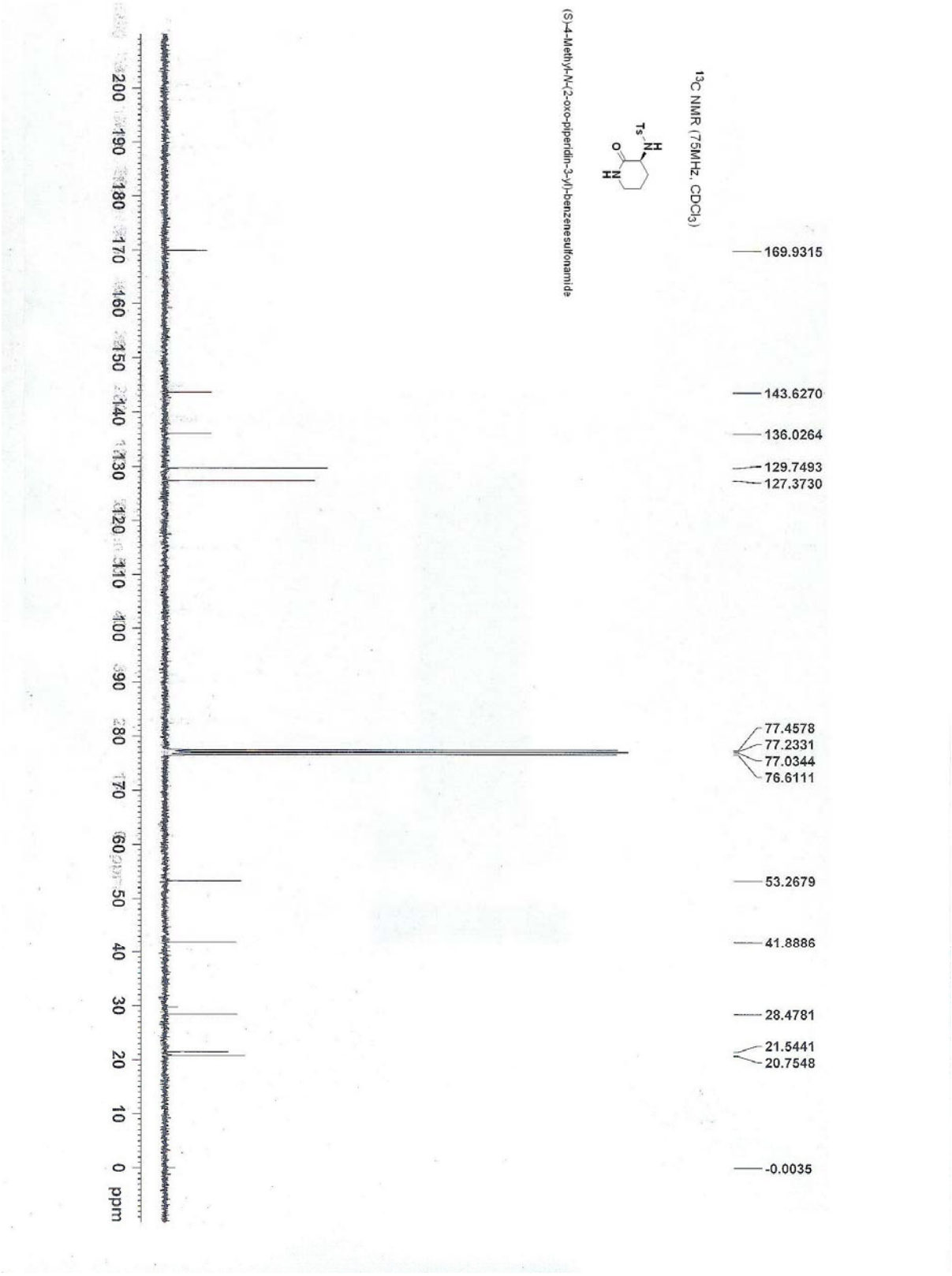
Result File : C:\PenExe\TcWS\Ver6.3.0\Examples\KSY\dapoxetine\(R)dapoxetine.rst
Sequence File : C:\PenExe\TcWS\Ver6.3.0\Examples\090911-1.seq



DEFAULT REPORT

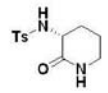
Peak #	Time [min]	Area [μV·s]	Height [μV]	Area [%]	BL	Adjusted Amount
1	4.422	45067.14	6729.87	0.47	BV	0.0451
2	4.583	803214.03	47198.45	8.42	VB	0.8032
3	9.066	8310331.53	588232.29	87.09	BB	8.3103
4	10.282	383169.66	25121.08	4.02	BB	0.3832
		9541782.36	667281.70	100.00		9.5418


(S)-4-Methyl-N-(2-oxo-piperidin-3-yl)-benzenesulfonamide
^{1}H NMR (300MHz, CDCl$_3$)
7.792
7.765
7.317
7.290
7.273
6.264
5.952
3.504
3.475
3.468
3.275
3.268
3.253
2.484
2.467
2.453
2.416
2.046
1.944
1.926
1.912
1.900
1.851
1.821
1.811
1.789
1.770
1.744
1.714
1.703
1.674
1.663
1.253
0.000
1.82
1.97
1.93
1.93
1.00
2.11
4.09
1.04
2.60
ppm

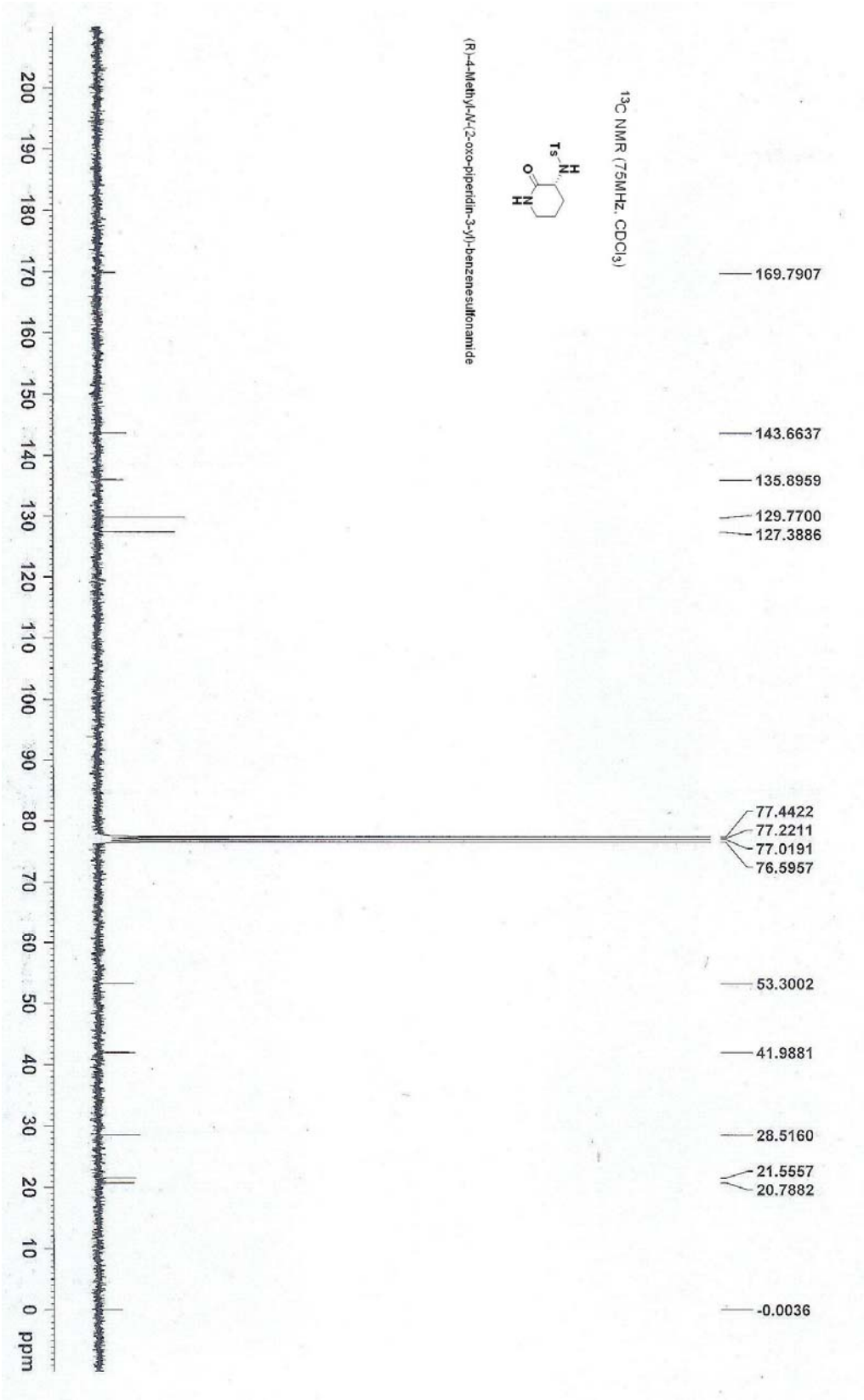

(S)-4-Methyl-N-(2-oxo-piperidin-3-yl)-benzenesulfonamide
^{13}C NMR (75MHz, CDCl$_3$)
169.9315
143.6270
136.0264
129.7493
127.3730
77.4578
77.2331
77.0344
76.6111
53.2679
41.8886
28.4781
21.5441
20.7548
-0.0035
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 ppm

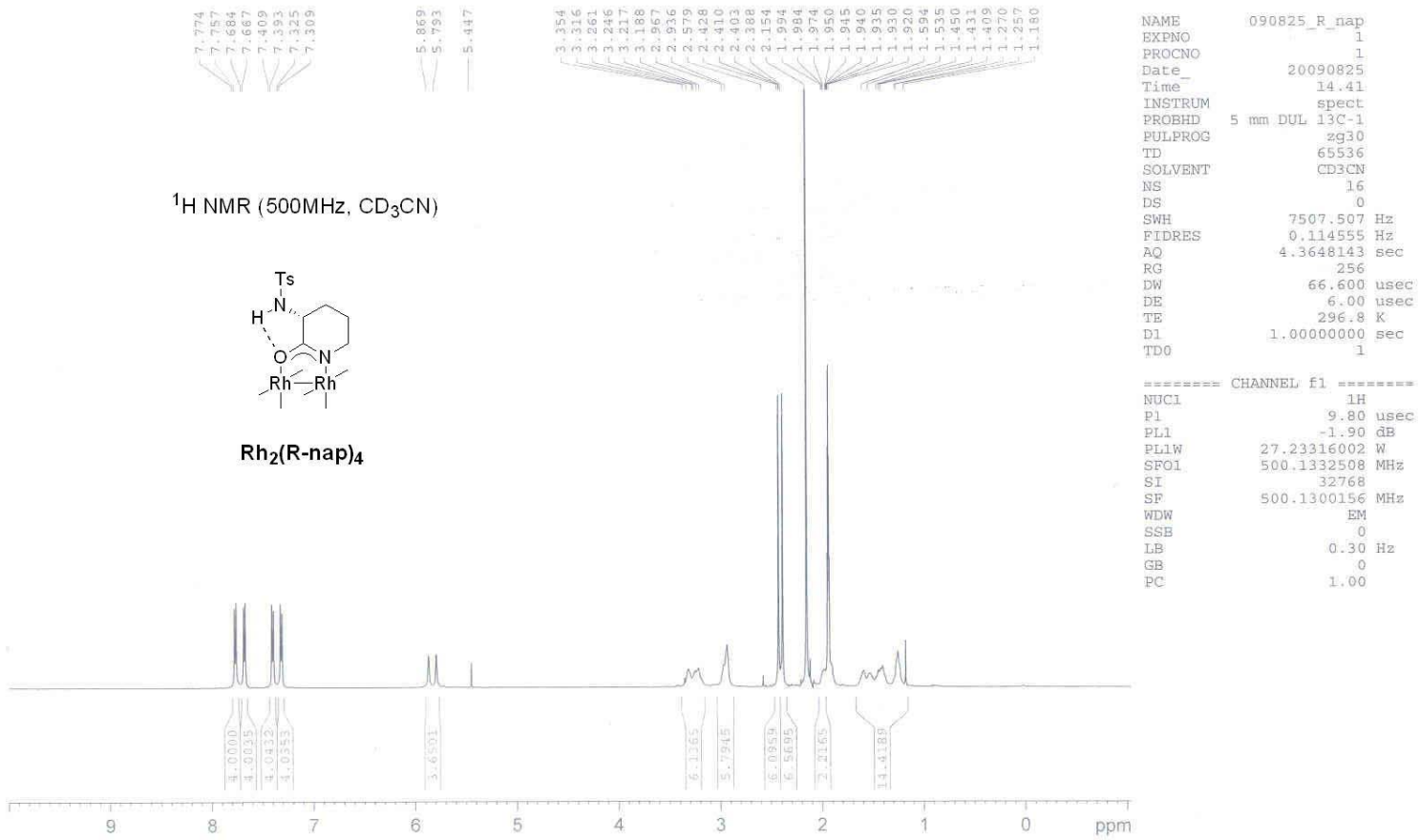
INDEX	FREQUENCY	PPM	HEIGHT
1	2339.436	7.800	37.8
2	2331.220	7.772	44.6
3	2197.119	7.325	39.6
4	2189.196	7.299	36.0
5	2180.833	7.271	30.0
6	2179.953	7.268	18.4
7	1796.722	5.990	10.8
8	1767.672	5.893	22.2
9	1050.069	3.501	6.5
10	1040.972	3.471	10.6
11	984.192	3.281	23.8
12	980.671	3.269	22.6
13	749.588	2.499	9.3
14	745.480	2.485	8.7
15	740.051	2.467	8.1
16	726.260	2.421	147.5
17	587.463	1.959	4.3
18	583.062	1.944	5.6
19	578.073	1.927	11.3
20	574.259	1.915	11.2
21	560.614	1.869	3.6
22	547.849	1.826	6.1
23	535.378	1.785	15.1
24	526.722	1.756	17.6
25	518.359	1.728	7.6
26	515.424	1.718	8.8
27	505.447	1.685	29.4
28	1.027	0.003	6.2
29	0.000	0.000	4.4

^{1}H NMR (300MHz, $CDCl_3$)

