Supporting information for

Symmetry in Cascade Chirality-Transfer Processes: A Catalytic Atroposelective Direct Arylation Approach to BINOL Derivatives

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General Methods.

All reactions were carried out in oven-dried glassware under air with magnetic stirring. All Naphthol compounds were purchased from Sigma-Aldrich Co. and used without further purification. Reactions were monitored by TLC on silica gel 60 F254 plates Column chromatography was carried out on silica gel (200-300 mesh). Proton (^{1}H) and carbon (^{13}C) NMR spectra were recorded on an ACF* 300Q Bruker spectrometer operating at 300 MHz (or 500 MHz) for proton and 75 MHz (or 151 MHz) for carbon nuclei using $CDCl_3$ [or $(CD_3)_2SO$] as solvent, respectively. Chemical shifts are expressed as parts per million (δ, ppm) and are referenced to 7.26 ($CDCl_3$) or 2.50 $(CD_3)_2SO$ for ^{1}H NMR and 77.23 ($CDCl_3$) or 39.51 $(CD_3)_2SO$ for ^{13}C NMR. Data for ^{1}H NMR are recorded as follows: chemical shift (δ, ppm), multiplicity (s = singlet, d = doublet, t = triplet, m = multiplet or unresolved, br s = broad singlet, coupling constant (s) in Hz, integration). Data for ^{13}C NMR are reported in terms of chemical shift (δ, ppm). High Resolution Mass Spectrometry was performed on a Agilent Technologies 6230 TOF LC/MS under the conditions of electrospray ionization (ESI) in both positive and negative mode. Optical rotations were measured using a 2-mL cell with a 10-cm path length on Rudolph Autopol® IV automatic polarimeter, and concentrations (c) were reported in $g\times(100\ mL)^{-1}$. Analytical HPLC was recorded on a HPLC machine equipped with SHIMADZU LC-20AT HPLC Pump and SHIMADZU SPD-20A Photodiode Array Detector (SHIMADZU HPLC machine). The chiral stationary phase was Daicel Chiralpak AD-H or IA, IA-3 column (Ø = 0.46 cm, length = 25.0 cm). Melting points were recorded on Tianjin Analysis Instrument Factory RY-1.

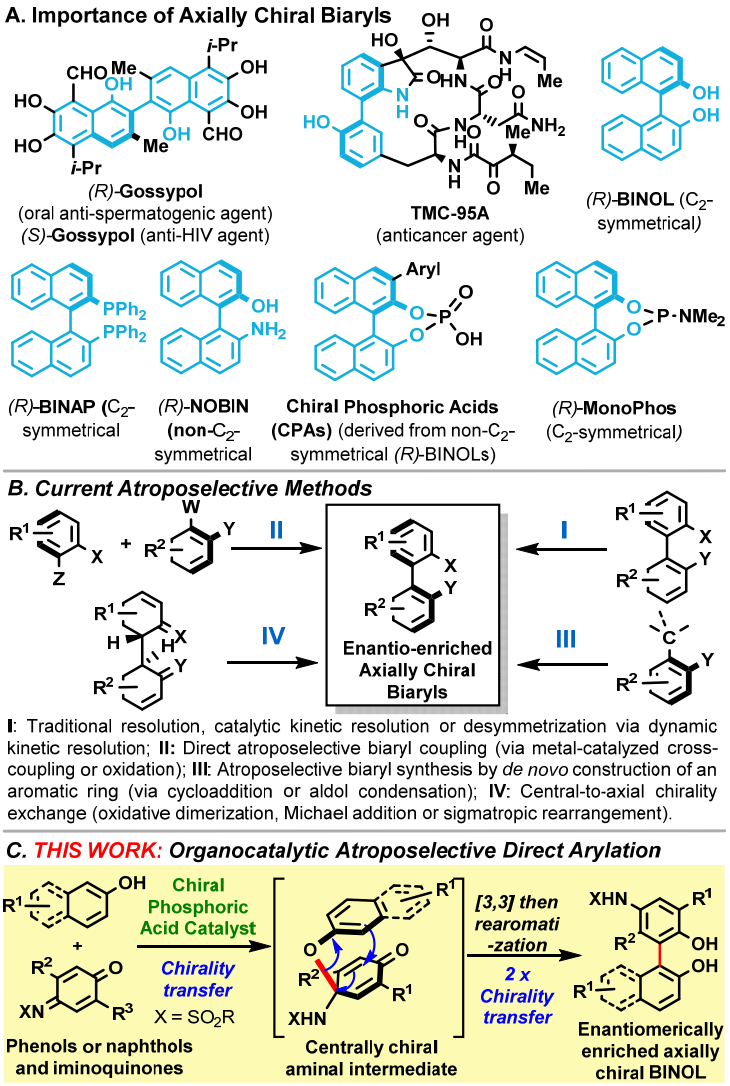


Figure 1. Organocatalytic atroposelective direct arylation of hydroxyarenes to afford non-C2-symmetrical BINOLs.

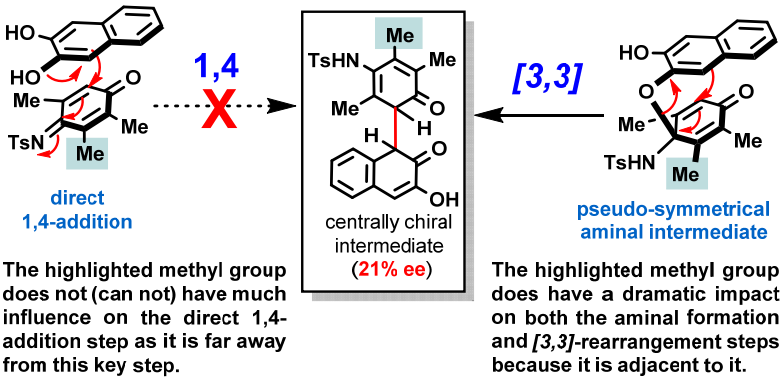
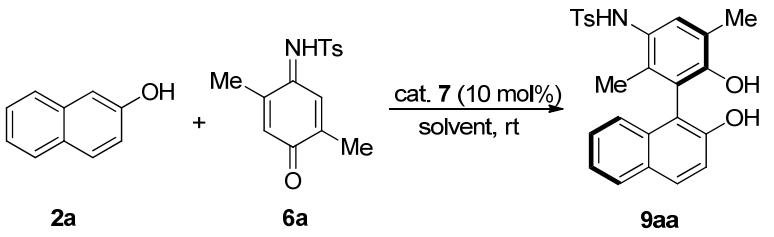
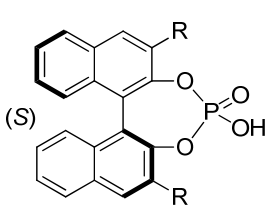


Figure 4. The case is made for the aminal-formation/[3,3]-rearrangement sequence as opposed to a 1,4-direct addition.

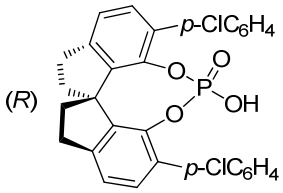
Optimization of the reaction conditions for the conversion of 2a + 6a → 9aa.



2a **6a** **9aa**



7a, R = H
7b, R = $SiPh_3$
7c, R = 2,4,6-(^{i}Pr)$_3$C$_6$H$_2$
7d, R = 2,6-(^{i}Pr)$_2$-4-^{t}BuC$_6$H$_2$
7e, R = 3,5-(CF$_3$)$_2$C$_6$H$_3$
7f, R = diphenyl
7g, R = 2-Naphthyl



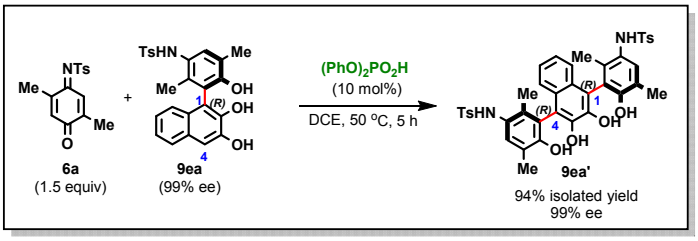
7h

entry	**cat.**	solvent	time (h)	ee (%) [b]
1	**7a**	CH_2Cl_2	48	25
2	**7b**	CH_2Cl_2	48	49
3	**7c**	CH_2Cl_2	48	77
4	**7d**	CH_2Cl_2	48	44
5	**7e**	CH_2Cl_2	8	25
6	**7f**	CH_2Cl_2	8	30
7	**7g**	CH_2Cl_2	8	46
8	**7h**	CH_2Cl_2	8	41
9	**7c**	CH_3CN	48	53
10	**7c**	toluene	48	72
11	**7c**	DCE	48	88
12	**7c**	THF	48	5
13	**7c**	$CHCl_3$	48	81
14	**7c**	chlorobenzene	84	94
15	**7c**	1,3-di-CF_3-benzene	60	86
16 [c]	**7c**	DCE	24	88
17 [c]	**7c**	chlorobenzene	48	92
18 [d]	**7c**	DCE	8	82
19 [c,e]	**7c**	DCE	100	77

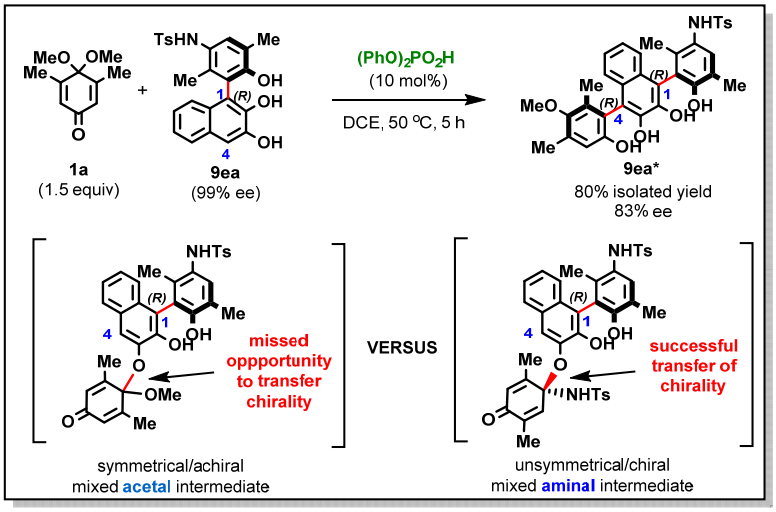
[a] Reaction conditions: **2a** (0.075 mmol), **6a** (0.05 mmol), cat. (10 mol%), solvent (1 mL). [b] Determined by HPLC analysis. [c] Reacted at 50 °C. [d] Reacted at 80 °C. [e] Using 5 mol% **7c**.

Explanation of substrate stereocontrol.

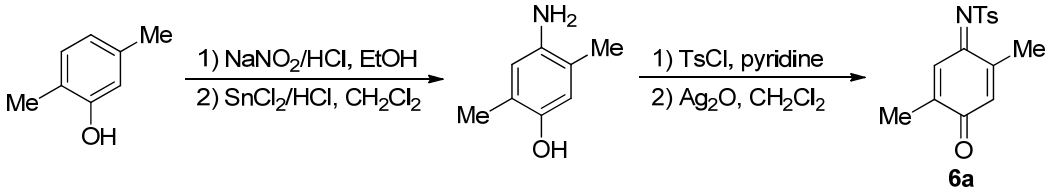
The description about **9ea'** refers to the possibility that once the first axis of chirality was established in position #1 of the 2,3-dihydroxynaphthalene nucleus, the now existing axially chiral stereocenter would exert significant influence over the stereroselectivity of the second aryl-aryl bond-forming step in position #4. To demonstrate that this substrate control is truly operational and completely independent of the chirality of the acid catalyst, we conducted a control experiment (see scheme at left) in which enantiomerically pure biaryl **9ea** was reacted with slight excess of iminoquinone **6a** (1.5 equivalents) at 50 ˚C in DCE using 10 mol% of the achiral diphenylphosphoric acid as catalyst. Indeed the product **9ea'** was obtained in excellent isolated yield and also as a single enantiomer (99% *ee*; the stereochemistry at the two chiral axes were determined to be *R,R* using X-ray crystallography). Not even traces of the *meso* diastereomer (*R,S*) were observed using LC/MS analysis.



Moreover, the coupling reaction between symmetrical quinone monoacetal **1a** and enantiomerically pure biaryl **9ea** was also successful (see scheme below) and gave rise to enantiomerically enriched terphenyl **9ea*** in 83% *ee*. Clearly substrate stereocontrol was operational in this case but to a lesser extent than during the formation of terphenyl **9ea**'. Since only a symmetrical acetal intermediate could be formed the system *"missed an opportunity"* to transfer chirality in the first step and the stereoselectivity of the second ary-aryl bond-forming step (i.e., via the *[3,3]*-sigmatropic rearrangement) could not be perfectly controlled by the substrate.



General procedure for synthesis of the substrates 6. [1]



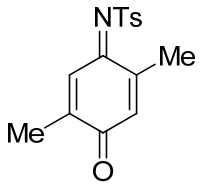
The phenol (50.0 mmol) was dissolved in HCl (33 mL, 12 mol/L) and 95% ethanol (30 mL). $NaNO_2$ (5.0 g) was slowly added at 0 °C (5 min) maintaining the stirring for 1 h at 0 °C. Ethanol (10 mL) was then added and the stirring was matintained for a further hour at room temperature. The reaction mixture was diluted with water (300 mL) and extracted with ethyl ether. The organic phase was extracted with 10% aqueous Na_2CO_3 solution. The carbonate solution on acidification with HCl (3 mol/L) yielded a precipitate, wash the precipitate with hexane to eliminate soluble impurities.

To an eggplant shaped bottle para-benzoquinone mono-oxime (10.0 mmol) was dissolved in CH_2Cl_2 (100 mL), then concentrated HCl (2 mL) was added. The solution was heated to reflux, then $SnCl_2$ (5.7 g, 30.0 mmol) was added. The mixture was heated to reflux for 24 h. Then remove the CH_2Cl_2 under reduced pressure, and the residue was dissolved in ethyl acetate and washed with concentrated aqueous $NaHCO_3$. Filter off the precipitate and the organic layer was dried over anhydrous Na_2SO_4 and the filtrate was concentrated under reduced pressure to afford the solid amino phenols.

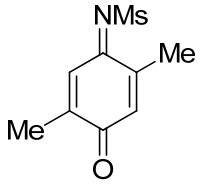
Then the para-amino-phenol (5.0 mmol) was dissolved in dry pyridine (6 mL) and

cooled to 0 °C. Para-toluenesulfonyl chloride (1.14 g, 6.0 mmol) was added in small portions. The mixture was warmed to room temperature and stirred under nitrogen for 24 h. The reaction mixture was diluted with EtOAc and washed with HCl (10 mol/L), the organic layer was dried over anhydrous $MgSO_4$, filtered, and concentrated to yield the crude sulfonamide.

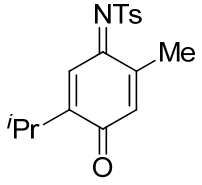
The N-tosyl-para-aminophenol (4.0 mmol) was dissolved in dry CH_2Cl_2 (15 mL) and Ag_2O (8.0 mmol) was added, and stirred. The reaction was monitored by TLC. When the reaction was completed, the solution was filtered through celatom. The organic layer was concentrated to yield the crude product. The product **6** was purified by silica gel column using petroleum ether/ acetone (20:1) as eluent. 35-45% yields (4 steps).



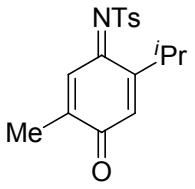
6a, yellow solid (920 mg, 45% yield). ^{1}H NMR (500 MHz, DMSO-d_6) δ 7.91 (d, J = 8.2 Hz, 2H), 7.83 (s, 1H), 7.51 (d, J = 8.2 Hz, 2H), 6.75 (s, 1H), 2.46 (s, 3H), 2.07 (s, 3H), 2.00 (s, 3H).



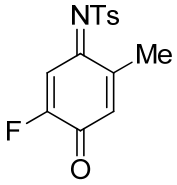
6b, brown solid (620 mg, 40% yield). ^{1}H NMR (500 MHz, DMSO-d_6) δ 7.64 (s, 1H), 6.75 (s, 1H), 3.40 (s, 3H), 2.10 (s, 3H), 2.03 (s, 3H).



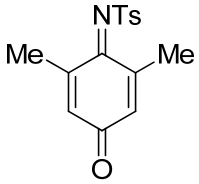
6c, yellow solid (420 mg, 35% yield). ^{1}H NMR (500 MHz, DMSO-d_6) δ 7.90 (d, J = 8.0 Hz, 2H), 7.74 (s, 1H), 7.51 (d, J = 7.6 Hz, 2H), 6.74 (s, 1H), 3.02-2.97 (m, 1H), 2.45 (s, 3H), 2.01 (s, 3H), 1.11 (d, J = 6.8 Hz, 6H).



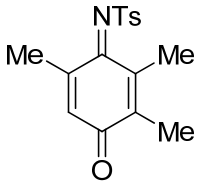
6d, yellow solid (470 mg, 38% yield). ^{1}H NMR (500 MHz, DMSO-d_6) δ 7.92-7.85 (m, 3H), 7.51 (d, J = 7.2 Hz, 2H), 6.60 (s, 1H), 3.00-2.92 (m, 1H), 2.45 (s, 3H), 2.07 (s, 3H), 1.05 (d, J = 7.2 Hz, 6H).



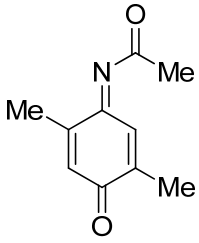
6e, brown solid (350 mg, 36% yield). ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.92-7.89 (m, 3H), 7.39 (d, J = 8.0 Hz, 2H), 6.60-6.57 (m, 1H), 2.48 (s, 3H), 2.11 (s, 3H).



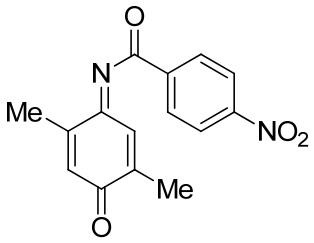
6f, orange solid (210 mg, 18% yield). ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.80 (s, J = 8.3 Hz, 2H), 7.28 (d, J = 8.2 Hz, 2H), 6.42 (s, 2H), 2.39 (s, 3H), 2.25 (s, 6H).



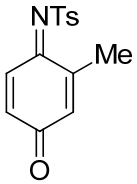
6g, orange solid (235 mg, 22% yield). ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.88 (d, J = 8.1 Hz, 2H), 7.35 (d, J = 8.0 Hz, 2H), 6.48 (s, 1H), 2.47 (s, 3H), 2.37 (s, 3H), 2.23 (s, 3H), 2.05 (s, 3H).



6h, yellow solid (450 mg, 40% yield). ^{1}H NMR (500 MHz, DMSO-d_6) δ 6.88 (s, 1H), 6.62 (s, 1H), 2.30 (s, 3H), 2.09 (s, 3H), 1.95 (s, 3H).



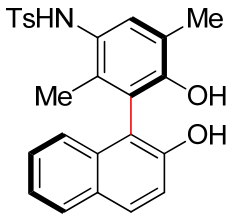
6i, yellow solid (380 mg, 38% yield). ^{1}H NMR (500 MHz, DMSO-d_6) δ 8.38 (d , J = 8.4 Hz, 2H), 8.17 (d, J = 8.4 Hz, 2H), 6.85 (s, 1H), 6.75 (s, 1H), 2.25 (s, 3H), 1.91 (s, 3H).



6j, brown solid (280 mg, 34% yield). ^{1}H NMR (300 MHz, $CDCl_3$) δ 8.19-8.15 (m, 1H), 7.89 (d, J = 7.9 Hz 2H), 7.36 (d, J = 8.0 Hz, 2H), 6.63-6.55 (m, 2H), 2.48 (s, 3H), 2.06 (s, 3H).

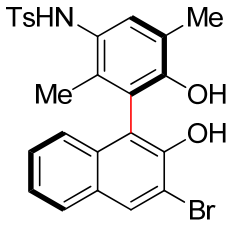
General procedure for the enantioselective synthesis of biaryls.

To a stirred solution of **2a** (32.5 mg, 0.225 mmol) and **6a** (43.5 mg, 0.15 mmol) in DCE or chlorobenzene (3 mL), cat. CPA **7c** (11.2 mg, 10 mol%) was added in one portion at room temperature, and it was stirred at rt or 50 ^{o}C until the reaction was completed. Solvent was removed under reduced pressure and the crude residue was purified by column chromatography on silica-gel (petroleum ether/acetone = 8:1 to 1:1) to give pure product **9aa** (63.0 mg, 97% yield).

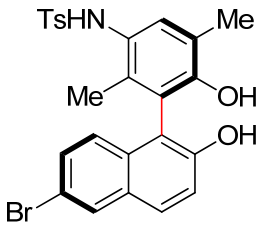


9aa, white solid, 97% yield (63.0 mg), 88% ee. [Daicel CHIRALPAK AD-H (0.46 cm x 25 cm); *n*-hexane/2-propanol = 70/30; flow rate = 1.0 mL/min; detection wavelength = 230 nm; t_R = 15.32 (minor), 50.88 (major) min]. $[\alpha]_D^{20}$ = -82.7 (c = 0.3, CH_3OH). ^{1}H NMR (500 MHz, DMSO-d_6) δ 9.22 (br s, 1H), 9.14 (br s, 1H), 7.77 (d, J

= 7.9 Hz, 1H), 7.73 (d, *J* = 8.8 Hz, 1H), 7.50 (d, *J* = 6.4 Hz, 2H), 7.49 (s, 1H), 7.32 (d, *J* = 8.0 Hz, 2H), 7.29-7.19 (m, 3H), 6.88 (s, 1H), 6.83 (d, *J* = 8.2 Hz, 1H), 2.31 (s, 3H), 2.12 (s, 3H), 1.21 (s, 3H). ^{13}C NMR (75 MHz, DMSO-d_6) δ 152.45, 151.96, 142.45, 137.76, 133.50, 133.32, 131.54, 129.56, 129.41, 128.67, 128.08, 127.84, 126.67, 125.94, 125.86, 123.77, 122.26, 121.52, 118.51, 116.09, 21.00, 16.55, 14.36. HRMS (ESI-TOF): Exact mass calcd. for $C_{25}H_{23}NO_4S$ $[M+Na]^+$ 456.1240, Found: 456.1240. MP 139-141 ^oC.

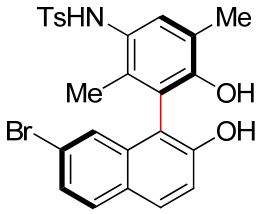


9ba, brown solid, 87% yield (66.9 mg), 92% ee. [Daicel CHIRALPAK AD-H (0.46 cm x 25 cm); *n*-hexane/2-propanol = 70/30; flow rate = 1.0 mL/min; detection wavelength = 230 nm; t_R = 11.38 (major), 16.62 (minor) min]. $[\alpha]_D^{20}$ = -56.0 (c = 0.3, CH_3OH). ^{1}H NMR (300 MHz, DMSO-d_6) δ 9.19 (br s, 1H), 8.39 (br s, 1H), 8.17 (s, 1H), 7.78 (dd, *J* = 3.5, 6.2 Hz, 1H), 7.50 (d, *J* = 8.2 Hz, 2H), 7.38-7.25 (m, 4H), 6.95 (s, 1H), 6.80-6.73 (m, 1H), 2.30 (s, 3H), 2.14 (s, 3H), 1.18 (s, 3H). ^{13}C NMR (75 MHz, DMSO-d_6) δ 152.66, 148.98, 142.85, 138.05, 133.68, 132.86, 131.56, 130.70, 129.80, 129.35, 127.42, 127.09, 126.80, 126.50, 124.39, 123.94, 122.83, 122.39, 119.60, 114.23, 21.39, 16.99, 14.74. HRMS (ESI-TOF): Exact mass calcd. for $C_{25}H_{22}BrNO_4S$ $[M+Na]^+$ 534.0345, Found: 534.0360. MP 113-115 ^oC.

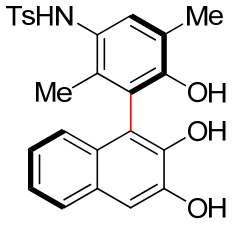


9ca, Brown solid, 88% yield (67.6 mg), 78% ee. [Daicel CHIRALPAK AD-H (0.46 cm x 25 cm); *n*-hexane/2-propanol = 70/30; flow rate = 1.0 mL/min; detection wavelength = 230 nm; t_R = 11.53 (major), 14.36 (minor) min]. $[\alpha]_D^{20}$ = -71.0 (c = 0.3,

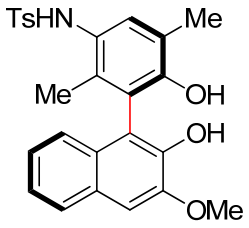
CH_3OH). ^1H NMR (300 MHz, DMSO-d_6) δ 9.41 (br s, 1H), 9.16 (br s, 1H), 8.03 (s, 1H), 7.74 (d, J = 8.9 Hz, 1H), 7.48 (d, J = 8.0 Hz, 2H), 7.41 (dd, J = 1.6, 8.8 Hz, 1H), 7.34 (d, J = 8.1 Hz, 2H), 7.24 (d, J = 8.9 Hz, 1H), 6.91 (s, 1H), 6.74 (d, J = 8.9 Hz, 1H), 2.32 (s, 3H), 2.12 (s, 3H), 1.16 (s, 3H). ^{13}C NMR (75 MHz, DMSO-d_6) δ 153.39, 152.33, 142.82, 138.09, 133.62, 132.57, 130.18, 129.89, 129.83, 129.69, 129.20, 128.34, 127.08, 126.51, 126.29, 123.58, 122.09, 120.11, 116.91, 115.49, 21.37, 16.93, 14.67. HRMS (ESI-TOF): Exact mass calcd. for $C_{25}H_{22}BrNO_4S$ $[M+Na]^+$ 534.0345, Found: 534.0351. MP 113-115 °C.



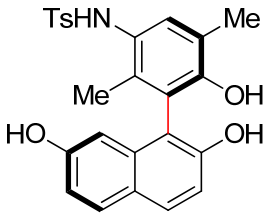
9da, brown solid, 84% yield (64.6 mg), 81% ee. [Daicel CHIRALPAK AD-H (0.46 cm x 25 cm); *n*-hexane/2-propanol = 70/30; flow rate = 1.0 mL/min; detection wavelength = 230 nm; t_R = 11.60 (minor), 21.28 (major) min]. $[\alpha]_D^{20}$ = -52.0 (c = 0.3, CH_3OH). ^1H NMR (300 MHz, $CDCl_3$) δ 7.83 (d, J = 8.9 Hz, 1H), 7.69 (d, J = 8.7 Hz, 1H), 7.60 (d, J = 8.3 Hz, 2H), 7.44 (dd, J = 1.9, 11.2 Hz, 1H), 7.36 (s, 1H), 7.28 (d, J = 8.2 Hz, 2H), 7.25 (s, 1H), 7.16 (d, J = 1.7 Hz, 1H), 6.14 (br s, 1H), 4.99 (br s, 1H), 4.60 (br s, 1H), 2.39 (s, 3H), 2.29 (s, 3H), 1.37 (s, 3H). ^{13}C NMR (75 MHz, $CDCl_3$) δ 153.49, 151.86, 142.45, 137.84, 134.93, 133.23, 130.25, 129.86, 129.28, 128.79, 126.49, 126.00, 125.17, 125.08, 123.06, 121.74, 119.69, 119.09, 115.68, 20.92, 16.47, 14.27. HRMS (ESI-TOF): Exact mass calcd. for $C_{25}H_{22}BrNO_4S$ $[M+Na]^+$ 534.0345, Found: 534.0340. MP 129-131 °C.



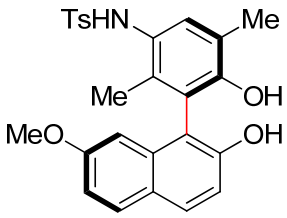
9ea, white solid, 80% yield (54.0 mg), 96% ee. [Daicel CHIRALPAK AD-H (0.46 cm x 25 cm); *n*-hexane/2-propanol = 70/30; flow rate = 1.0 mL/min; detection wavelength = 230 nm; t_R = 25.50 (minor), 43.86 (major) min]. $[\alpha]_D^{20}$ = -86.3 (c = 0.3 CH_3OH). ^1H NMR (300 MHz, CD_3OD) δ 7.60-7.55 (m, 3H), 7.29 (d, *J* = 7.9 Hz, 2H), 7.23-7.18 (m, 2H), 7.10 (t, *J* = 7.3 Hz, 1H), 7.00 (s, 1H), 6.85 (d, *J* = 8.2 Hz, 1H), 2.35 (s, 3H), 2.18 (s, 3H), 1.33 (s, 3H). ^{13}C NMR (75 MHz, CD_3OD) δ 153.47, 147.47, 145.79, 144.75, 138.97, 135.39, 131.59, 131.19, 130.66, 129.70, 128.45, 127.80, 127.37, 125.00, 124.65, 124.58, 124.02, 123.79, 117.09, 110.65, 21.63, 16.55, 15.00. HRMS (ESI-TOF): Exact mass calcd. for $C_{25}H_{23}NO_5S$ $[M+Na]^+$ 472.1189, Found: 472.1197. MP 138-140 °C.



9fa, white solid, 89% yield (61.9 mg), 85% ee. [Daicel CHIRALPAK AD-H (0.46 cm x 25 cm); *n*-hexane/2-propanol = 70/30; flow rate = 1.0 mL/min; detection wavelength = 230 nm; t_R = 31.69 (major), 35.00 (minor) min]. $[\alpha]_D^{20}$ = -58.3 (c = 0.3, CH_3OH). ^1H NMR (300 MHz, DMSO-d_6) δ 9.15 (br s, 1H), 8.58 (br s, 1H), 7.72 (d, *J* = 7.8 Hz, 1H), 7.50 (br s, 1H), 7.48 (d, *J* = 7.9 Hz, 2H), 7.34 (s, 1H), 7.30 (d, *J* = 7.9 Hz, 2H), 7.24 (t, *J* = 7.1 Hz, 1H), 7.15 (t, *J* = 7.1 Hz, 1H), 6.88 (s, 1H), 6.75(d, *J* = 8.0 Hz, 1H), 3.95 (s, 3H), 2.31 (s, 3H), 2.11 (s, 3H), 1.20 (s, 3H). ^{13}C NMR (75 MHz, DMSO-d_6) δ 151.79, 148.41, 144.17, 142.35, 137.71, 133.14, 129.51, 129.32, 128.47, 128.37, 126.57, 126.51, 125.75, 123.49, 123.42, 122.83, 121.44, 116.79, 105.68, 55.51, 20.95, 16.46, 14.29. HRMS (ESI-TOF): Exact mass calcd. for $C_{26}H_{25}NO_5S$ $[M+Na]^+$ 486.1347. Found: 486.1352. MP 129-131 °C.

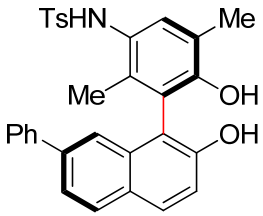


9ga, brown solid, 78% yield (52.6 mg), 85% ee. [Daicel CHIRALPAK AD-H (0.46 cm x 25 cm); *n*-hexane/2-propanol = 70/30; flow rate = 1.0 mL/min; detection wavelength = 230 nm; t_R = 16.30 (minor), 25.72 (major) min]. $[\alpha]_D^{20}$ = +105.3 (c = 0.3, CH_3OH). ^{1}H NMR (300 MHz, DMSO-d_6) δ 9.40 (s, 1H), 9.12 (s, 1H), 9.05 (s, 1H), 7.59 (t, *J* = 8.3 Hz, 2H), 7.50 (d, *J* = 8.1 Hz, 2H), 7.41 (s, 1H), 7.30 (d, *J* = 8.1 Hz, 2H), 6.94 (d, *J* = 8.8 Hz, 1H), 8.86 (s, 1H), 6.80 (dd, *J* = 1.8, 8.8 Hz, 1H), 6.23 (d, *J* = 1.7 Hz, 1H), 2.27 (s, 3H), 2.12 (s, 3H), 1.15 (s, 3H). ^{13}C NMR (125 MHz, DMSO-d_6) δ 155.52, 152.72, 151.83, 142.29, 137.94, 135.28, 133.39, 129.61, 129.32, 128.44, 126.58, 125.92, 124.12, 122.84, 121.32, 115.04, 114.74, 114.34, 105.49, 20.91, 16.47, 14.07. HRMS (ESI-TOF): Exact mass calcd. for $C_{25}H_{23}NO_5S$ $[M+Na]^+$ 472.1189, Found: 472.1186. MP 128-130 °C.

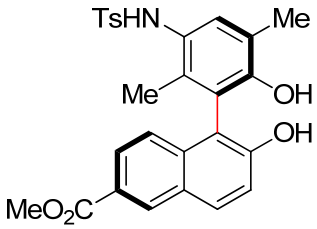


9ha, brown solid, 87% yield (60.5 mg), 89% ee. [Daicel CHIRALPAK AD-H (0.46 cm x 25 cm); *n*-hexane/2-propanol = 70/30; flow rate = 1.0 mL/min; detection wavelength = 230 nm; t_R = 11.92 (minor), 22.11 (major) min]. $[\alpha]_D^{20}$ = -25.0 (c = 0.3, CH_3OH). ^{1}H NMR (300 MHz, DMSO-d_6) δ 9.21 (br s, 1H), 9.16 (br s, 1H), 7.72 (d, *J* = 8.8 Hz, 1H), 7.67 (d, *J* = 8.8 Hz, 1H), 7.52 (br s, 1H), 7.50 (d, *J* = 8.0 Hz, 2H), 7.31 (d, *J* = 8.0 Hz, 2H), 7.04 (d, *J* = 8.8 Hz, 1H), 6.94 (dd, *J* = 2.1, 8.8 Hz, 1H), 6.70 (s, 1H), 6.28 (s, 1H), 3.64 (s, 3H), 2.32 (s, 3H), 2.07 (s, 3H), 1.39 (s, 3H). ^{13}C NMR (75 MHz, $CDCl_3$) δ 159.34, 152.73, 151.90, 144.14, 136.91, 134.36, 133.15, 131.19, 130.97, 130.25, 129.75, 127.43, 127.33, 124.84, 123.75, 118.80, 115.66, 115.23,

111.33, 103.45, 55.46, 21.75, 16.16, 14.60. HRMS (ESI-TOF): Exact mass calcd. for $C_{26}H_{25}NO_5S$ $[M+Na]^+$ 486.1346, Found: 486.1339. MP 124-126 °C.