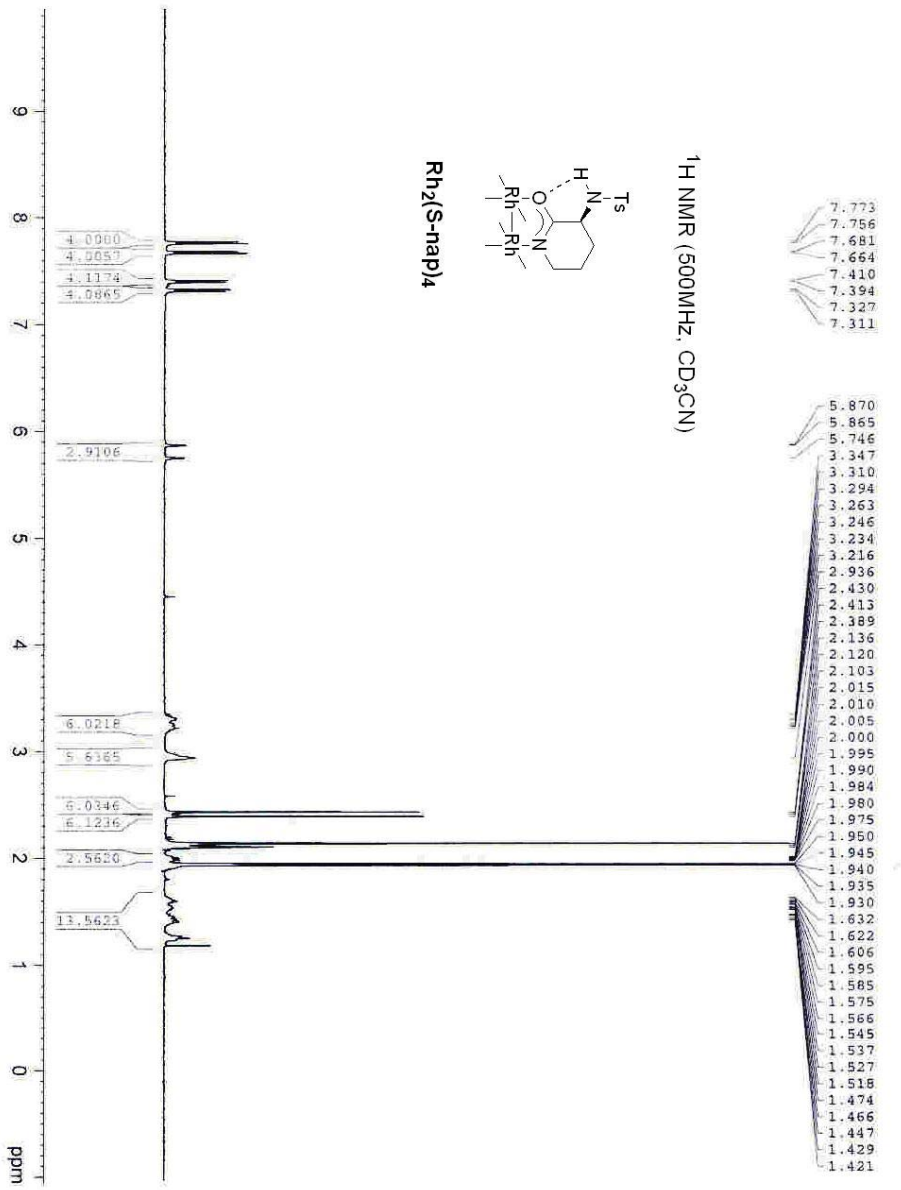


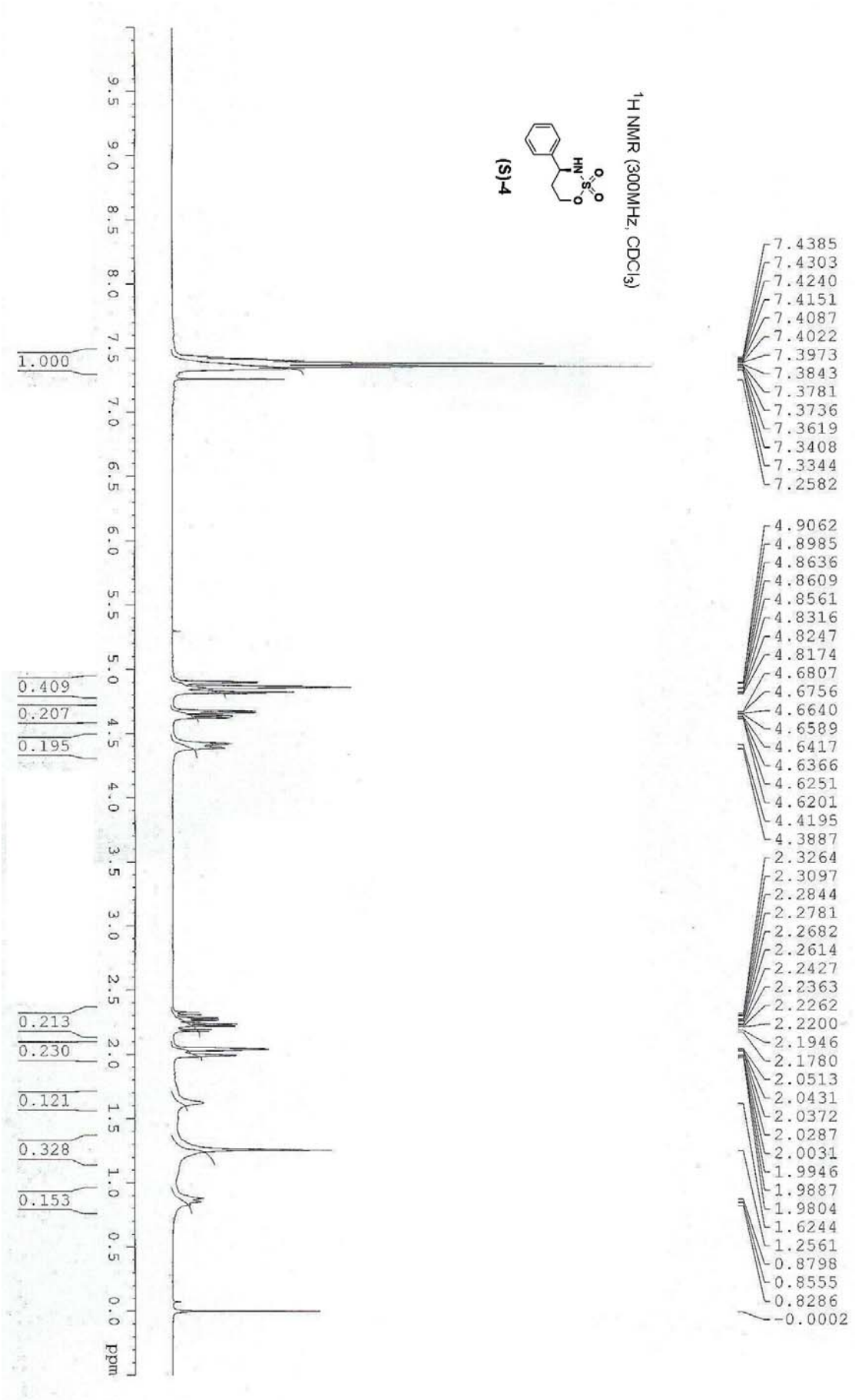
(R)-4-Methyl-*N*-(2-oxo-piperidin-3-yl)-benzenesulfonamide

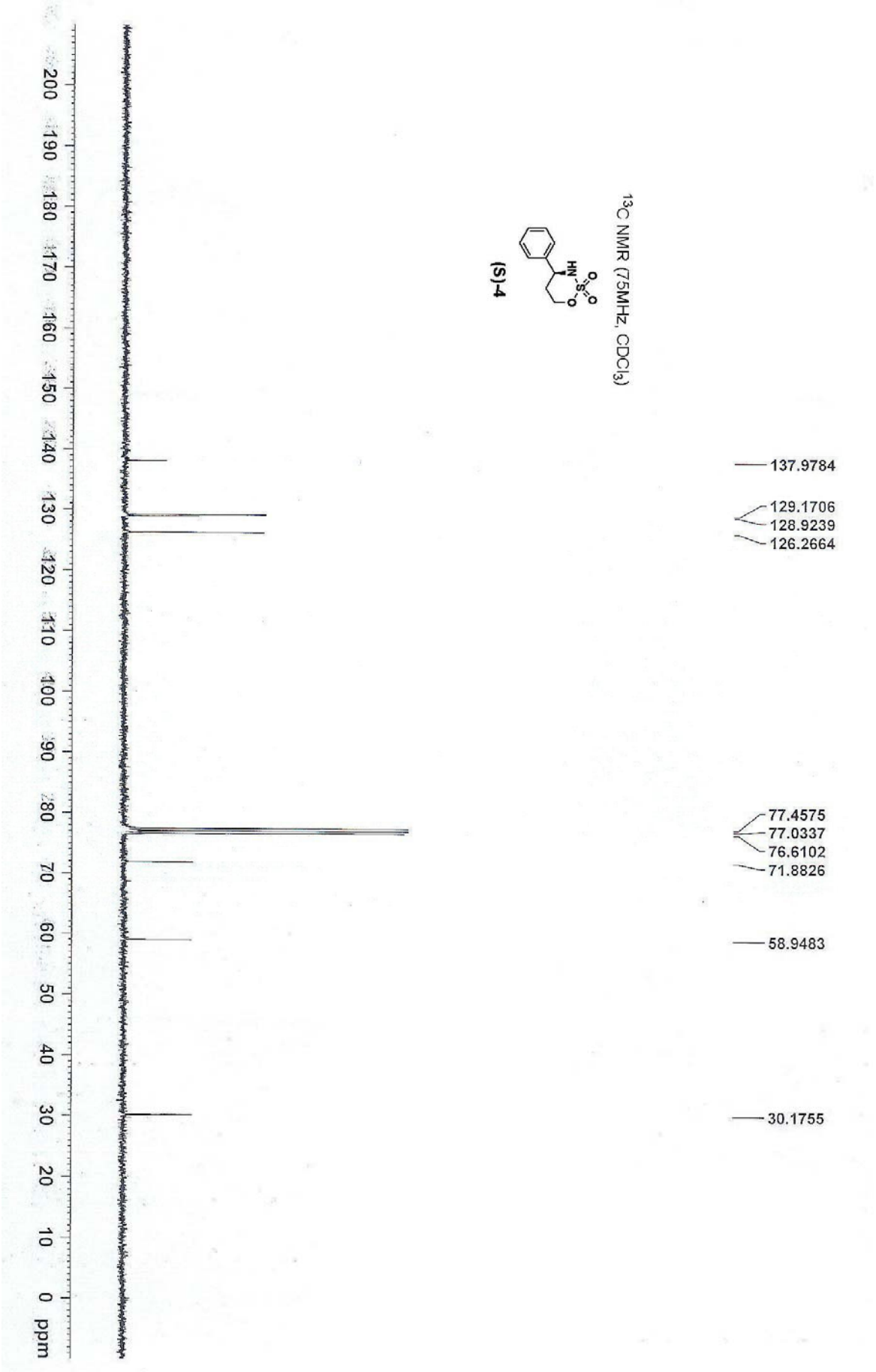

(R)-4-Methyl-N-(2-oxo-piperidin-3-yl)-benzenesulfonamide
^{13}C NMR (75MHz, CDCl$_3$)
169.7907
143.6637
135.8959
129.7700
127.3886
77.4422
77.2211
77.0191
76.5957
53.3002
41.9881
28.5160
21.5557
20.7882
-0.0036
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 ppm