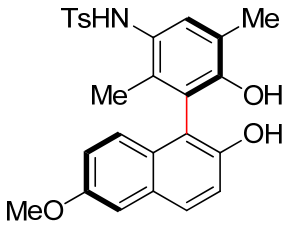


9ia, white solid, 90% yield (69.0 mg), 87% ee. [Daicel CHIRALPAK AD-H (0.46 cm x 25 cm); *n*-hexane/2-propanol = 70/30; flow rate = 1.0 mL/min; detection wavelength = 230 nm; t_R = 14.11 (minor), 33.44 (major) min]. $[\alpha]_D^{20}$ = -110.33 (c = 0.3, CH_3OH). ^1H NMR (300 MHz, DMSO-d_6) δ 9.40 (br s, 1H), 9.24 (s, 1H), 7.90 (d, *J* = 8.4 Hz, 1H), 7.79 (d, *J* = 8.8 Hz, 1H), 7.67 (br s, 1H), 7.60-7.45 (m, 5H), 7.43-7.35 (m, 3H). 7.23 (d, *J* = 8.9 Hz, 1H), 7.13 (s, 1H), 6.93 (d, *J* = 8.1 Hz, 2H), 6.78 (s, 1H), 2.14 (s, 3H), 2.11 (s, 3H), 1.30 (s, 3H). ^{13}C NMR (75 MHz, DMSO-d_6) δ 152.86, 152.02, 142.28, 140.93, 137.88, 137.64, 133.79, 133.58, 129.74, 129.02, 128.98, 128.66, 128.38, 127.40, 127.34, 126.77, 126.44, 125.89, 123.71, 121.57, 121.53, 121.35, 118.70, 116.54, 20.82, 16.49, 14.62. HRMS (ESI-TOF): Exact mass calcd. for $C_{31}H_{27}NO_4S$ $[M+Na]^+$ 532.1553, Found: 532.1543. MP 86-88 °C.

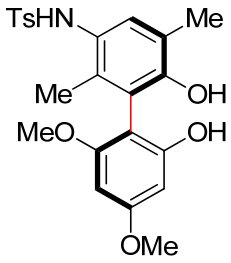


9ja, white solid, 62% yield (45.7 mg), 85% ee. [Daicel CHIRALPAK AD-H (0.46 cm x 25 cm); *n*-hexane/2-propanol = 70/30; flow rate = 1.0 mL/min; detection wavelength = 230 nm; t_R = 11.44 (major), 16.66 (minor) min]. $[\alpha]_D^{20}$ = -92.3 (c = 0.3, CH_3OH). ^1H NMR (300 MHz, DMSO-d_6) δ 9.79 (br s, 1H), 9.17 (s, 1H), 8.50 (s, 1H), 7.96 (d, *J* = 8.9 Hz, 1H), 7.77 (dd, *J* = 1.4, 8.9 Hz, 1H), 7.49 (d, *J* = 8.1 Hz, 2H), 7.33 (d, *J* = 8.1 Hz, 2H), 7.29 (d, *J* = 9.0 Hz, 1H), 6.92 (s, 1H), 6.86 (d, *J* = 8.9 Hz, 1H),

3.89 (s, 3H), 2.31 (s, 3H), 2.13 (s, 3H), 1.16 (s, 3H). ^{13}C NMR (75 MHz, DMSO-d_6) δ 166.98, 155.41, 152.35, 142.85, 138.06, 136.44, 133.56, 131.19, 130.87, 130.18, 129.81, 127.37, 127.10, 126.29, 125.36, 124.55, 123.65, 123.56, 122.13, 119.89, 116.94, 52.36, 21.35, 16.94, 14.71. HRMS (ESI-TOF): Exact mass calcd. for $C_{27}H_{25}NO_6S$ $[M+Na]^+$ 514.1295, Found: 514.1291. MP 119-121 °C.

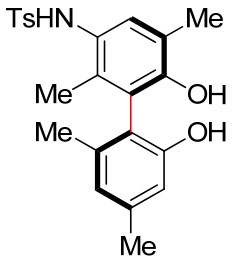


9ka, white solid, 99% yield (69.2 mg), 83% ee. [Daicel CHIRALPAK AD-H (0.46 cm x 25 cm); *n*-hexane/2-propanol = 70/30; flow rate = 1.0 mL/min; detection wavelength = 230 nm; t_R = 14.64 (major), 17.57 (minor) min]. $[\alpha]_D^{20}$ = -63.7 (c = 0.3, CH_3OH). ^{1}H NMR (300 MHz, DMSO-d_6) δ 9.21 (s, 1H), 9.06 (s, 1H), 7.65 (d, *J* = 8.8 Hz, 1H), 7.56 (s, 1H), 7.49 (d, *J* = 8.0 Hz, 2H), 7.33 (d, *J* = 7.9 Hz, 2H), 7.21-7.16 (m, 2H), 6.99 (d, *J* = 7.6 Hz, 1H), 6.92 (s, 1H), 6.73 (d, *J* = 9.1 Hz, 1H), 3.82 (s, 3H), 2.31 (s, 3H), 2.13 (s, 3H), 1.18 (s, 3H). ^{13}C NMR (75 MHz, DMSO-d_6) δ 154.86, 151.85, 150.67, 142.38, 137.67, 133.19, 129.46, 129.37, 128.82, 128.65, 127.37, 126.62, 125.76, 125.29, 123.86, 121.45, 118.83, 118.18, 116.30, 106.47, 55.08, 21.00, 16.54, 14.31. HRMS (ESI-TOF): Exact mass calcd. for $C_{26}H_{25}NO_5S$ $[M+Na]^+$ 486.1346, Found: 486.1340. MP 200-202 °C.

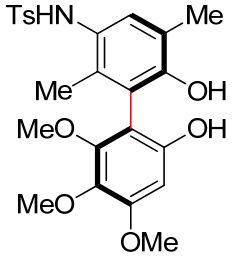


9la, brown solid, 64% yield (42.6 mg), 76% ee. [Daicel CHIRALPAK AD-H (0.46 cm x 25 cm); *n*-hexane/2-propanol = 70/30; flow rate = 1.0 mL/min; detection wavelength = 230 nm; t_R = 50.36 (minor), 55.42 (major) min]. $[\alpha]_D^{20}$ = -7.7 (c = 0.3, CH_3OH). ^{1}H NMR (300 MHz, DMSO-d_6) δ 9.07 (s, 1H), 9.04 (s, 1H), 7.48 (d, *J* = 8.3

Hz, 2H), 7.32-7.28 (m, 3H), 6.58 (s, 1H), 6.06 (dd, J = 2.2, 8.3 Hz, 2H), 3.69 (s, 3H), 3.52 (s, 3H), 2.34 (s, 3H), 1.99 (s, 3H), 1.37 (s, 3H). ^{13}C NMR (75 MHz, DMSO-d_6) δ 160.10, 158.67, 156.25, 151.81, 142.27, 138.30, 133.84, 129.24, 128.67, 126.59, 125.40, 122.46, 120.63, 104.68, 93.72, 89.86, 55.20, 54.80, 20.94, 16.40, 14.59. HRMS (ESI-TOF): Exact mass calcd. for $C_{23}H_{25}NO_6S$ $[M+Na]^+$ 466.1295, Found: 466.129. MP 97-98 ^{o}C.

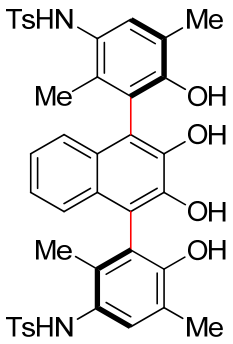


9ma, brown solid, 49% yield (30.0 mg), 75% ee. [Daicel CHIRALPAK AD-H (0.46 cm x 25 cm); n-hexane/2-propanol = 70/30; flow rate = 1.0 mL/min; detection wavelength = 230 nm; t_R = 9.42 (minor), 77.47 (major) min]. $[\alpha]_D^{20}$ = +12.67 (c = 0.3, CH_3OH). ^{1}H NMR (300 MHz, DMSO-d_6) δ 9.09 (s, 1H), 9.72 (s, 1H), 7.45-7.41 (m, 3H), 7.29 (d, J = 8.1 Hz, 2H), 6.71 (s, 1H), 6.49 (s, 2H), 2.35 (s, 3H), 2.18 (s, 3H), 2.06 (s, 3H), 1.66 (s, 3H), 1.30 (s, 3H). ^{13}C NMR (75 MHz, DMSO-d_6) δ 154.63, 151.18, 142.51, 136.81, 129.39, 128.98, 125.80, 121.34, 120.75, 113.46, 21.00, 20.93, 19.27, 16.50, 14.34. HRMS (ESI-TOF): Exact mass calcd. for $C_{23}H_{25}NO_4S$ $[M+Na]^+$ 434.1367, Found: 434.1395. MP 119-121 ^{o}C.

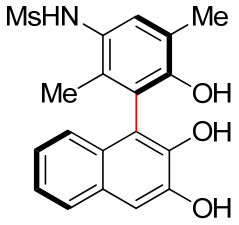


9na, brown solid, 97% yield (69.4 mg), 21% ee. [Daicel CHIRALPAK AD-H (0.46 cm x 25 cm); *n*-hexane/2-propanol = 70/30; flow rate = 1.0 mL/min; detection wavelength = 230 nm; t_R = 10.10 (minor), 54.73 (major), min]. $[\alpha]_D^{20}$ = +5.7 (c = 0.3,

CH_3OH). ^1H NMR (300 MHz, DMSO-d_6) δ 9.07 (s, 1H), 8.86 (br s, 1H), 7.49 (br s, 1H), 7.49 (d, J = 7.8 Hz, 2H), 7.30 (d, J = 8.0 Hz, 2H), 6.64 (s, 1H), 6.31 (s, 1H), 3.74 (s, 3H), 3.64 (s, 3H), 3.35 (s, 3H), 2.34 (s, 3H), 2.04 (s, 3H), 1.48 (s, 3H). ^{13}C NMR (75 MHz, DMSO-d_6) δ 152.59, 151.90, 151.83, 151.09, 142.41, 138.09, 134.53, 133.57, 129.31, 128.99, 126.66, 125.45, 122.51, 120.85, 109.82, 95.76, 60.43, 59.82, 55.39, 20.96, 16.50, 14.92. HRMS (ESI-TOF): Exact mass calcd. for $C_{24}H_{27}NO_7S$ $[M+Na]^+$ 496.1400, Found: 496.1403. MP 58-60 °C.

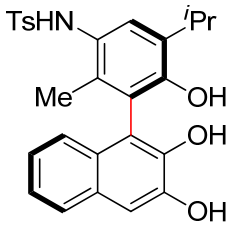


9ea', white solid, 90% yield (100.0 mg), 99% ee. [Daicel CHIRALPAK IC (0.46 cm x 25 cm); *n*-hexane/2-propanol = 60/40; flow rate = 1.0 mL/min; detection wavelength = 230 nm; t_R = 29.12 (major), 55.25 (minor) min]. $[\alpha]_D^{20}$ = +85.0 (c = 0.3, CH_3OH). ^1H NMR (500 MHz, DMSO-d_6) δ 9.18 (s, 2H), 8.41 (br s, 2H), 7.65-7.56 (m, 6H), 7.36-7.38 (m, 4H), 7.09-7.00 (m, 4H), 6.74 (s, 2H), 2.35 (s, 6H), 2.18 (s, 6H), 1.34 (s, 6H). ^{13}C NMR (75 MHz, DMSO-d_6) δ 152.05, 143.80, 142.33, 137.88, 133.70, 129.60, 129.32, 128.10, 126.59, 125.88, 123.69, 123.21, 122.42, 121.41, 116.25, 20.99, 16.46, 14.56. HRMS (ESI-TOF): Exact mass calcd. for $C_{40}H_{38}N_2O_8S_2$ $[M+Na]^+$ 761.1962, Found: 761.1975. MP 251-253 °C.

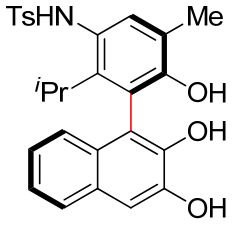


9eb, white solid, 98% yield (54.9 mg), 87% ee. [Daicel CHIRALPAK AD-H (0.46 cm

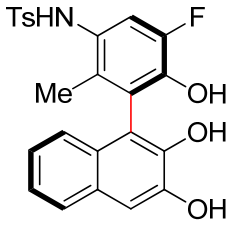
x 25 cm); *n*-hexane/2-propanol = 70/30; flow rate = 1.0 mL/min; detection wavelength = 230 nm; t_R = 16.45 (minor), 22.31 (major), min]. $[\alpha]_D^{20}$ = -2.3 (c = 0.3, CH_3OH). ^1H NMR (300 MHz, DMSO-d_6) δ 8.75 (br s, 1H), 7.69 (d, *J* = 8.0 Hz, 1H), 7.19-7.14 (m, 2H), 7.07-7.03 (m, 2H), 6.89 (d, *J* = 8.3 Hz, 1H), 2.92 (s, 3H), 2.18 (s, 3H), 1.73 (s, 3H). ^{13}C NMR (75 MHz, DMSO-d_6) δ 152.40, 146.74, 144.89, 134.08, 129.61, 129.29, 128.35, 126.82, 126.32, 124.25, 123.86, 123.25, 123.09, 122.10, 117.40, 109.16, 40.24, 16.89, 15.64. HRMS (ESI-TOF): Exact mass calcd. for $C_{19}H_{19}NO_5S$ $[M+Na]^+$ 396.0876, Found: 396.0860. MP 127-129 °C.



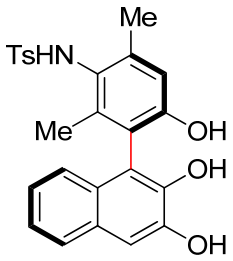
9ec, brown solid, 68% yield (48.7 mg), 91% ee. [Daicel CHIRALPAK AD-H (0.46 cm x 25 cm); *n*-hexane/2-propanol = 70/30; flow rate = 1.0 mL/min; detection wavelength = 230 nm; t_R = 17.88 (major), 20.24 (minor) min]. $[\alpha]_D^{20}$ = -32.3 (c = 0.3, CH_3OH). ^1H NMR (300 MHz, DMSO-d_6) δ 10.07 (br s, 1H), 9.07 (s, 1H), 8.45 (br s, 1H), 7.59 (d, *J* = 8.0 Hz, 1H), 7.51(d, *J* = 8.0 Hz, 2H), 7.35 (d, *J* = 8.0 Hz, 2H), 7.27 (s, 1H), 7.20-7.06 (m, 3H), 6.73 (d, *J* = 8.2 Hz, 1H), 6.64 (s, 1H), 3.15-3.08 (m, 1H), 2.34 (s, 3H), 1.40 (s, 3H), 1.02 (d, *J* = 6.7 Hz, 6H). ^{13}C NMR (125 MHz, DMSO-d_6) δ 150.47, 146.13, 144.57, 142.38, 137.51, 133.39, 131.66, 129.23, 128.80, 127.90, 126.80, 126.06, 125.75, 124.51, 123.59, 123.32, 122.73, 122.55, 116.43, 108.72, 25.71, 22.51, 22.41, 20.87, 14.53. HRMS (ESI-TOF): Exact mass calcd. for $C_{27}H_{27}NO_5S$ $[M+Na]^+$ 500.1502, Found: 500.1482. MP 159-161 °C.



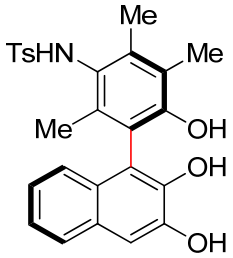
9ed, brown solid, 63% yield (45.1 mg), 73% ee. [Daicel CHIRALPAK AD-H (0.46 cm x 25 cm); *n*-hexane/2-propanol = 70/30; flow rate = 1.0 mL/min; detection wavelength = 230 nm; t_R = 11.98 (minor), 18.16 (major) min]. $[\alpha]_D^{20}$ = -17.7 (c = 0.3, CH_3OH). ^1H NMR (300 MHz, DMSO-d_6) δ 10.07 (br s, 1H), 8.94 (s, 1H), 8.41 (br s, 1H), 7.71 (d, *J* = 8.2 Hz, 2H), 7.58 (d, *J* = 8.1 Hz, 1H), 7.43 (d, *J* = 8.1 Hz, 2H), 7.30 (s, 1H), 7.18-7.14 (m, 2H), 7.05 (t, *J* = 8.2 Hz, 1H), 6.84 (d, *J* = 8.3 Hz, 1H), 6.40 (s, 1H), 2.73-2.68 (m, 1H), 2.41 (s, 3H), 1.94 (s, 3H), 0.88 (d, *J* = 7.1 Hz, 3H), 0.77 (d, *J* = 6.9 Hz, 3H). ^{13}C NMR (125 MHz, DMSO-d_6) δ 157.06, 151.14, 149.78, 148.86, 147.43, 144.48, 134.93, 134.41, 133.93, 133.62, 131.82, 130.96, 130.69, 129.06, 128.50, 127.60, 127.38, 126.08, 122.17, 113.67, 34.67, 26.93, 26.83, 25.98, 21.30. HRMS (ESI-TOF): Exact mass calcd. for $C_{27}H_{27}NO_5S$ $[M+Na]^+$ 500.1502, Found: 500.1483. MP 115-117 °C.



9ee, yellow solid, 56% yield (38.1 mg), 78% ee. [Daicel CHIRALPAK IA-3 (0.46 cm x 25 cm); *n*-hexane/2-propanol = 70/30; flow rate = 1.0 mL/min; detection wavelength = 230 nm; t_R = 17.85 (minor), 33.92 (major) min]. $[\alpha]_D^{20}$ = -42.33 (c = 0.3, CH_3OH). ^1H NMR (300 MHz, DMSO-d_6) δ 10.02 (s, 1H), 9.37 (s, 1H), 8.95 (s, 1H), 8.48 (s, 1H), 7.56 (d, *J* = 7.6 Hz, 1H), 7.48 (d, *J* = 8.0 Hz, 2H), 7.33 (d, *J* = 7.8 Hz, 2H), 7.18-7.04 (m, 3H), 6.88 (d, *J* = 11.8 Hz, 1H), 6.65 (d, *J* = 8.1 Hz, 1H), 2.30 (s, 3H), 1.21 (s, 3H). ^{13}C NMR (75 MHz, DMSO-d_6) δ 150.39, 147.25, 146.10, 143.94, 142.71, 141.66, 137.25, 131.36, 129.49, 128.57, 127.41, 126.56, 125.79, 125.41, 123.19, 122.80 (d, *J* = 12.0 Hz), 114.25, 114.03 (d, *J* = 6.0 Hz), 108.62, 20.96, 13.99. HRMS (ESI-TOF): Exact mass calcd. for $C_{24}H_{20}FNO_5S$ $[M+Na]^+$ 476.0938, Found: 476.0918. MP 109-111 °C.

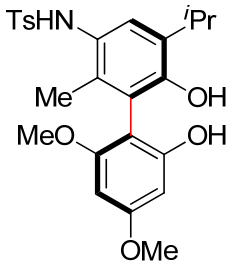


9ef, white solid, 31% yield (21.0 mg), 4% ee. [Daicel CHIRALPAK AD-H (0.46 cm x 25 cm); *n*-hexane/2-propanol = 70/30; flow rate = 1.0 mL/min; detection wavelength = 230 nm; t_R = 27.42 (minor), 31.95 (major) min]. $[\alpha]_D^{20}$ = +1.0 (c = 0.1, CH_3OH). ^1H NMR (300 MHz, DMSO-d_6) δ 10.07 (br s, 1H), 8.98 (s, 1H), 8.82 (br s, 1H), 8.28 (br s, 1H), 7.57-7.52 (m, 3H), 7.32 (d, *J* = 8.1 Hz, 2H), 7.09-7.18 (m, 3H), 6.87 (d, *J* = 1.9 Hz, 1H), 6.62 (s, 1H), 2.30 (s, 3H), 2.08 (s, 3H), 1.26 (s, 3H). ^{13}C NMR (75 MHz, DMSO-d_6) δ 154.08, 146.14, 143.79, 142.26, 138.85, 138.30, 137.54, 129.44, 128.58, 127.82, 126.52, 125.67, 124.48, 123.71, 122.55, 121.28, 117.88, 114.63, 108.23, 20.92, 18.95, 15.42. HRMS (ESI-TOF): Exact mass calcd. for $C_{25}H_{23}NO_5S$ $[M+Na]^+$ 472.1189, Found: 472.0672. MP 167-169 °C.

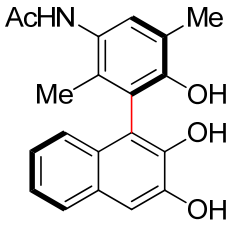


9eg, yellow solid, 68% yield (47.3 mg), 21% ee. [Daicel CHIRALPAK AD-H (0.46 cm x 25 cm); *n*-hexane/2-propanol = 70/30; flow rate = 1.0 mL/min; detection wavelength = 230 nm; t_R = 19.42 (major), 21.77 (minor) min]. $[\alpha]_D^{20}$ = +14.7 (c = 0.3, CH_3OH). ^1H NMR (300 MHz, DMSO-d_6) δ 9.94 (br s, 1H), 9.03 (s, 1H), 8.35 (br s, 1H), 7.58 (d, *J* = 8.2 Hz, 1H), 7.52 (d, *J* = 8.0 Hz, 2H), 7.30 (d, *J* = 7.8 Hz, 2H), 7.18 (t, *J* = 7.6 Hz, 1H), 7.12 (s, 2H), 6.85 (d, *J* = 7.8 Hz, 1H), 2.29 (s, 3H), 2.09 (s, 3H), 1.18 (s, 3H). ^{13}C NMR (75 MHz, DMSO-d_6) δ 151.55, 146.17, 142.13, 136.59, 134.66, 134.38, 129.40, 128.78, 127.99, 126.55, 125.75, 124.93, 123.62, 122.72, 122.58, 121.09, 120.70, 116.82, 108.62, 20.92, 16.33, 15.37, 12.97. HRMS

(ESI-TOF): Exact mass calcd. for $C_{26}H_{25}NO_5S$ $[M+Na]^+$ 486.1346, Found: 486.1334. MP 134-136 °C.

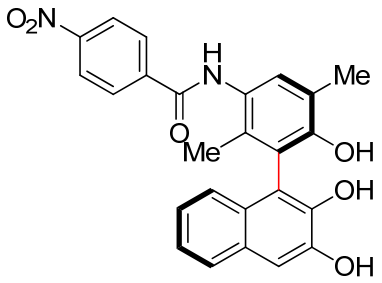


9lc, brown solid, 48% yield (34.0 mg), 83% ee. [Daicel CHIRALPAK AD-H (0.46 cm x 25 cm); *n*-hexane/2-propanol = 70/30; flow rate = 1.0 mL/min; detection wavelength = 230 nm; t_R = 13.93 (minor), 47.81 (major), min]. $[\alpha]_D^{20}$ = -6.0 (c = 0.3, CH_3OH). ^1H NMR (300 MHz, DMSO-d_6) δ 9.08 (br s, 1H), 8.97 (s, 1H), 7.54 (d, *J* = 7.7 Hz, 2H), 7.35 (d, *J* = 7.7 Hz, 2H), 7.02 (br s, 1H), 6.36 (s, 1H), 6.11 (d, *J* = 7.2 Hz, 2H), 3.73 (s, 3H), 3.57 (s, 3H), 3.08-3.04 (m, 1H), 2.38 (s, 3H), 1.63 (s, 3H), 0.93 (m, 6H). ^{13}C NMR (75 MHz, DMSO-d_6) δ 160.75, 159.34, 156.90, 151.10, 142.87, 138.60, 134.68, 131.37, 129.72, 127.39, 126.25, 124.27, 122.95, 104.91, 94.33, 90.56, 55.78, 55.31, 26.17, 23.00, 22.91, 21.41, 15.39. HRMS (ESI-TOF): Exact mass calcd. for $C_{25}H_{29}NO_6S$ $[M+Na]^+$ 494.1608, Found: 494.1593. MP 206-208 °C.

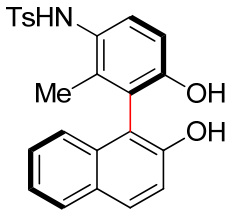


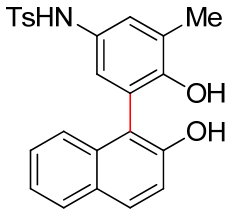
9eh, white solid, 98% yield (49.6 mg), 76% ee. [Daicel CHIRALPAK AD-H (0.46 cm x 25 cm); *n*-hexane/2-propanol = 80/20; flow rate = 1.0 mL/min; detection wavelength = 230 nm; t_R = 8.64 (minor), 12.96 (major), min]. $[\alpha]_D^{20}$ = -3.7 (c = 0.3, CH_3OH). ^1H NMR (300 MHz, DMSO-d_6) δ 9.09 (s, 1H), 7.61 (d, *J* = 7.9 Hz, 1H), 7.20-7.15 (m, 2H), 7.08-7.04 (m, 2H), 6.93 (d, *J* = 8.4 Hz, 1H), 2.17 (s, 3H), 2.00 (s, 3H), 1.62 (s, 3H). ^{13}C NMR (75 MHz, DMSO-d_6) δ 167.98, 150.56, 146.24, 144.44, 130.41, 128.78, 128.04, 127.88, 127.44, 125.81, 123.64, 123.25, 122.61, 120.97,

117.19, 108.55, 23.03, 16.49, 14.73. HRMS (ESI-TOF): Exact mass calcd. for $C_{20}H_{19}NO_4$ $[M+H]^+$ 338.1387, Found: 338.1382. MP 129-131 °C.



9ei, yellow solid, 69% yield (45.7 mg), 58% ee. [Daicel CHIRALPAK AD-H (0.46 cm x 25 cm); *n*-hexane/2-propanol = 70/30; flow rate = 1.0 mL/min; detection wavelength = 230 nm; t_R = 6.57 (minor), 11.19 (major) min]. $[\alpha]_D^{20}$ = +1.0 (c = 0.3, CH_3OH). ^1H NMR (300 MHz, DMSO-d_6) δ 10.07 (s, 1H), 8.35 (d, *J* = 8.6 Hz, 2H), 8.21 (d, *J* = 8.5 Hz, 2H), 7.63 (d, *J* = 7.9 Hz, 1H), 7.21-7.07 (m, 4H), 6.99 (d, *J* = 8.2 Hz, 1H), 2.24 (s, 3H), 1.68 (s, 3H). ^{13}C NMR (75 MHz, DMSO-d_6) δ 163.71, 151.47, 149.00, 146.23, 144.55, 140.56, 131.87, 128.95, 128.80, 128.23, 128.04, 127.08, 125.85, 123.61, 123.56, 123.49, 122.71, 122.64, 121.36, 116.98, 108.64, 16.45, 14.85. HRMS (ESI-TOF): Exact mass calcd. for $C_{25}H_{20}N_2O_6$ $[M+Na]^+$ 467.1214, Found: 467.1204. MP 103-105 °C.

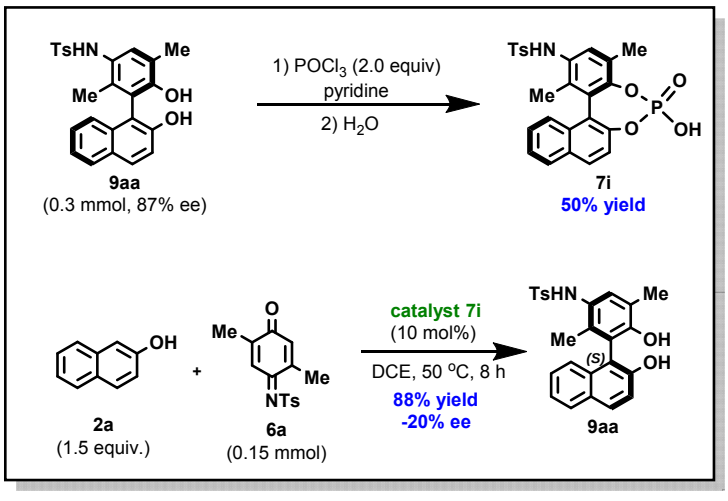




9aj and **9aj'**, white solid, 99% yield (63 mg), 82% ee for **9aj**. [Daicel CHIRALPAK AD-H (0.46 cm x 25 cm); *n*-hexane/2-propanol = 70/30; flow rate = 1.0 mL/min; detection wavelength = 230 nm; t_R = 19.59 (minor), 30.77 (major) min]. $[\alpha]_D^{20}$ = -42.7 (c = 0.3, CH_3OH). ^1H NMR (300 MHz, DMSO-d_6) δ 9.16 (br s, 1H), 8.92 (br s, 1H), 7.75-7.68 (m, 2H), 7.51 (d, *J* = 7.9 Hz, 2H), 7.32-7.15 (m, 6H), 6.70 (s, 1H), 6.42 (s, 1H), 2.21 (s, 3H), 2.08 (s, 3H). HRMS (ESI-TOF): Exact mass calcd. for $C_{24}H_{21}NO_4S$ $[M+Na]^+$ 442.1084, Found: 442.1089. MP 89-91 °C.

General procedure for synthesis of chiral CPA 7i and used as a catalyst.

The **9aa** (0.15 mmol, 87% ee) was dissolved in dry pyridine in a three-necked flask. Under the argon condition, $POCl_3$ (0.3 mmol) was added dropwise. The mixture was allowed to stir at room temperature for 3 h and the reaction. Then the mixture was cooled to 0 ^oC, add water (0.5 mL) slowly and stirred at room temperature for 30 min. Add CH_2Cl_2 to dissolve the mixture completely, wash the organic phase using 1N HCl. Then the organic phase was dried over anhydrous Na_2SO_4 and the filtrate was concentrated under reduced pressure. The product was purified column chromatography on silica-gel (AcOEt : MeOH = 25:1 to 7:1) to give the white solid. Dissolved the solid to CH_2Cl_2 and washed with 1N HCl, The organic phase was dried over anhydrous Na_2SO_4 and the filtrate was concentrated under reduced pressure. 7i, white solid, 50% yield (74 mg). ^1H NMR (300 MHz, DMSO-d_6) δ 9.46 (s, 1H), 7.89 (d, J = 8.4 Hz, 2H), 7.61 (d, J = 8.1 Hz, 2H), 7.43-7.30 (m, 5H), 6.70-6.96 (m, 2H), 2.41 (s, 3H), 2.24 (s, 3H), 1.42 (s, 3H). ^{31}P NMR (75 MHz, DMSO-d_6) δ 2.74. HRMS (ESI-TOF): Exact mass calcd. for $C_{25}H_{22}NO_6PS$ $[M+Na]^+$ 518.0798, Found: 518.0794.



The novel non-C_2-symmetrical CPA **7i** proved to be a viable catalyst for the coupling of **2a** and **6a** and afforded functionalized biaryl **9aa** in 88% isolated yield. The level of enantio-induction was poor (-20%, giving rise to the (*S*)-enantiomer) which was

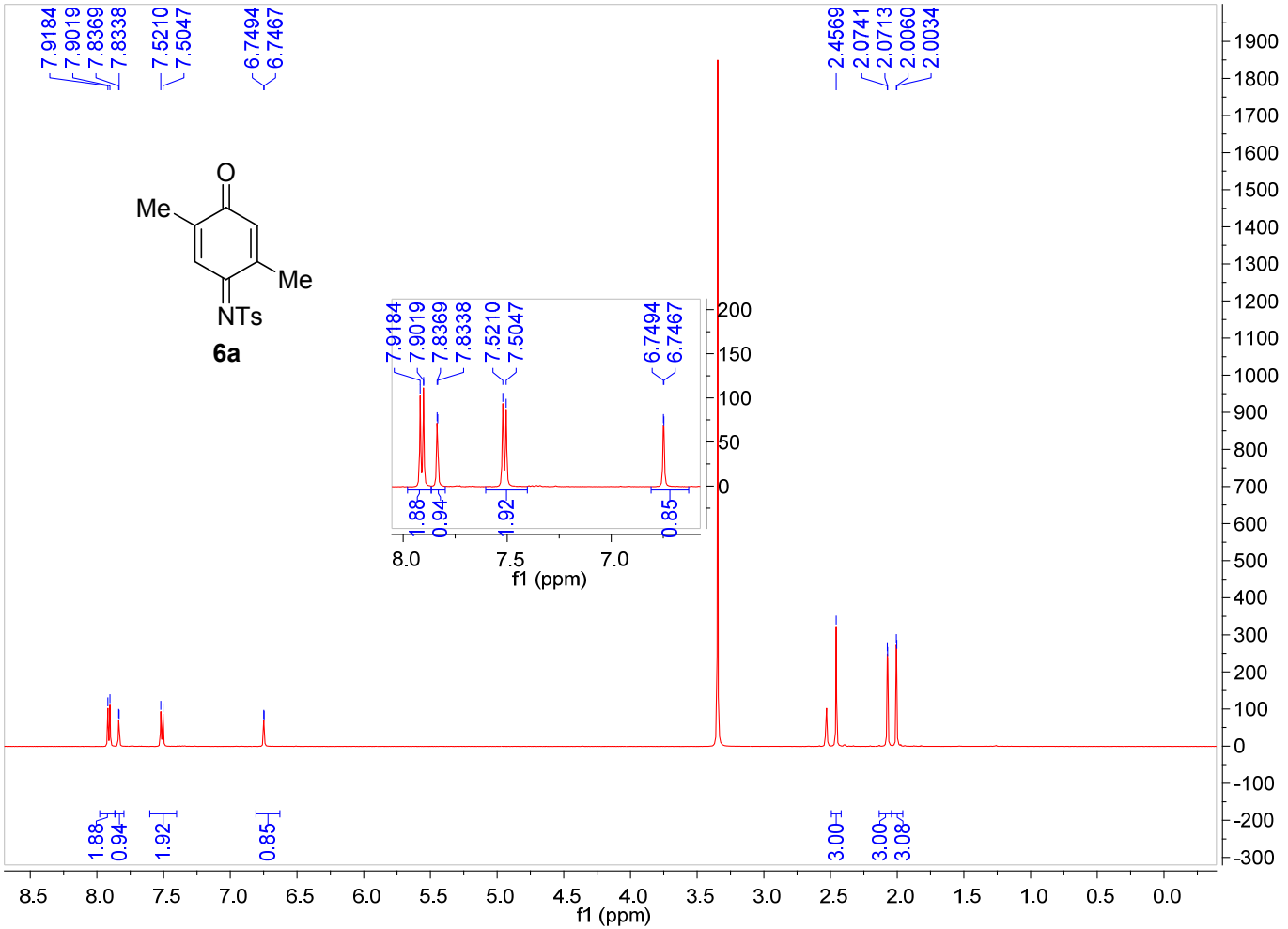
not surprising as no steric modifier is present in **7i** in the 2'-position of the naphthalene nucleus that plays a huge role in determining the stereoselectivity of the reactions in our manuscript.

General procedure for synthesis of compound 9ea*.

To a stirred solution of **9ea** (45 mg, 0.1 mmol) and **6k** (27 mg, 0.15 mmol) in toluene or DCE (3 mL), TFA (1.2 mg, 0.8 uL, 0.01 mmol) or $(PhO)_2PO_2H$ was added in one portion at room temperature, and it was stirred at 100 ^oC for 3-8 hours. Solvent was removed under reduced pressure and the crude residue was purified by column chromatography on silica-gel (hexane/ethyl acetate = 5:1 to 1:1) to give pure product **9ea*** (48 mg, 80% yield), 83% ee. [Daicel CHIRALPAK AD-H (0.46 cm x 25 cm); *n*-hexane/2-propanol = 70/30; flow rate = 1.0 mL/min; detection wavelength = 230 nm; t_R = 9.73 (minor), 46.05 (major) min]. ^1H NMR (300 MHz, DMSO-d_6) δ 9.18 (s, 1H), 8.38 (br s, 3H), 7.65 (br s, 1H), 7.53 (d, J = 8.1 Hz, 2H), 7.34 (d, J = 8.1 Hz, 2H), 7.07-7.03 (m, 2H), 7.02-6.97 (m, 2H), 6.76-6.73 (m, 2H), 6.64 (s, 1H), 3.65 (s, 3H), 2.33 (s, 3H), 2.27 (s, 3H), 2.16 (s, 3H), 1.82 (s, 3H), 1.31 (s, 3H). ^{13}C NMR (75 MHz, DMSO-d_6) δ 152.97, 152.25, 150.16, 144.75, 144.27, 143.31, 138.75, 134.36, 132.24, 130.26, 130.37, 130.25, 129.04, 128.85, 127.49, 126.79, 124.94, 124.59, 124.47, 123.33, 123.26, 122.38, 121.68, 118.15, 116.88, 115.54, 60.34, 21.90, 17.38, 16.89, 15.50, 14.11. MP 165-167 ^oC. HRMS (ESI-TOF): Exact mass calcd. for $C_{34}H_{33}NO_7S$ $[M+Na]^+$ 622.1870, Found: 622.1862.

Reference:

[1] Uliana, M. P.; Servilha, B. M.; Alexopoulos, O.; de Oliveira, K. T.; Tormena, C. F.; Ferreira, M. A. B.; Brocksom, T. J. *Tetrahedron* **2014**, *70*, 6963.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2.4569
2.0741
2.0713
2.0060
2.0034
O
Me
Me
NTs
6a
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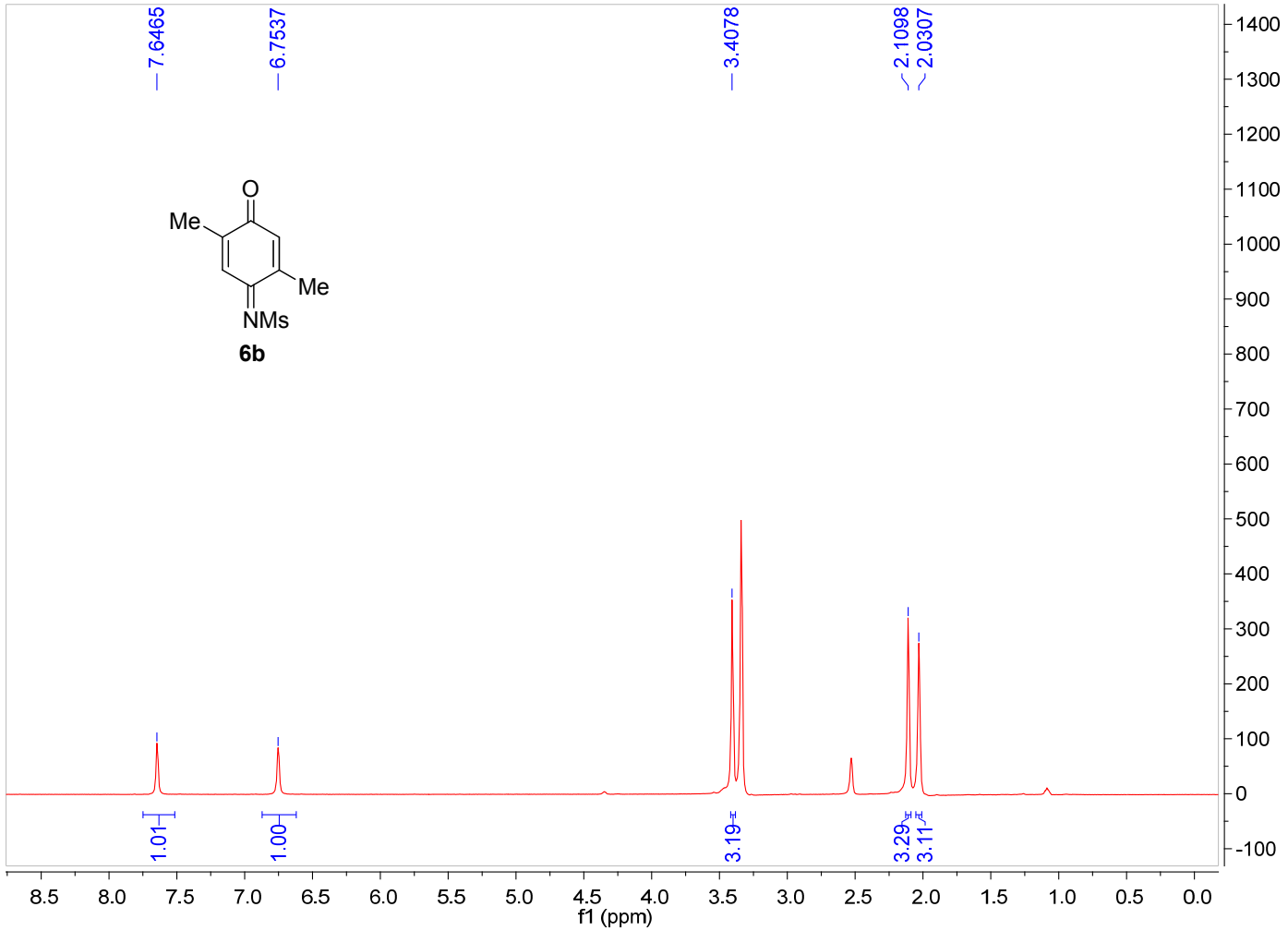
0.94
1.92
0.85
3.00
3.00
3.08
f1 (ppm)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Me
NMs
6b
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3.29
3.11
8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)
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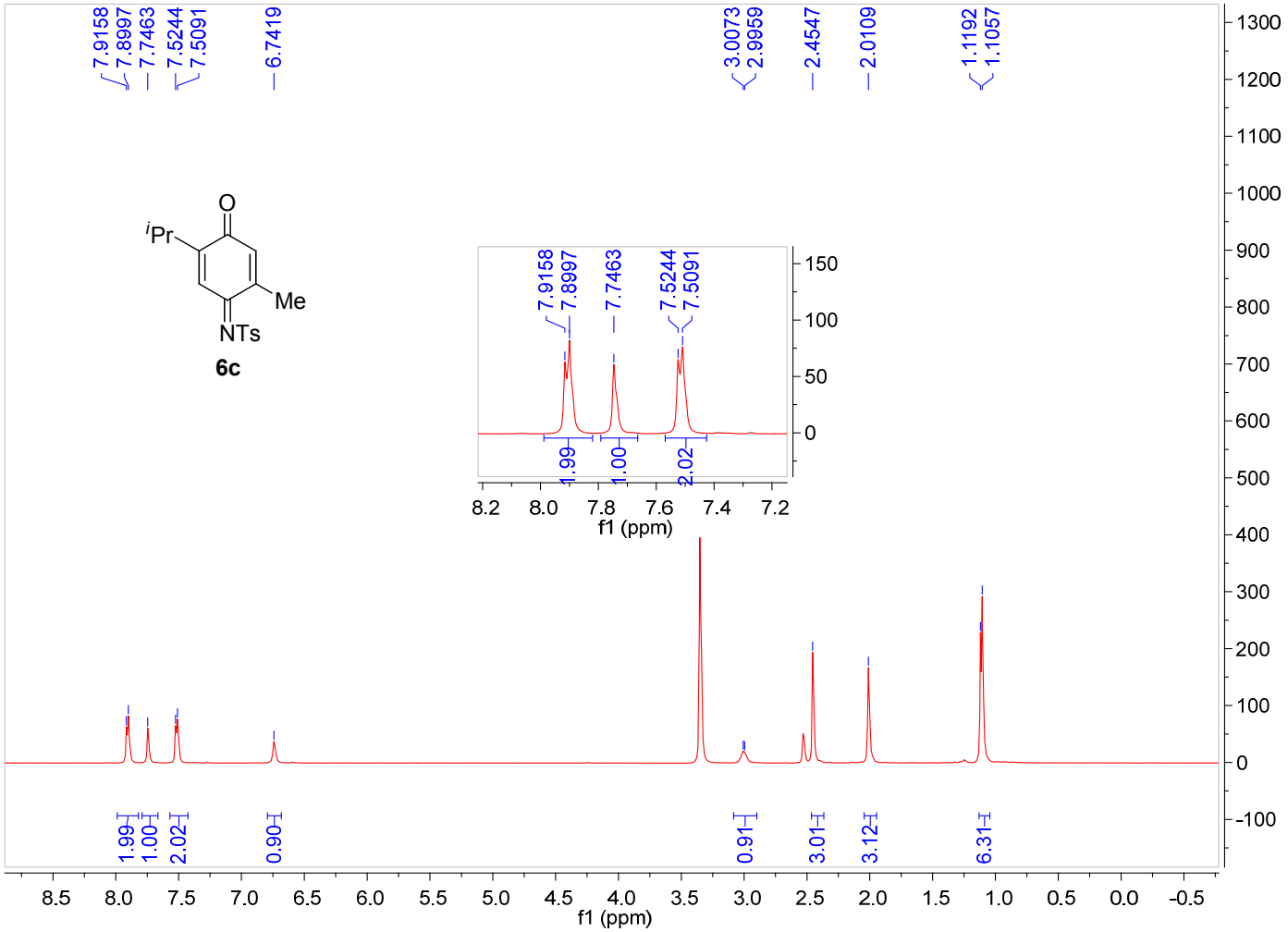
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1.1057
O
iPr
Me
NTs
6c
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2.02
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3.01
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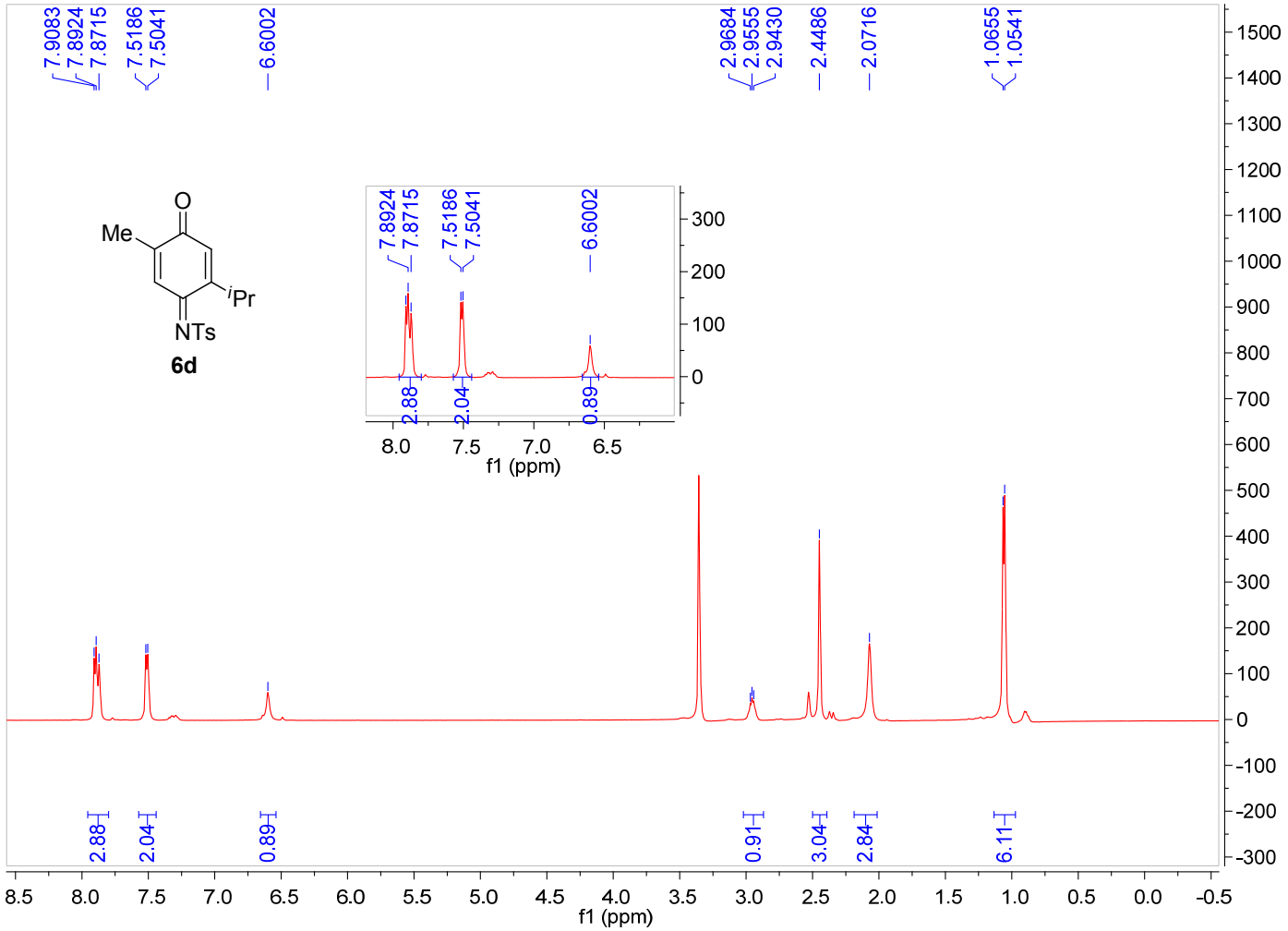
f1 (ppm)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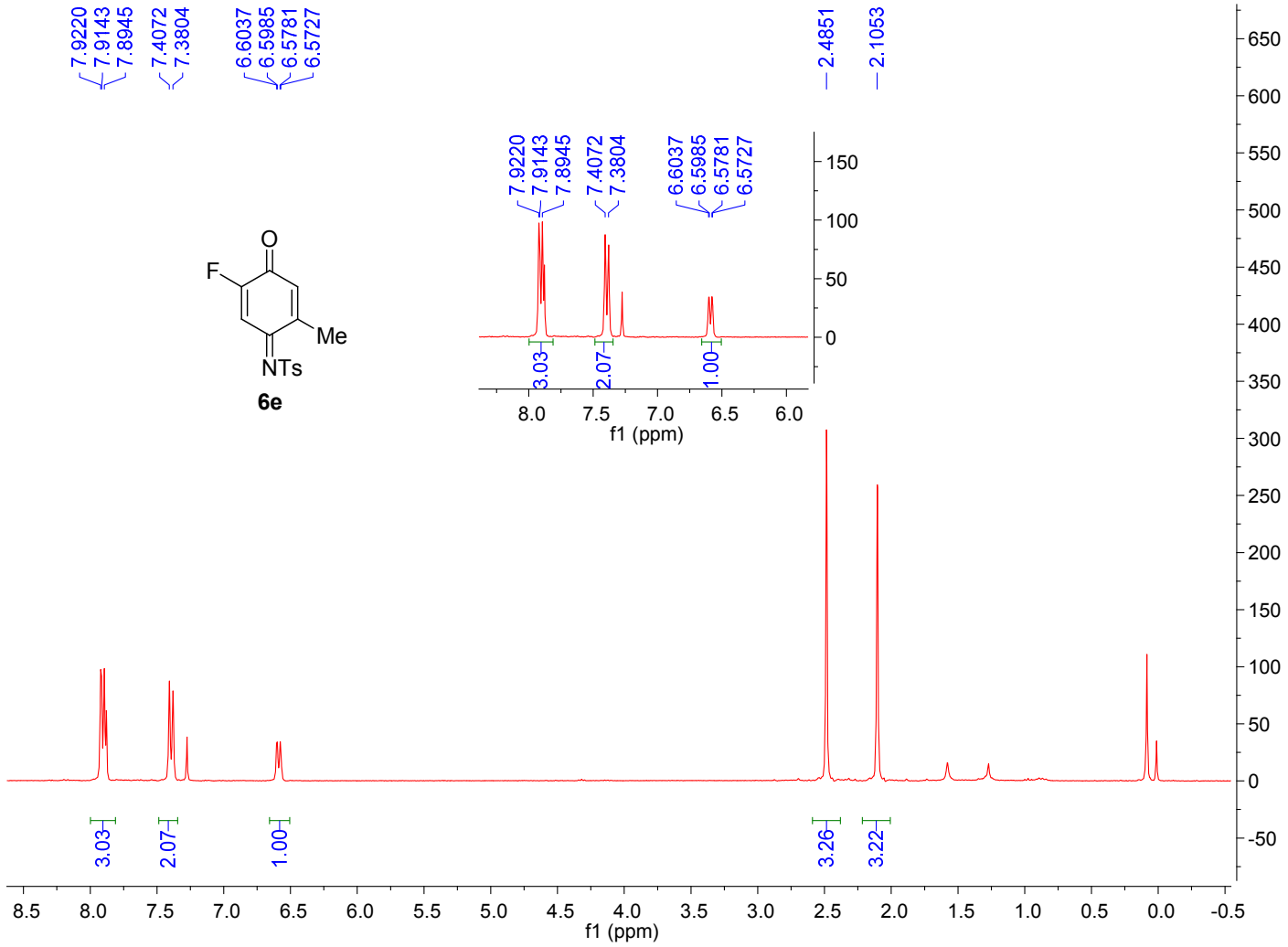
f1 (ppm)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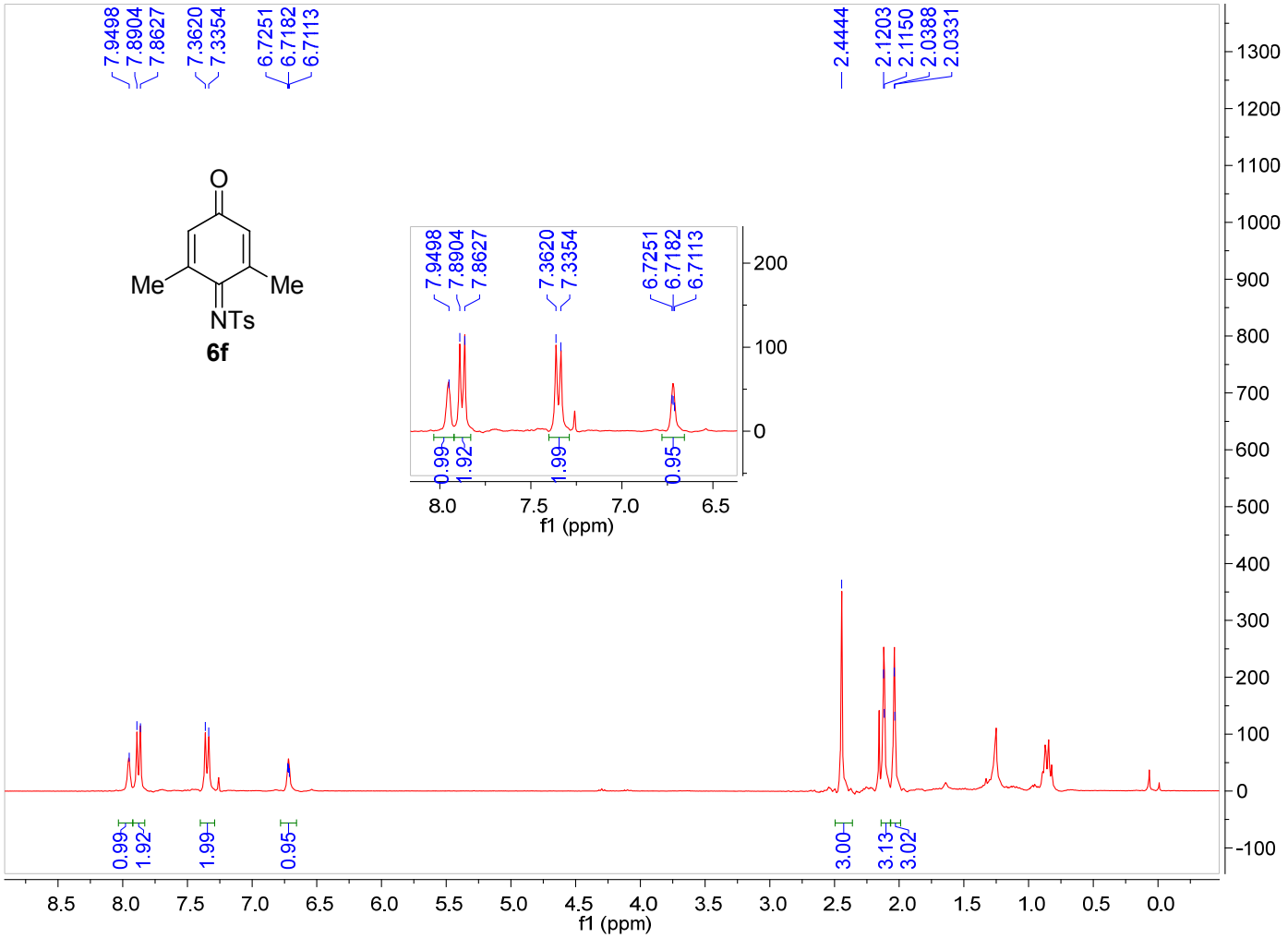
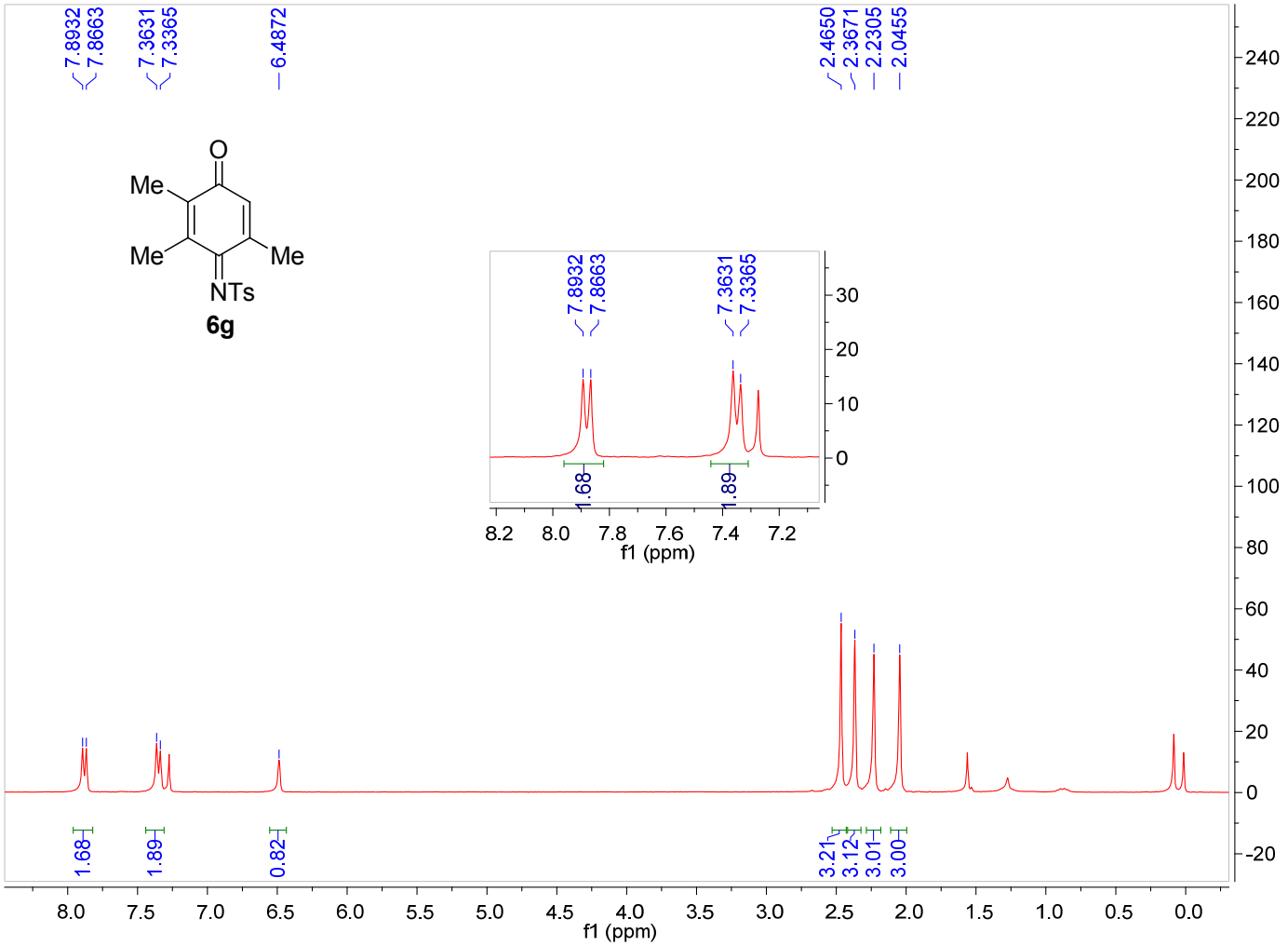
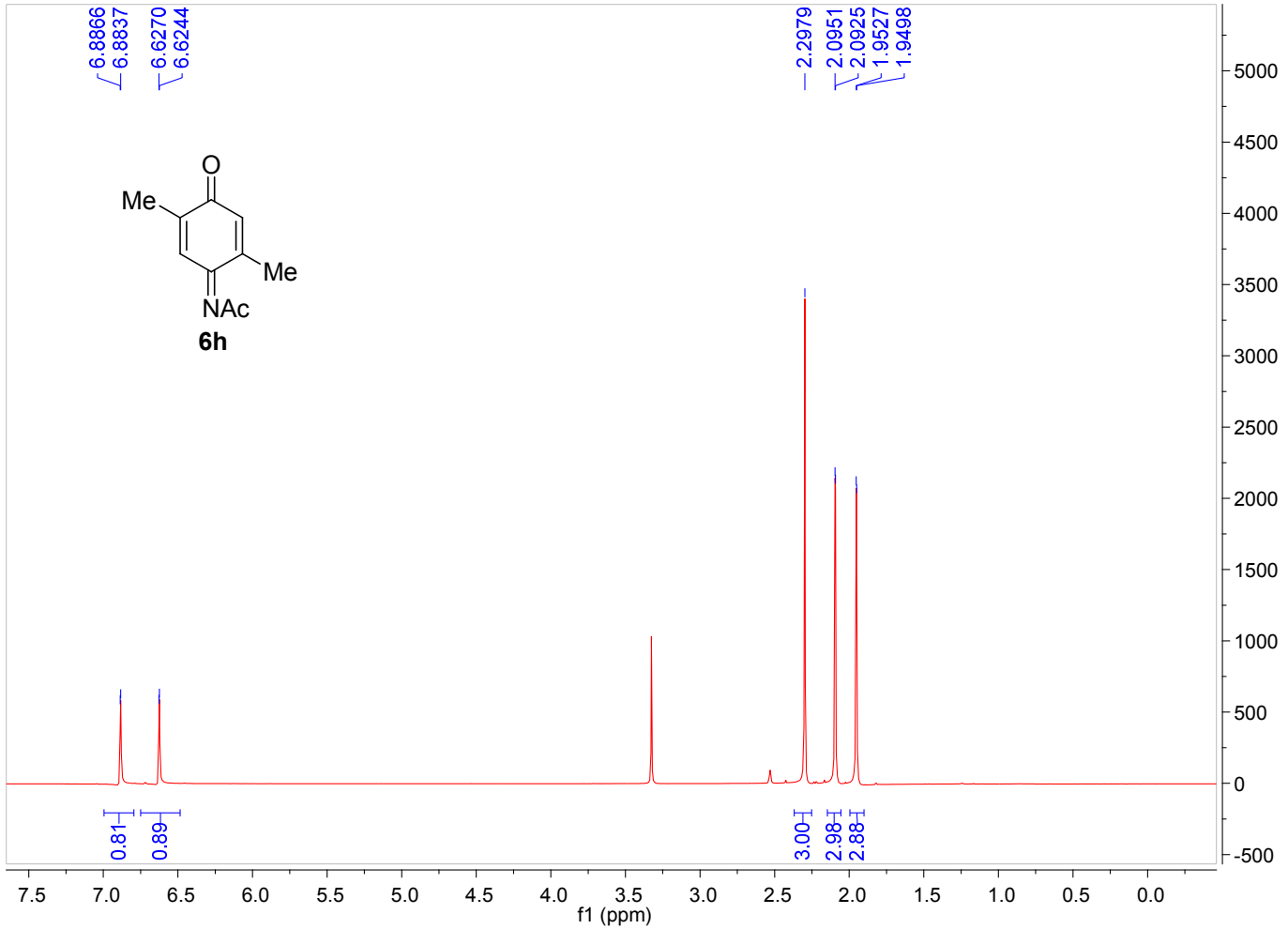
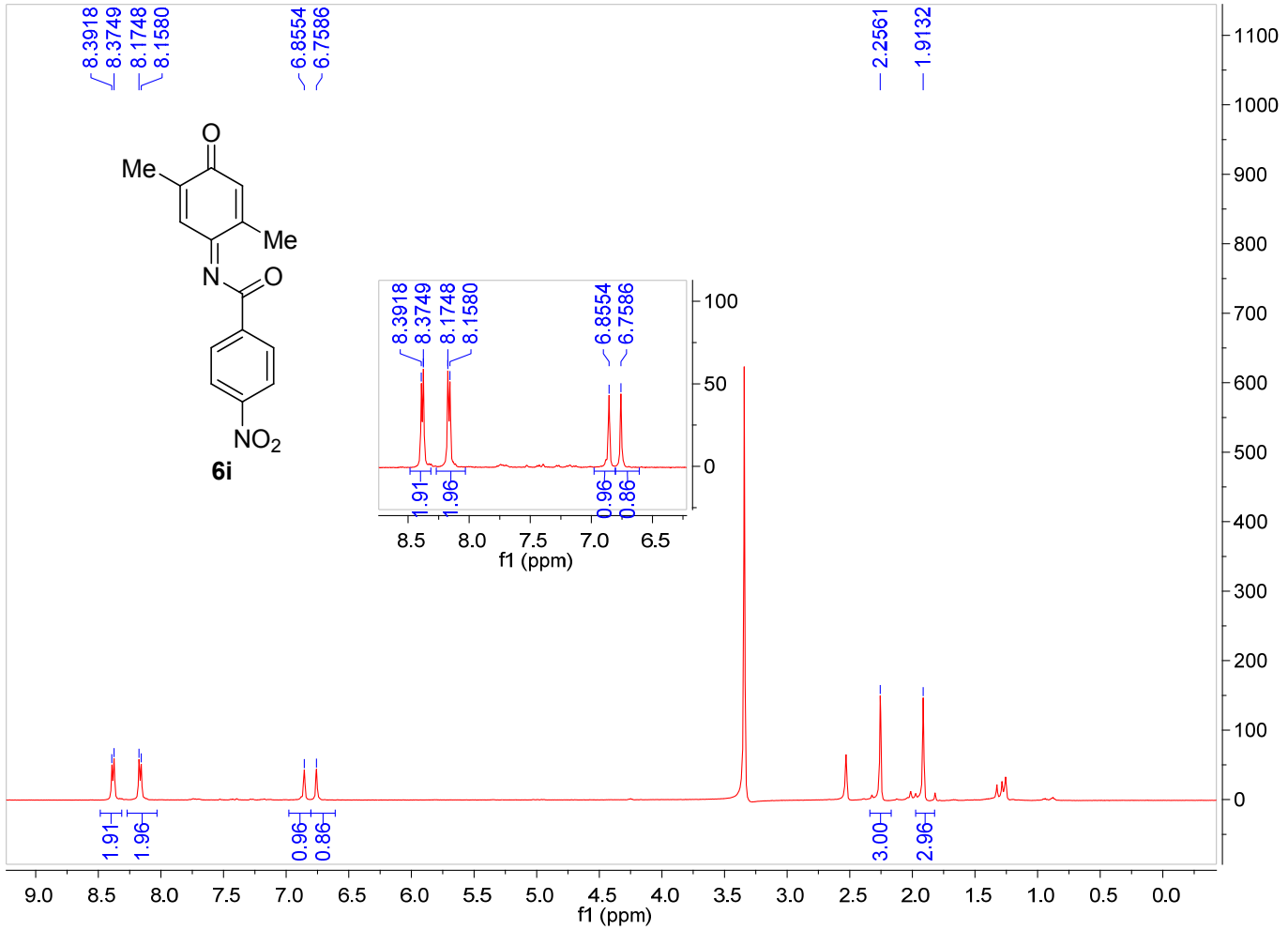
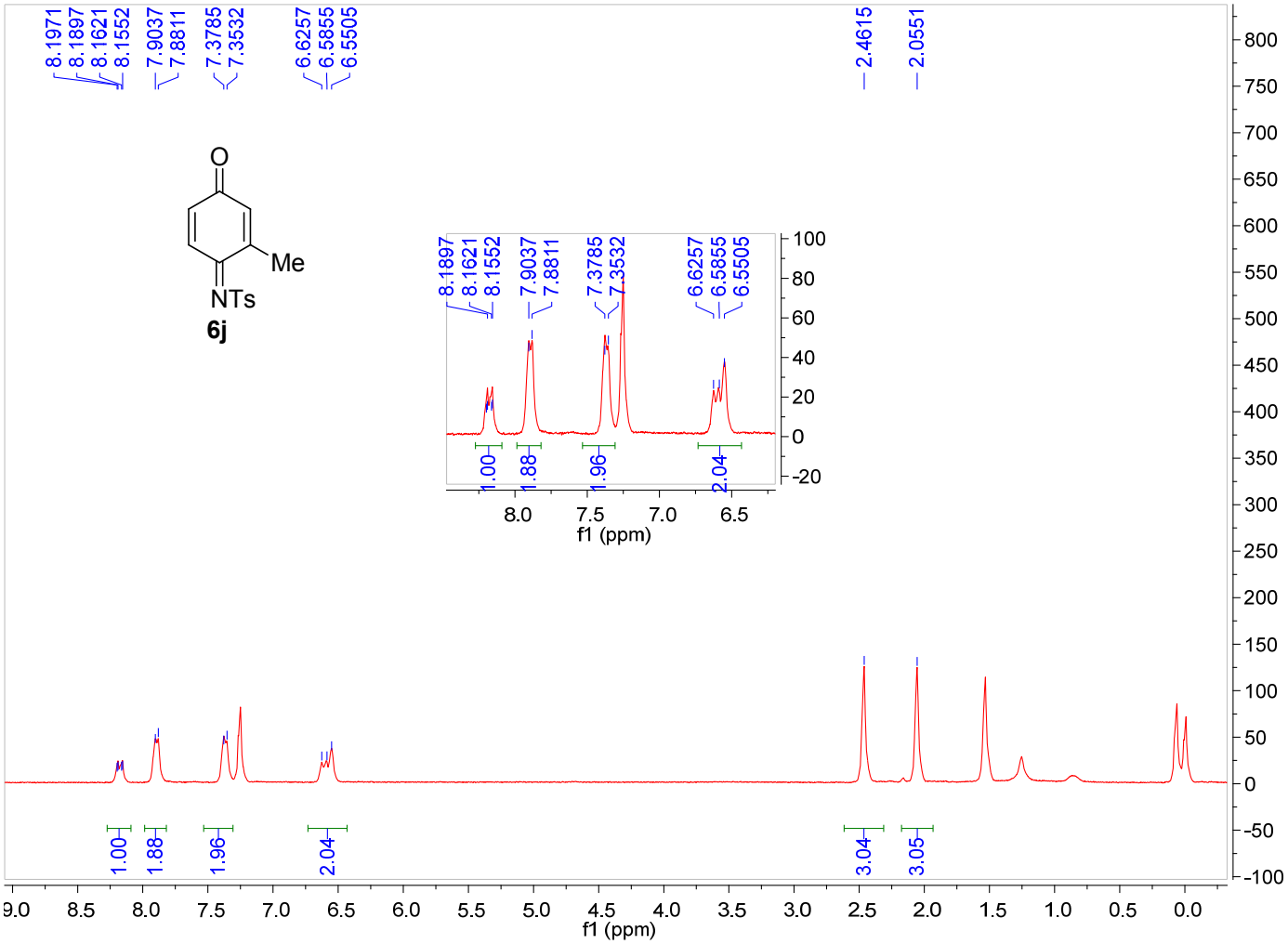
F
Me
NTs
6e
3.03
2.07
1.00
3.26
3.22
f1 (ppm)