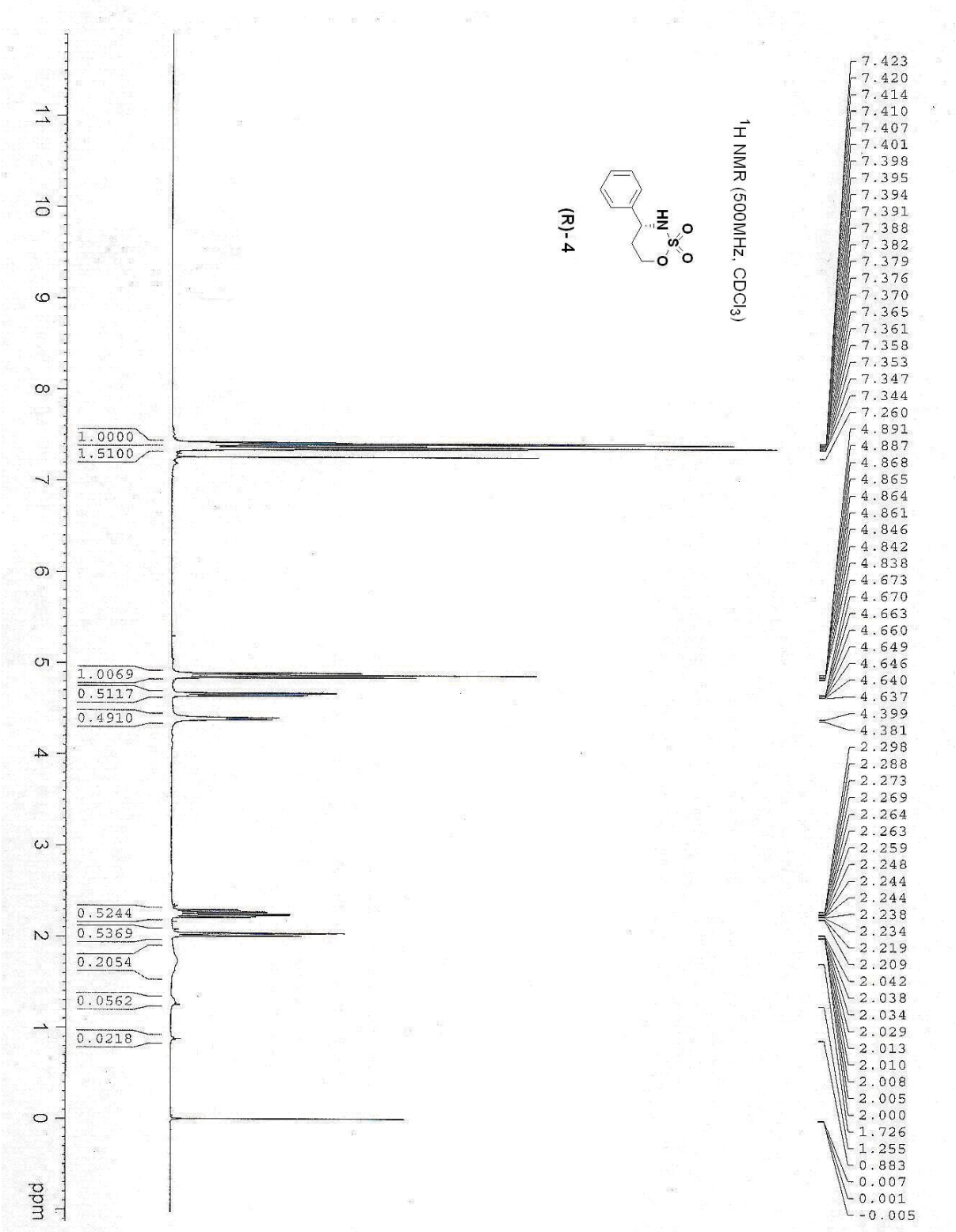


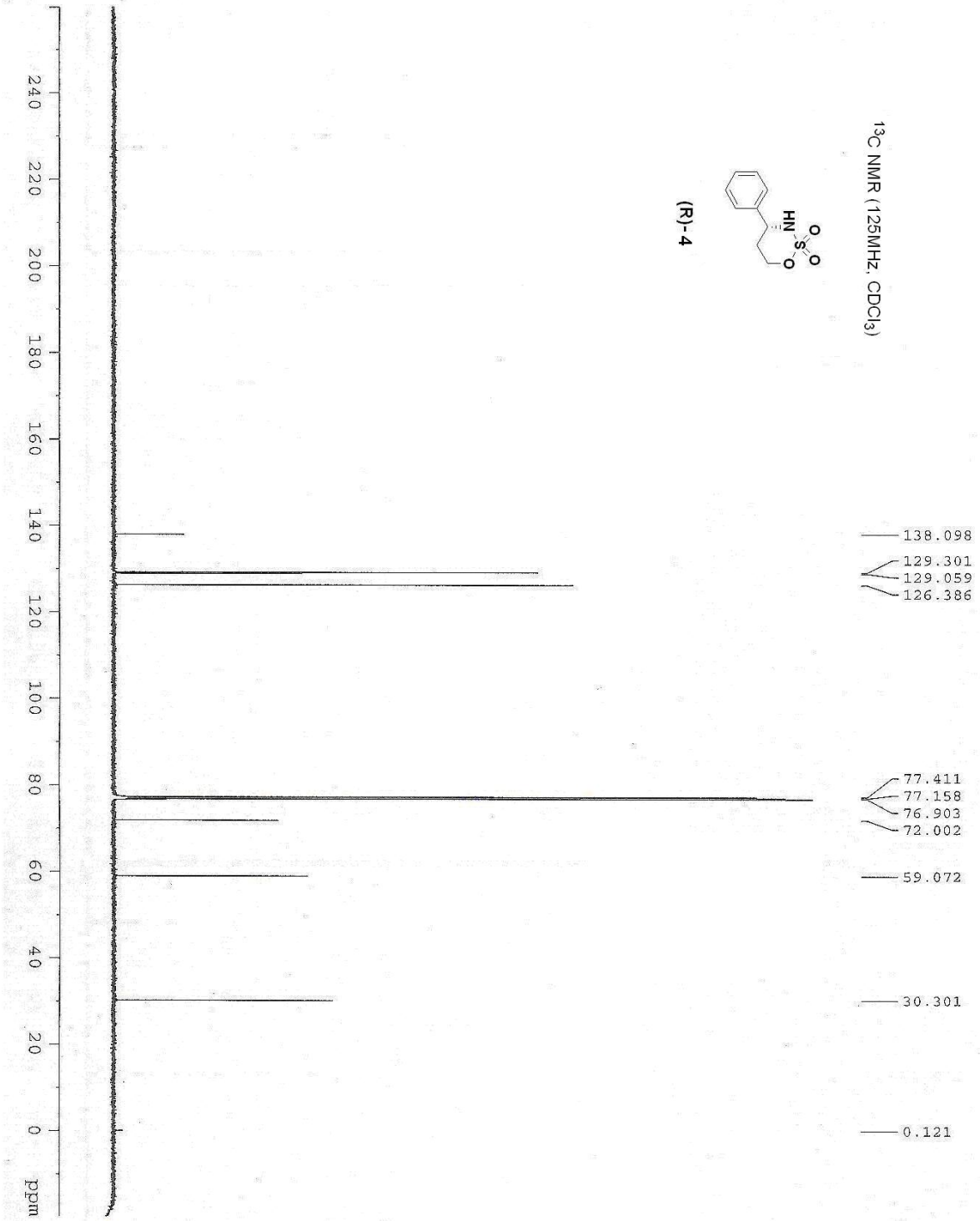
NAME	090825_R_nap
EXPNO	1
PROCNO	1
Date_	20090825
Time	14.41
INSTRUM	spect
PROBHD	5 mm DUL 13C-1
PULPROG	zg30
TD	65536
SOLVENT	CD3CN
NS	16
DS	0
SWH	7507.507 Hz
FIDRES	0.114555 Hz
AQ	4.3648143 sec
RG	256
DW	66.600 usec
DE	6.00 usec
TE	296.8 K
D1	1.00000000 sec
TD0	1
======== CHANNEL f1 ========	
NUC1	1H
P1	9.80 usec
PL1	-1.90 dB
PL1W	27.23316002 W
SFO1	500.1332508 MHz
SI	32768
SF	500.1300156 MHz
WDW	EM
SSB	0
LB	0.30 Hz
GB	0
PC	1.00

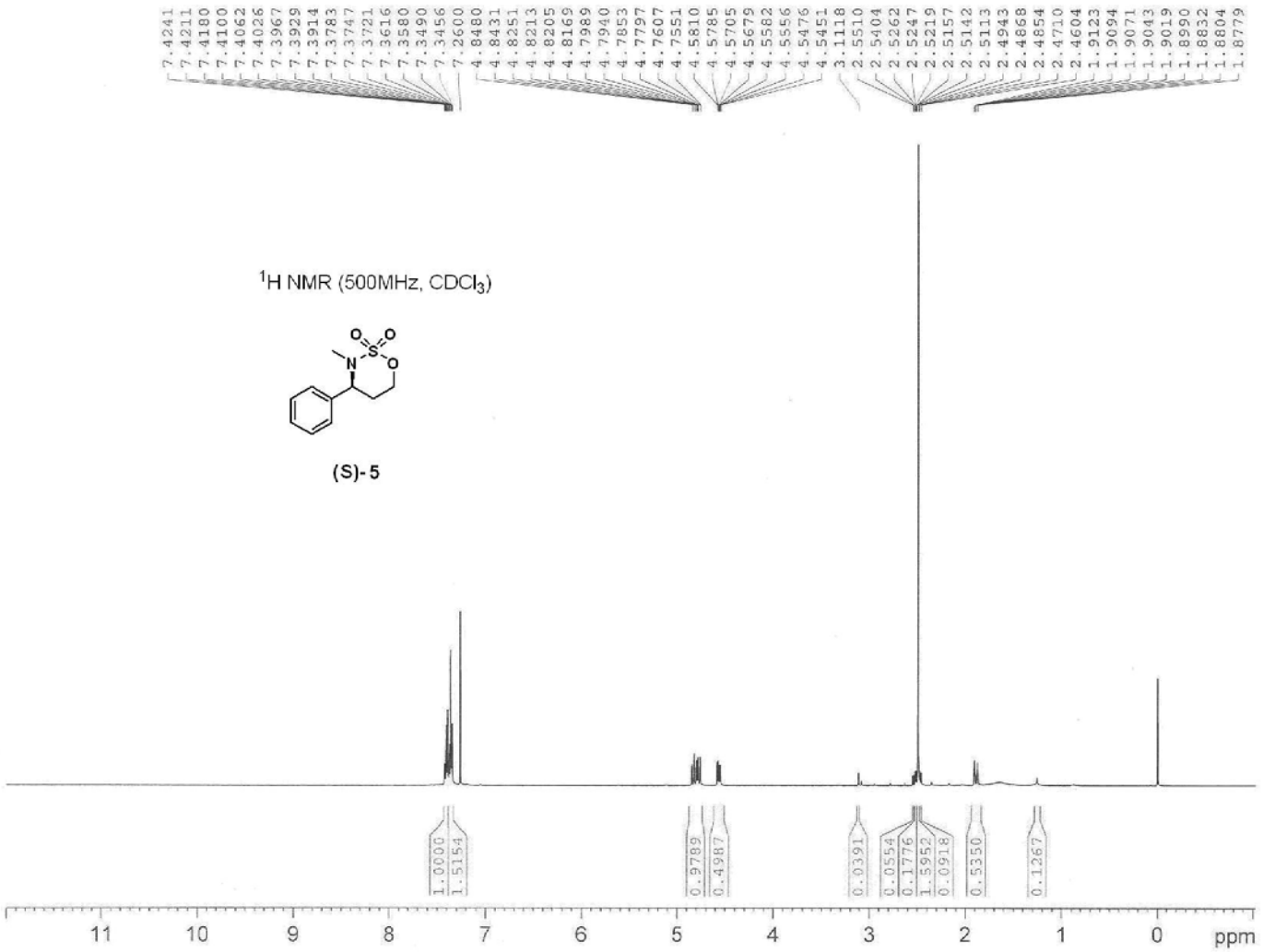

^{1}H NMR (500MHz, CD$_3$CN)
Rh$_2$(S-nap)$_4$
Ts
4.0000
4.0057
4.1174
4.0865
2.9106
6.0218
5.6365
6.0346
6.1236
2.5620
13.5623
ppm
7.773
7.756
7.681
7.664
7.410
7.394
7.327
7.311
5.870
5.865
5.746
3.347
3.310
3.294
3.263
3.246
3.234
3.216
2.936
2.430
2.413
2.389
2.136
2.120
2.103
2.015
2.010
2.005
2.000
1.995
1.990
1.984
1.980
1.975
1.950
1.945
1.940
1.935
1.930
1.632
1.622
1.606
1.595
1.585
1.575
1.566
1.545
1.537
1.527
1.518
1.474
1.466
1.447
1.429
1.421
NAME 090826_S_nap 0826
EXPNO 1
PROCNO 1
Date_ 20090826
Time_ 16.14
INSTRUM spect
PROBHD 5 mm DUL 13C-1
PULPROG zg30
TD 65536
SOLVENT CD3CN
NS 16
DS 0
SWH 7507.507 Hz
FIDRES 0.114555 Hz
AQ 4.3648143 sec
RG 574.7
DW 66.600 usec
DE 6.00 usec
TE 296.6 K
D1 1.00000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 1H
P1 9.80 usec
PL1 -1.90 dB
PL1W 27.23316002 W
SFO1 500.1332508 MHz
SI 32768
SF 500.1300155 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00


^{1}H NMR (300MHz, CDCl$_3$)
(S)-4
7.4385
7.4303
7.4240
7.4151
7.4087
7.4022
7.3973
7.3843
7.3781
7.3736
7.3619
7.3408
7.3344
7.2582
4.9062
4.8985
4.8636
4.8609
4.8561
4.8316
4.8247
4.8174
4.6807
4.6756
4.6640
4.6589
4.6417
4.6366
4.6251
4.6201
4.4195
4.3887
2.3264
2.3097
2.2844
2.2781
2.2682
2.2614
2.2427
2.2363
2.2262
2.2200
2.1946
2.1780
2.0513
2.0431
2.0372
2.0287
2.0031
1.9946
1.9887
1.9804
1.6244
1.2561
0.8798
0.8555
0.8286
-0.0002
1.000
0.409
0.207
0.195
0.213
0.230
0.121
0.328
0.153
ppm


(S)-4
^{13}C NMR (75MHz, CDCl$_3$)
137.9784
129.1706
128.9239
126.2664
77.4575
77.0337
76.6102
71.8826
58.9483
30.1755
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
ppm


^{1}H NMR (500MHz, $CDCl_3$)
(R)-4
HN
S
O
O
O
7.423
7.420
7.414
7.410
7.407
7.401
7.398
7.395
7.394
7.391
7.388
7.382
7.379
7.376
7.370
7.365
7.361
7.358
7.353
7.347
7.344
7.260
4.891
4.887
4.868
4.865
4.864
4.861
4.846
4.842
4.838
4.673
4.670
4.663
4.660
4.649
4.646
4.640
4.637
4.399
4.381
2.298
2.288
2.273
2.269
2.264
2.263
2.259
2.248
2.244
2.244
2.238
2.234
2.219
2.209
2.042
2.038
2.034
2.029
2.013
2.010
2.008
2.005
2.000
1.726
1.255
0.883
0.007
0.001
-0.005
1.0000
1.5100
1.0069
0.5117
0.4910
0.5244
0.5369
0.2054
0.0562
0.0218
ppm


13C NMR (125MHz, CDCl3)
(R)-4
HN
S
O
O
O
138.098
129.301
129.059
126.386
77.411
77.158
76.903
72.002
59.072
30.301
0.121
240
220
200
180
160
140
120
100
80
60
40
20
0
ppm

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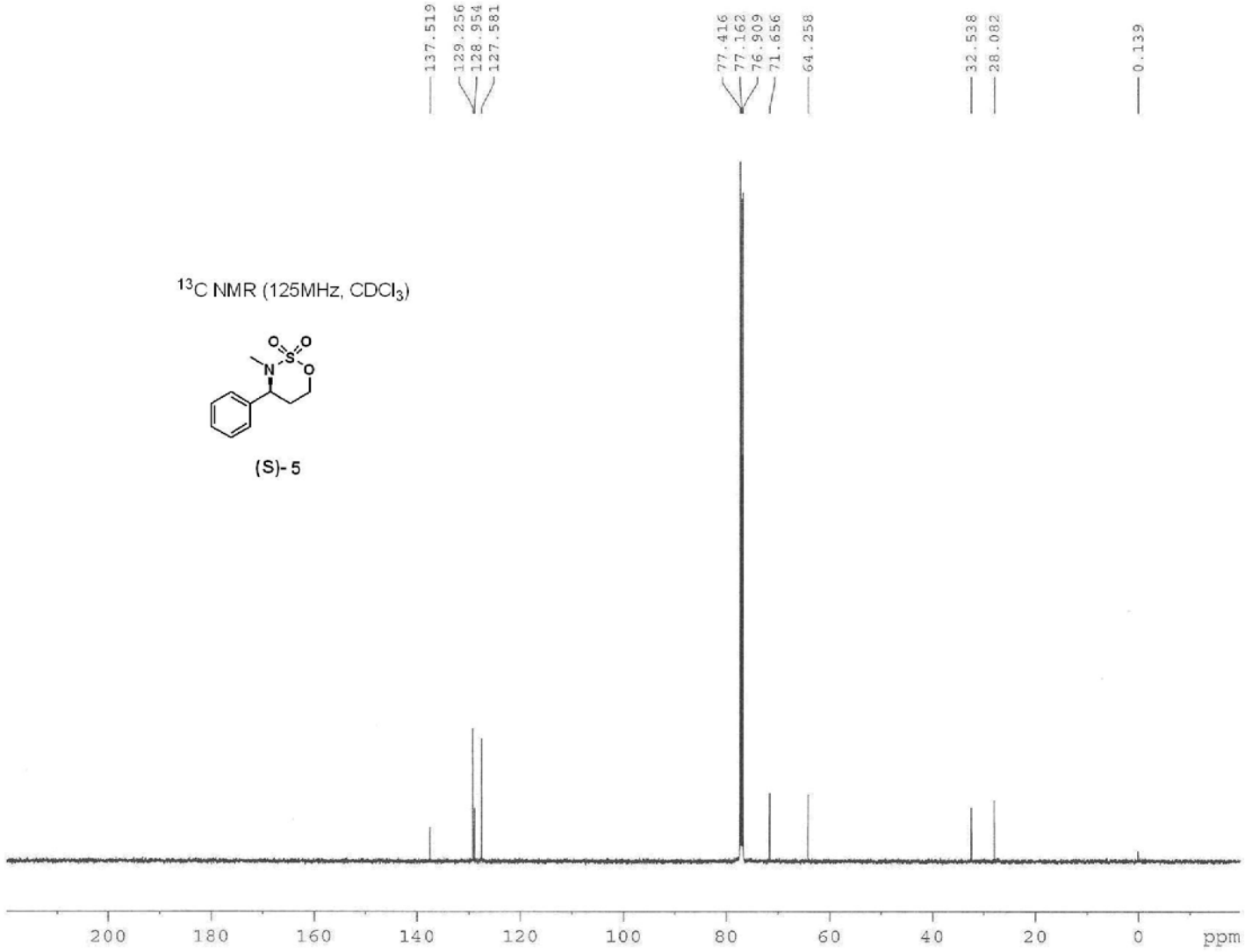
NAME        090529_KSY_4_73_1
EXPNO                       1
PROCNO                      1
Date_                20090529
Time                    18.18
INSTRUM                 spect
PROBHD    5 mm DUL 13C-1
PULPROG                  zg30
TD                      65536
SOLVENT                 CDCl3
NS                         16
DS                          0
SWH                  7507.507 Hz
FIDRES              0.114555 Hz
AQ                 4.3648143 sec
RG                        256
DW                     66.600 usec
DE                      6.00 usec
TE                     296.9 K
D1                1.00000000 sec
TD0                         1