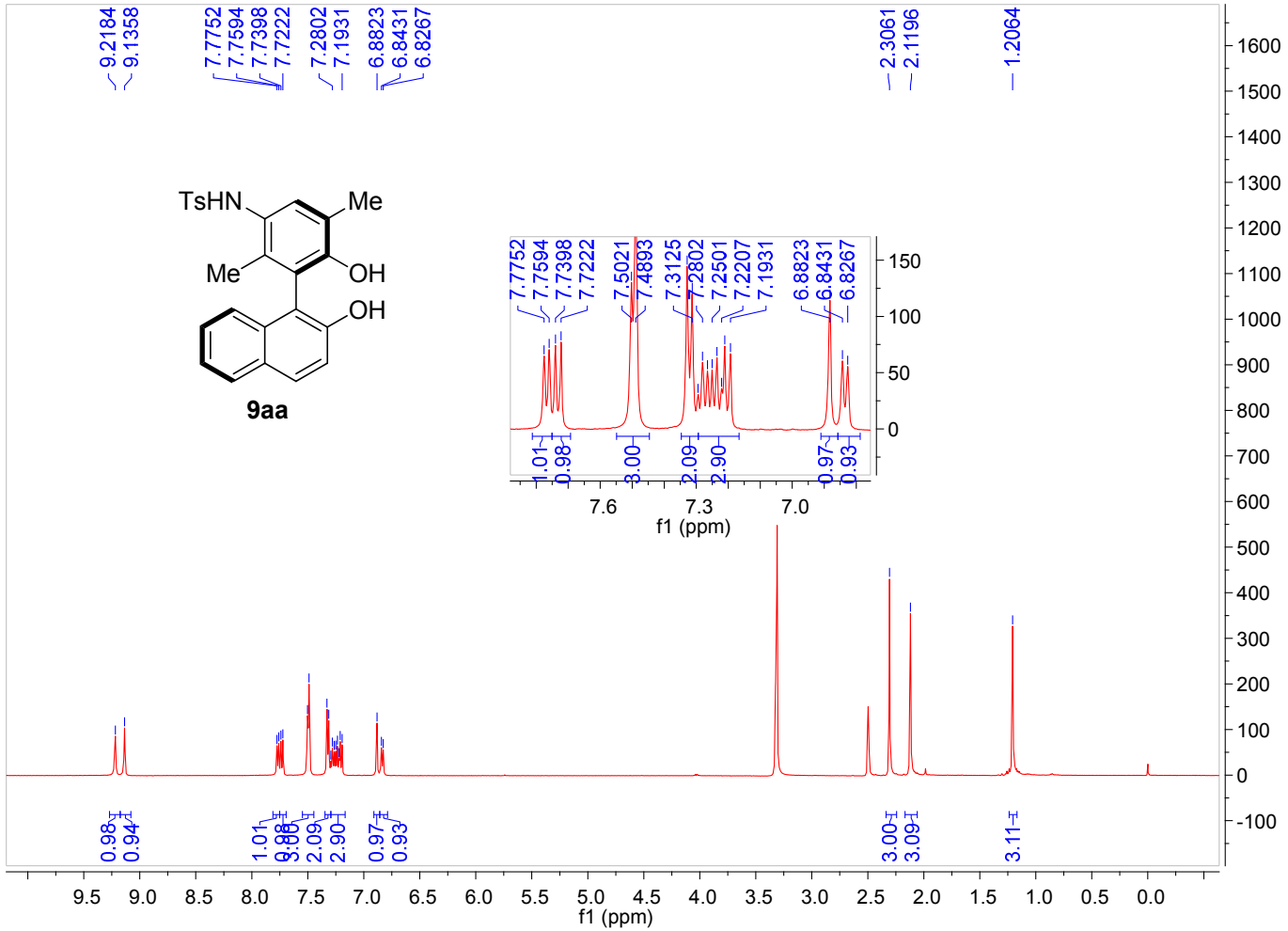

7.9498
7.8904
7.8627
7.3620
7.3354
6.7251
6.7182
6.7113
2.4444
2.1203
2.1150
2.0388
2.0331
O
Me
Me
NTs
6f
0.99
1.92
1.99
0.95
3.00
3.13
3.02
f1 (ppm)

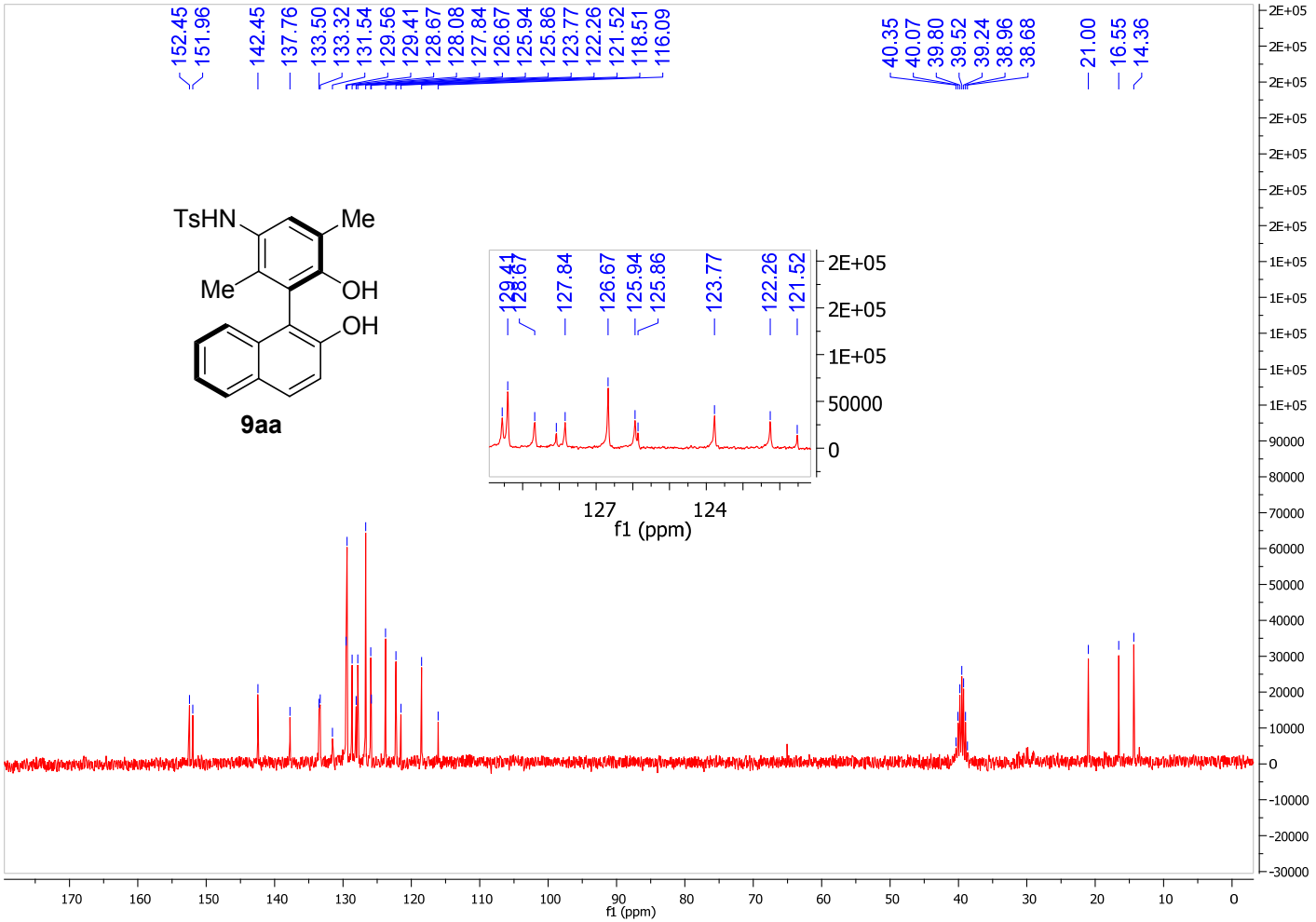

7.8932
7.8663
7.3631
7.3365
6.4872
2.4650
2.3671
2.2305
2.0455
O
Me
Me
Me
NTs
6g
1.68
1.89
0.82
3.21
3.12
3.01
3.00
f1 (ppm)

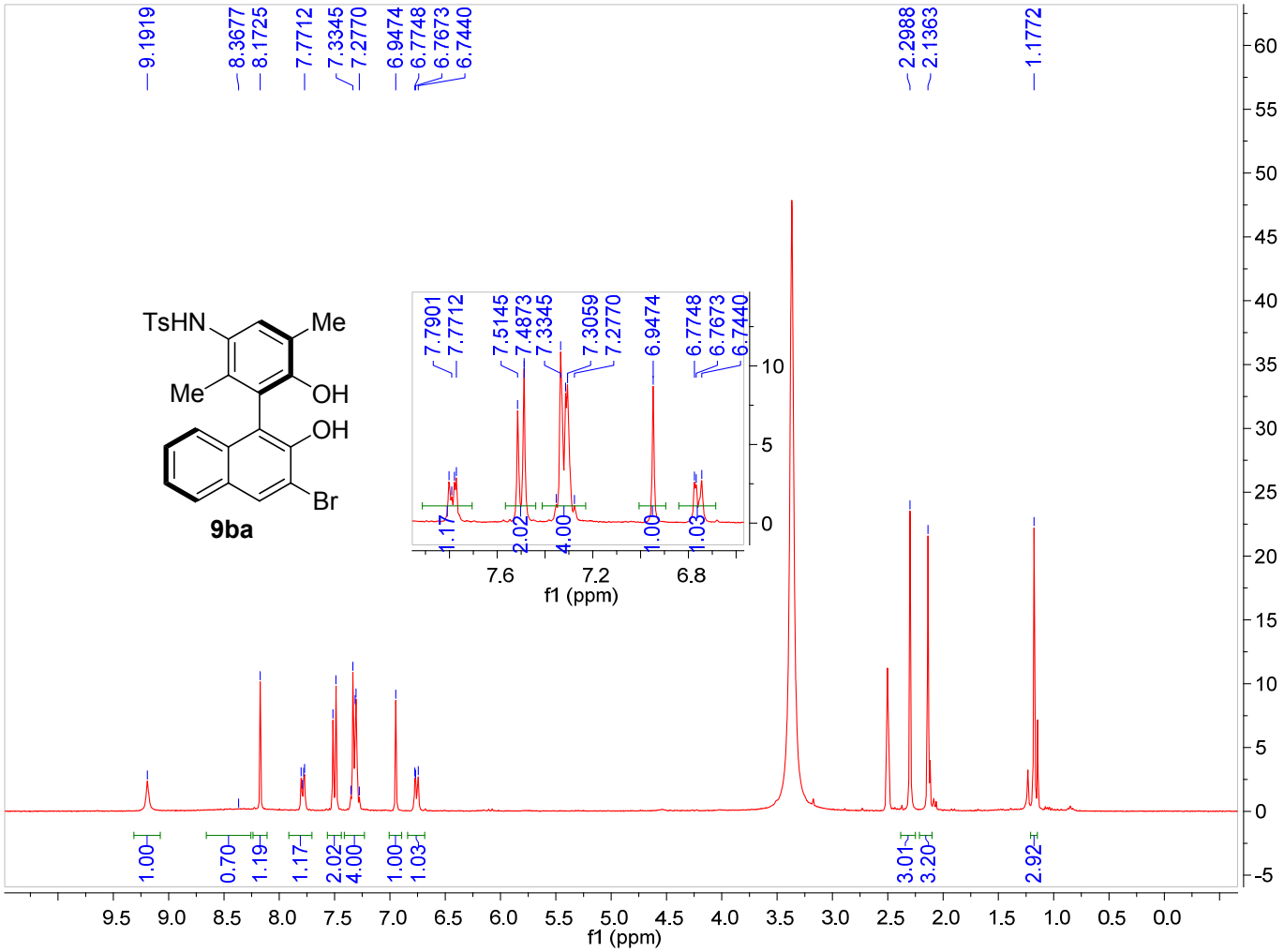

6.8866
6.8837
6.6270
6.6244
2.2979
2.0951
2.0925
1.9527
1.9498
O
Me
Me
NAc
6h
0.81
0.89
3.00
2.98
2.88
f1 (ppm)

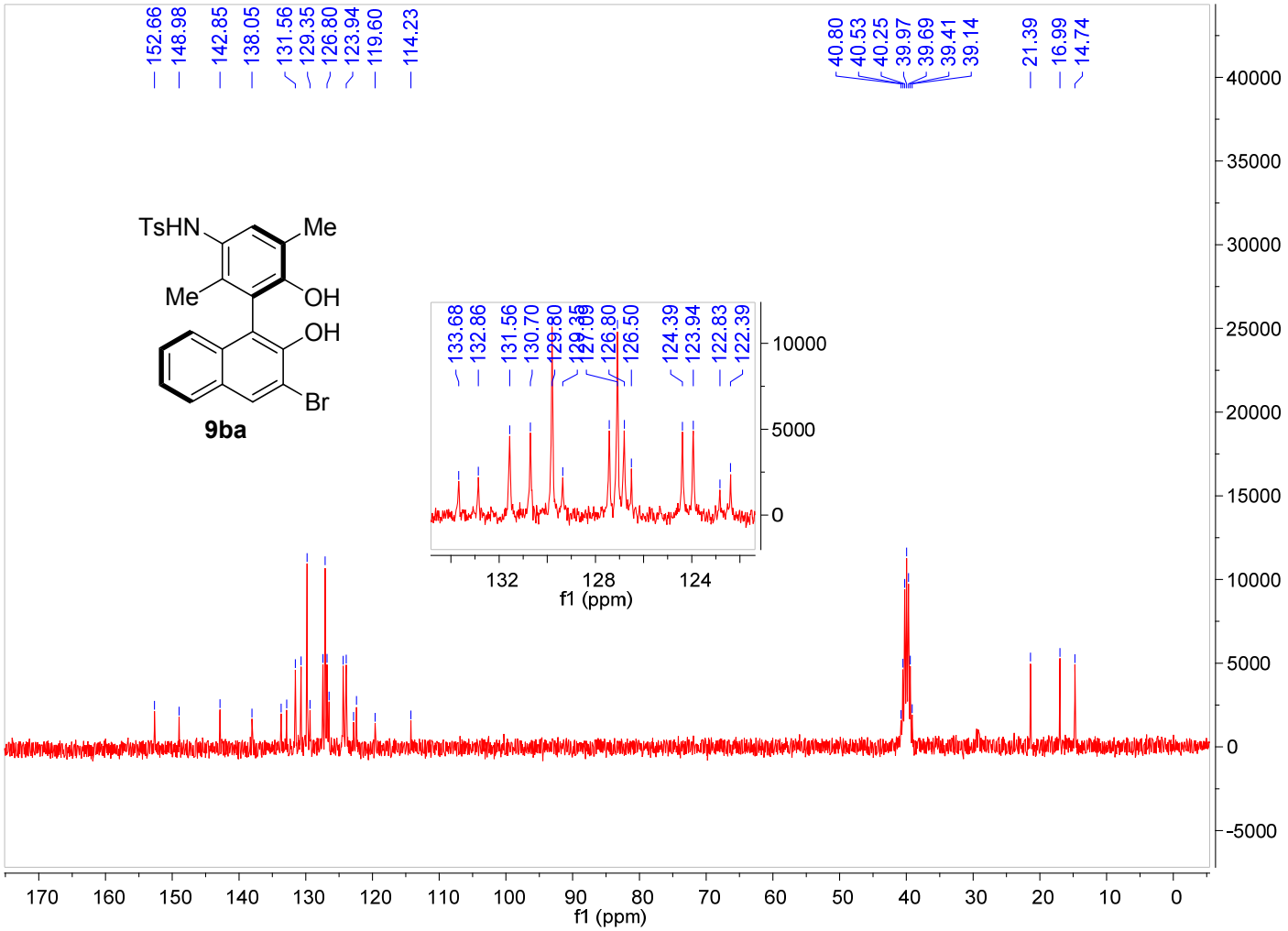

8.3918
8.3749
8.1748
8.1580
6.8554
6.7586
2.2561
1.9132
O
Me
Me
N
O
NO2
6i
1.91
1.96
0.96
0.86
3.00
2.96
f1 (ppm)

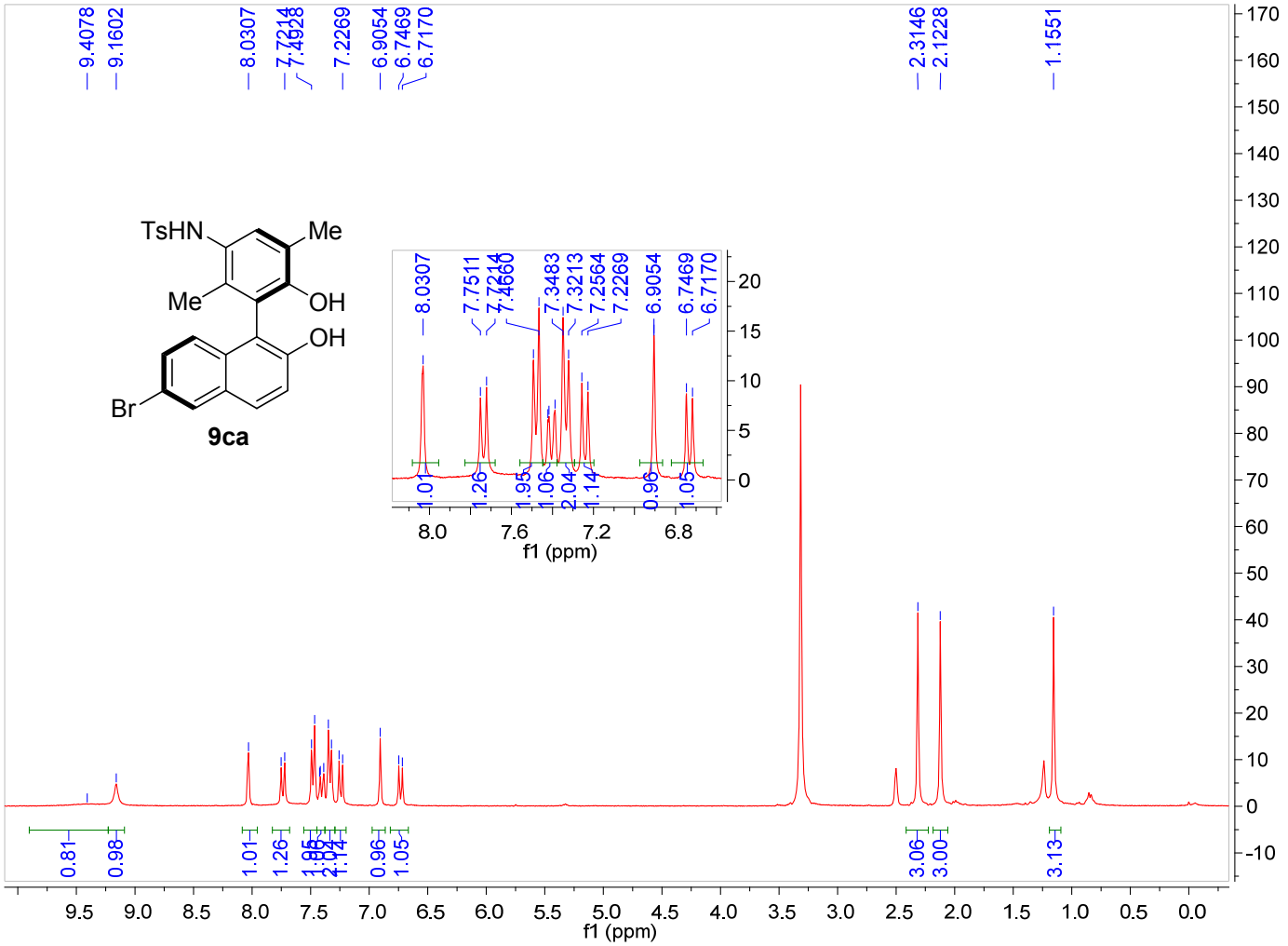

8.1971
8.1897
8.1621
8.1552
7.9037
7.8811
7.3785
7.3532
6.6257
6.5855
6.5505
2.4615
2.0551
O
Me
NTs
6j
1.00
1.88
1.96
2.04
3.04
3.05
f1 (ppm)

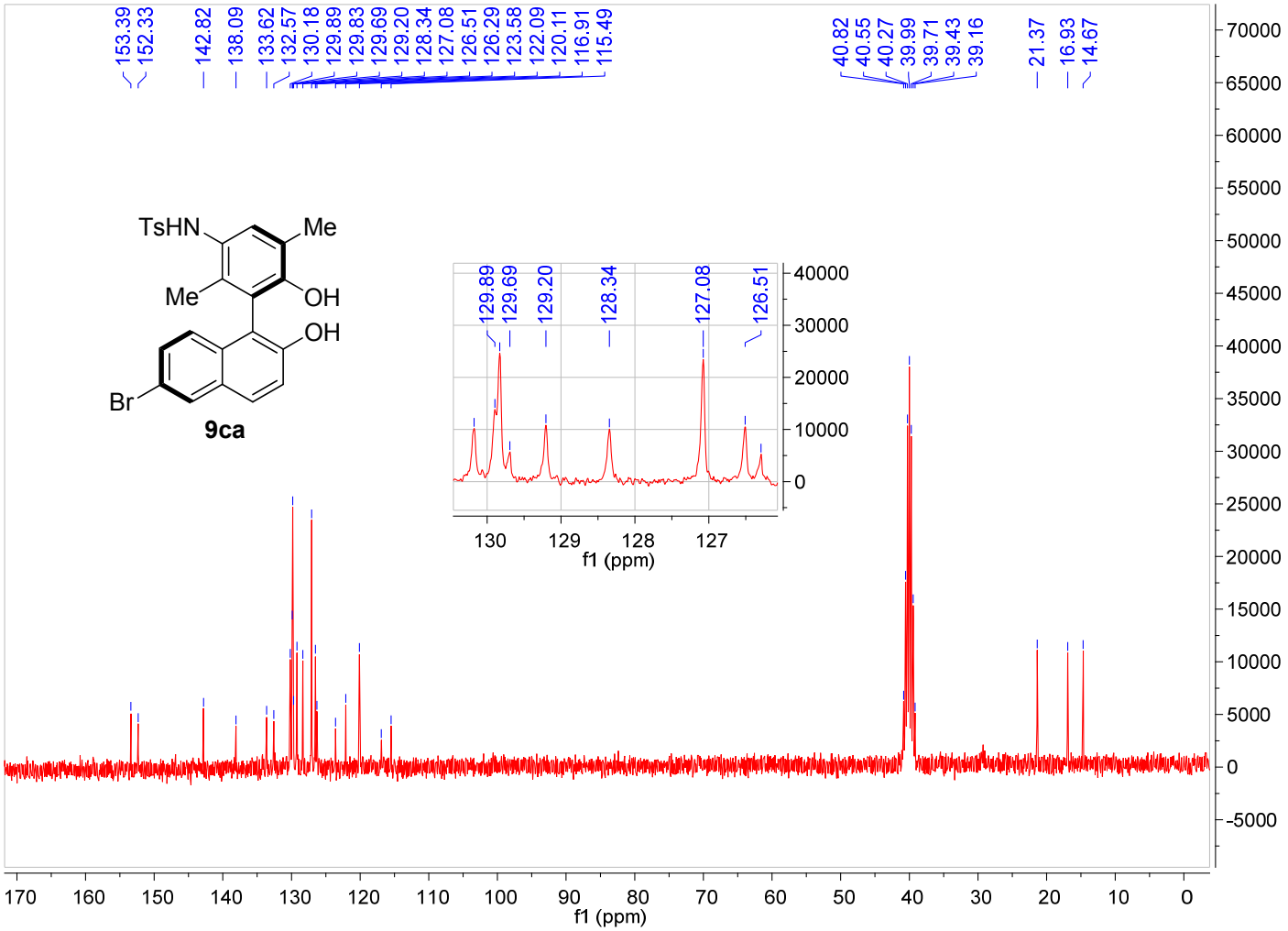

9.2184
9.1358
7.7752
7.7594
7.7398
7.7222
7.2802
7.1931
6.8823
6.8431
6.8267
2.3061
2.1196
1.2064
TsHN
Me
Me
OH
OH
9aa
f1 (ppm)
f1 (ppm)

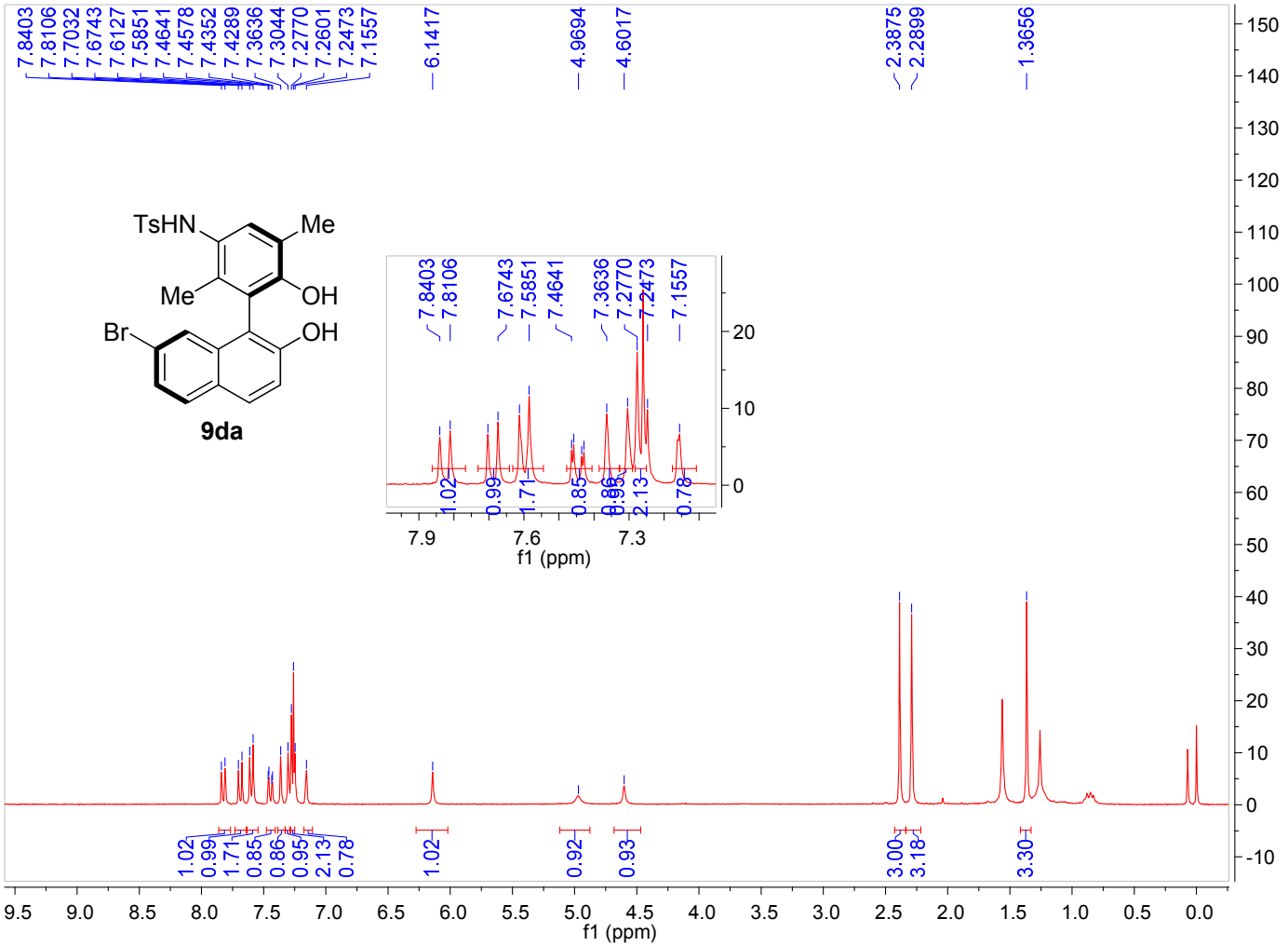

152.45
151.96
142.45
137.76
133.50
133.32
131.54
129.56
129.41
128.67
128.08
127.84
126.67
125.94
125.86
123.77
122.26
121.52
118.51
116.09
40.35
40.07
39.80
39.52
39.24
38.96
38.68
21.00
16.55
14.36
TsHN
Me
Me
OH
OH
9aa
127.84
126.67
125.94
125.86
123.77
122.26
121.52
2E+05
1E+05
50000
0
127
124
f1 (ppm)
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