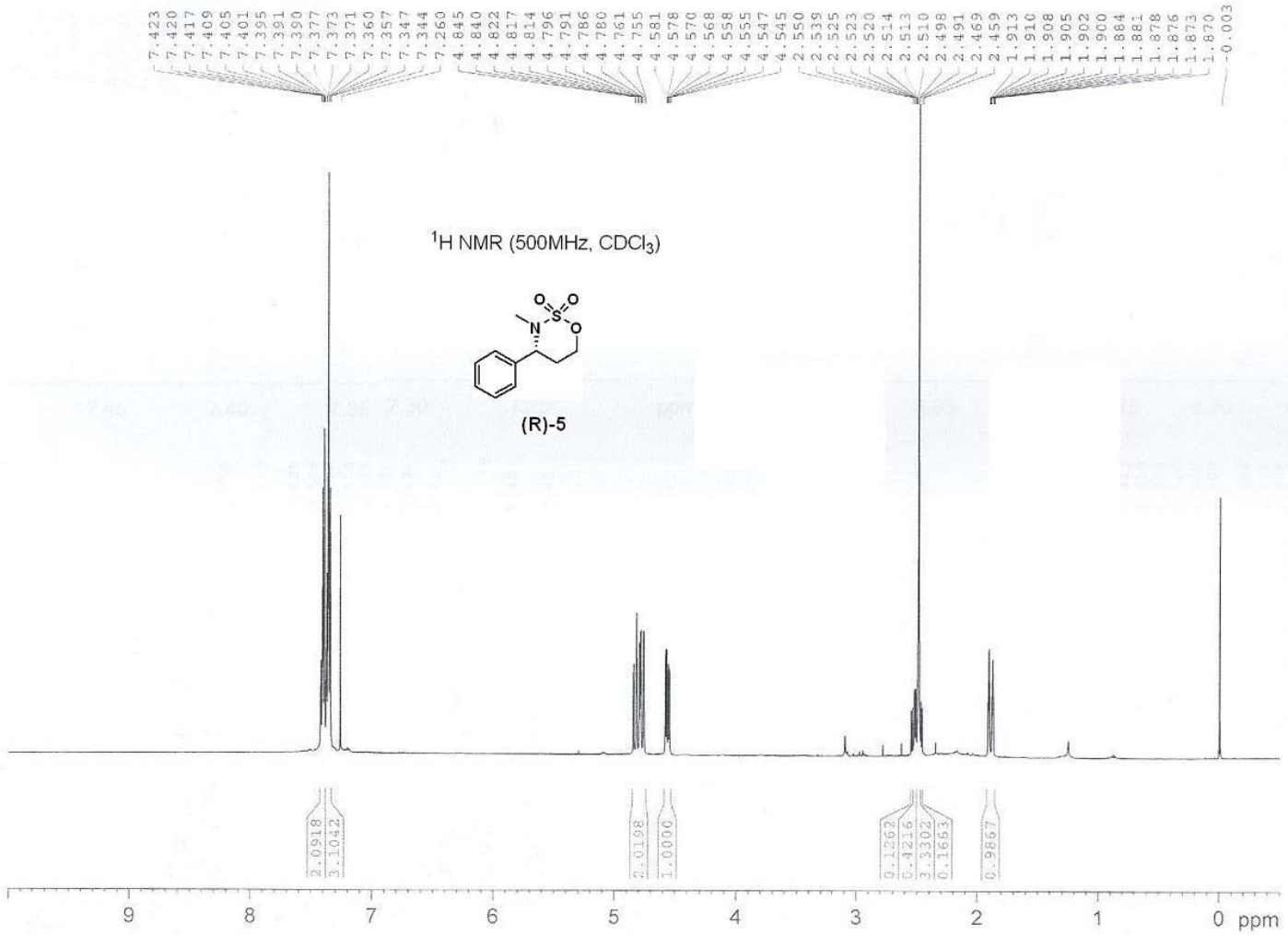
======== CHANNEL f1 ========
NUC1                       1H
P1                       9.80 usec
PL1                     -1.90 dB
PL1W              27.23316002 W
SFO1              500.1332508 MHz
SI                      32768
SF                500.1300139 MHz
WDW                        EM
SSB                         0
LB                       0.30 Hz
GB                          0
PC                       1.00
```



^{13}C NMR (125MHz, $CDCl_3$)

(S)-5

NAME	090529_KSY_4_73_1
EXPNO	2
PROCNO	1
Date_	20090529
Time	19.10
INSTRUM	spect
PROBHD	5 mm DUL 13C-1
PULPROG	zgpg30
TD	65536
SOLVENT	CDCl3
NS	1024
DS	2
SWH	35211.270 Hz
FIDRES	0.537281 Hz
AQ	0.9306754 sec
RG	512
DW	14.200 usec
DE	6.00 usec
TE	297.8 K
D1	2.00000000 sec
D11	0.03000000 sec
TD0	1
======== CHANNEL f1 ========	
NUC1	13C
P1	8.00 usec
PL1	1.40 dB
PL1W	70.60439301 W
SFO1	125.7728799 MHz
======== CHANNEL f2 ========	
CPDPRG2	waltz16
NUC2	1H
PCPD2	100.00 usec
PL2	-1.90 dB
PL12	16.00 dB
PL13	19.00 dB
PL2W	27.23316002 W
PL12W	0.44167015 W
PL13W	0.22135943 W
SFO2	500.1320005 MHz
SI	32768
SF	125.7577709 MHz
WDW	EM
SSB	0
LB	1.00 Hz
GB	0
PC	1.40



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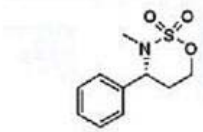
EXPNO	1
PROCNO	1
Date_	20090917
Time	18.04
INSTRUM	spect
PROBHD	5 mm DUL 13C-1
PULPROG	zg30
TD	65536
SOLVENT	CDCl3
NS	32
DS	0
SWH	7507.507 Hz
FIDRES	0.114555 Hz
AQ	4.3648143 sec
RG	128
DW	66.600 usec
DE	6.00 usec
TE	296.8 K
D1	1.00000000 sec
TD0	1
======== CHANNEL f1 ========	
NUC1	1H
P1	9.80 usec
PL1	-1.90 dB
PL1W	27.23316002 W
SFO1	500.1332508 MHz
SI	32768
SF	500.1300139 MHz
WDW	EM
SSB	0
LB	0.30 Hz
GB	0
PC	1.00

^{13}C NMR (125MHz, $CDCl_3$)

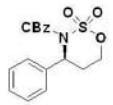


(R)-5

NAME	090917_KSY_MeN	
EXPNO	2	
PROCNO	1	
Date_	20090917	
Time	18.56	
INSTRUM	spect	
PROBHD	5 mm DUL 13C-1	
PULPROG	zgpg30	
TD	65536	
SOLVENT	CDCl3	
NS	1024	
DS	2	
SWH	35211.270	Hz
FIDRES	0.537281	Hz
AQ	0.9306754	sec
RG	9195.2	
DW	14.200	usec
DE	6.00	usec
TE	297.4	K
D1	2.00000000	sec
D11	0.03000000	sec
TD0	1	
========	CHANNEL f1	========
NUC1	13C	
P1	8.00	usec
PL1	1.40	dB
PL1W	70.60439301	W
SFO1	125.7728799	MHz
========	CHANNEL f2	========
CPDPRG2	waltz16	
NUC2	1H	
PCPD2	100.00	usec
PL2	-1.90	dB
PL12	16.00	dB
PL13	19.00	dB
PL2W	27.23316002	W
PL12W	0.44167015	W
PL13W	0.22135943	W
SFO2	500.1320005	MHz
SI	32768	
SF	125.7577736	MHz
WDW	EM	
SSB	0	
LB	1.00	Hz
GB	0	
PC	1.40	

INDEX	FREQUENCY	PPM	HEIGHT	INDEX	FREQUENCY	PPM	HEIGHT
1	2223.675	7.414	7.3	40	745.920	2.487	10.5
2	2214.872	7.384	91.3	41	743.866	2.480	8.9
3	2210.911	7.371	222.7	42	741.078	2.471	7.6
4	2206.509	7.356	115.2	43	739.024	2.464	8.8
5	2205.335	7.352	117.5	44	737.704	2.459	8.9
6	2200.640	7.337	45.4	45	734.769	2.450	9.9
7	2197.559	7.326	46.0	46	732.569	2.442	8.8
8	2192.130	7.308	23.0	47	731.248	2.438	8.7
9	2187.142	7.292	10.7	48	729.194	2.431	7.0
10	2176.138	7.255	22.1	49	468.474	1.562	21.8
11	1728.205	5.762	16.7	50	376.481	1.255	19.1
12	1724.096	5.748	27.9	51	263.801	0.879	4.7
13	1720.282	5.735	17.6	52	256.172	0.854	4.9
14	1593.810	5.314	151.2	53	248.982	0.830	3.4
15	1416.867	4.724	11.3	54	0.000	0.000	31.0
16	1408.210	4.695	18.6				
17	1406.303	4.689	16.2				
18	1400.287	4.668	14.3				
19	1398.820	4.664	14.4				
20	1332.650	4.443	10.2				
21	1326.194	4.421	12.0				
22	1321.793	4.407	19.1				
23	1315.196	4.385	19.4				
24	1310.935	4.371	10.4				
25	1304.333	4.349	9.2				
26	906.871	3.023	4.5				
27	902.029	3.007	5.1				
28	899.388	2.998	5.8				
29	894.693	2.983	8.4				
30	892.052	2.974	9.3				
31	887.651	2.959	10.2				
32	884.570	2.949	9.5				
33	880.902	2.937	10.3				
34	876.207	2.921	7.4				
35	873.566	2.912	6.7				
36	868.724	2.896	5.7				
37	752.376	2.508	10.0				
38	749.441	2.499	11.6				
39	747.094	2.491	10.4				

^{1}H NMR (300MHz, $CDCl_3$)



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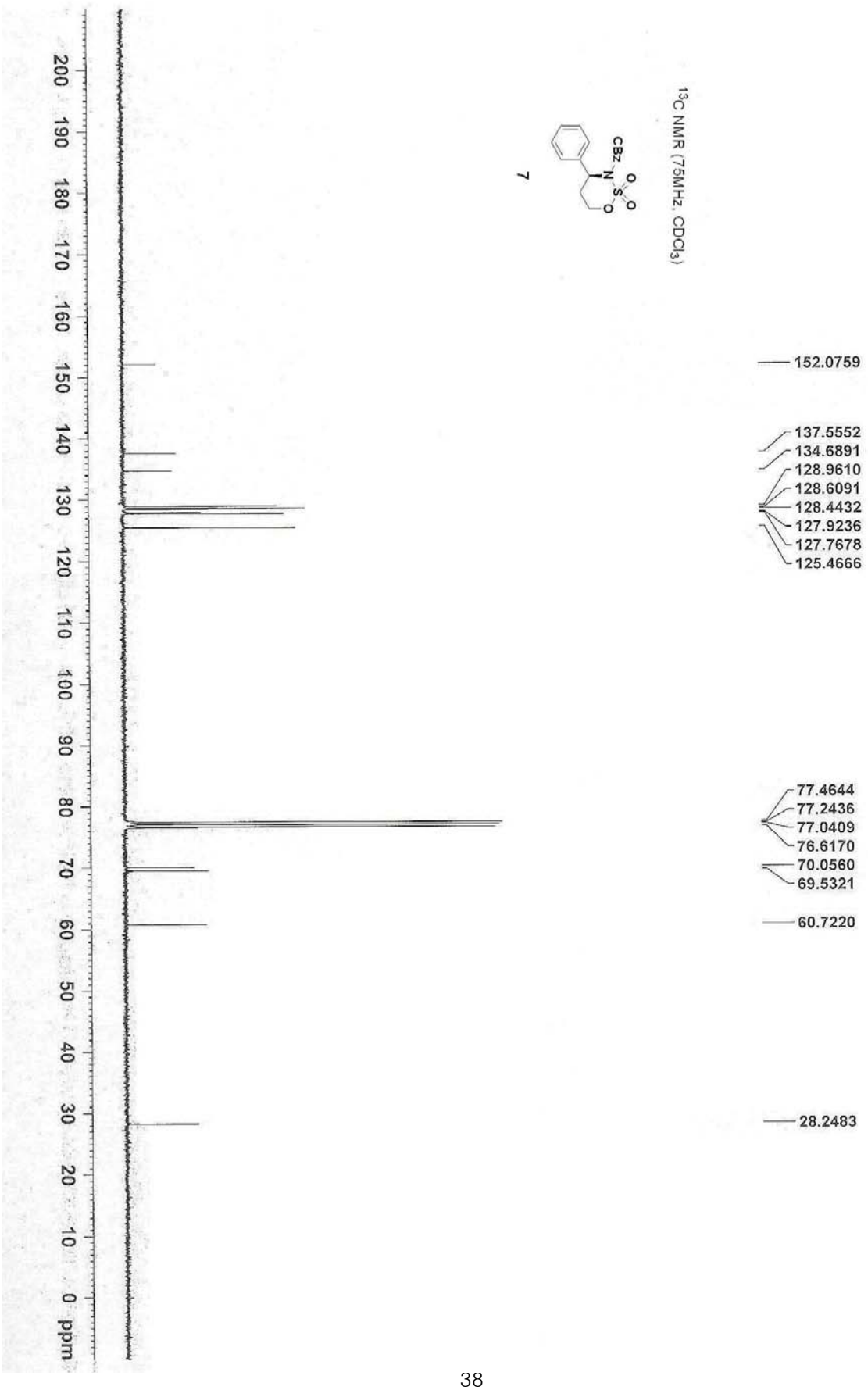
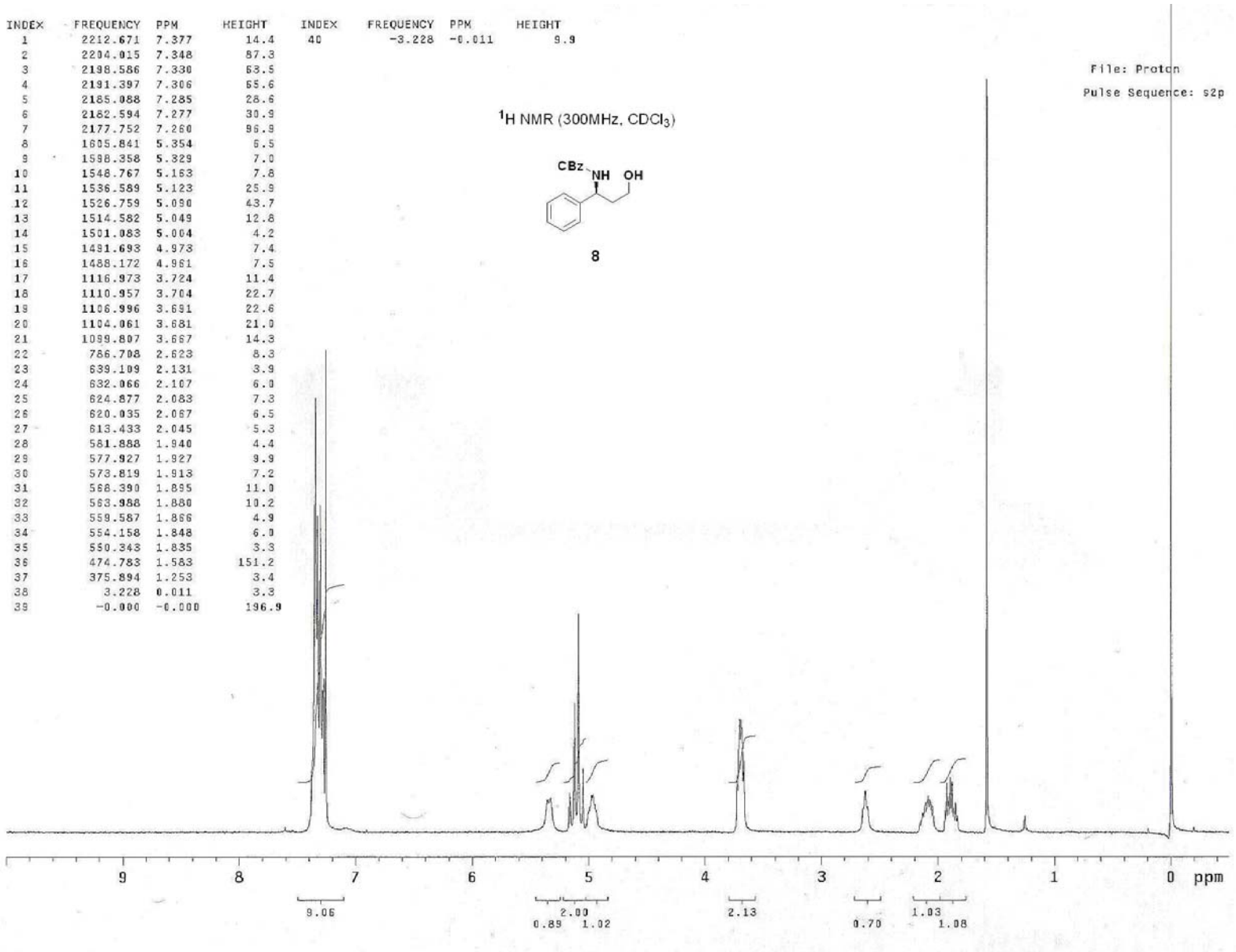
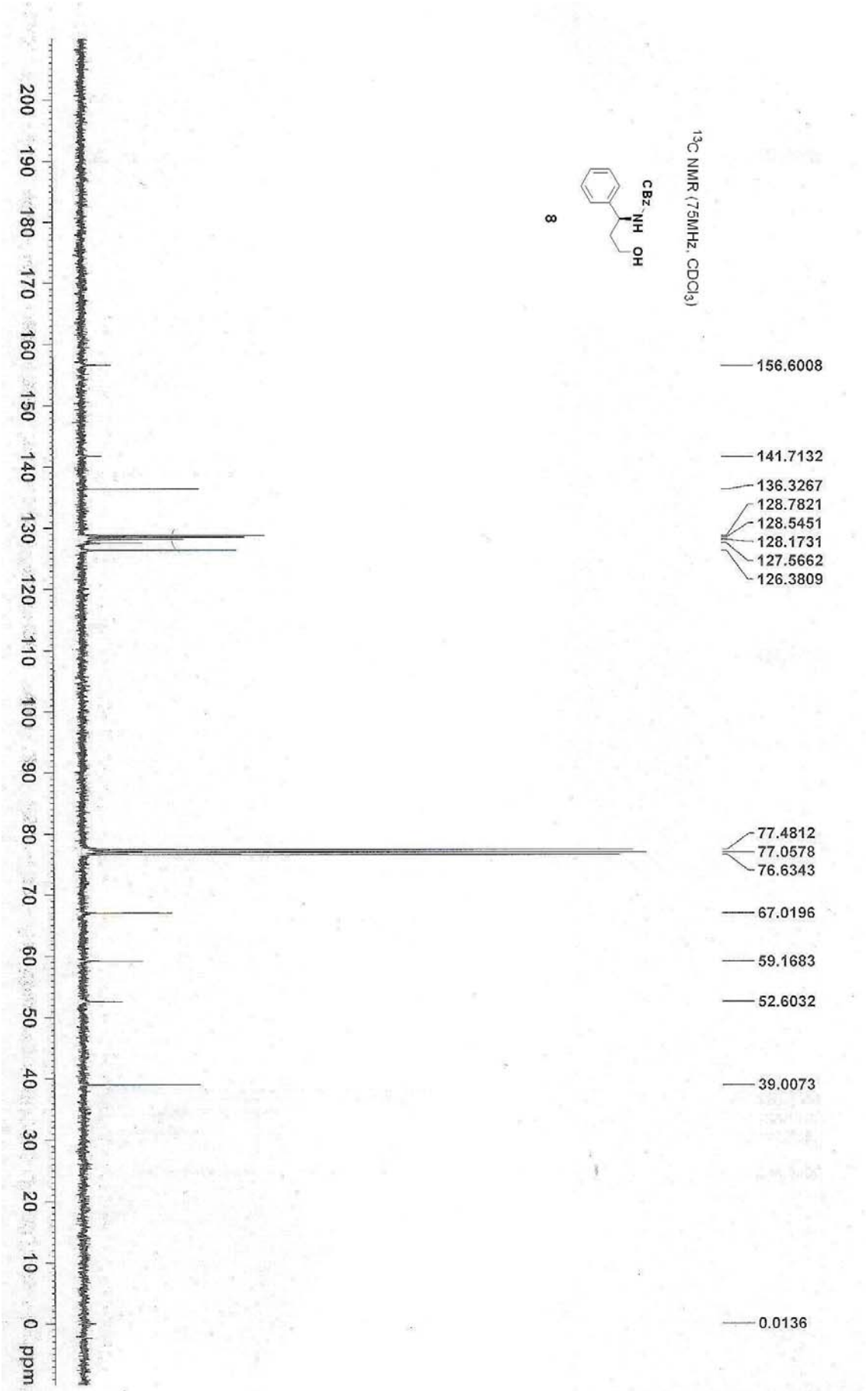
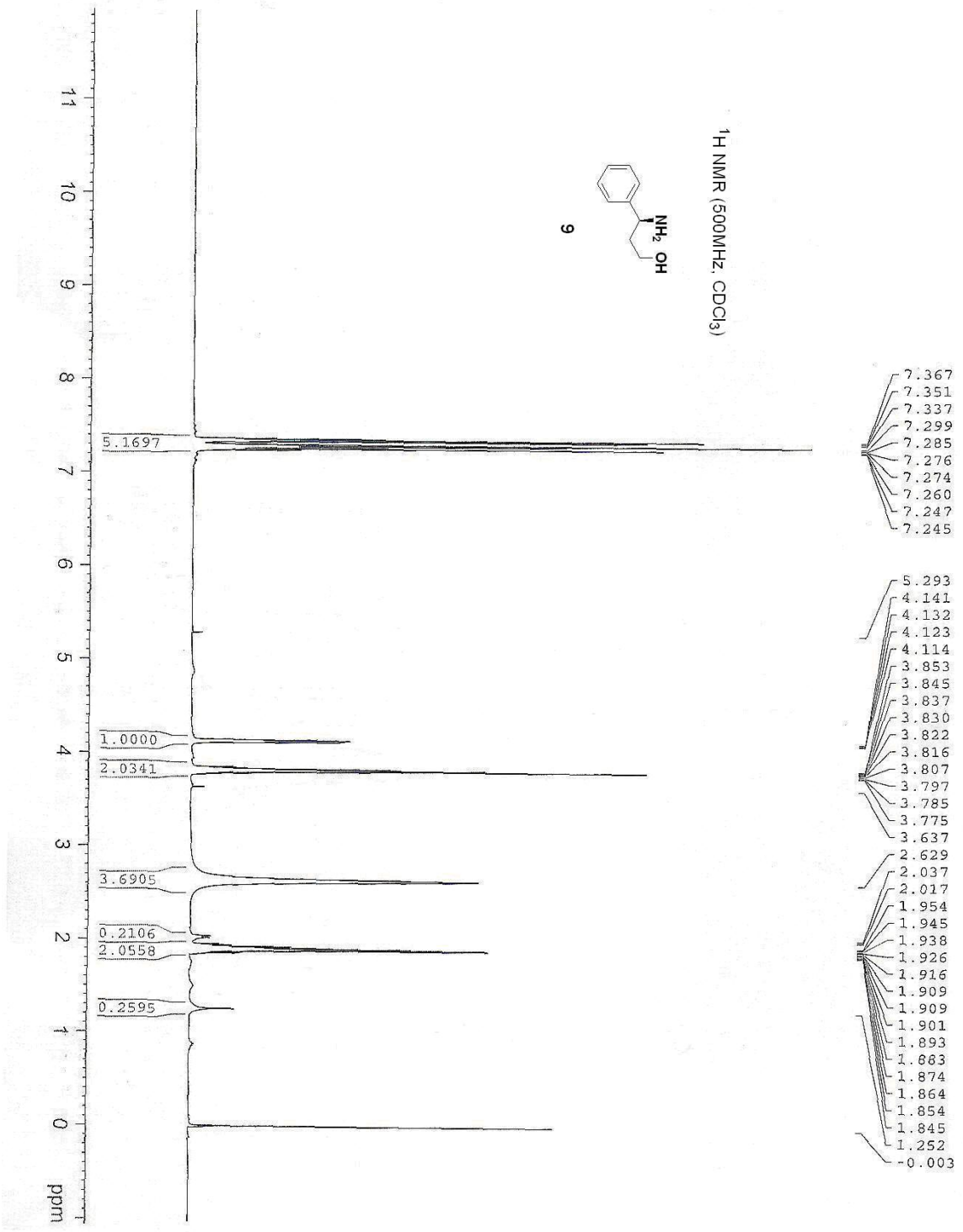
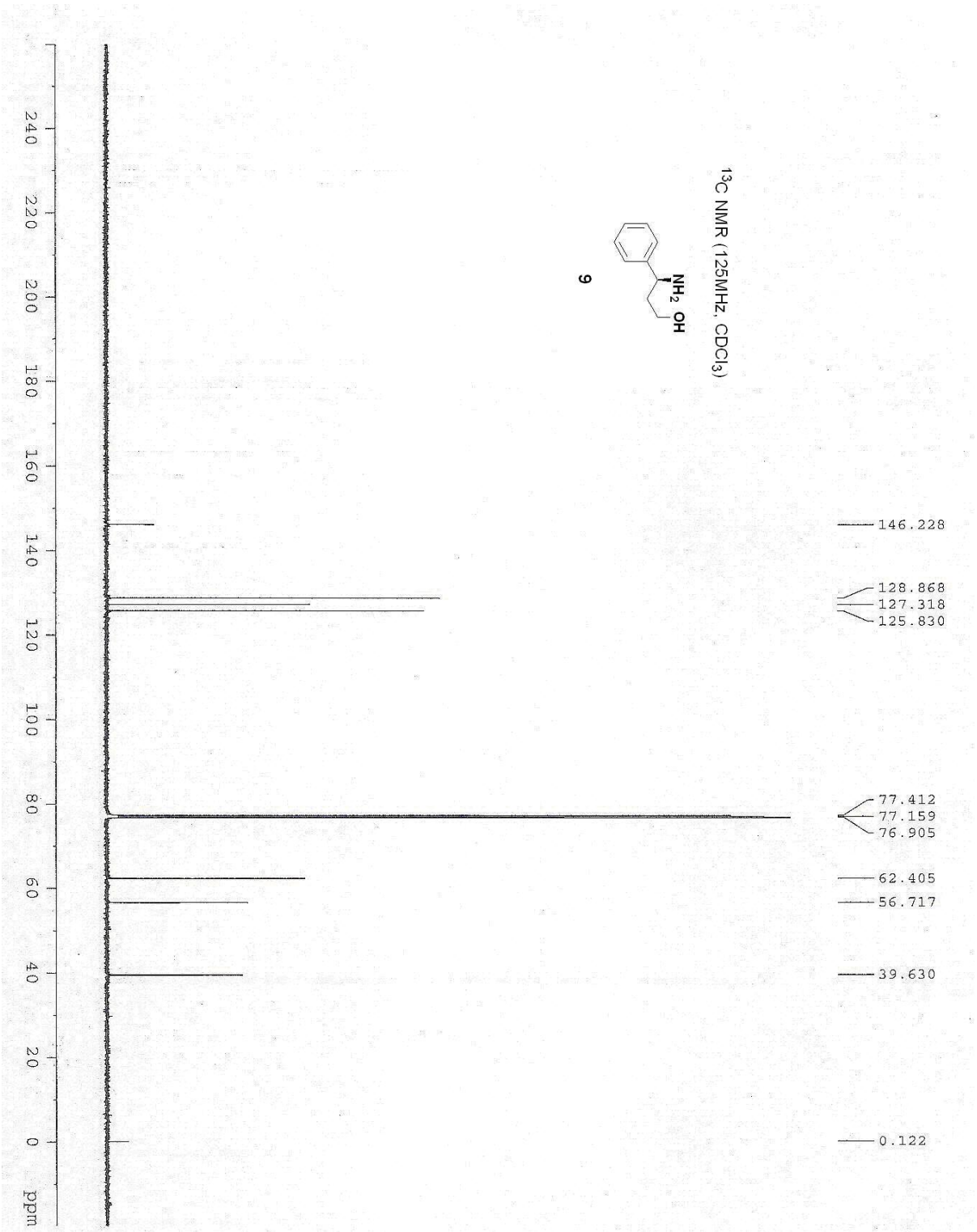

^{13}C NMR (75MHz, CDCl$_3$)
CBz
N
S
O
O
O
7
152.0759
137.5552
134.6891
128.9610
128.6091
128.4432
127.9236
127.7678
125.4666
77.4644
77.2436
77.0409
76.6170
70.0560
69.5321
60.7220
28.2483
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
ppm