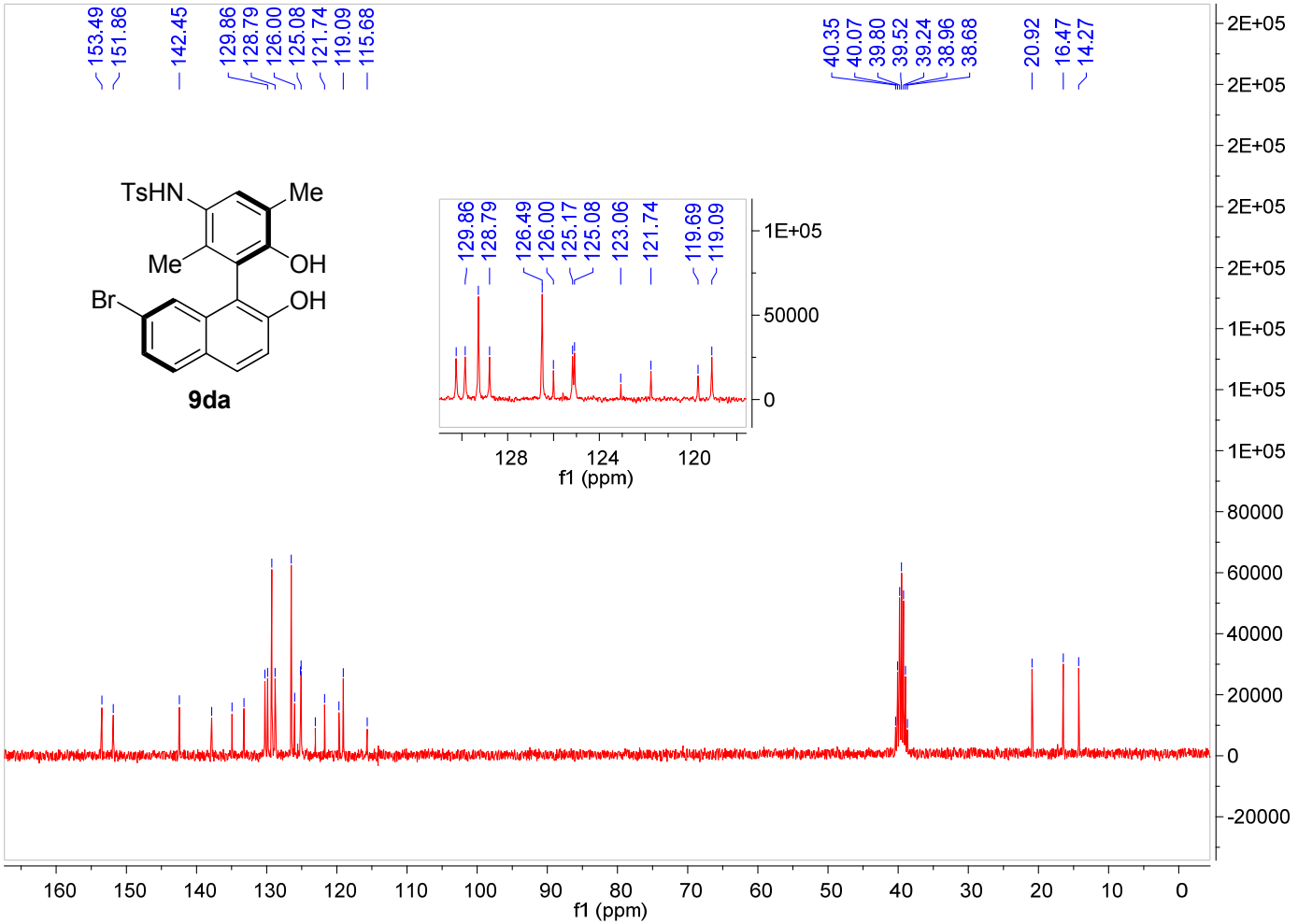

9.1919
8.3677
8.1725
7.7712
7.3345
7.2770
6.9474
6.7748
6.7673
6.7440
2.2988
2.1363
1.1772
TsHN
Me
Me
OH
OH
Br
9ba
7.7901
7.7712
7.5145
7.4873
7.3345
7.3059
7.2770
6.9474
6.7748
6.7673
6.7440
1.17
2.02
4.00
1.00
1.03
f1 (ppm)
1.00
0.70
1.19
1.17
2.02
4.00
1.00
1.03
3.01
3.20
2.92
f1 (ppm)


152.66
148.98
142.85
138.05
131.56
129.35
126.80
123.94
119.60
114.23
40.80
40.53
40.25
39.97
39.69
39.41
39.14
21.39
16.99
14.74
TsHN
Me
Me
OH
OH
Br
9ba
133.68
132.86
131.56
130.70
129.80
126.80
126.50
124.39
123.94
122.83
122.39
f1 (ppm)
f1 (ppm)


9.4078
9.1602
8.0307
7.7214
7.4928
7.2269
6.9054
6.7469
6.7170
2.3146
2.1228
1.1551
TsHN
Me
Me
OH
OH
Br
9ca
f1 (ppm)
f1 (ppm)


153.39
152.33
142.82
138.09
133.62
132.57
130.18
129.89
129.83
129.69
129.20
128.34
127.08
126.51
126.29
123.58
122.09
120.11
116.91
115.49
40.82
40.55
40.27
39.99
39.71
39.43
39.16
21.37
16.93
14.67
TsHN
Me
Me
OH
OH
Br
9ca
129.89
129.69
129.20
128.34
127.08
126.51
f1 (ppm)
f1 (ppm)


TsHN
Me
Me
OH
Br
OH
9da
f1 (ppm)
f1 (ppm)


153.49
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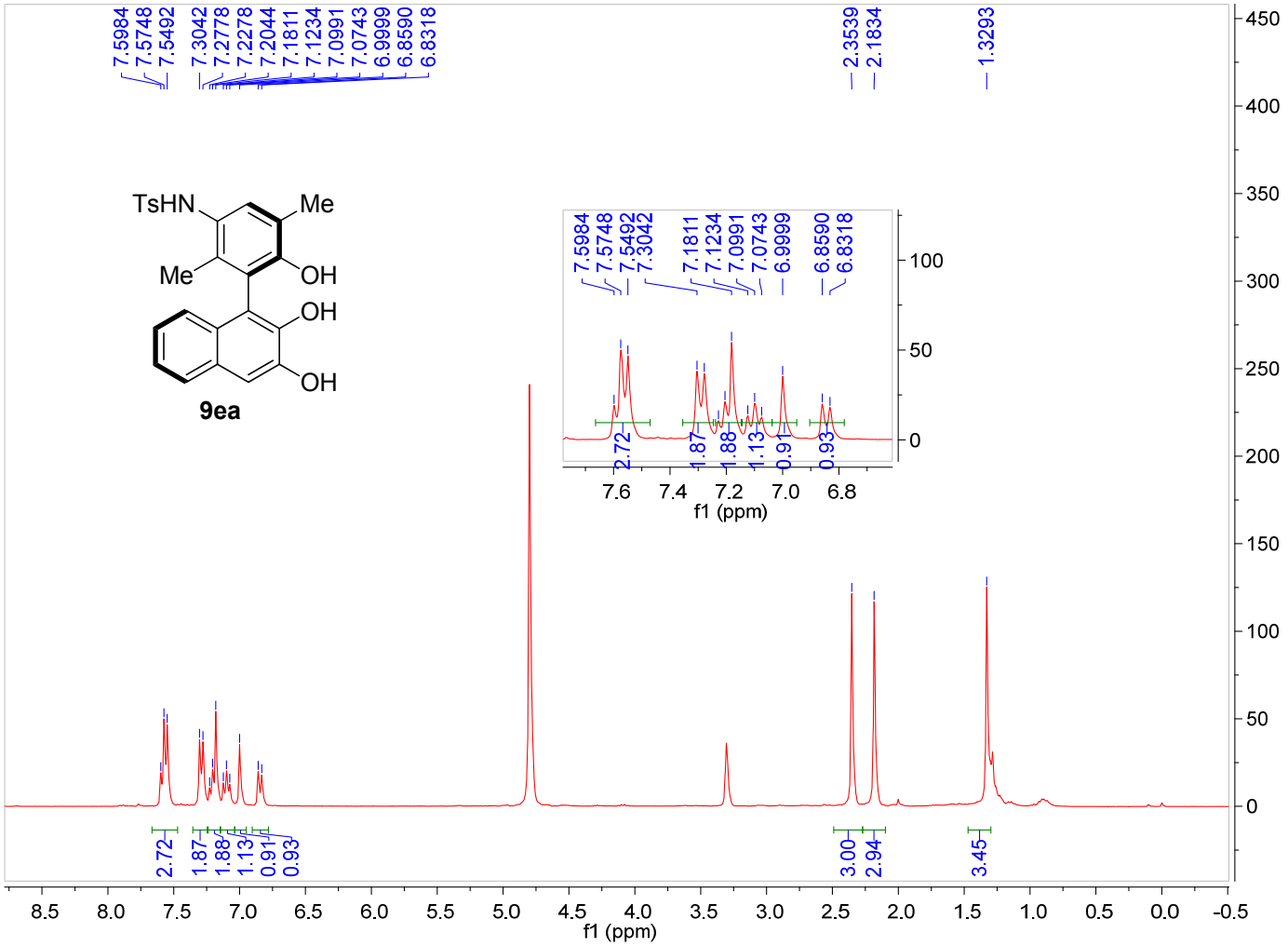
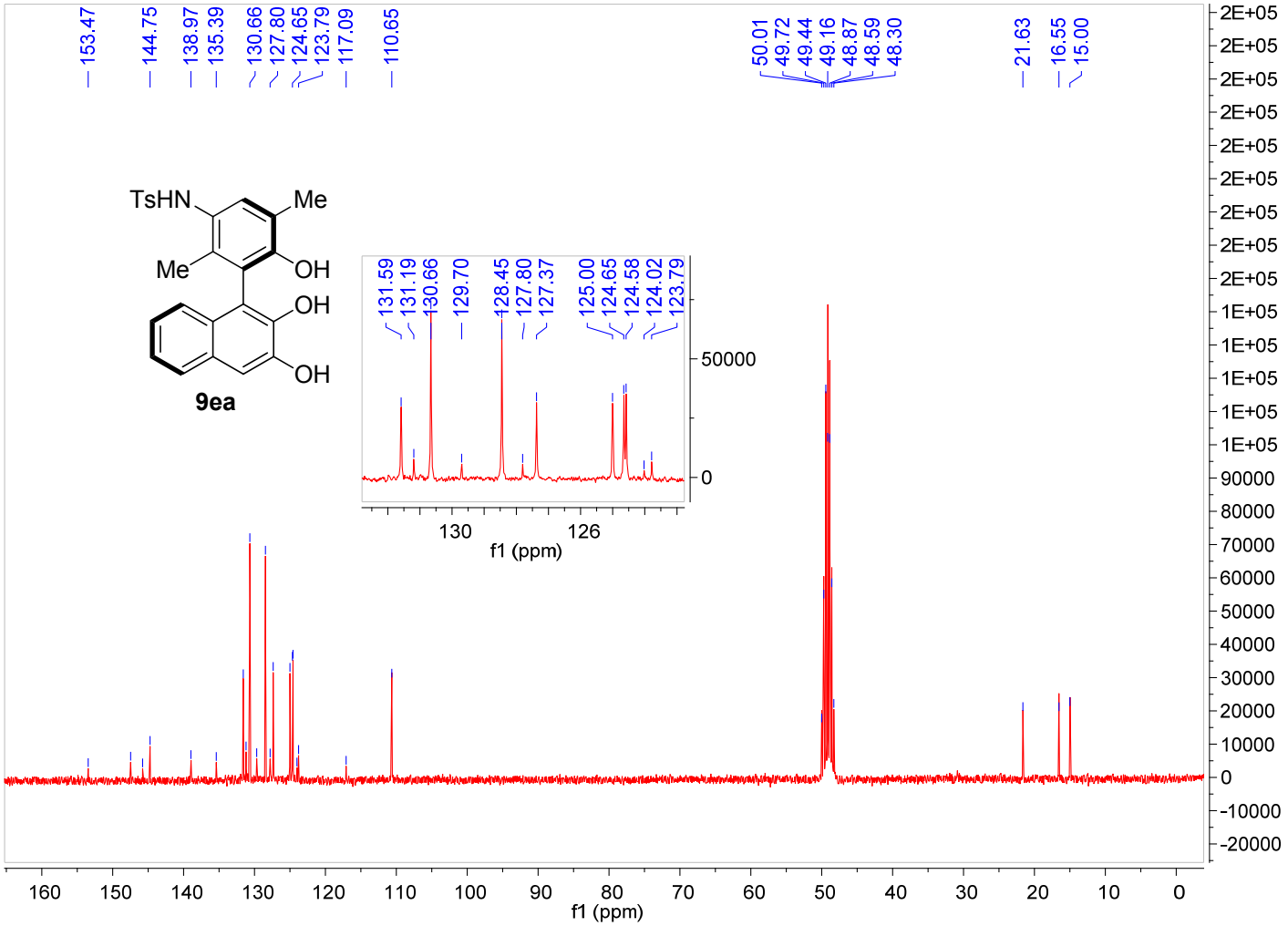
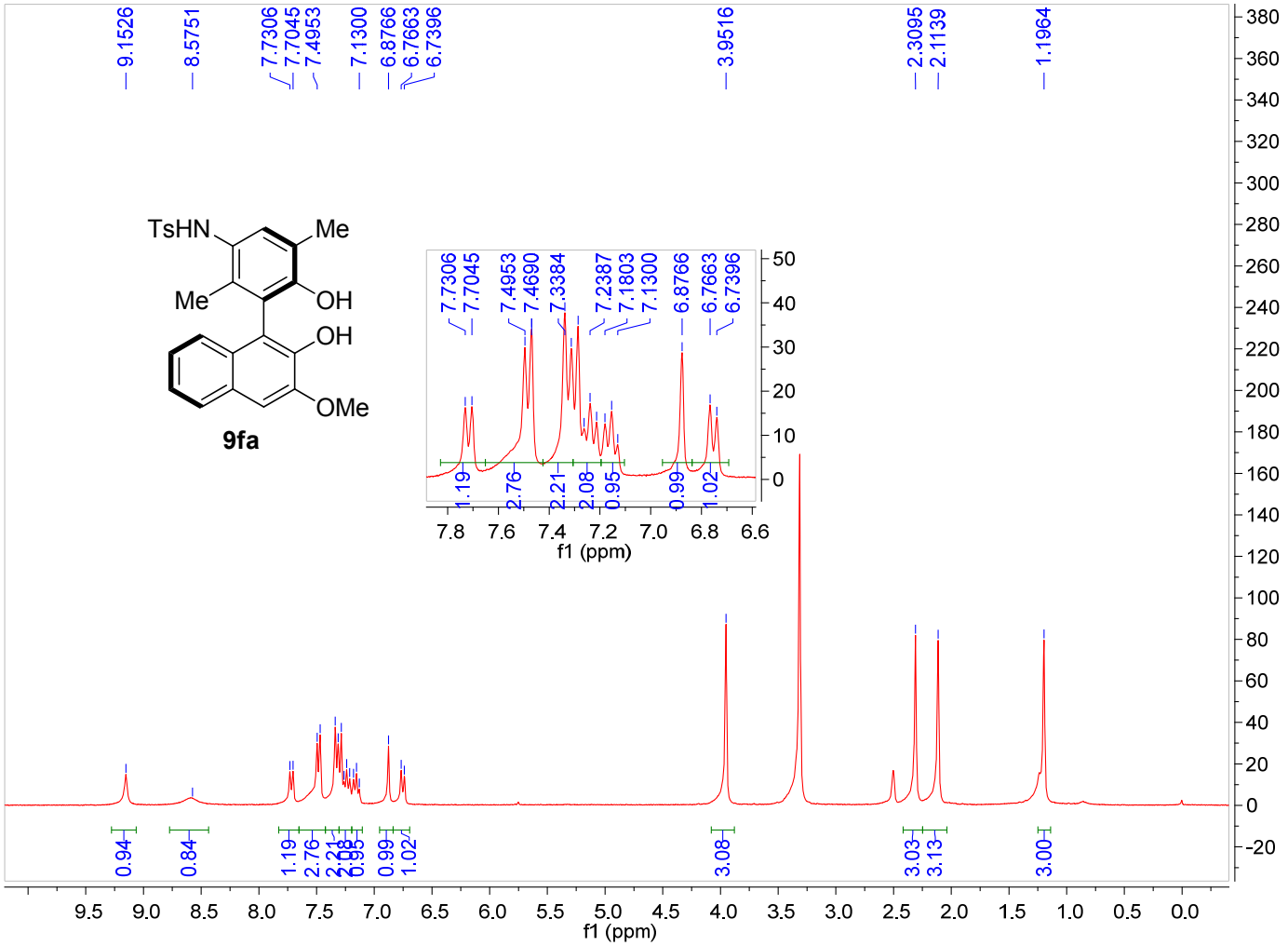
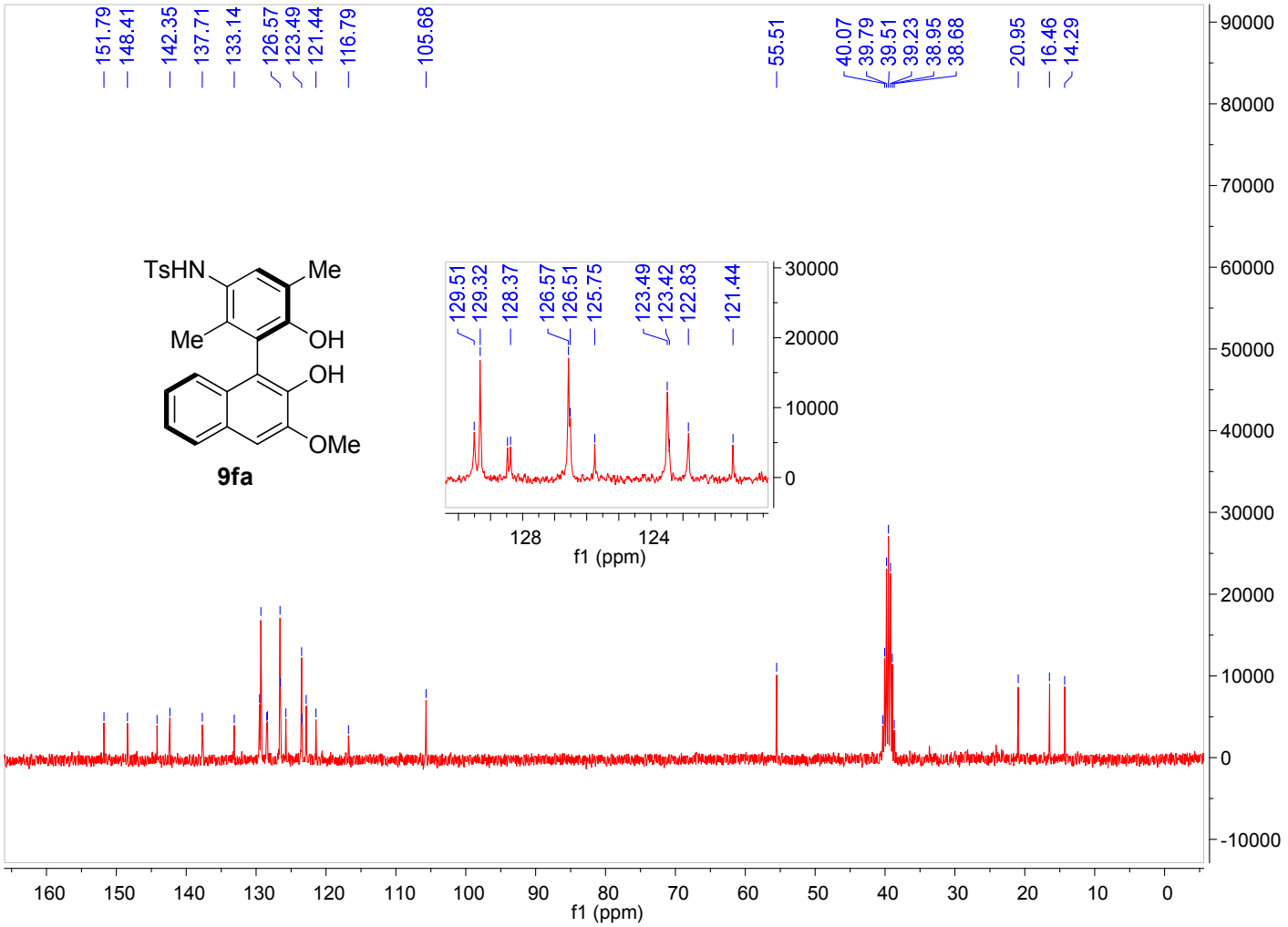
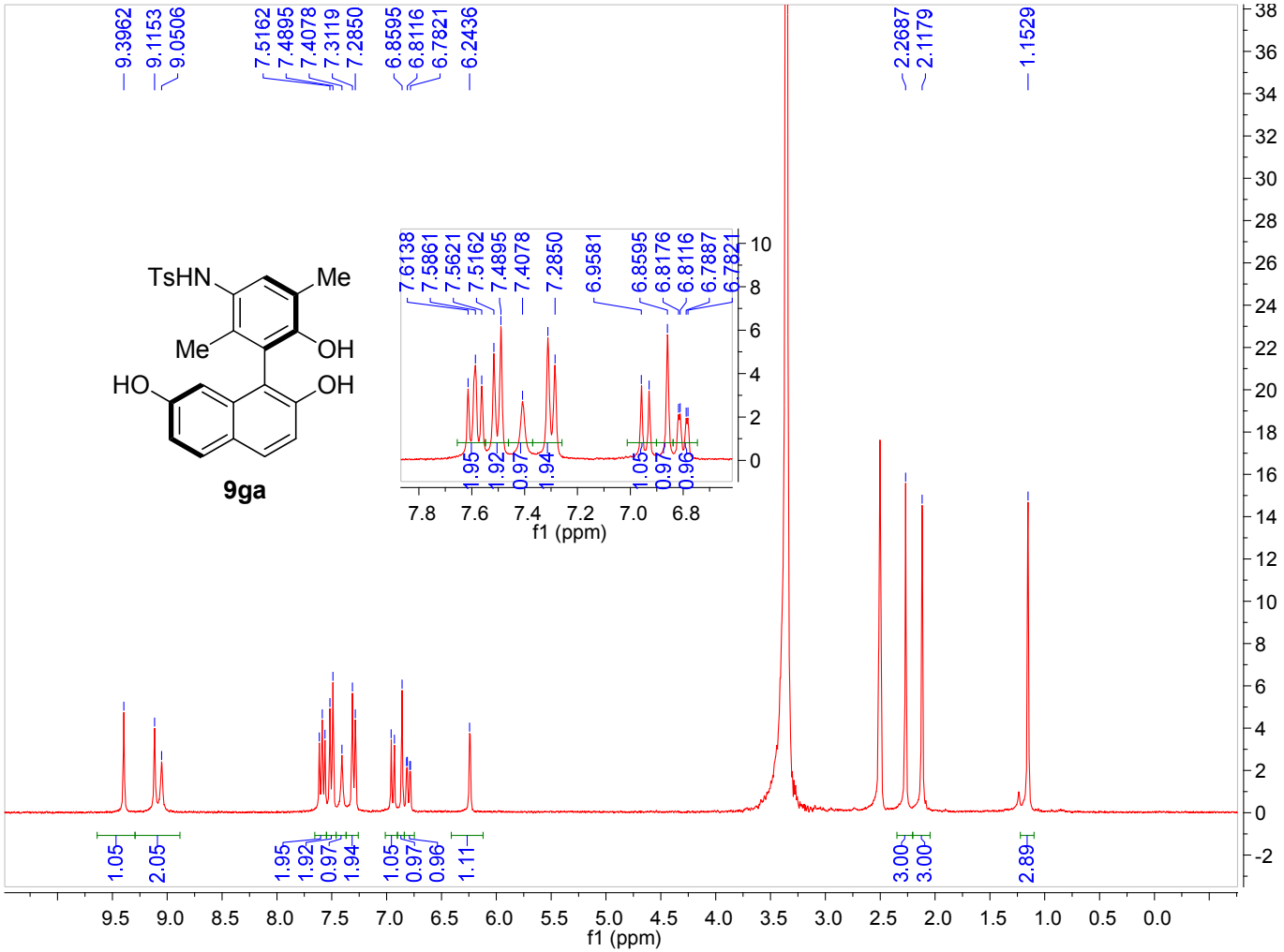
142.45
129.86
128.79
126.00
125.08
121.74
119.09
115.68
40.35
40.07
39.80
39.52
39.24
38.96
38.68
20.92
16.47
14.27
TsHN
Me
Me
OH
Br
OH
9da
129.86
128.79
126.49
126.00
125.17
125.08
123.06
121.74
119.69
119.09
1E+05
50000
0
128
124
120
f1 (ppm)
2E+05
2E+05
2E+05
2E+05
2E+05
2E+05
1E+05
1E+05
1E+05
80000
60000
40000
20000
0
-20000
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)


7.5984
7.5748
7.5492
7.3042
7.2778
7.2278
7.2044
7.1811
7.1234
7.0991
7.0743
6.9999
6.8590
6.8318
2.3539
2.1834
1.3293
TsHN
Me
Me
OH
OH
OH
9ea
2.72
1.87
1.88
1.13
0.91
0.93
3.00
2.94
3.45
f1 (ppm)


153.47
144.75
138.97
135.39
130.66
127.80
124.65
123.79
117.09
110.65
50.01
49.72
49.44
49.16
48.87
48.59
48.30
21.63
16.55
15.00
TsHN
Me
Me
OH
OH
OH
9ea
131.59
131.19
130.66
129.70
128.45
127.80
127.37
125.00
124.65
124.58
124.02
123.79
50000
0
130
126
f1 (ppm)
2E+05
1E+05
90000
80000
70000
60000
50000
40000
30000
20000
10000
0
-10000
-20000
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)


9.1526
8.5751
7.7306
7.7045
7.4953
7.1300
6.8766
6.7663
6.7396
3.9516
2.3095
2.1139
1.1964
TsHN
Me
Me
OH
OH
OMe
9fa
f1 (ppm)
f1 (ppm)