INDEX	FREQUENCY	PPM	HEIGHT	INDEX	FREQUENCY	PPM	HEIGHT
1	2212.671	7.377	14.4	40	-3.228	-0.011	9.9
2	2204.015	7.348	87.3				
3	2198.586	7.330	63.5				
4	2191.397	7.306	65.6				
5	2185.088	7.285	28.6				
6	2182.594	7.277	30.9				
7	2177.752	7.260	96.8				
8	1605.841	5.354	6.5				
9	1598.358	5.329	7.0				
10	1548.767	5.163	7.8				
11	1536.589	5.123	25.9				
12	1526.759	5.090	43.7				
13	1514.582	5.049	12.8				
14	1501.083	5.004	4.2				
15	1491.693	4.973	7.4				
16	1488.172	4.961	7.5				
17	1116.973	3.724	11.4				
18	1110.957	3.704	22.7				
19	1106.996	3.691	22.6				
20	1104.061	3.681	21.0				
21	1099.807	3.667	14.3				
22	786.708	2.623	8.3				
23	639.109	2.131	3.9				
24	632.066	2.107	6.0				
25	624.877	2.083	7.3				
26	620.035	2.067	6.5				
27	613.433	2.045	5.3				
28	581.858	1.940	4.4				
29	577.927	1.927	9.9				
30	573.819	1.913	7.2				
31	568.390	1.895	11.0				
32	563.958	1.880	10.2				
33	559.587	1.866	4.9				
34	554.158	1.848	6.0				
35	550.348	1.835	3.3				
36	474.783	1.583	151.2				
37	375.894	1.253	3.4				
38	3.228	0.011	3.3				
39	-0.000	-0.000	196.9				



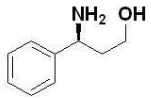

^{13}C NMR (75MHz, CDCl$_3$)
8
CBz
NH
OH
156.6008
141.7132
136.3267
128.7821
128.5451
128.1731
127.5662
126.3809
77.4812
77.0578
76.6343
67.0196
59.1683
52.6032
39.0073
0.0136
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
ppm


^{1}H NMR (500MHz, $CDCl_3$)
9
NH_2 OH
5.1697
1.0000
2.0341
3.6905
0.2106
2.0558
0.2595
ppm
7.367
7.351
7.337
7.299
7.285
7.276
7.274
7.260
7.247
7.245
5.293
4.141
4.132
4.123
4.114
3.853
3.845
3.837
3.830
3.822
3.816
3.807
3.797
3.785
3.775
3.637
2.629
2.037
2.017
1.954
1.945
1.938
1.926
1.916
1.909
1.909
1.901
1.893
1.883
1.874
1.864
1.854
1.845
1.252
-0.003

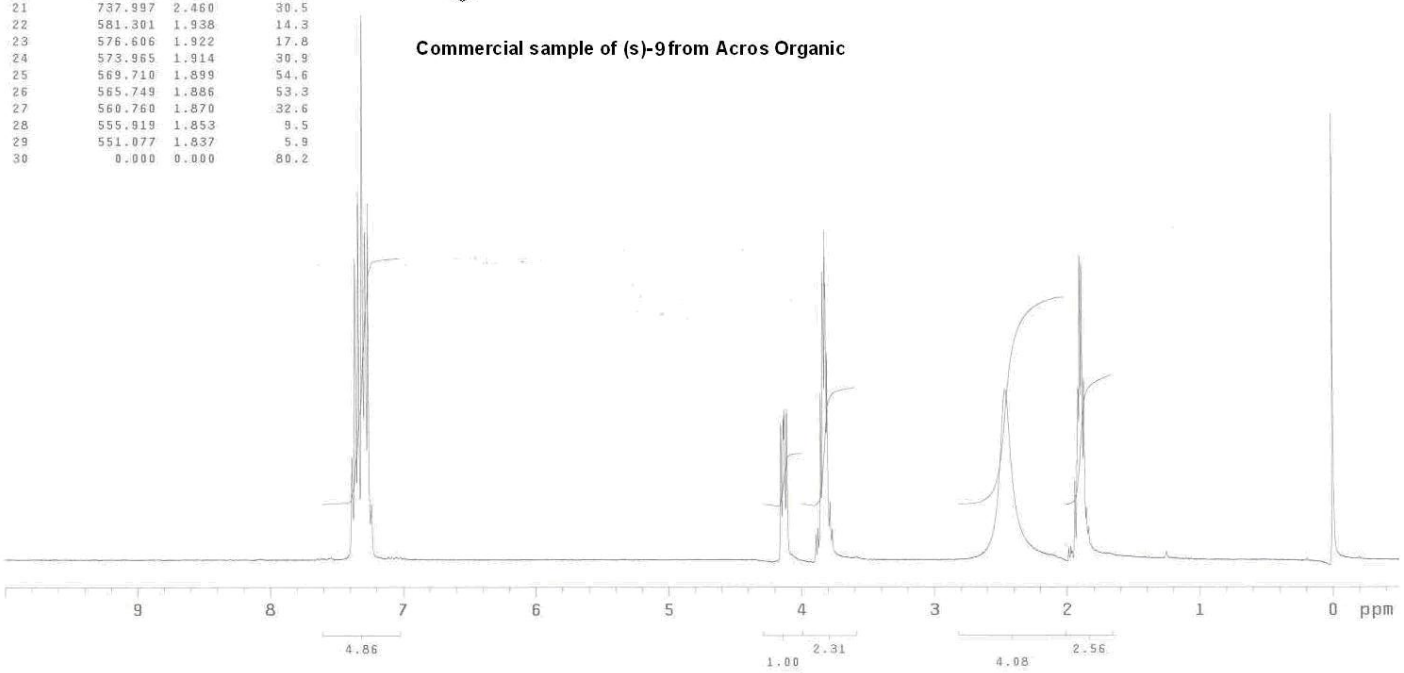

^{13}C NMR (125MHz, CDCl$_3$)
9
NH$_2$ OH
146.228
128.868
127.318
125.830
77.412
77.159
76.905
62.405
56.717
39.630
0.122
240
220
200
180
160
140
120
100
80
60
40
20
0
ppm

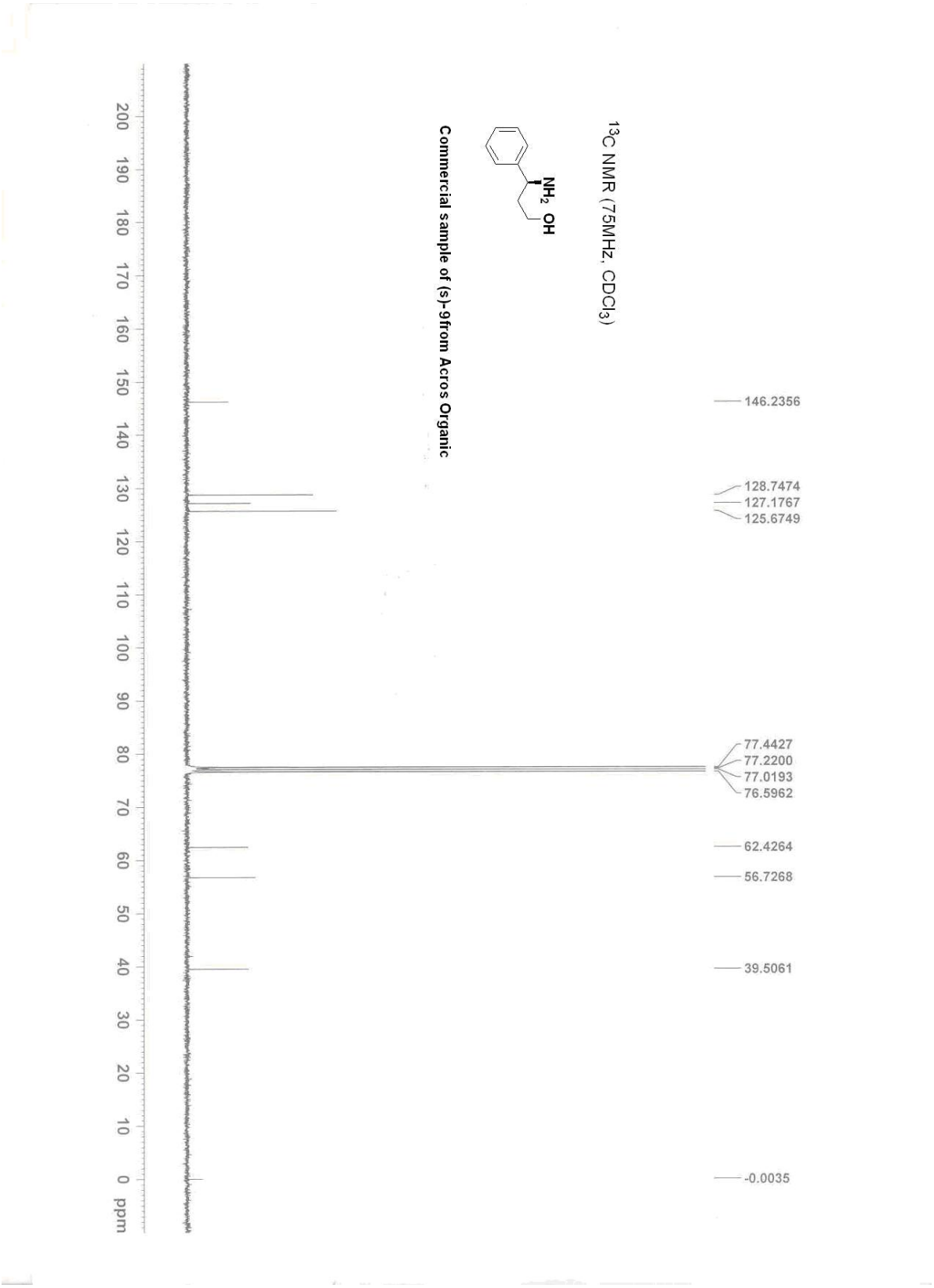
INDEX	FREQUENCY	PPM	HEIGHT
1	2214.725	7.384	18.5
2	2207.389	7.359	53.9
3	2200.200	7.335	66.1
4	2191.250	7.305	97.9
5	2184.501	7.283	58.8
6	2178.192	7.262	63.9
7	2171.150	7.238	10.1
8	1245.205	4.151	24.4