151.79
148.41
142.35
137.71
133.14
126.57
123.49
121.44
116.79
105.68
55.51
40.07
39.79
39.51
39.23
38.95
38.68
20.95
16.46
14.29
TsHN
Me
Me
OH
OH
OMe
9fa
129.51
129.32
128.37
126.57
126.51
125.75
123.49
123.42
122.83
121.44
f1 (ppm)
f1 (ppm)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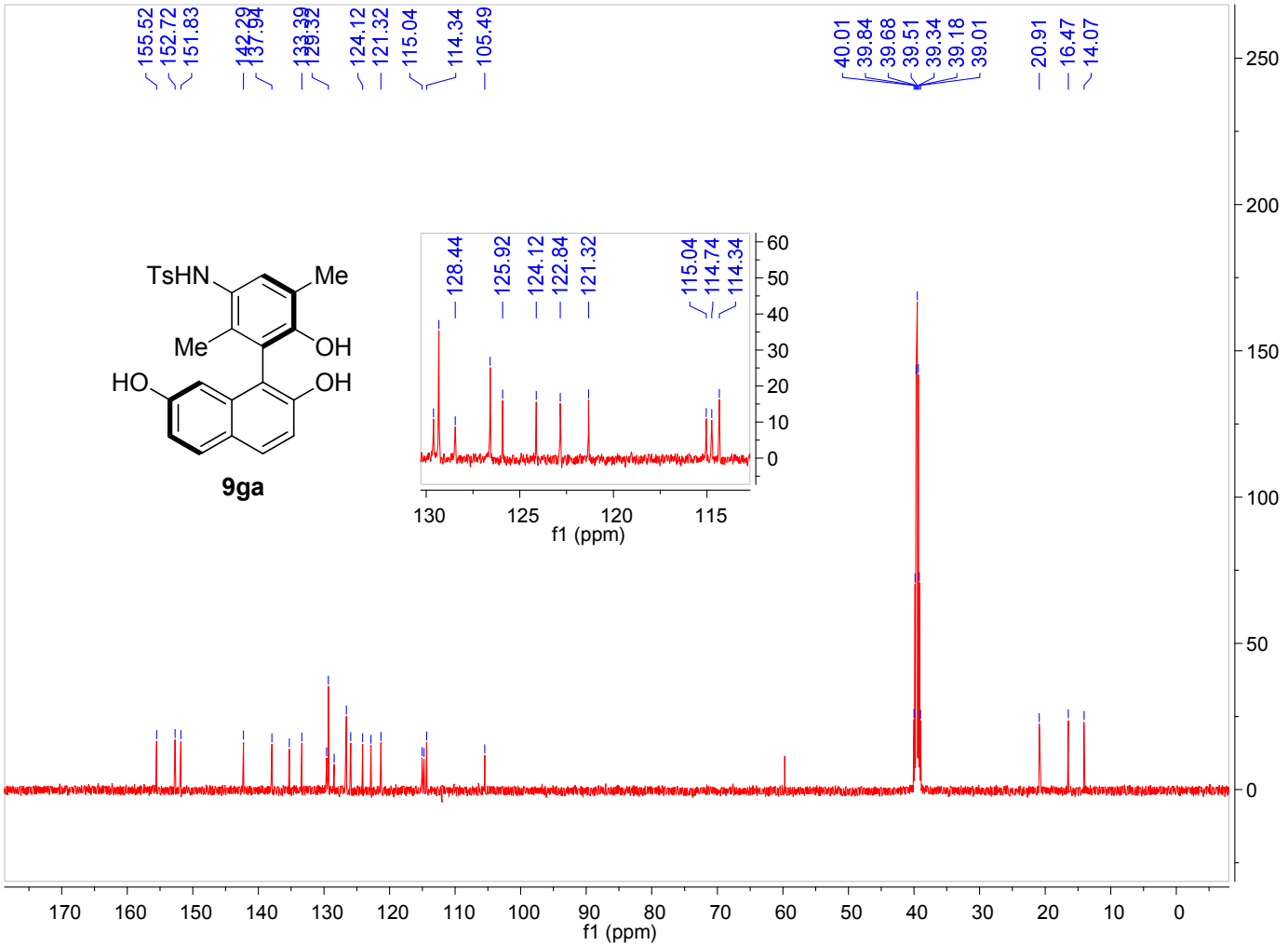
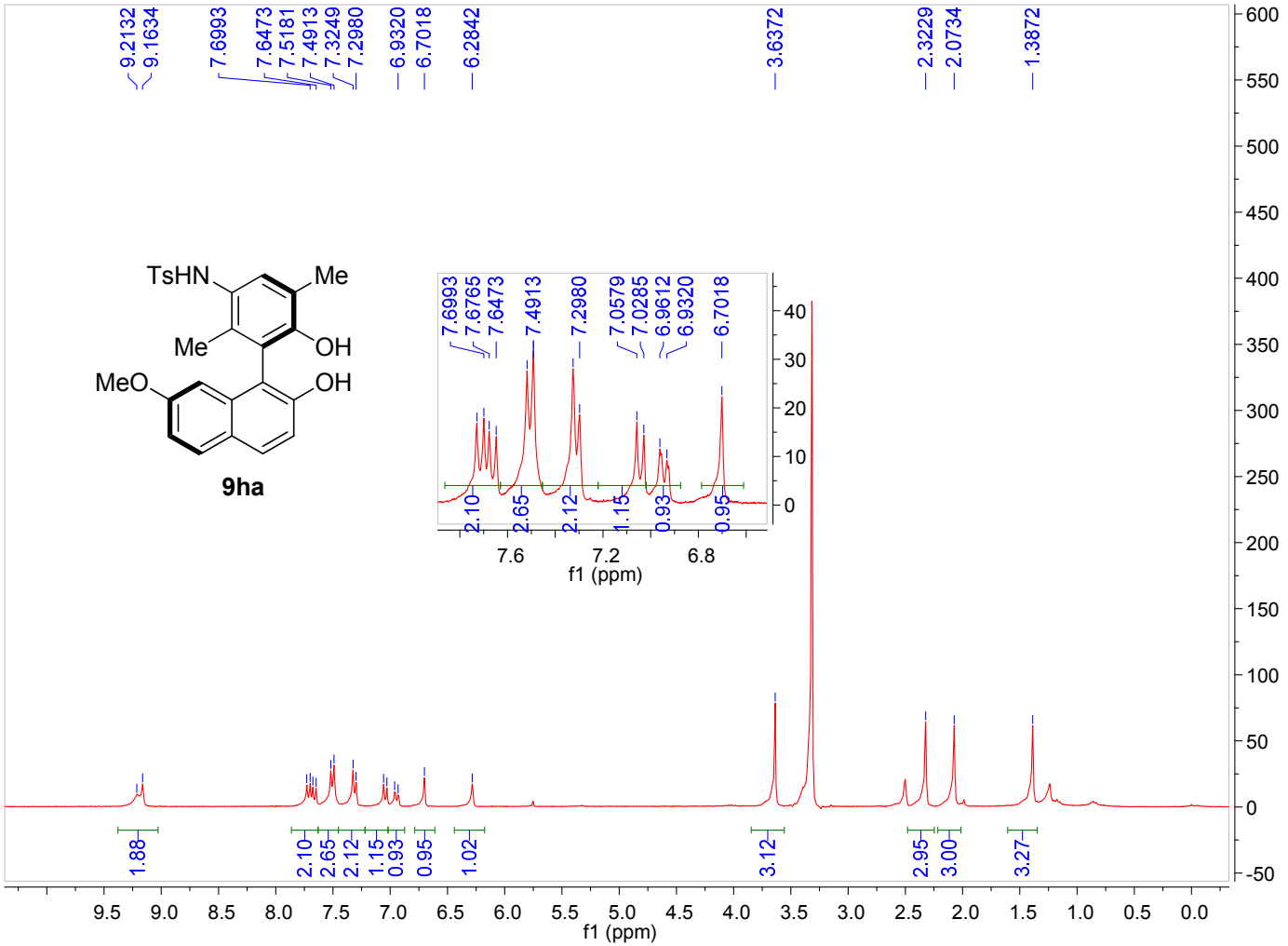
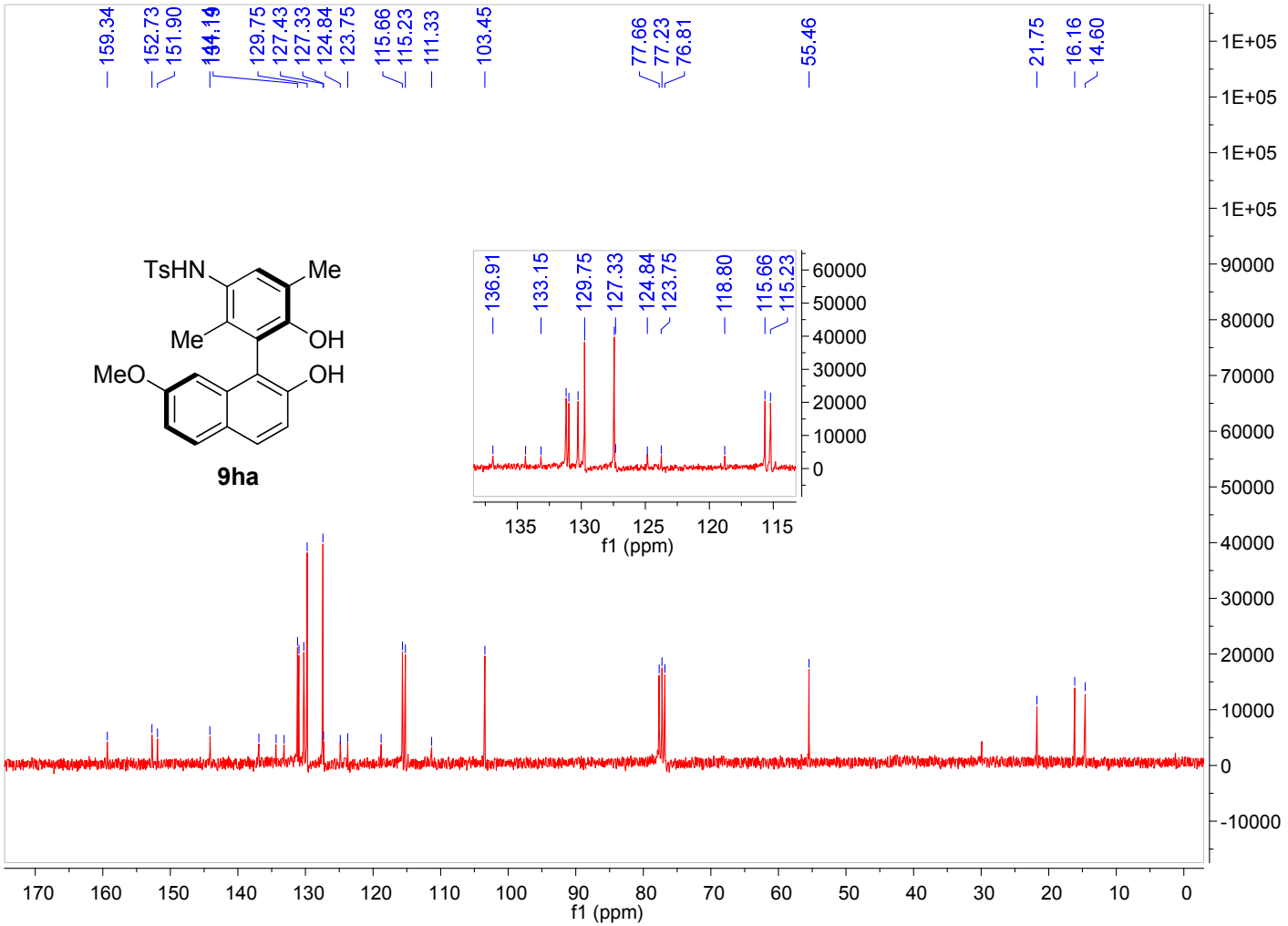
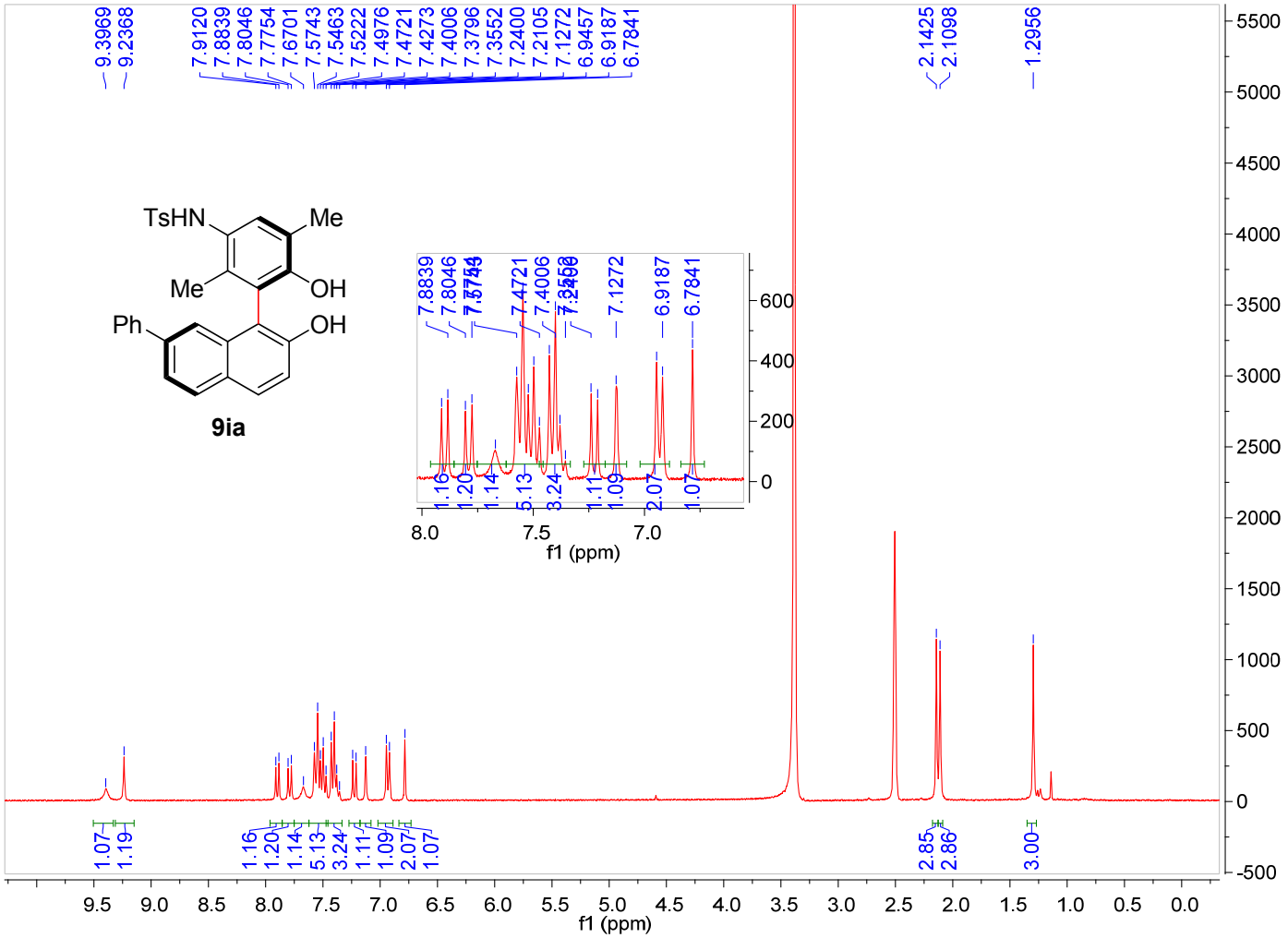
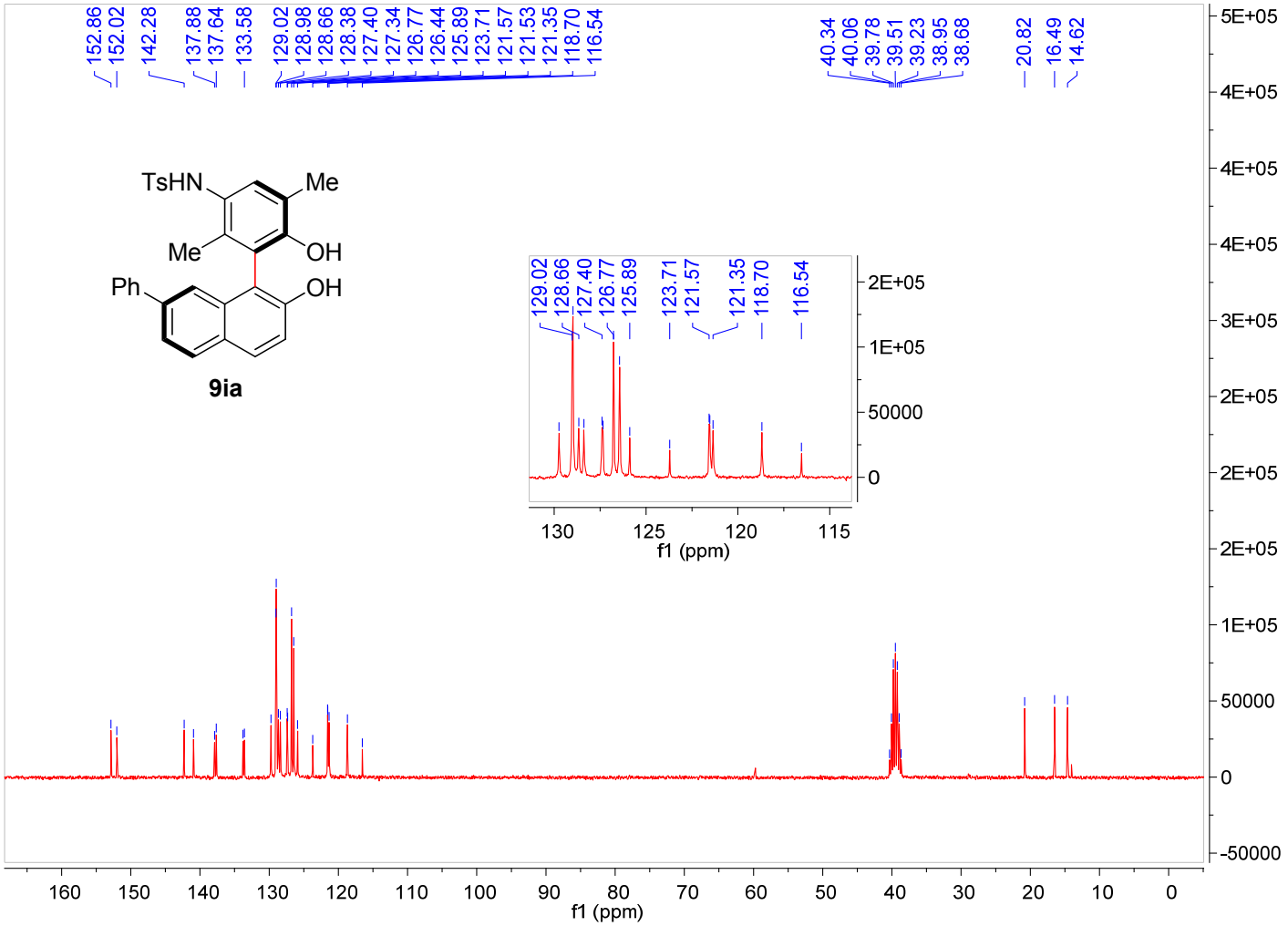
9.0506
7.5162
7.4895
7.4078
7.3119
7.2850
6.8595
6.8116
6.7821
6.2436
2.2687
2.1179
1.1529
TsHN
Me
Me
OH
HO
OH
9ga
7.6138
7.5861
7.5621
7.5162
7.4895
7.4078
7.2850
6.9581
6.8595
6.8176
6.8116
6.7887
6.7821
1.95
1.92
0.97
1.94
1.05
0.97
0.96
f1 (ppm)
1.05
2.05
1.95
1.92
0.97
1.94
1.05
0.97
0.96
1.11
3.00
3.00
2.89
f1 (ppm)


155.52
152.72
151.83
124.12
121.32
115.04
114.34
105.49
40.01
39.84
39.68
39.51
39.34
39.18
39.01
20.91
16.47
14.07
TsHN
Me
Me
OH
HO
OH
9ga
128.44
125.92
124.12
122.84
121.32
115.04
114.74
114.34
f1 (ppm)
f1 (ppm)


9.2132
9.1634
7.6993
7.6473
7.5181
7.4913
7.3249
7.2980
6.9320
6.7018
6.2842
3.6372
2.3229
2.0734
1.3872
TsHN
Me
Me
OH
MeO
OH
9ha
7.6993
7.6765
7.6473
7.4913
7.2980
7.0579
7.0285
6.9612
6.9320
6.7018
2.10
2.65
2.12
1.15
0.93
0.95
f1 (ppm)
1.88
2.10
2.65
2.12
1.15
0.93
0.95
1.02
3.12
2.95
3.00
3.27
f1 (ppm)


159.34
152.73
151.90
144.19
129.75
127.43
127.33
124.84
123.75
115.66
115.23
111.33
103.45
77.66
77.23
76.81
55.46
21.75
16.16
14.60
TsHN
Me
Me
OH
MeO
OH
9ha
136.91
133.15
129.75
127.33
124.84
123.75
118.80
115.66
115.23
f1 (ppm)
f1 (ppm)


TsHN
Me
Me
OH
Ph
OH
9ia
f1 (ppm)
f1 (ppm)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152.02
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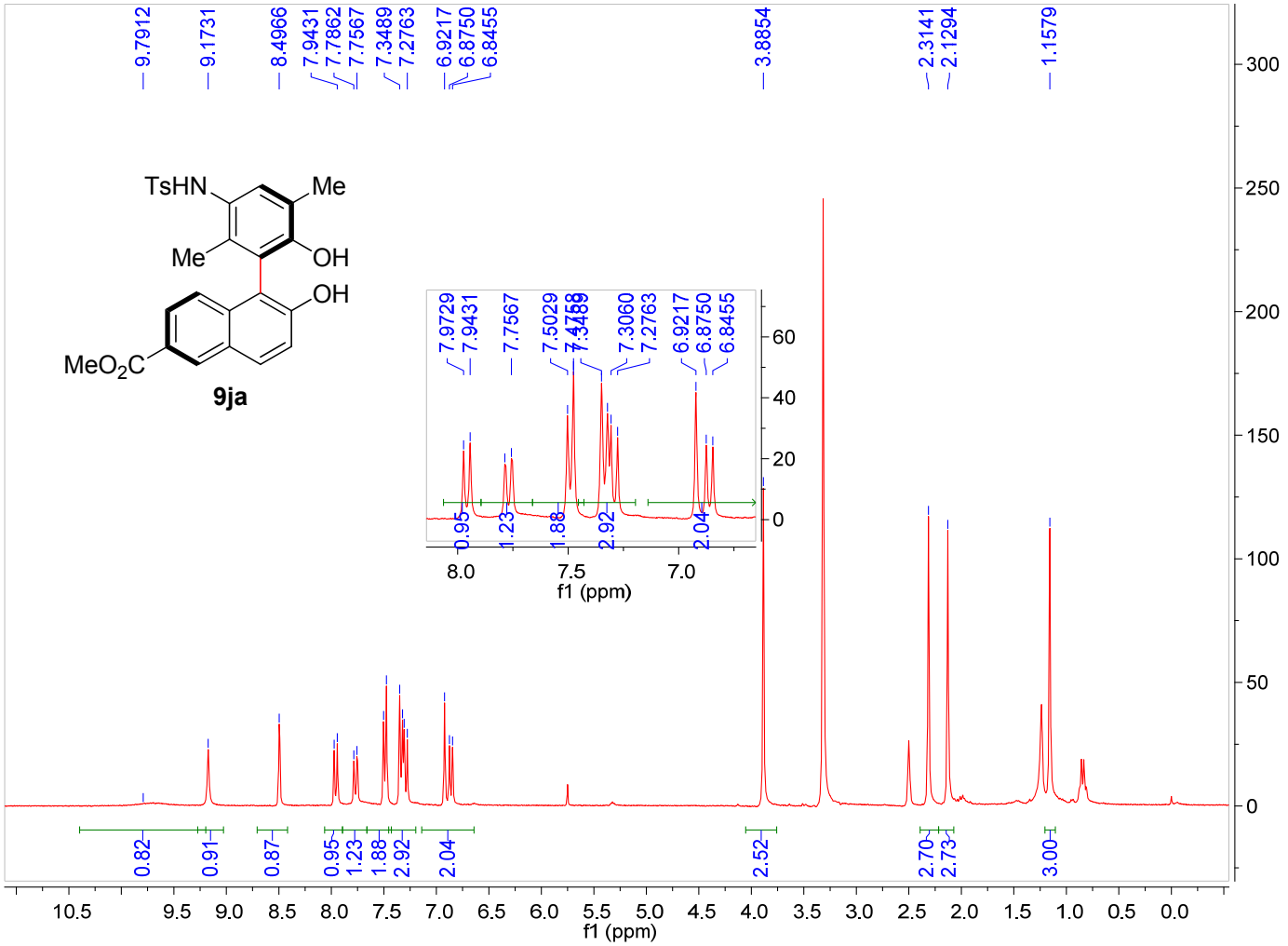
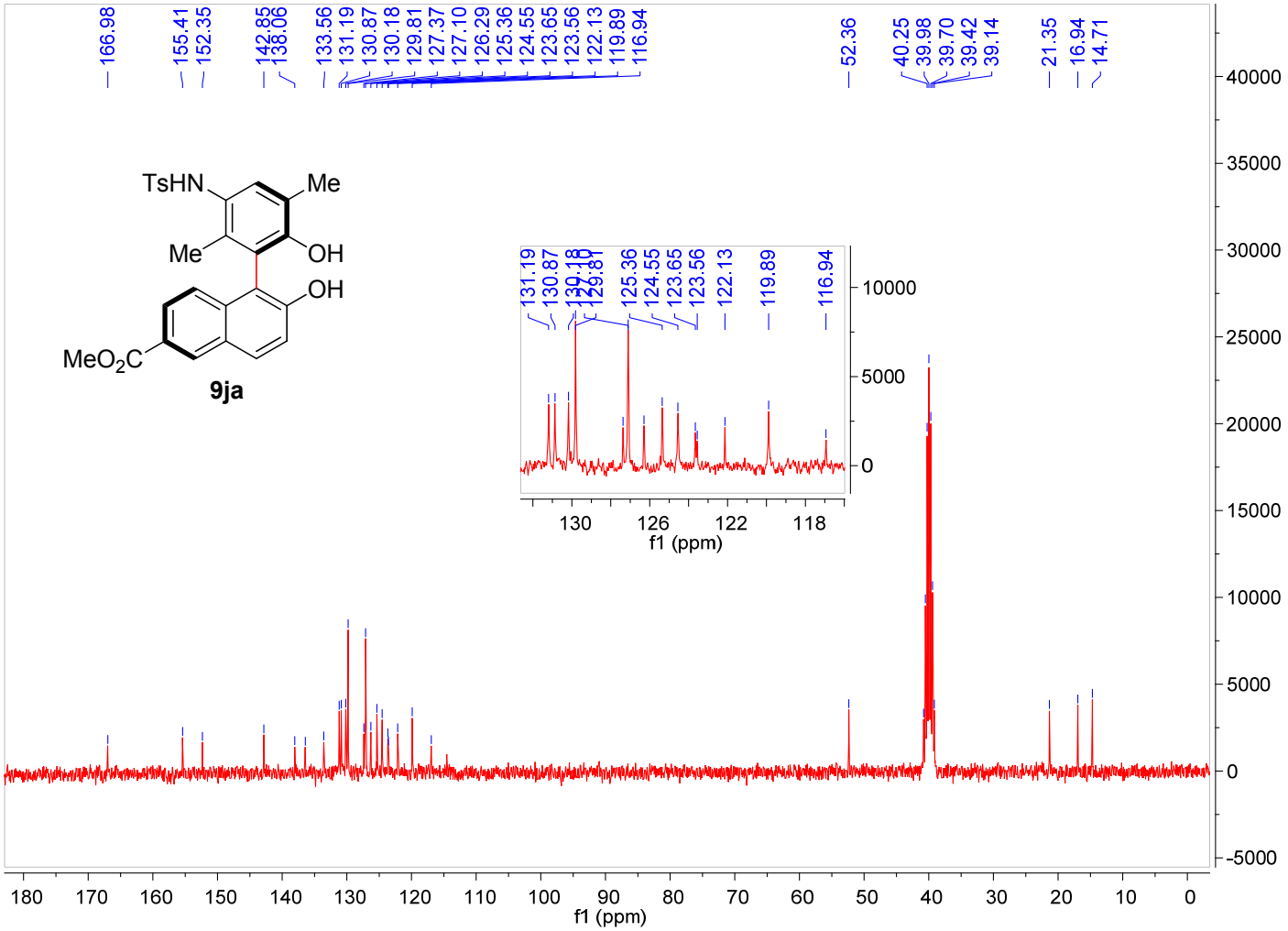
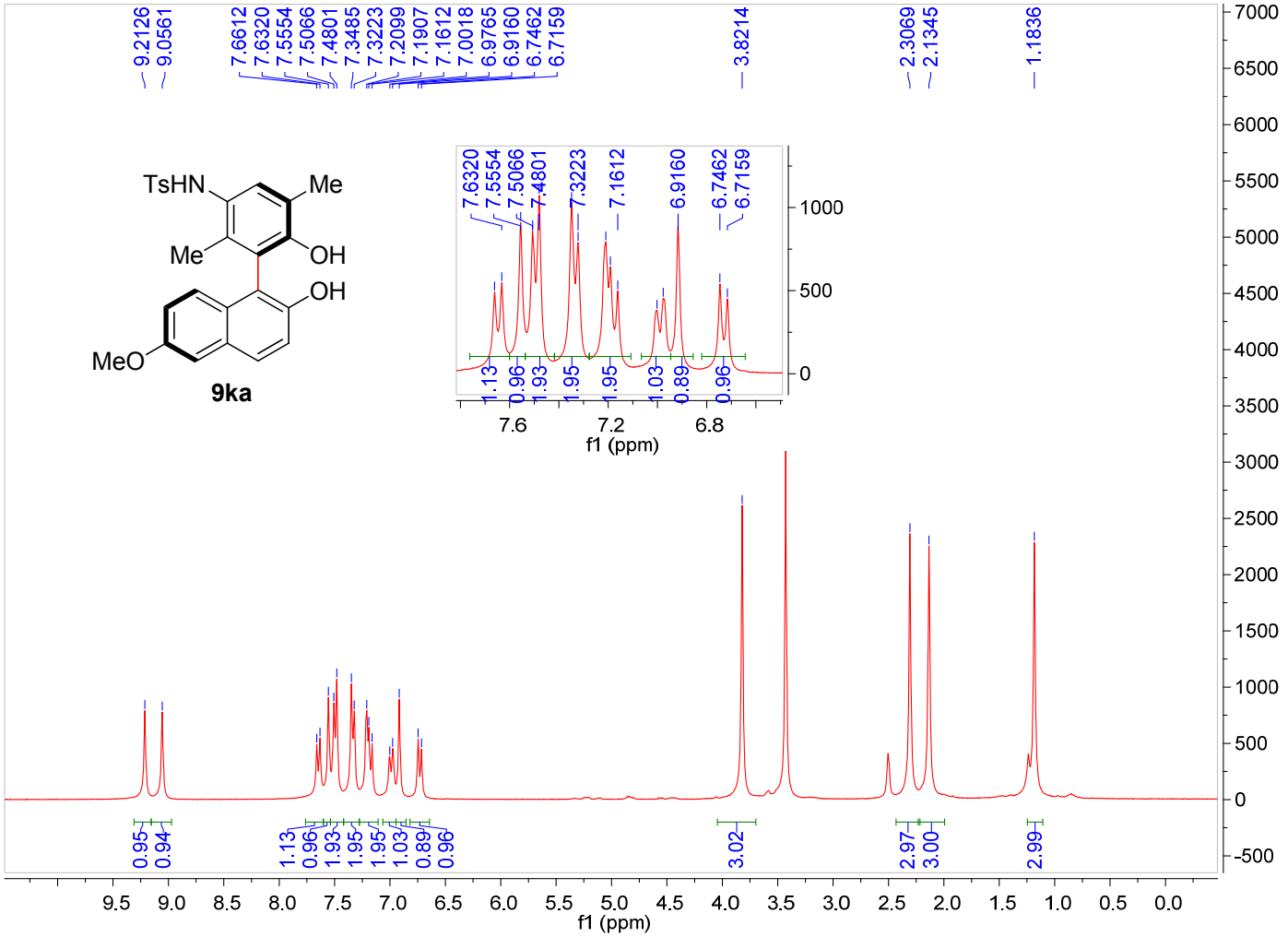
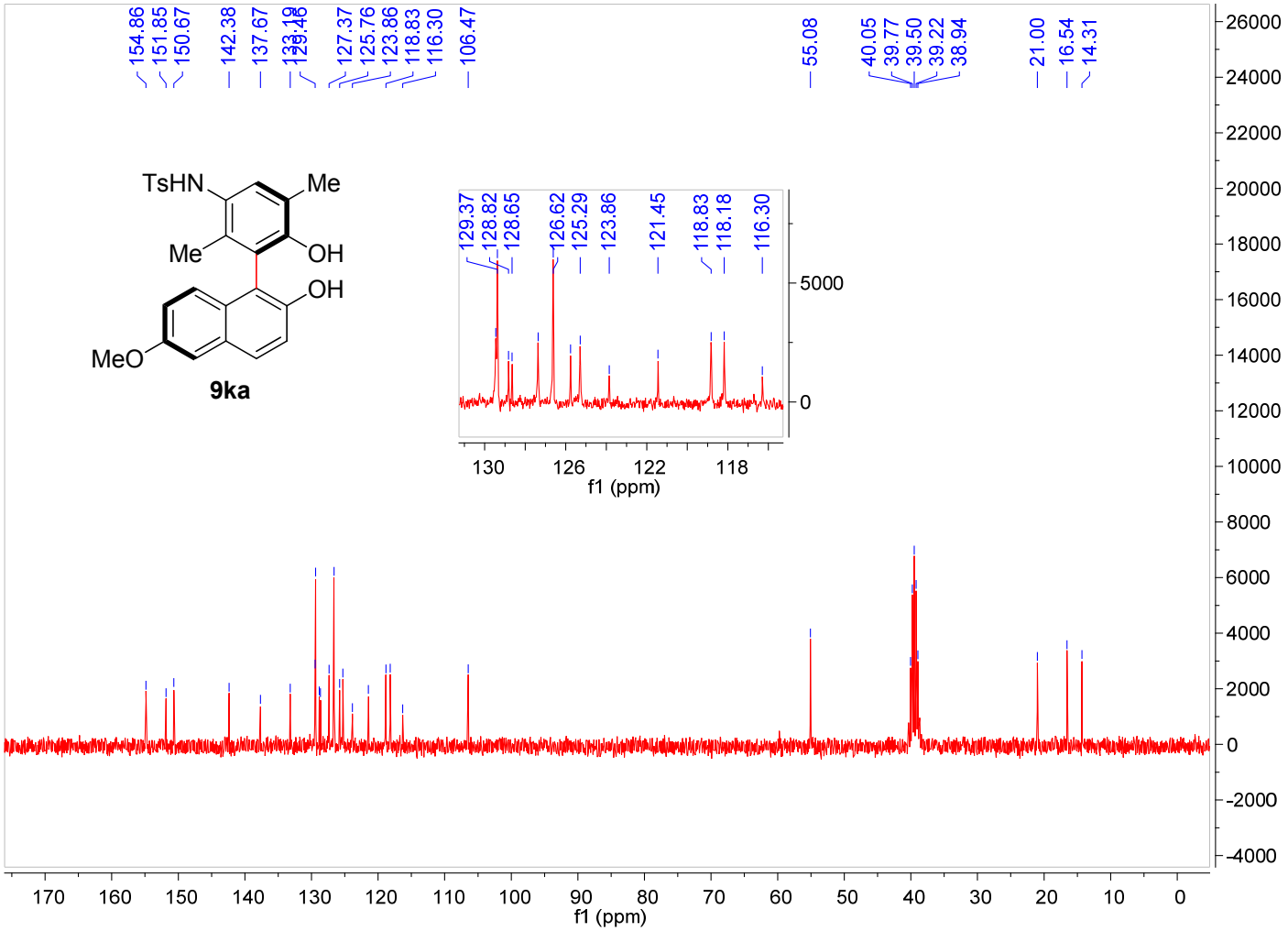
133.58
129.02
128.98
128.66
128.38
127.40
127.34
126.77
126.44
125.89
123.71
121.57
121.53
121.35
118.70
116.54
40.34
40.06
39.78
39.51
39.23
38.95
38.68
20.82
16.49
14.62
TsHN
Me
Me
OH
Ph
OH
9ia
129.02
128.66
127.40
126.77
125.89
123.71
121.57
121.35
118.70
116.54
f1 (ppm)
f1 (ppm)


9.7912
9.1731
8.4966
7.9431
7.7862
7.7567
7.3489
7.2763
6.9217
6.8750
6.8455
3.8854
2.3141
2.1294
1.1579
TsHN
Me
Me
OH
OH
MeO2C
9ja
f1 (ppm)
0.82
0.91
0.87
0.95
1.23
1.88
2.92
2.04
2.52
2.70
2.73
3.00


166.98
155.41
152.35
142.85
138.06
133.56
131.19
130.87
130.18
129.81
127.37
127.10
126.29
125.36
124.55
123.65
123.56
122.13
119.89
116.94
52.36
40.25
39.98
39.70
39.42
39.14
21.35
16.94
14.71
TsHN
Me
Me
OH
OH
MeO2C
9ja
f1 (ppm)
f1 (ppm)