9	1240.070	4.134	25.5
10	1237.429	4.125	26.8
11	1232.147	4.108	27.0
12	1166.710	3.890	4.7
13	1162.162	3.875	5.7
14	1155.560	3.853	29.9
15	1150.425	3.835	51.6
16	1145.583	3.819	59.0
17	1144.116	3.814	49.5
18	1140.741	3.803	37.1
19	1134.579	3.783	10.5
20	1129.884	3.767	5.6
21	737.997	2.460	30.5
22	581.301	1.938	14.3
23	576.606	1.922	17.8
24	573.965	1.914	30.9
25	569.710	1.899	54.6
26	565.749	1.886	53.3
27	560.760	1.870	32.6
28	555.919	1.853	9.5
29	551.077	1.837	5.9
30	0.000	0.000	80.2

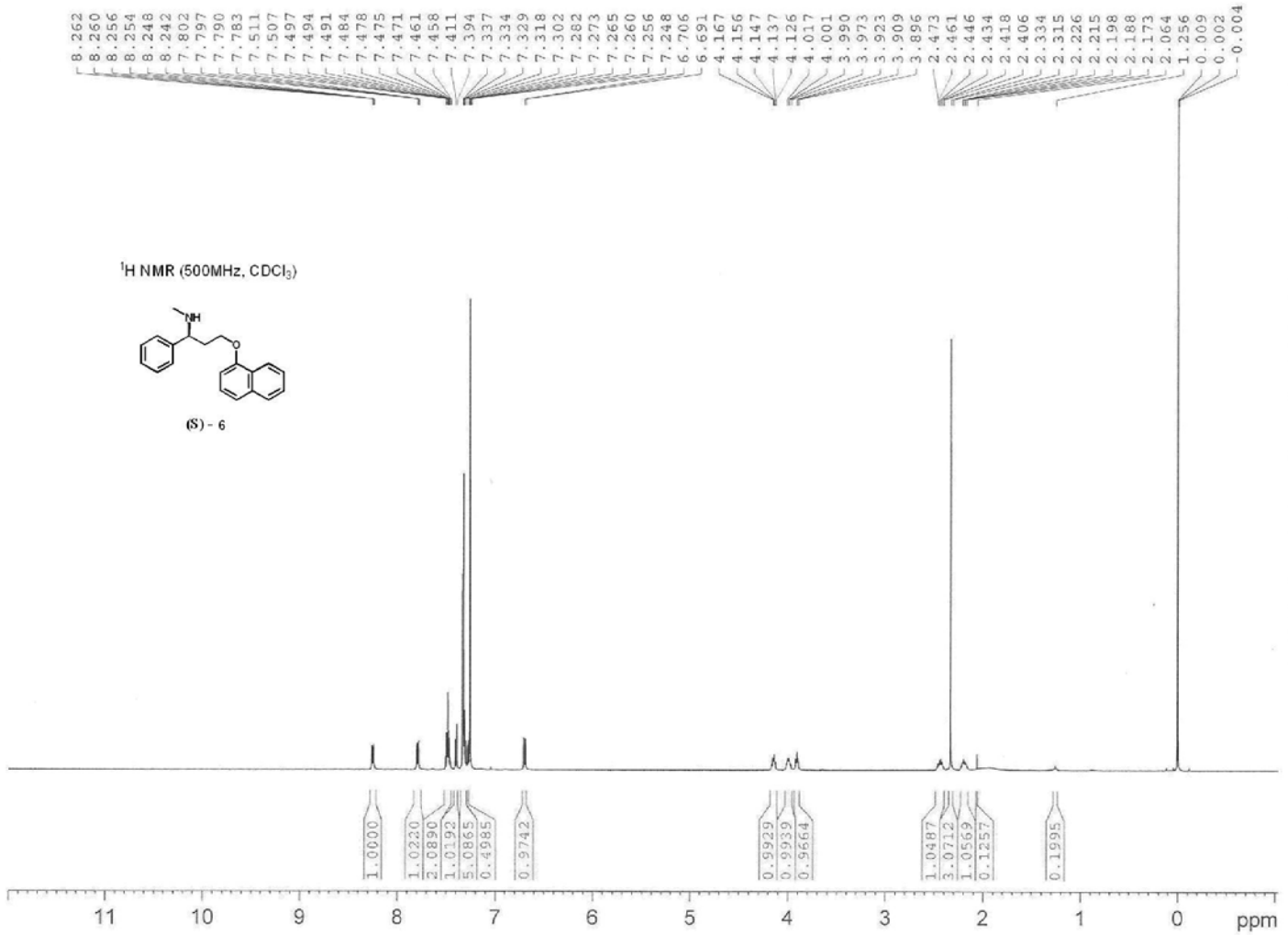
^{1}H NMR (300MHz, $CDCl_3$)



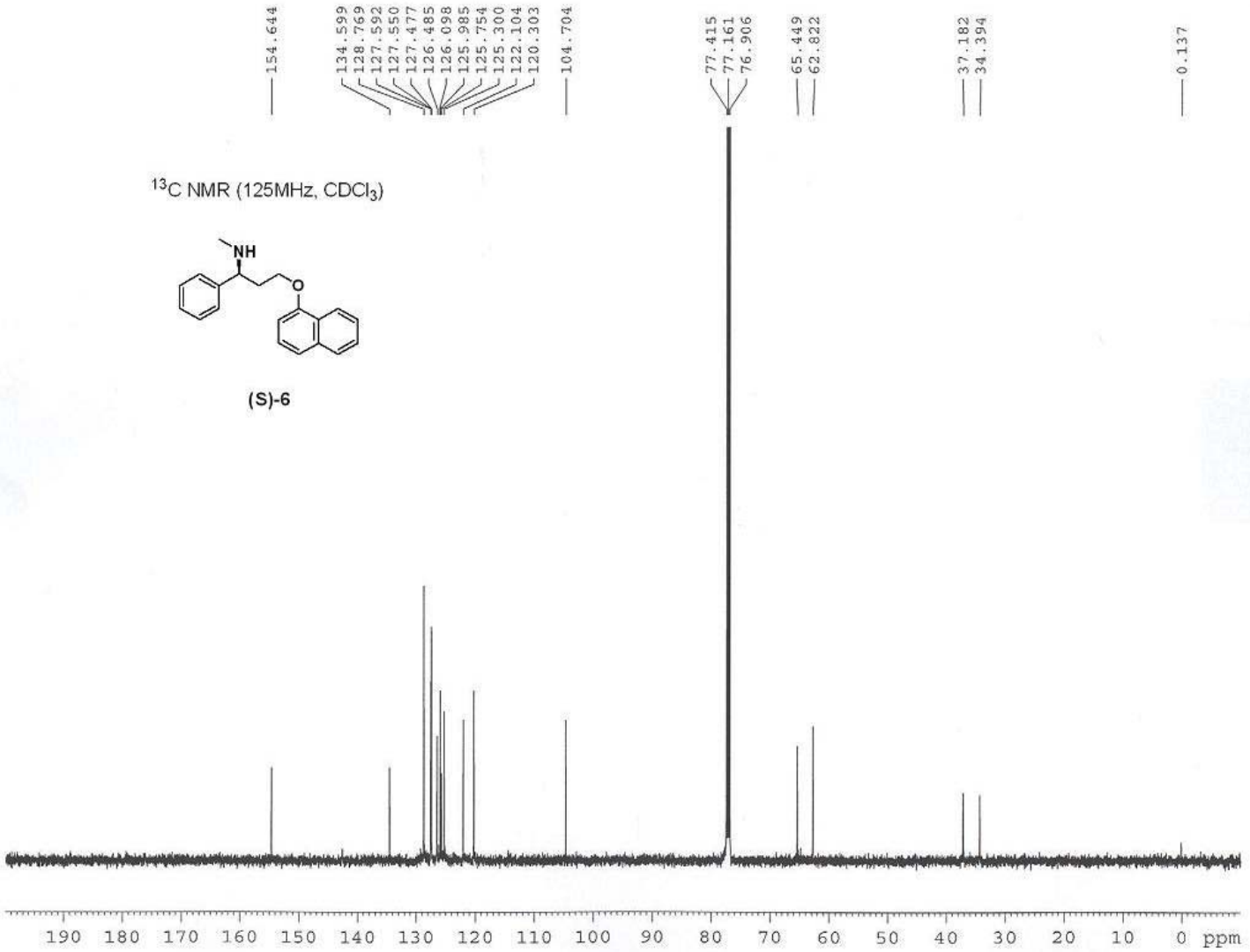
Commercial sample of (s)-9 from Acros Organic



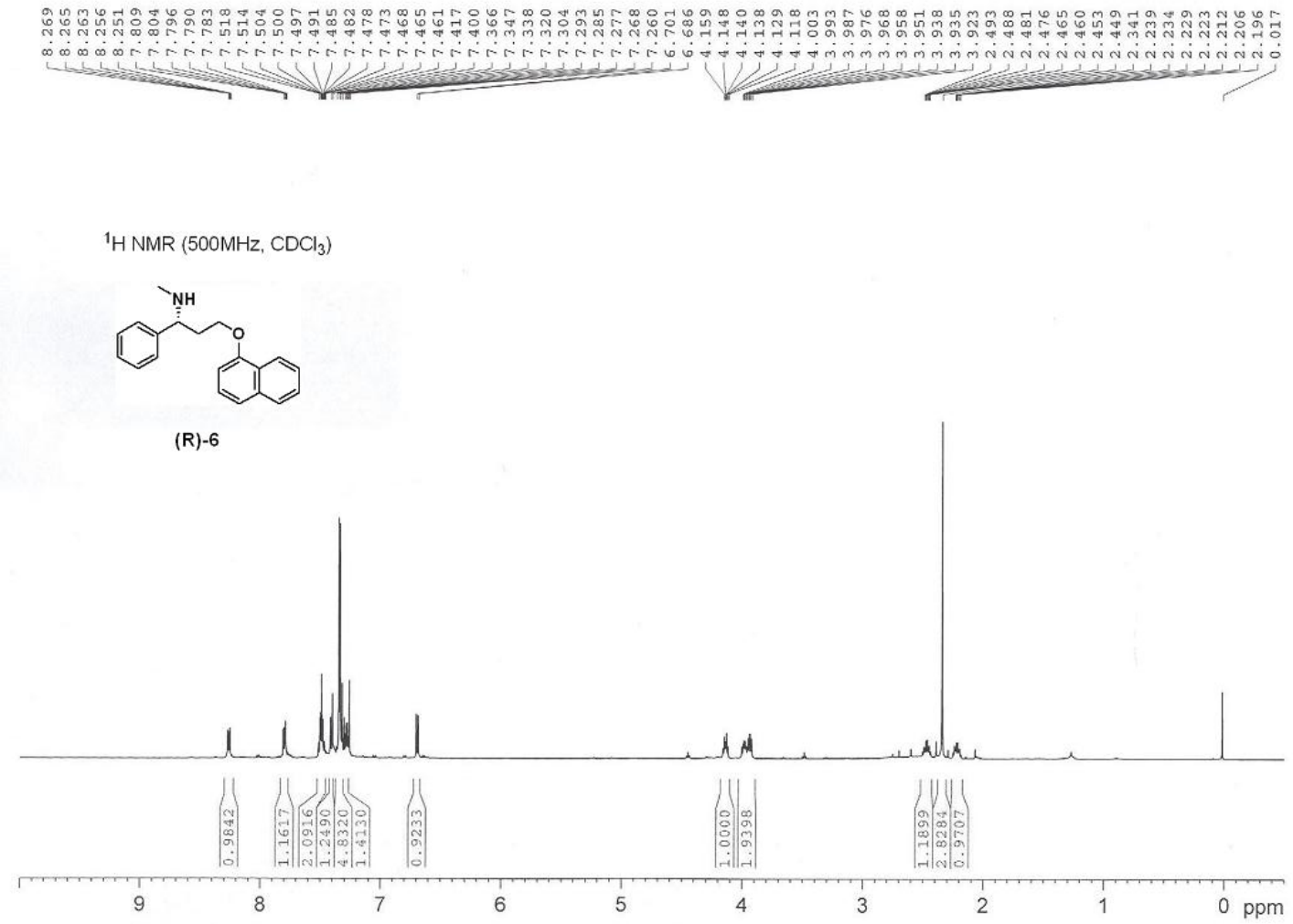

13C NMR (75MHz, CDCl3)
NH2
OH
Commercial sample of (s)-9from Acros Organic
146.2356
128.7474
127.1767
125.6749
77.4427
77.2200
77.0193
76.5962
62.4264
56.7268
39.5061
-0.0035
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 ppm



NAME	090529_KSY_4_75_1
EXPNO	1
PROCNO	1
Date_	20090529
Time	20.16
INSTRUM	spect
PROBHD	5 mm DUL 13C-1
PULPROG	zg30
TD	65536
SOLVENT	CDCl3
NS	16
DS	0
SWH	7507.507 Hz
FIDRES	0.114555 Hz
AQ	4.3648143 sec
RG	362
DW	66.600 usec
DE	6.00 usec
TE	297.4 K
D1	1.00000000 sec
TD0	1
========	CHANNEL f1 ========
NUC1	1H
P1	9.80 usec
PL1	-1.90 dB
PL1W	27.23316002 W
SFO1	500.1332508 MHz
SI	32768
SF	500.1300139 MHz
WDW	EM
SSB	0
LB	0.30 Hz
GB	0
PC	1.00

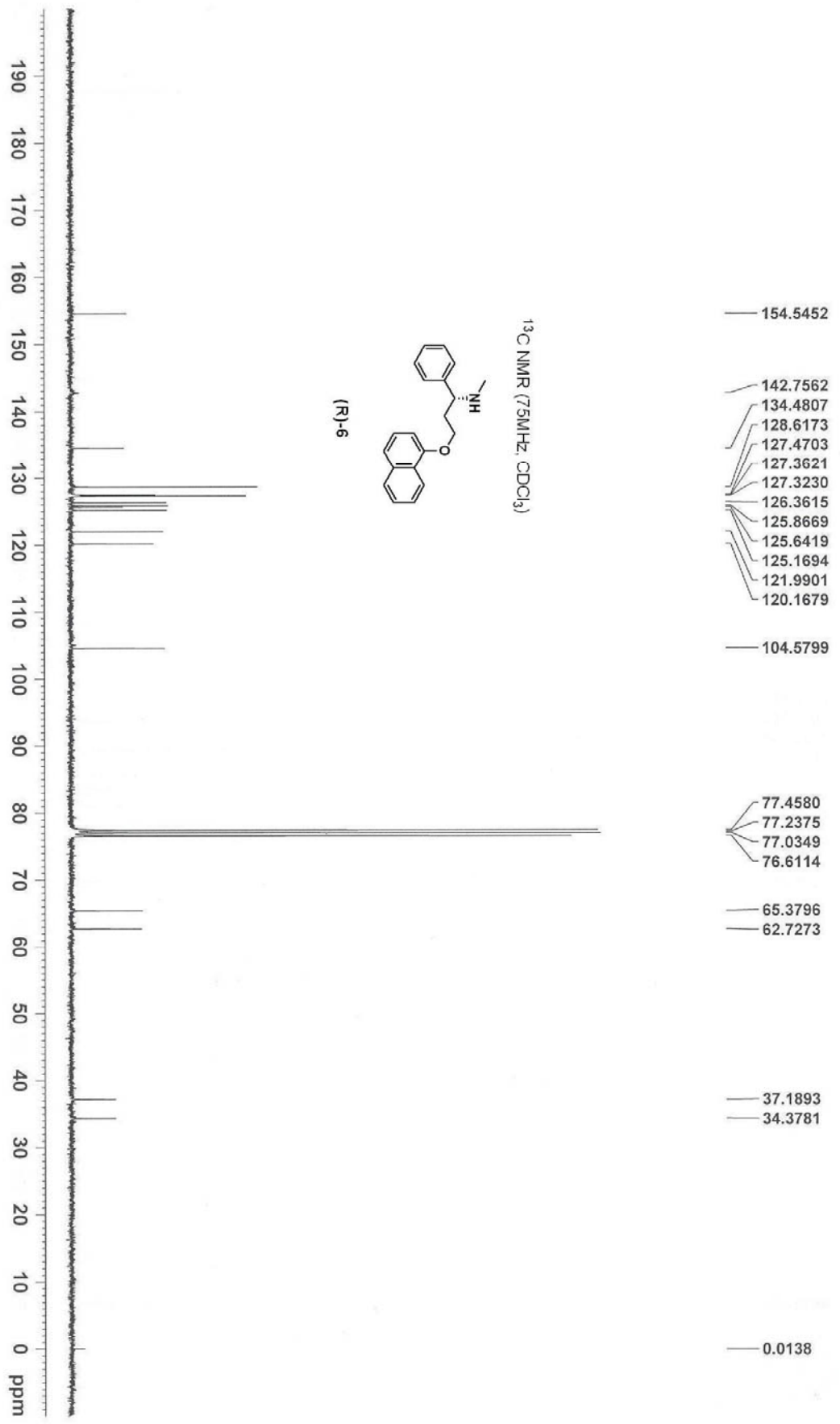


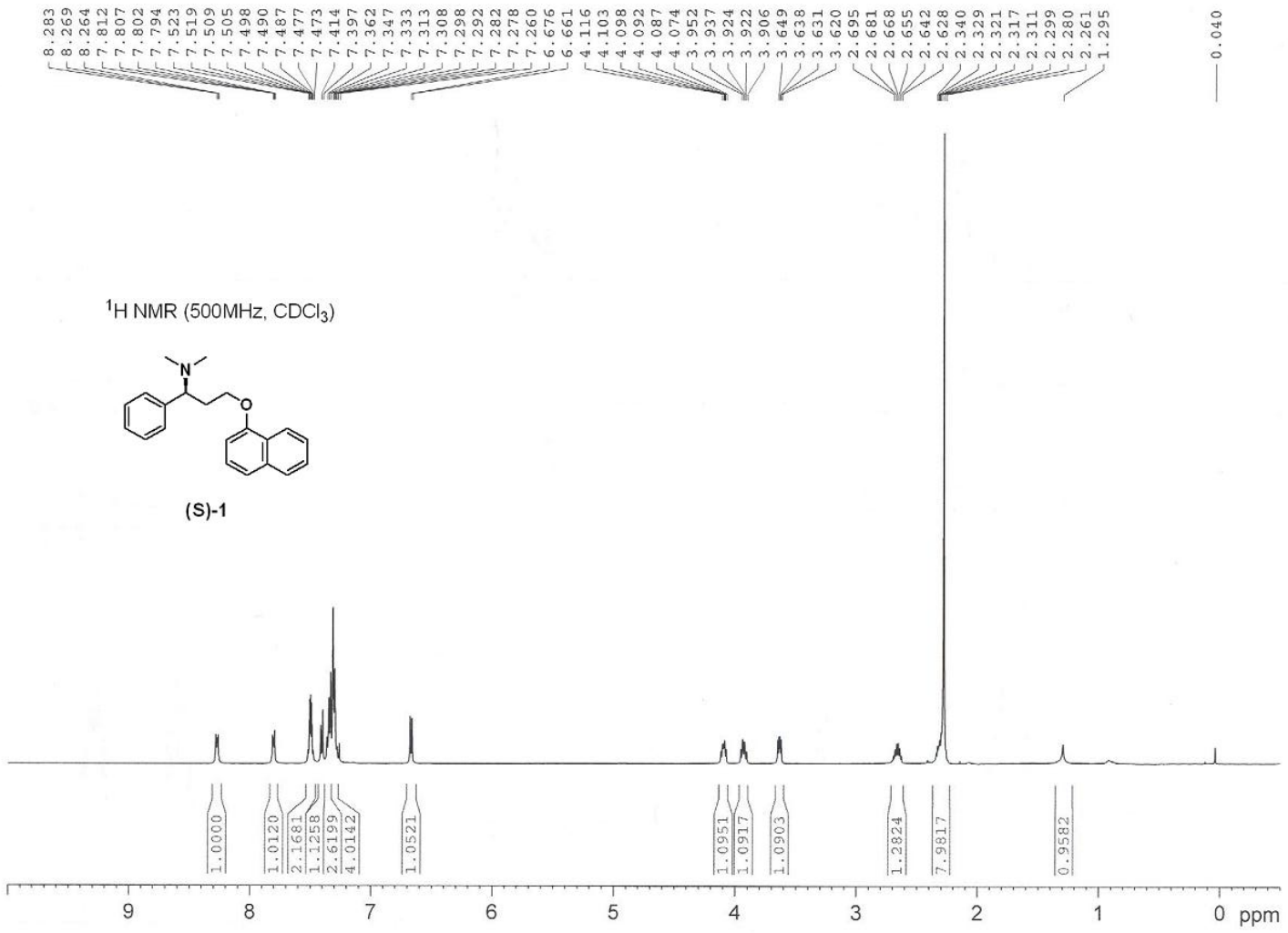
NAME	090921_KSY_MeNH
EXPNO	2
PROCNO	1
Date_	20090921
Time	18.56
INSTRUM	spect
PROBHD	5 mm DUL 13C-1
PULPROG	zgpg30
TD	65536
SOLVENT	CDCl3
NS	1024
DS	2
SWH	35211.270 Hz
FIDRES	0.537281 Hz
AQ	0.9306754 sec
RG	7298.2
DW	14.200 usec
DE	6.00 usec
TE	300.0 K
D1	2.00000000 sec
D11	0.03000000 sec
TD0	1
========	CHANNEL f1 ========
NUC1	13C
P1	8.00 usec
PL1	1.40 dB
PL1W	70.60439301 W
SFO1	125.7728799 MHz
========	CHANNEL f2 ========
CPDPRG2	waltz16
NUC2	1H
PCPD2	100.00 usec
PL2	-1.90 dB
PL12	16.00 dB
PL13	19.00 dB
PL2W	27.23316002 W
PL12W	0.44167015 W
PL13W	0.22135943 W
SFO2	500.1320005 MHz
SI	32768
SF	125.7577750 MHz
WDW	EM
SSB	0
LB	1.00 Hz
GB	0
PC	1.40



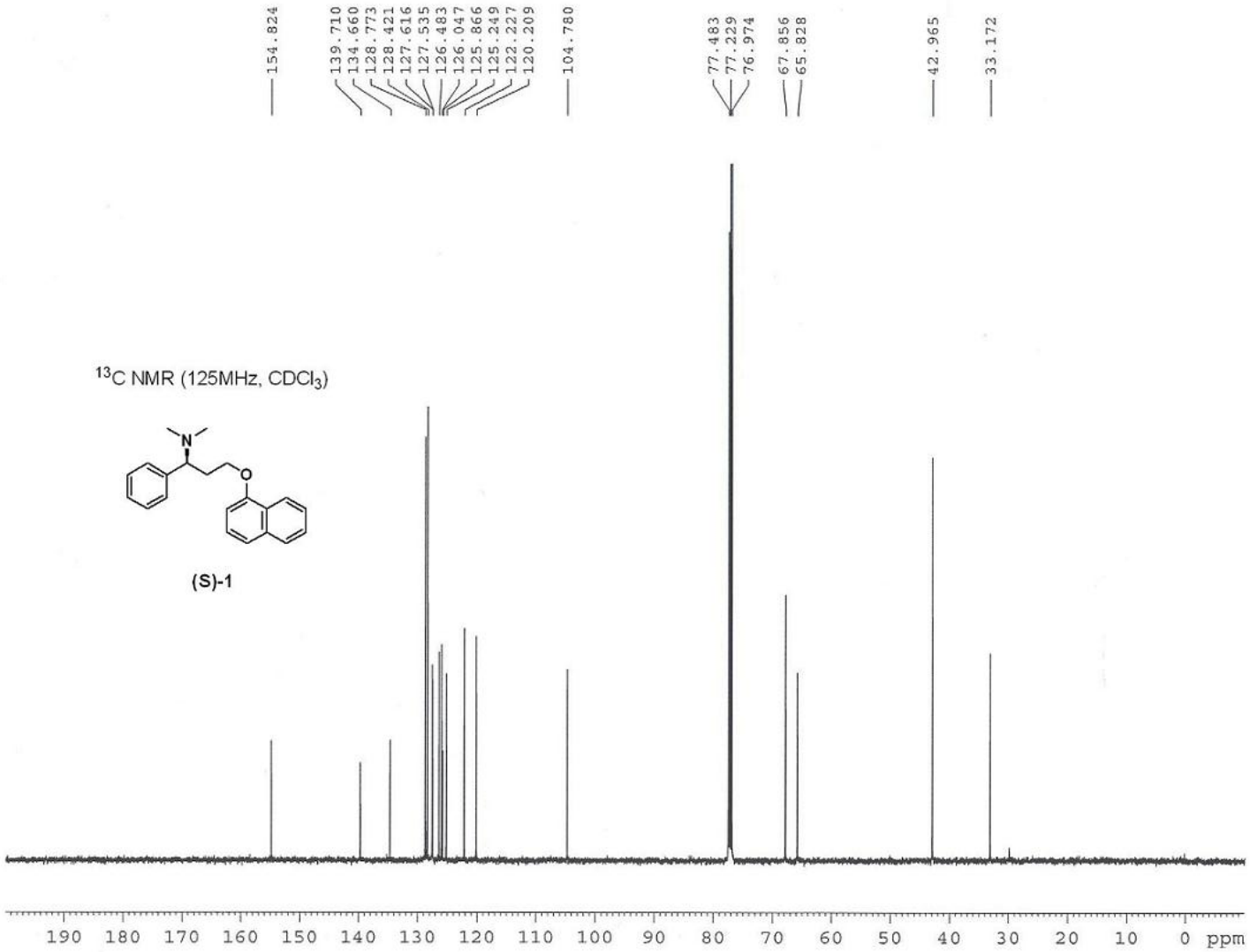