9.2126
9.0561
7.6612
7.6320
7.5554
7.5066
7.4801
7.3485
7.3223
7.2099
7.1907
7.1612
7.0018
6.9765
6.9160
6.7462
6.7159
3.8214
2.3069
2.1345
1.1836
TsHN
Me
Me
OH
OH
MeO
9ka
f1 (ppm)
f1 (ppm)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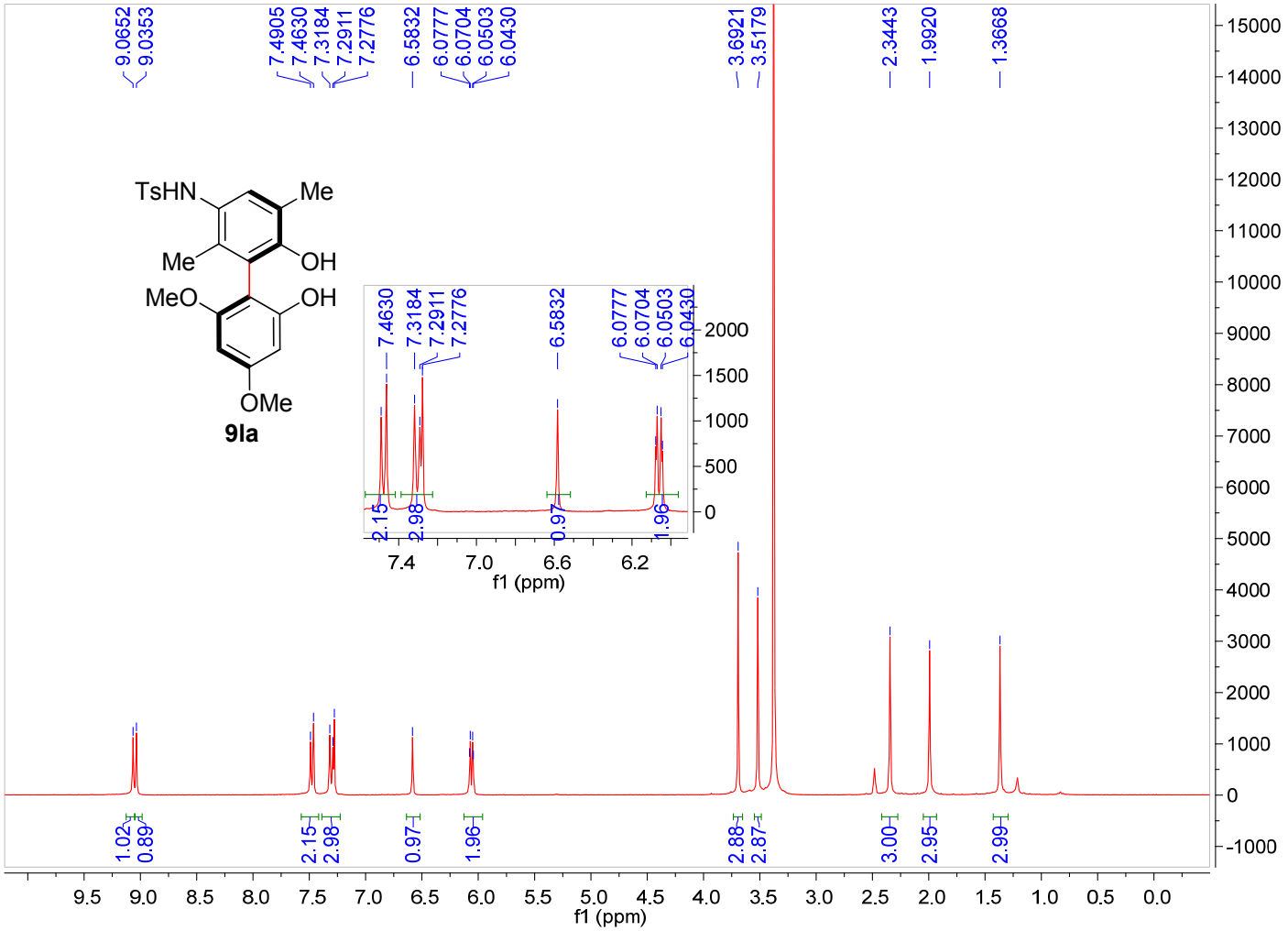
151.85
150.67
142.38
137.67
127.37
125.76
123.86
118.83
116.30
106.47
55.08
40.05
39.77
39.50
39.22
38.94
21.00
16.54
14.31
TsHN
Me
Me
OH
OH
MeO
9ka
129.37
128.82
128.65
126.62
125.29
123.86
121.45
118.83
118.18
116.30
5000
0
130
126
122
118
f1 (ppm)
26000
24000
22000
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
-2000
-4000
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)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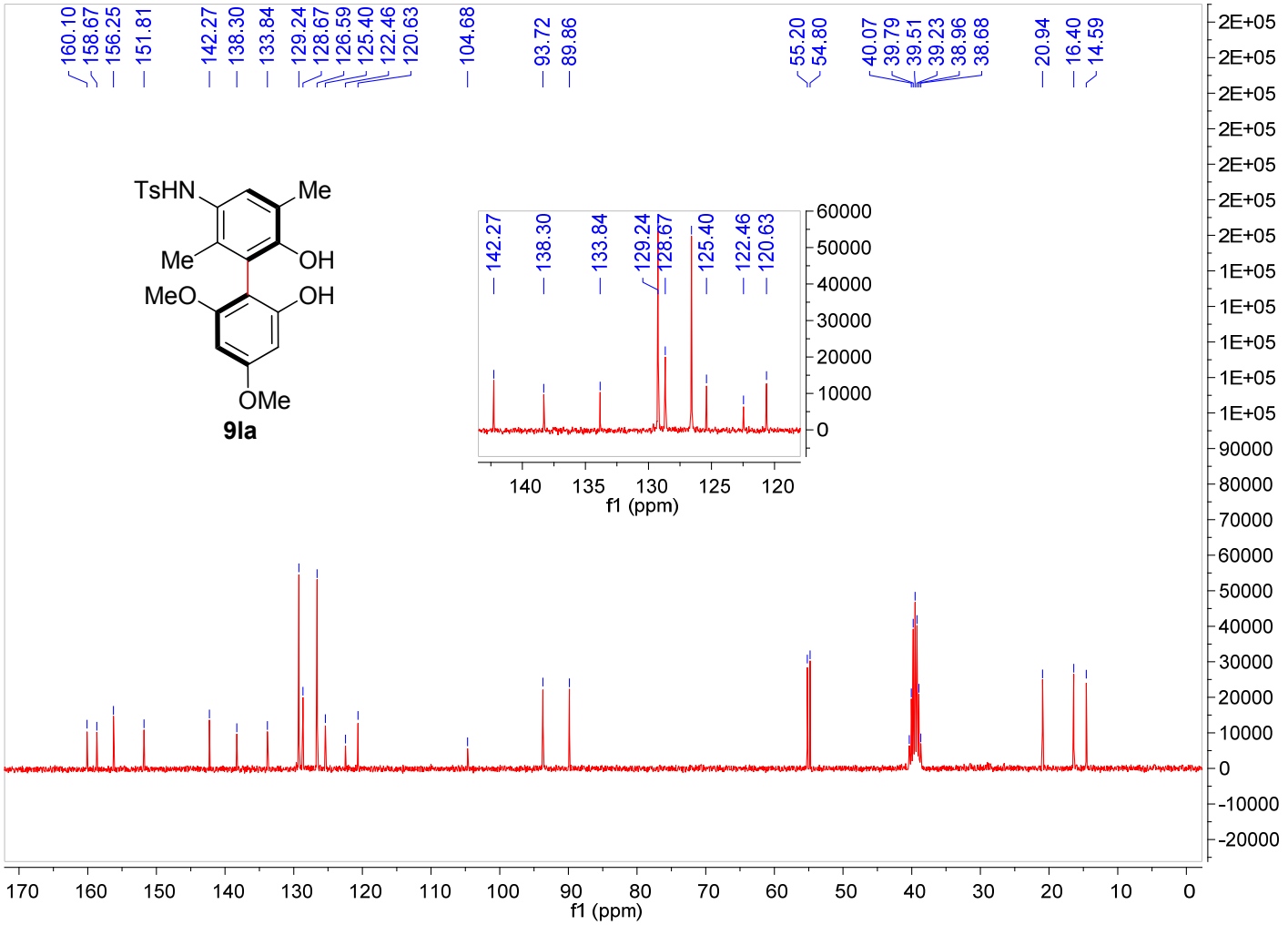
9.0353
7.4905
7.4630
7.3184
7.2911
7.2776
6.5832
6.0777
6.0704
6.0503
6.0430
3.6921
3.5179
2.3443
1.9920
1.3668
TsHN
Me
Me
OH
MeO
OH
OMe
9la
f1 (ppm)
f1 (ppm)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158.67
156.25
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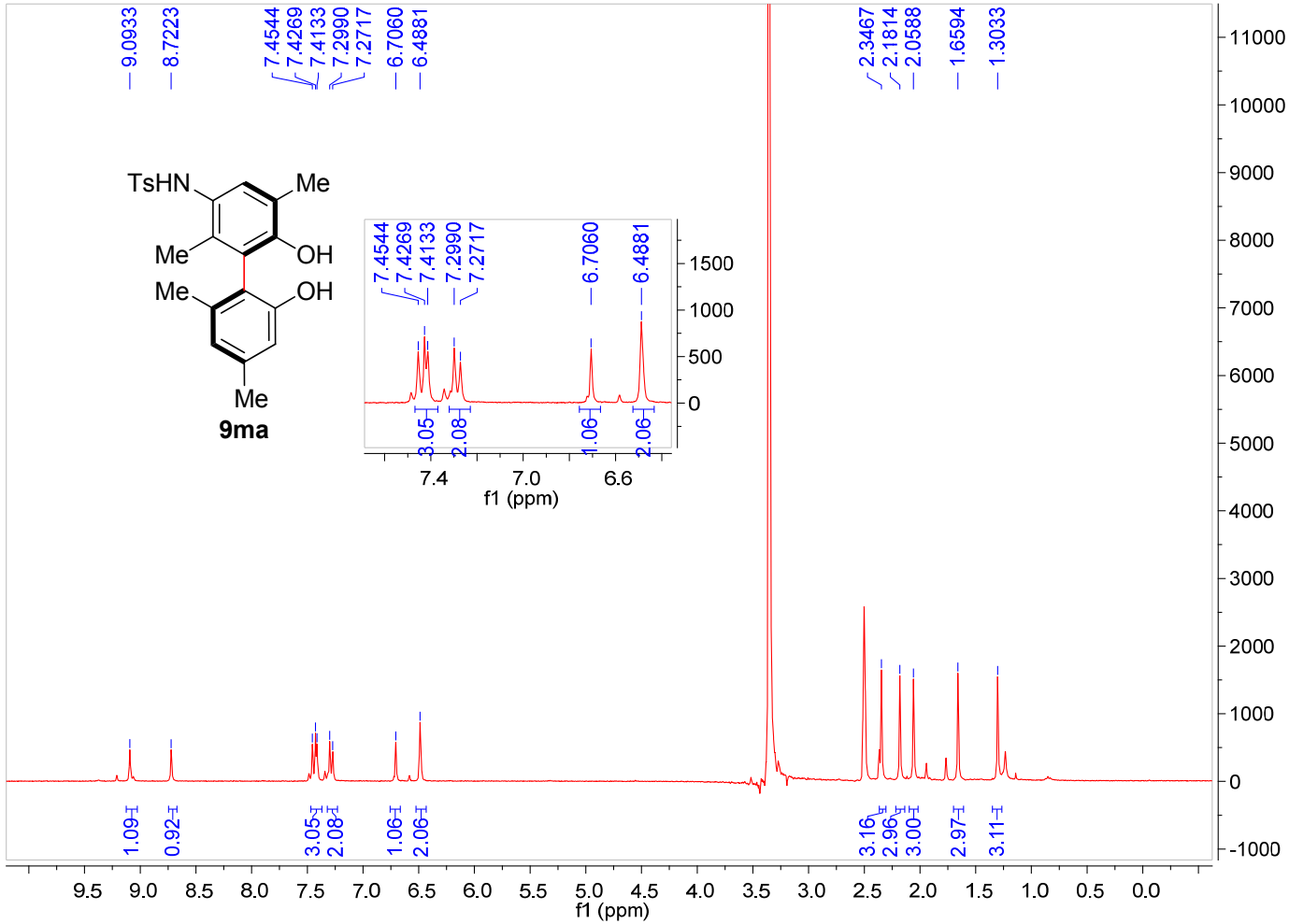
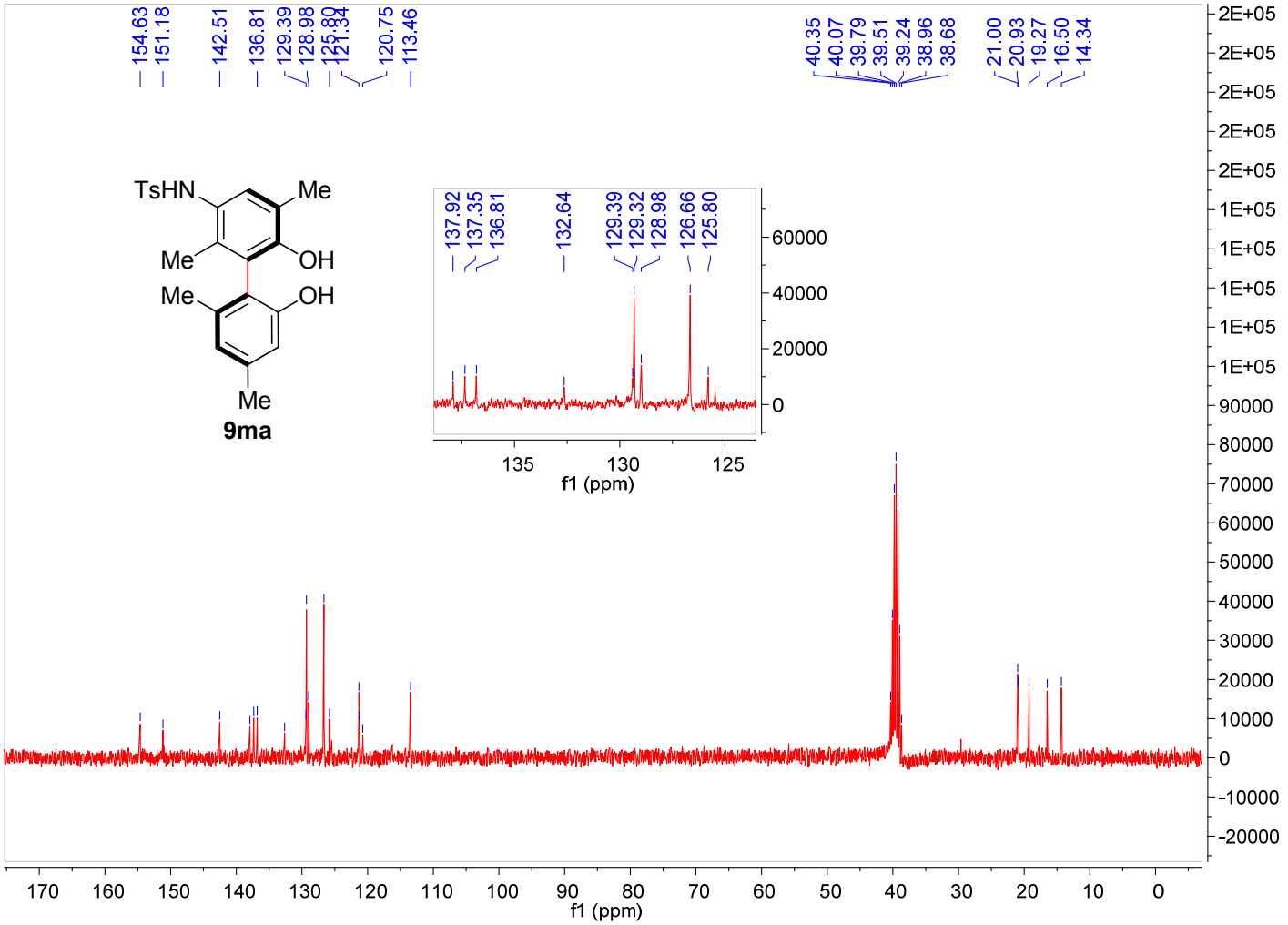
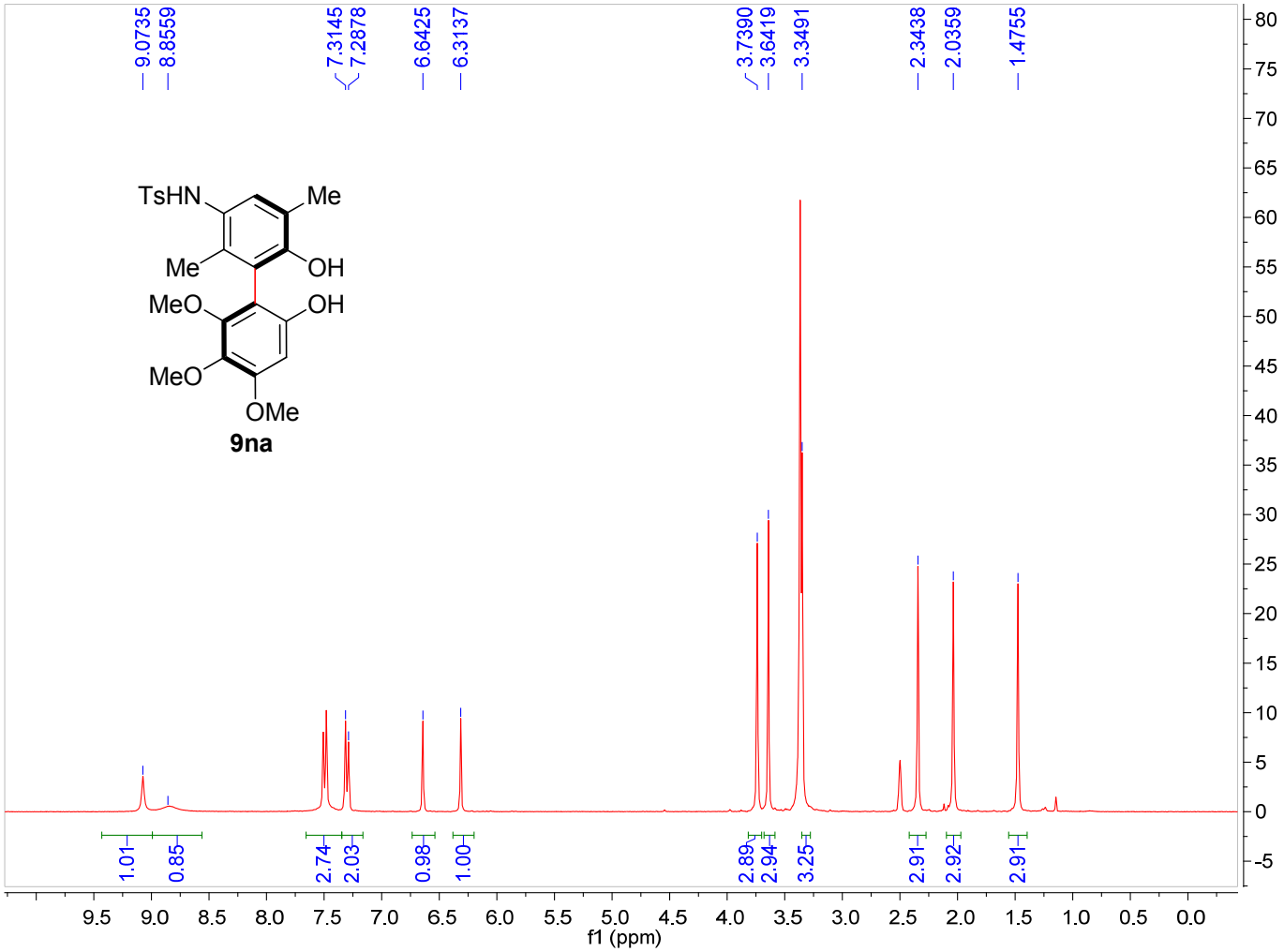
142.27
138.30
133.84
129.24
128.67
126.59
125.40
122.46
120.63
104.68
93.72
89.86
55.20
54.80
40.07
39.79
39.51
39.23
38.96
38.68
20.94
16.40
14.59
TsHN
Me
Me
OH
MeO
OH
OMe
9la
f1 (ppm)
f1 (ppm)


9.0933
8.7223
7.4544
7.4269
7.4133
7.2990
7.2717
6.7060
6.4881
2.3467
2.1814
2.0588
1.6594
1.3033
TsHN
Me
Me
OH
Me
OH
Me
9ma
f1 (ppm)
f1 (ppm)


154.63
151.18
142.51
136.81
129.39
128.98
125.80
121.34
120.75
113.46
40.35
40.07
39.79
39.51
39.24
38.96
38.68
21.00
20.93
19.27
16.50
14.34
TsHN
Me
Me
OH
Me
OH
Me
9ma
137.92
137.35
136.81
132.64
129.39
129.32
128.98
126.66
125.80
60000
40000
20000
0
135
130
125
f1 (ppm)
2E+05
1E+05
90000
80000
70000
60000
50000
40000
30000
20000
10000
0
-10000
-20000
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)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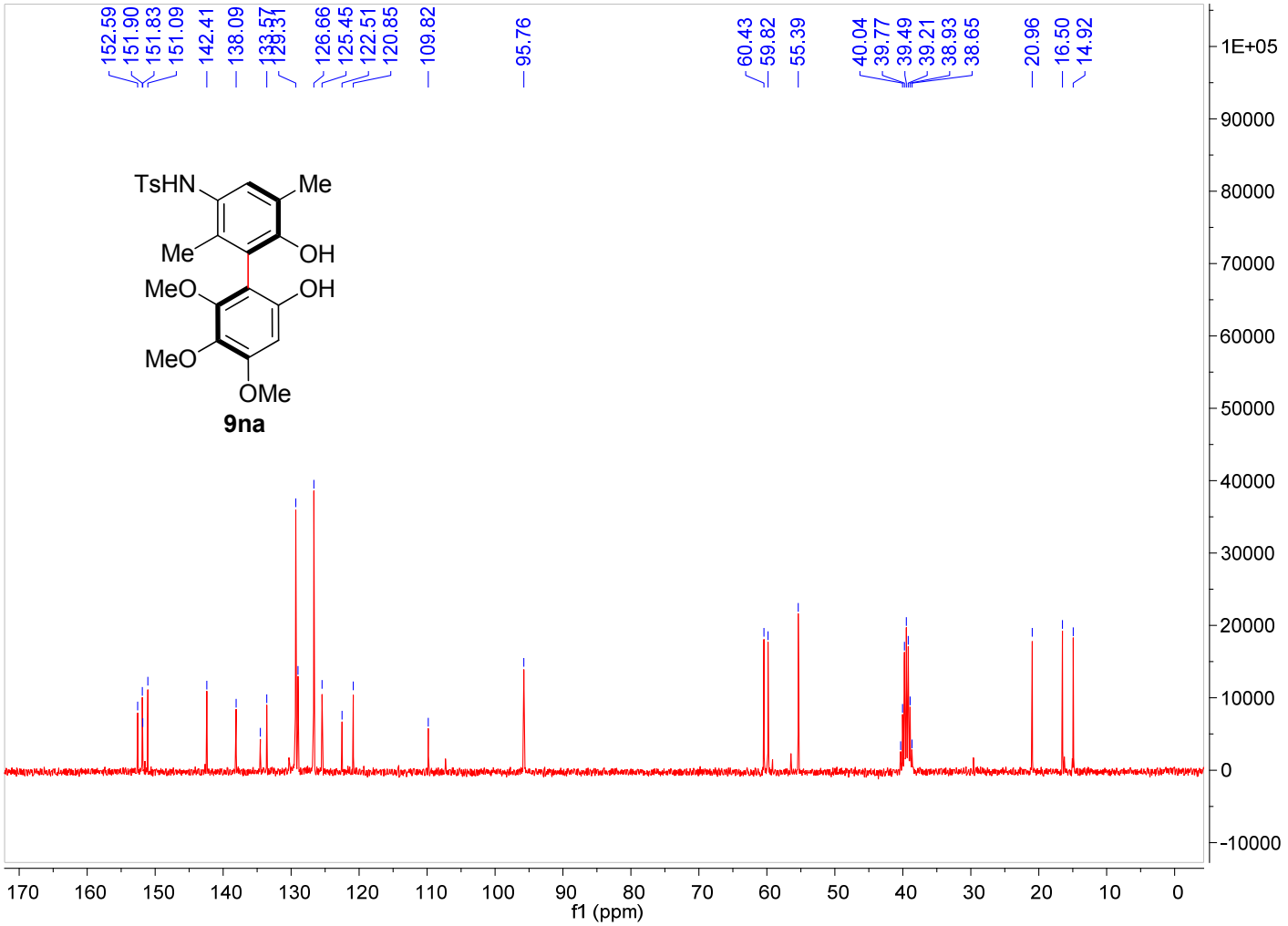
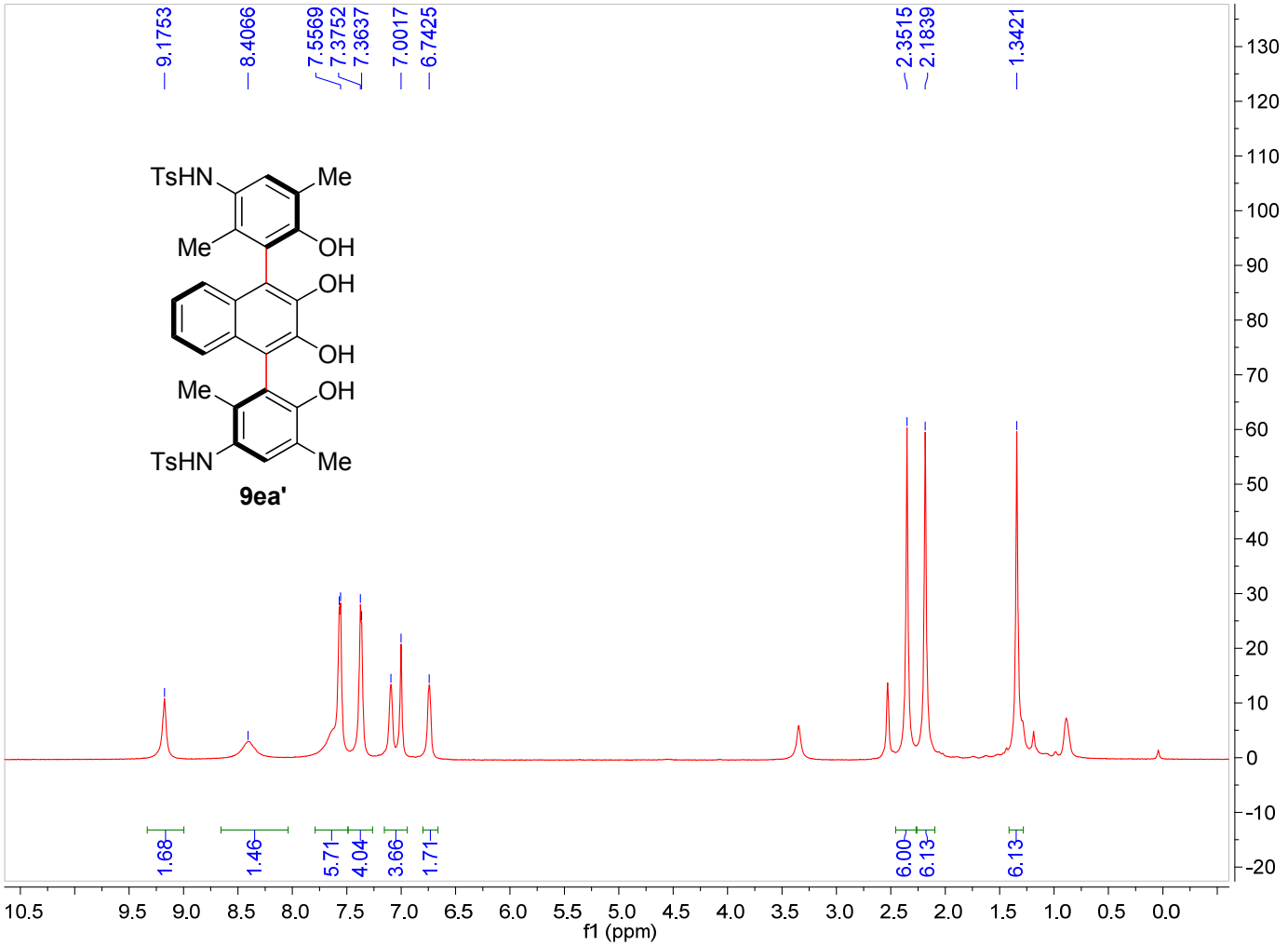
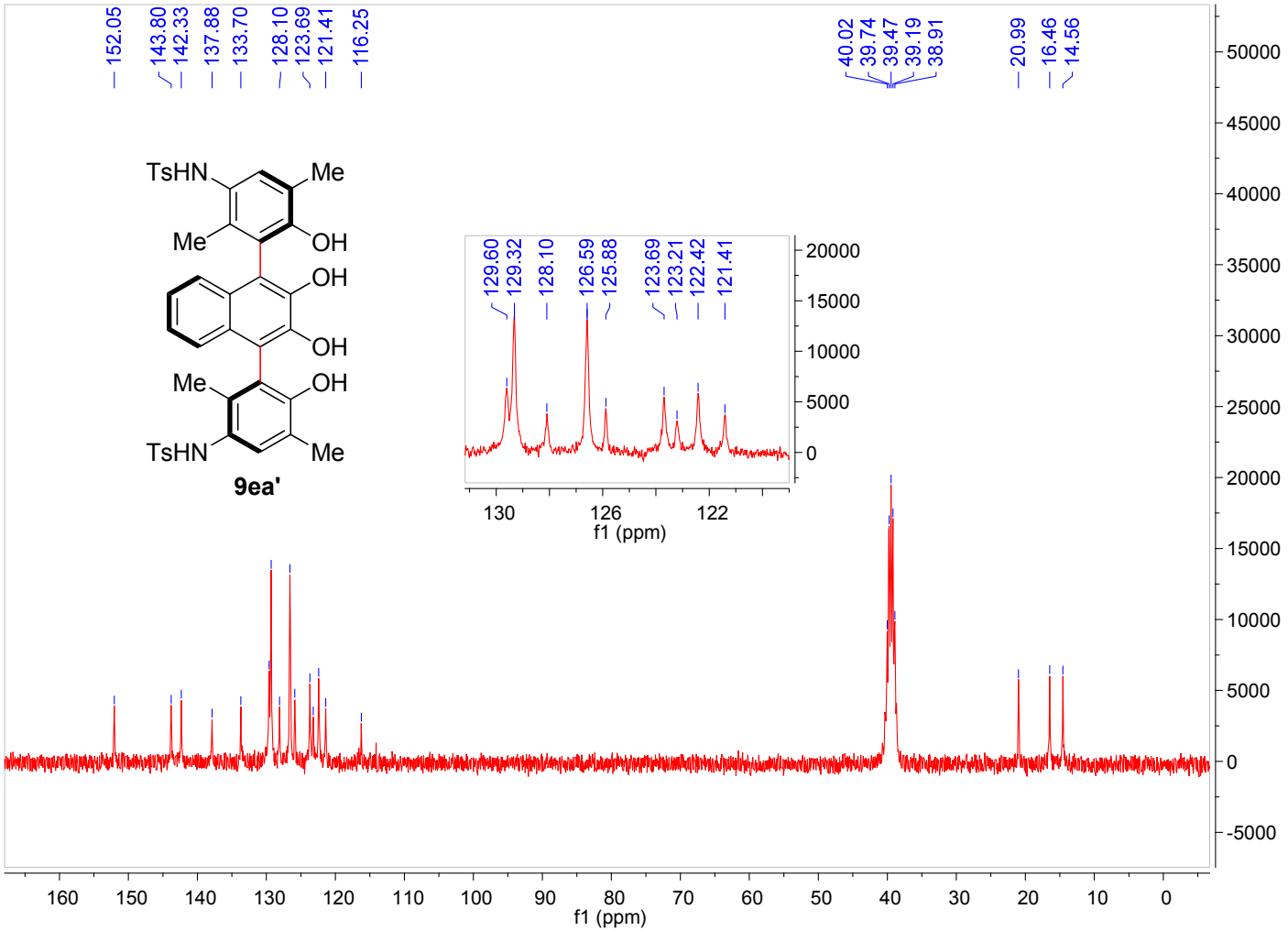
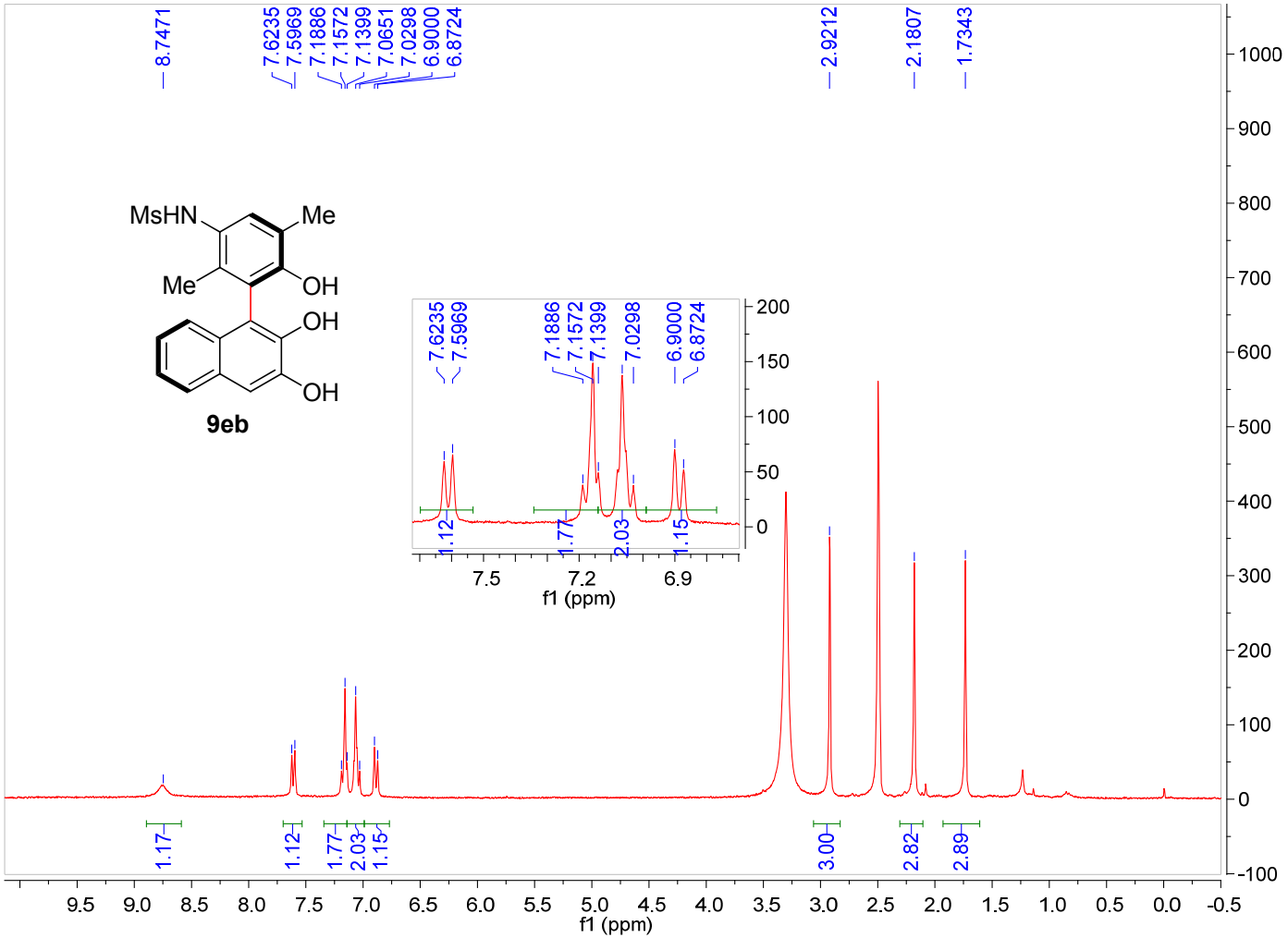
8.8559
7.3145
7.2878
6.6425
6.3137
3.7390
3.6419
3.3491
2.3438
2.0359
1.4755
TsHN
Me
Me
OH
MeO
OH
MeO
OMe
9na
1.01
0.85
2.74
2.03
0.98
1.00
2.89
2.94
3.25
2.91
2.92
2.91
f1 (ppm)


152.59
151.90
151.83
151.09
142.41
138.09
133.57
129.31
126.66
125.45
122.51
120.85
109.82
95.76
60.43
59.82
55.39
40.04
39.77
39.49
39.21
38.93
38.65
20.96
16.50
14.92
TsHN
Me
Me
OH
MeO
OH
MeO
OMe
9na
1E+05
90000
80000
70000
60000
50000
40000
30000
20000
10000
0
-10000
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)


9.1753
8.4066
7.5569
7.3752
7.3637
7.0017
6.7425
2.3515
2.1839
1.3421
TsHN
Me
Me
OH
OH
OH
Me
OH
TsHN
Me
9ea'
1.68
1.46
5.71
4.04
3.66
1.71
6.00
6.13
6.13
f1 (ppm)