```
NAME          090921_KSY_MeNH
EXPNO                       1
PROCNO                      1
Date_                20090921
Time                    18.04
INSTRUM                 spect
PROBHD       5 mm DUL 13C-1
PULPROG                 zg30
TD                     65536
SOLVENT                CDCl3
NS                        32
DS                         0
SWH                7507.507 Hz
FIDRES            0.114555 Hz
AQ                4.3648143 sec
RG                      90.5
DW                    66.600 usec
DE                     6.00 usec
TE                    300.0 K
D1                1.00000000 sec
TD0                         1

======== CHANNEL f1 ========
NUC1                       1H
P1                       9.80 usec
PL1                     -1.90 dB
PL1W             27.23316002 W
SFO1             500.1332508 MHz
SI                      32768
SF               500.1300137 MHz
WDW                        EM
SSB                         0
LB                       0.30 Hz
GB                          0
PC                       1.00
```

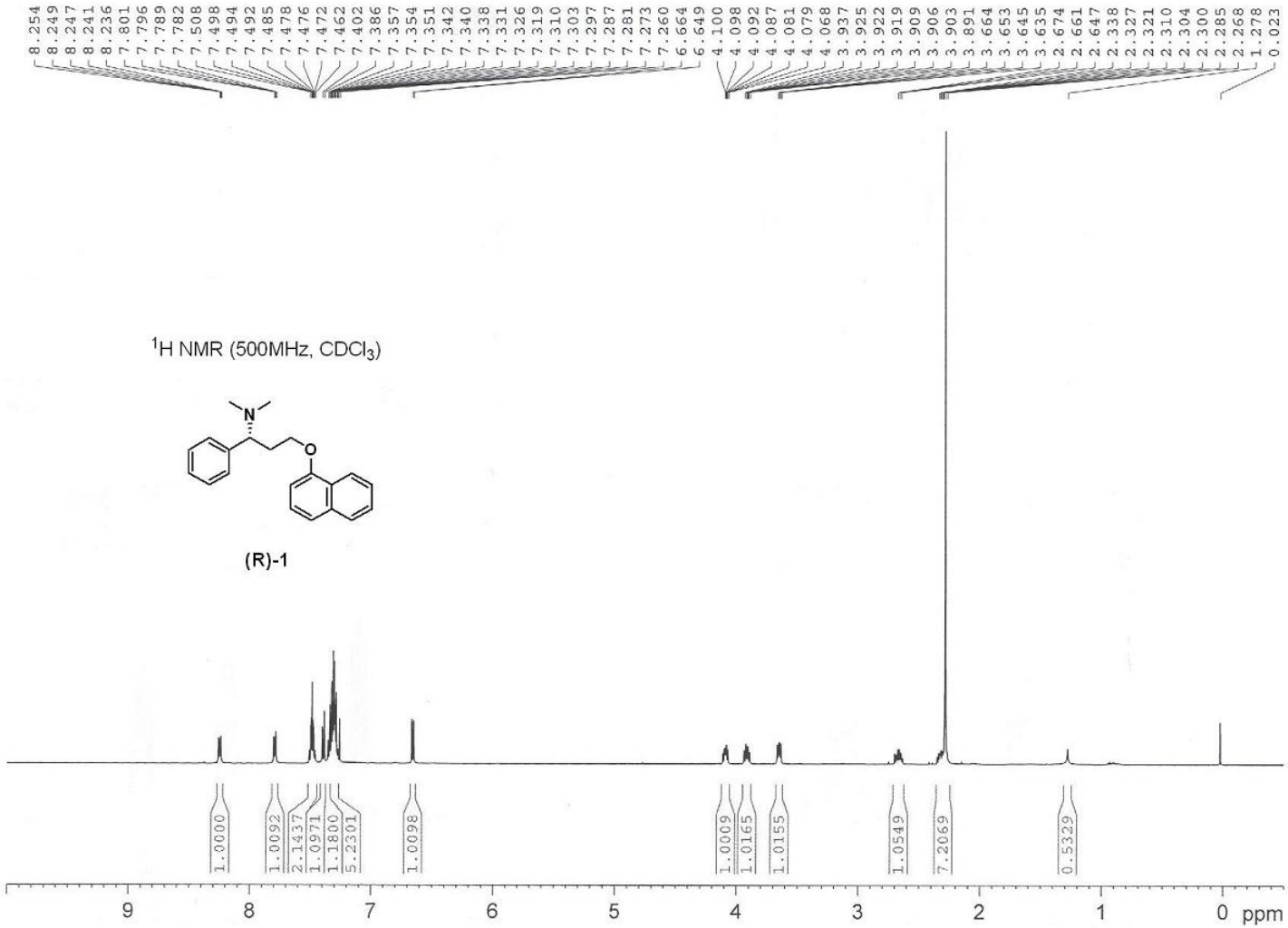

^{13}C NMR (75MHz, $CDCl_3$)
(R)-6
NH
O
154.5452
142.7562
134.4807
128.6173
127.4703
127.3621
127.3230
126.3615
125.8669
125.6419
125.1694
121.9901
120.1679
104.5799
77.4580
77.2375
77.0349
76.6114
65.3796
62.7273
37.1893
34.3781
0.0138
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
ppm



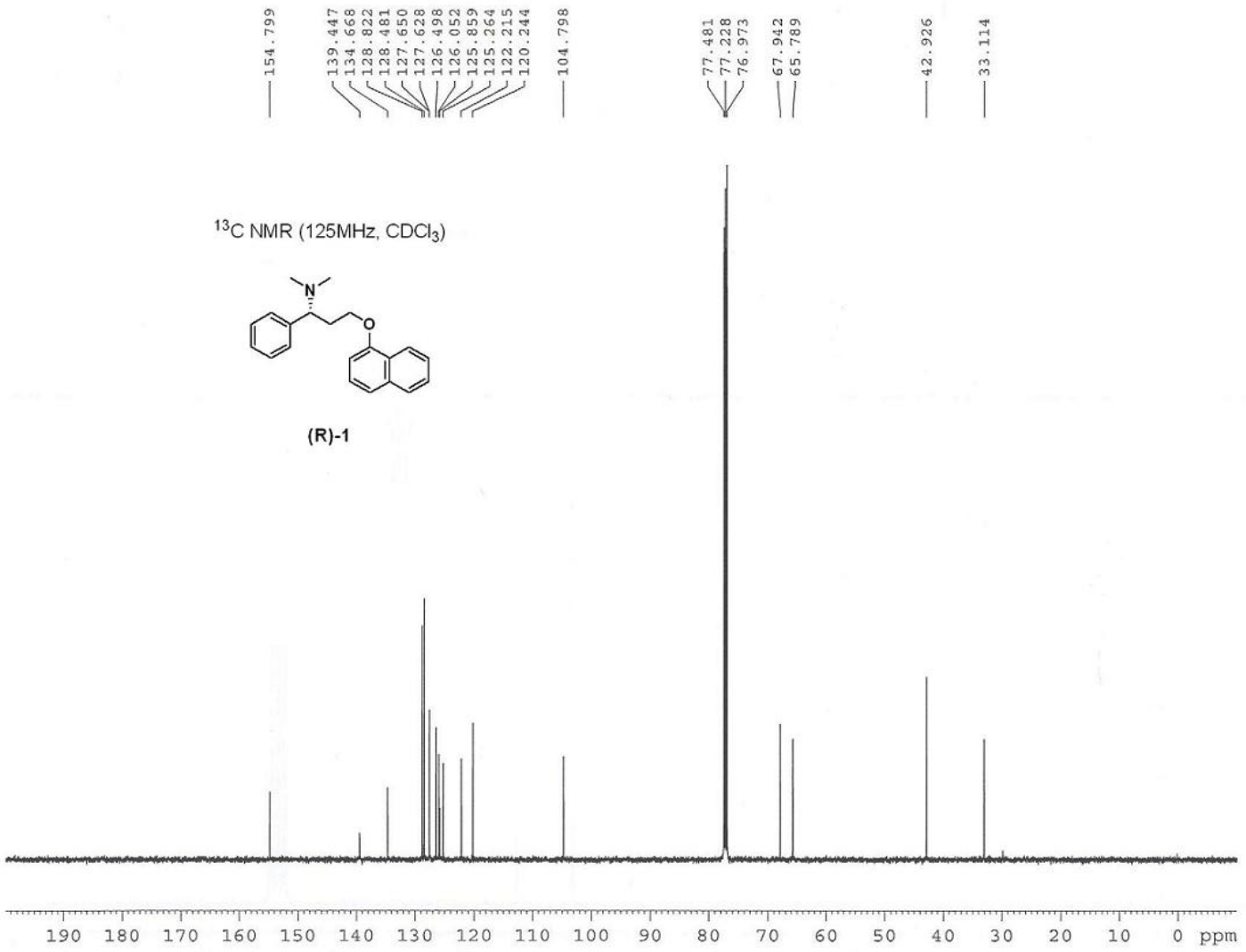
NAME	091009_KSY_091009
EXPNO	1
PROCNO	1
Date_	20091009
Time	10.33
INSTRUM	spect
PROBHD	5 mm DUL 13C-1
PULPROG	zg30
TD	65536
SOLVENT	CDCl3
NS	16
DS	0
SWH	7507.507 Hz
FIDRES	0.114555 Hz
AQ	4.3648143 sec
RG	35.9
DW	66.600 usec
DE	6.00 usec
TE	299.0 K
D1	1.00000000 sec
TD0	1
========	CHANNEL f1 ========
NUC1	1H
P1	9.80 usec
PL1	-1.90 dB
PL1W	27.23316002 W
SFO1	500.1332508 MHz
SI	32768
SF	500.1300138 MHz
WDW	EM
SSB	0
LB	0.30 Hz
GB	0
PC	1.00



NAME	091009_KSY_091009
EXPNO	2
PROCNO	1
Date_	20091009
Time	11.24
INSTRUM	spect
PROBHD	5 mm DUL 13C-1
PULPROG	zgpg30
TD	65536
SOLVENT	CDCl3
NS	1024
DS	2
SWH	35211.270 Hz
FIDRES	0.537281 Hz
AQ	0.9306754 sec
RG	2298.8
DW	14.200 usec
DE	6.00 usec
TE	299.8 K
D1	2.00000000 sec
D11	0.03000000 sec
TD0	1
======== CHANNEL f1 ========	
NUC1	13C
P1	8.00 usec
PL1	1.40 dB
PL1W	70.60439301 W
SFO1	125.7728799 MHz
======== CHANNEL f2 ========	
CPDPRG2	waltz16
NUC2	1H
PCPD2	100.00 usec
PL2	-1.90 dB
PL12	16.00 dB
PL13	19.00 dB
PL2W	27.23316002 W
PL12W	0.44167015 W
PL13W	0.22135943 W
SFO2	500.1320005 MHz
SI	32768
SF	125.7577696 MHz
WDW	EM
SSB	0
LB	1.00 Hz
GB	0
PC	1.40



NAME	091009_KSY_091009
EXPNO	1
PROCNO	1
Date_	20091009
Time	11.31
INSTRUM	spect
PROBHD	5 mm DUL 13C-1
PULPROG	zg30
TD	65536
SOLVENT	CDCl3
NS	16
DS	0
SWH	7507.507 Hz
FIDRES	0.114555 Hz
AQ	4.3648143 sec
RG	71.8
DW	66.600 usec
DE	6.00 usec
TE	299.3 K
D1	1.00000000 sec
TD0	1
========	CHANNEL f1 ========
NUC1	1H
P1	9.80 usec
PL1	-1.90 dB
PL1W	27.23316002 W
SFO1	500.1332508 MHz
SI	32768
SF	500.1300137 MHz
WDW	EM
SSB	0
LB	0.30 Hz
GB	0
PC	1.00



NAME	091009_KSY_091009
EXPNO	2
PROCNO	1
Date_	20091009
Time	12.23
INSTRUM	spect
PROBHD	5 mm DUL 13C-1
PULPROG	zgpg30
TD	65536
SOLVENT	CDCl3
NS	1024
DS	2
SWH	35211.270 Hz
FIDRES	0.537281 Hz
AQ	0.9306754 sec
RG	2048
DW	14.200 usec
DE	6.00 usec
TE	300.1 K
D1	2.00000000 sec
D11	0.03000000 sec
TD0	1
======== CHANNEL f1 ========	
NUC1	13C
P1	8.00 usec
PL1	1.40 dB
PL1W	70.60439301 W
SFO1	125.7728799 MHz
======== CHANNEL f2 ========	
CPDPRG2	waltz16
NUC2	1H
PCPD2	100.00 usec
PL2	-1.90 dB
PL12	16.00 dB
PL13	19.00 dB
PL2W	27.23316002 W
PL12W	0.44167015 W
PL13W	0.22135943 W
SFO2	500.1320005 MHz
SI	32768
SF	125.7577664 MHz
WDW	EM
SSB	0
LB	1.00 Hz
GB	0
PC	1.40