152.05
143.80
142.33
137.88
133.70
128.10
123.69
121.41
116.25
40.02
39.74
39.47
39.19
38.91
20.99
16.46
14.56
TsHN
Me
Me
OH
OH
OH
Me
OH
TsHN
Me
9ea'
129.60
129.32
128.10
126.59
125.88
123.69
123.21
122.42
121.41
f1 (ppm)
f1 (ppm)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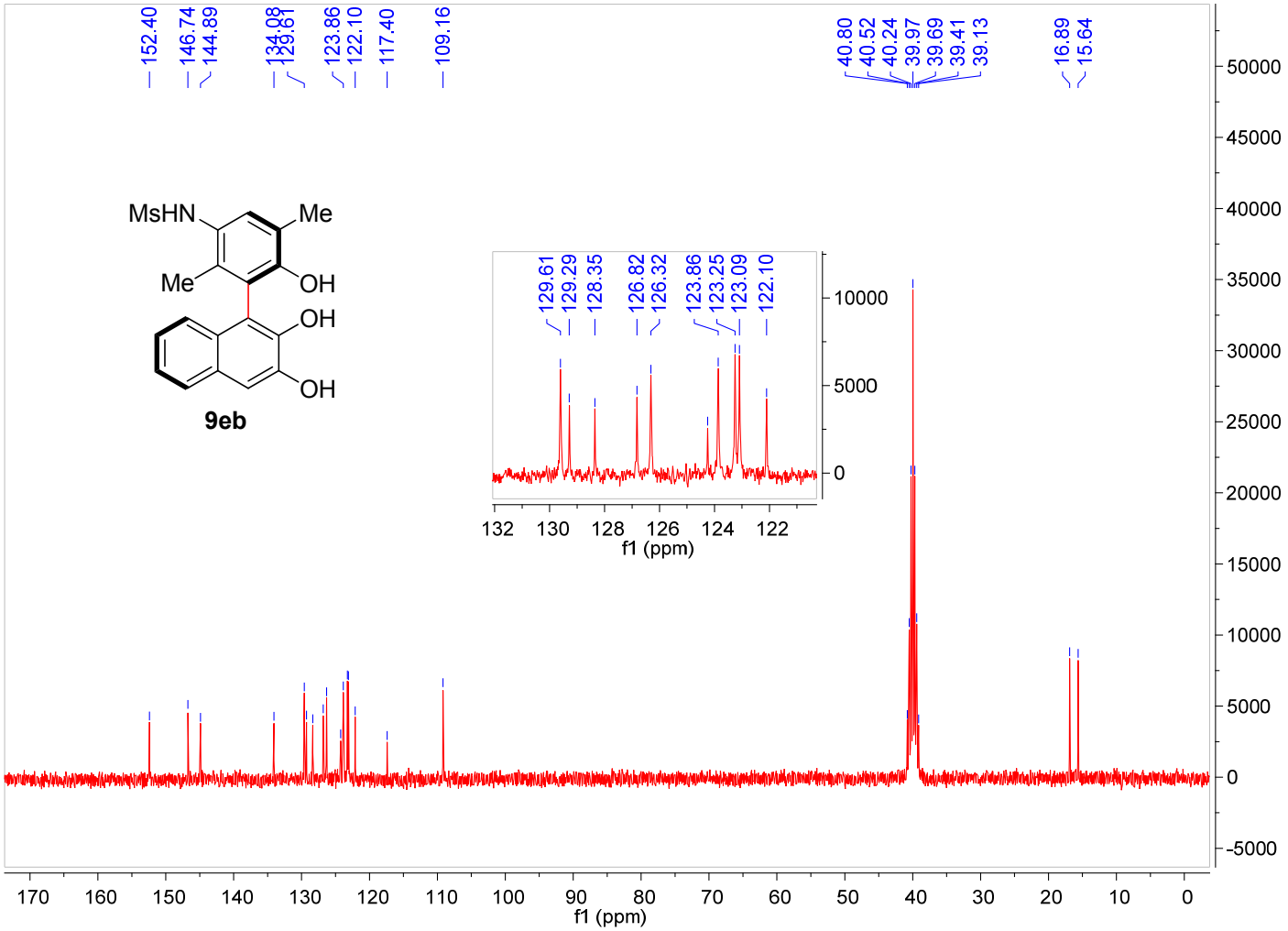
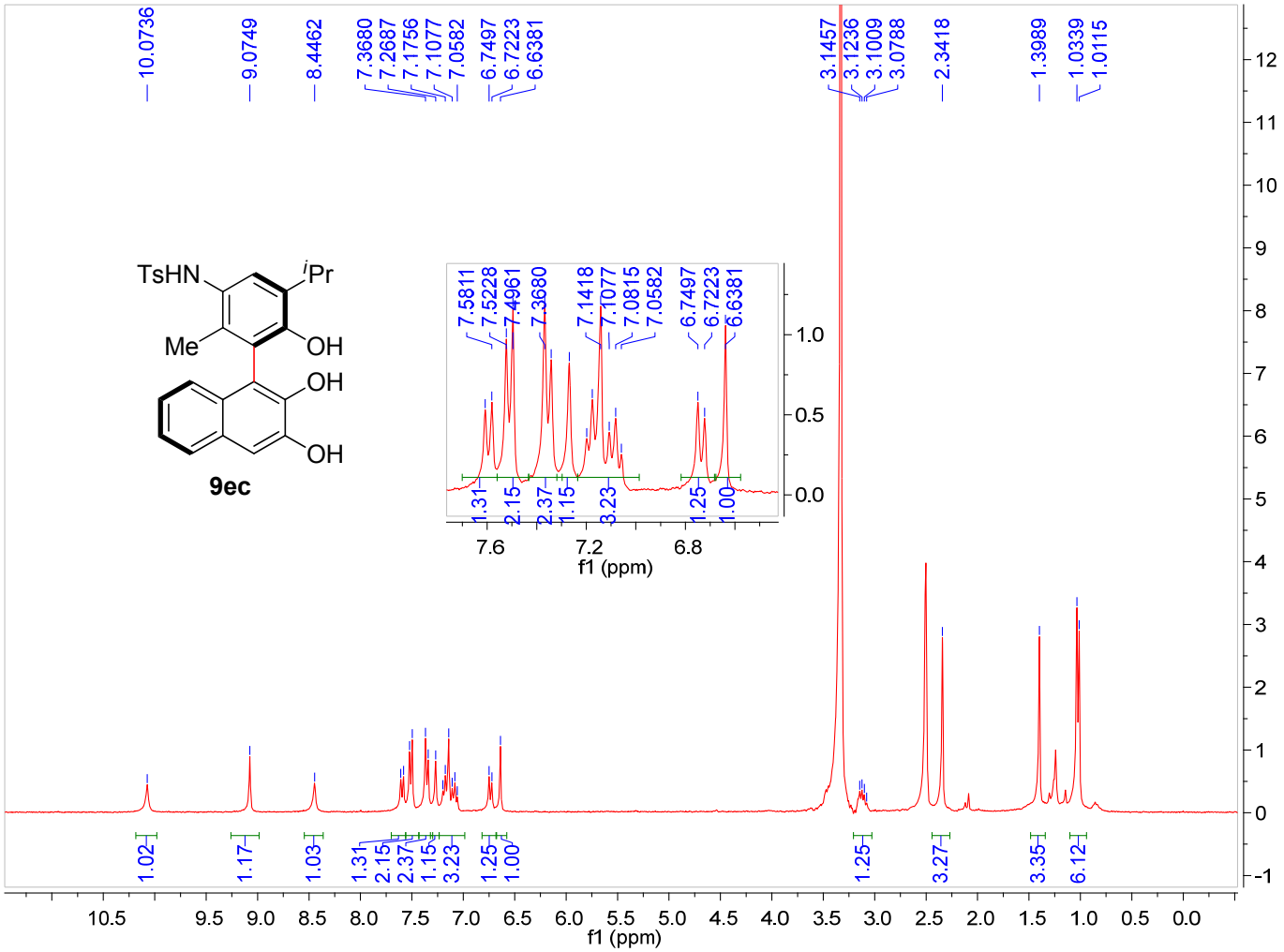
7.6235
7.5969
7.1886
7.1572
7.1399
7.0651
7.0298
6.9000
6.8724
2.9212
2.1807
1.7343
MsHN
Me
Me
OH
OH
OH
9eb
1.17
1.12
1.77
2.03
1.15
3.00
2.82
2.89
f1 (ppm)


152.40
146.74
144.89
134.08
129.61
123.86
122.10
117.40
109.16
40.80
40.52
40.24
39.97
39.69
39.41
39.13
16.89
15.64
MsHN
Me
Me
OH
OH
OH
9eb
129.61
129.29
128.35
126.82
126.32
123.86
123.25
123.09
122.10
f1 (ppm)
f1 (ppm)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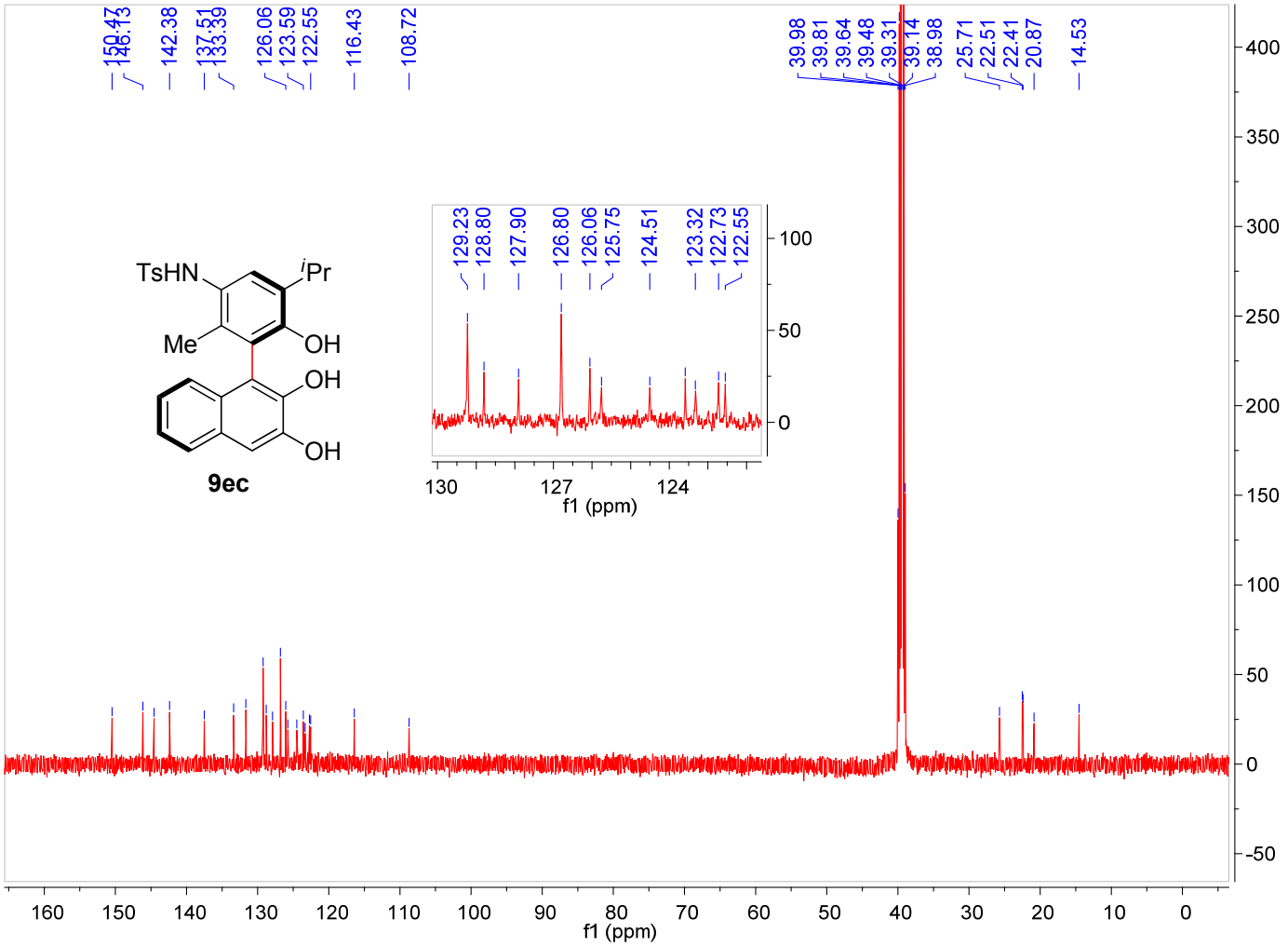
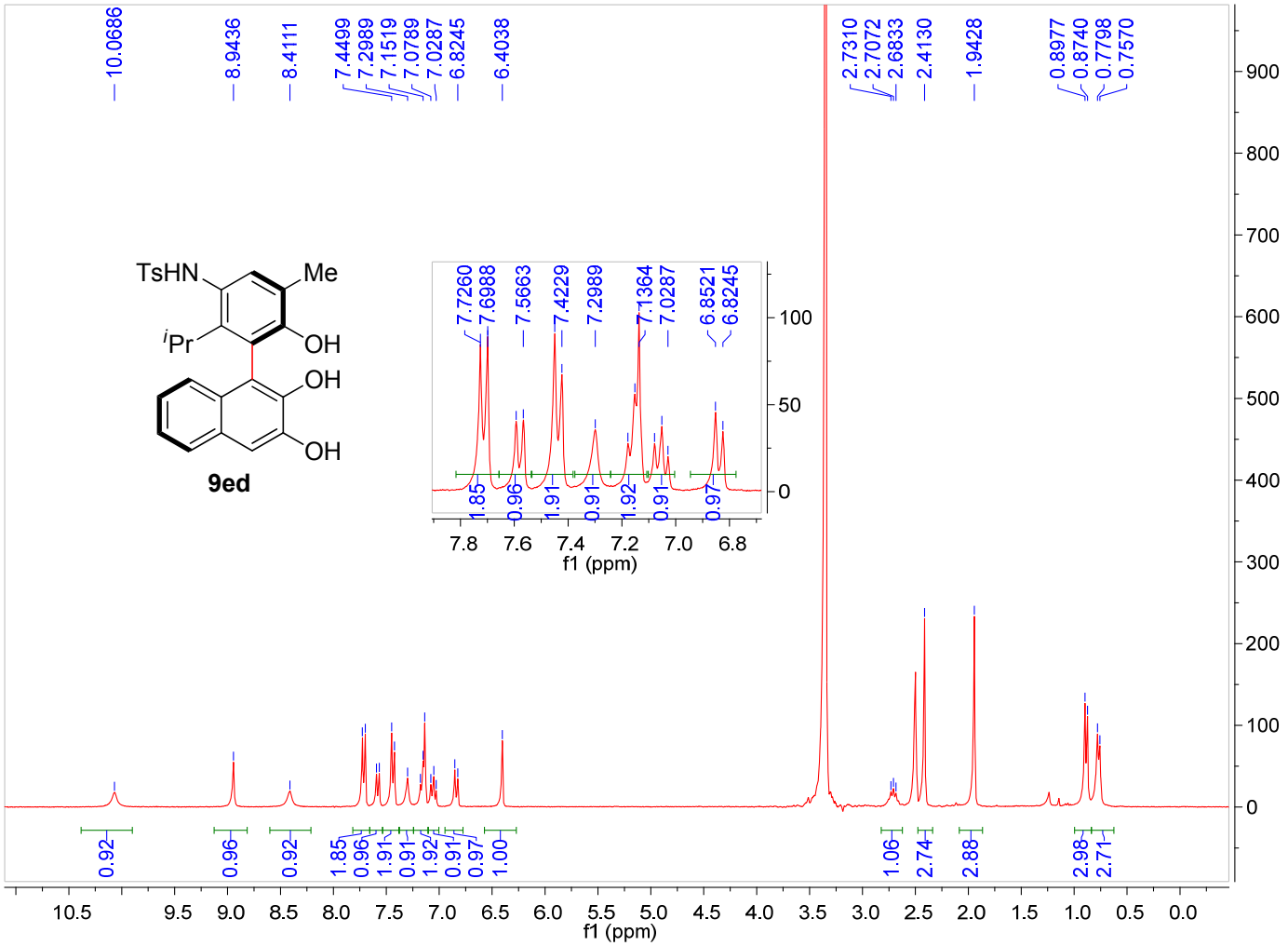
8.4462
7.3680
7.2687
7.1756
7.1077
7.0582
6.7497
6.7223
6.6381
3.1457
3.1236
3.1009
3.0788
2.3418
1.3989
1.0339
1.0115
TsHN
iPr
Me
OH
OH
OH
9ec
7.5811
7.5228
7.4961
7.3680
7.1418
7.1077
7.0815
7.0582
6.7497
6.7223
6.6381
1.31
2.15
2.37
1.15
3.23
1.25
1.00
f1 (ppm)
1.02
1.17
1.03
1.31
2.15
2.37
1.15
3.23
1.25
1.00
1.25
3.27
3.35
6.12
f1 (ppm)


150.47
146.13
142.38
137.51
133.39
126.06
123.59
122.55
116.43
108.72
39.98
39.81
39.64
39.48
39.31
39.14
38.98
25.71
22.51
22.41
20.87
14.53
TsHN
iPr
Me
OH
OH
OH
9ec
129.23
128.80
127.90
126.80
126.06
125.75
124.51
123.32
122.73
122.55
f1 (ppm)
f1 (ppm)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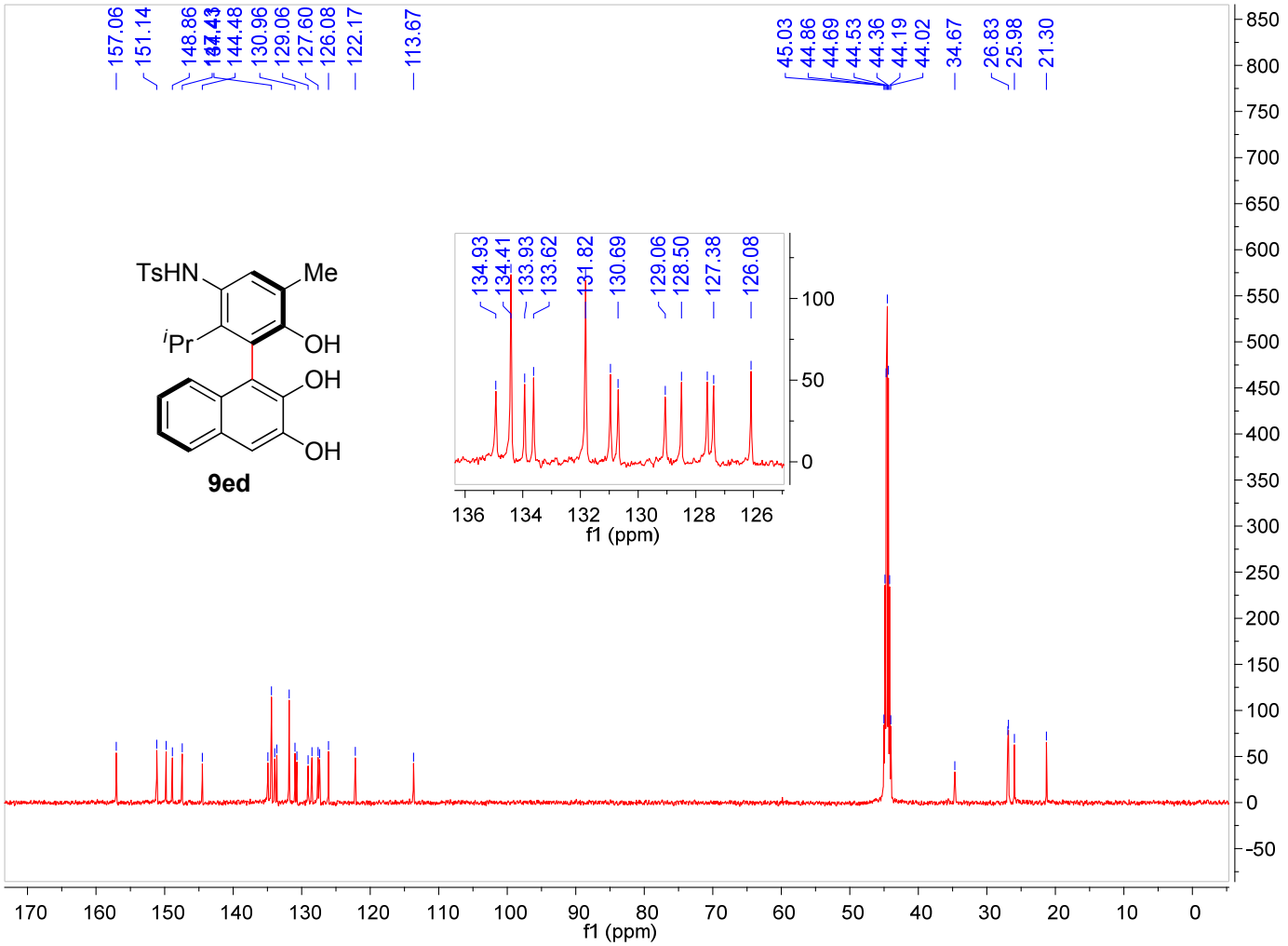
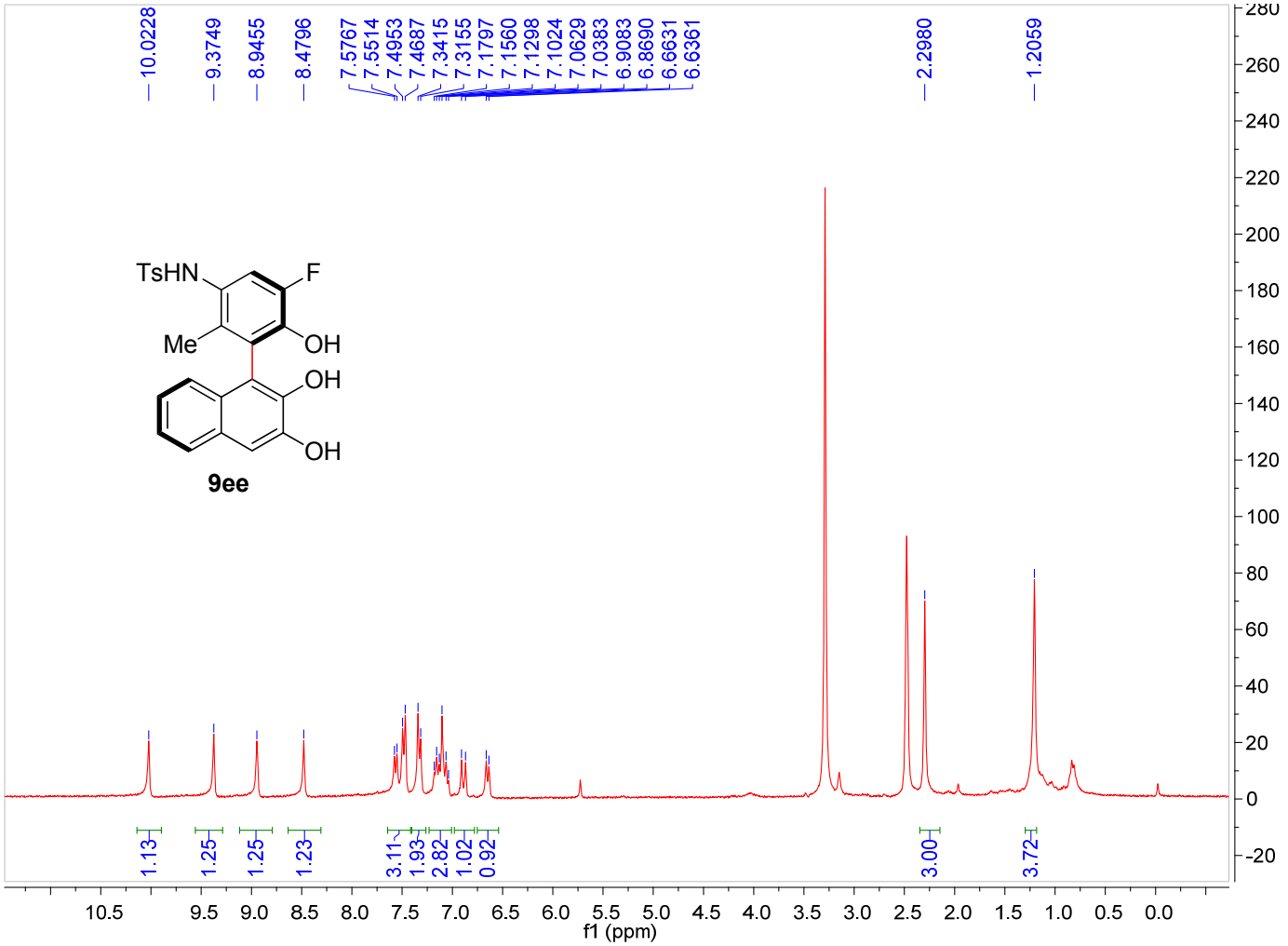
8.4111
7.4499
7.2989
7.1519
7.0789
7.0287
6.8245
6.4038
2.7310
2.7072
2.6833
2.4130
1.9428
0.8977
0.8740
0.7798
0.7570
TsHN
Me
iPr
OH
OH
OH
9ed
7.7260
7.6988
7.5663
7.4229
7.2989
7.1364
7.0287
6.8521
6.8245
1.85
0.96
1.91
0.91
1.92
0.91
0.97
f1 (ppm)
0.92
0.96
0.92
1.85
0.96
1.91
0.91
1.92
0.91
0.97
1.00
1.06
2.74
2.88
2.98
2.71
f1 (ppm)


157.06
151.14
148.86
144.48
130.96
129.06
127.60
126.08
122.17
113.67
45.03
44.86
44.69
44.53
44.36
44.19
44.02
34.67
26.83
25.98
21.30
TsHN
Me
iPr
OH
OH
OH
9ed
134.93
134.41
133.93
133.62
131.82
130.69
129.06
128.50
127.38
126.08
f1 (ppm)
f1 (ppm)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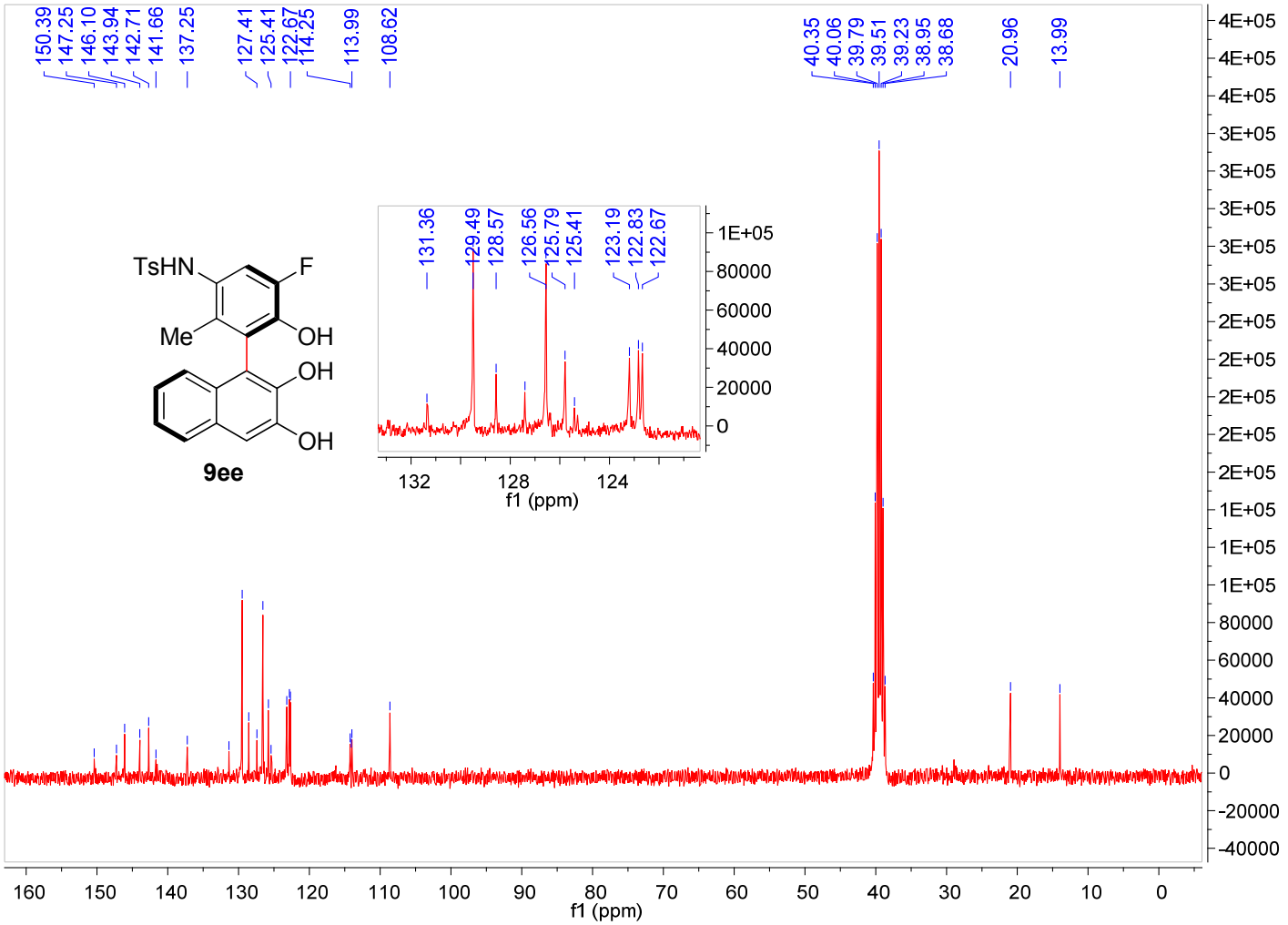
8.9455
8.4796
7.5767
7.5514
7.4953
7.4687
7.3415
7.3155
7.1797
7.1560
7.1298
7.1024
7.0629
7.0383
6.9083
6.8690
6.6631
6.6361
2.2980
1.2059
TsHN
F
Me
OH
OH
OH
9ee
1.13
1.25
1.25
1.23
3.11
1.93
2.82
1.02
0.92
3.00
3.72
f1 (ppm)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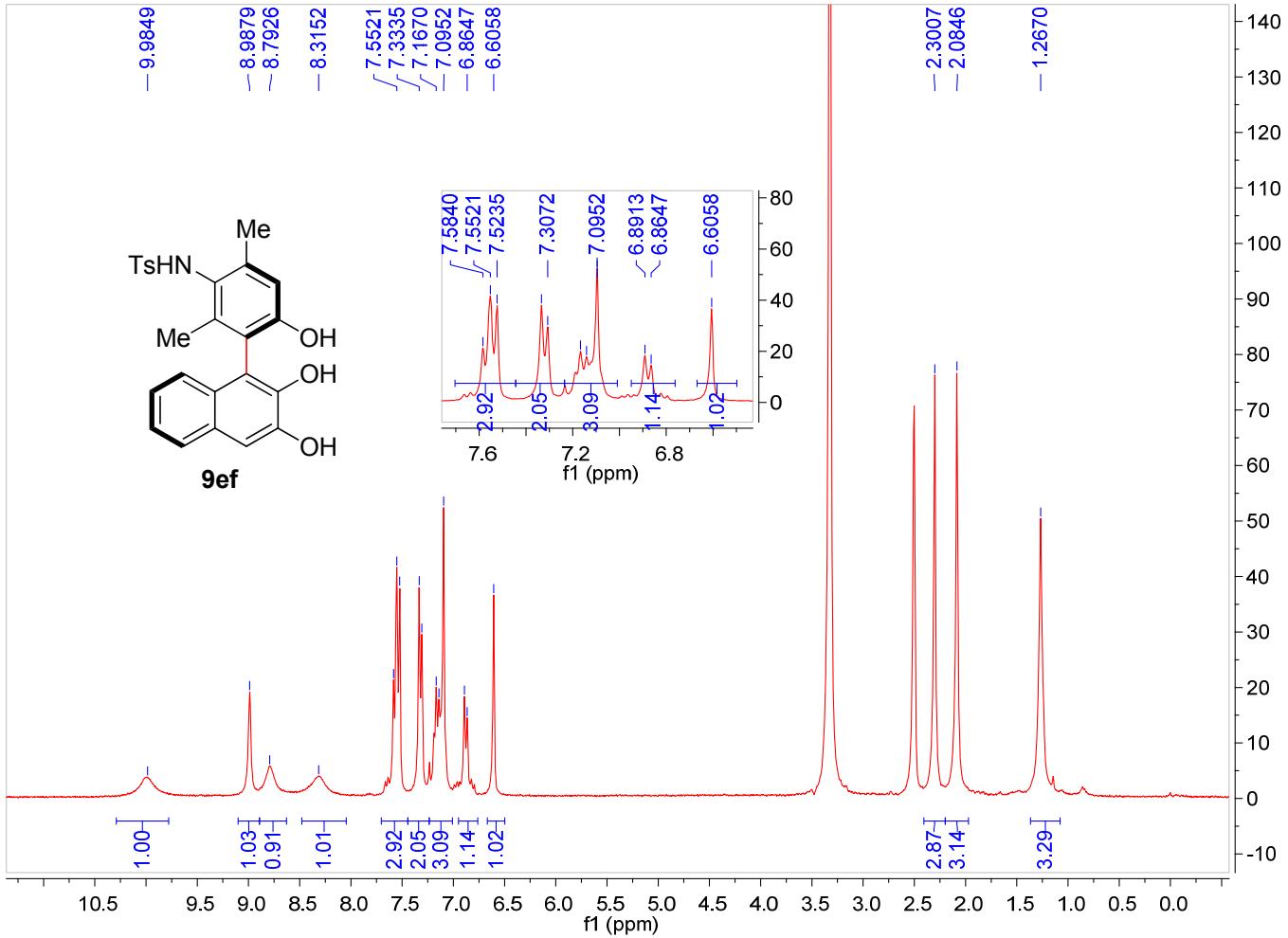
147.25
146.10
143.94
142.71
141.66
137.25
127.41
125.41
122.67
114.25
113.99
108.62
40.35
40.06
39.79
39.51
39.23
38.95
38.68
20.96
13.99
TsHN
F
Me
OH
OH
OH
9ee
131.36
129.49
128.57
126.56
125.79
125.41
123.19
122.83
122.67
f1 (ppm)
f1 (ppm)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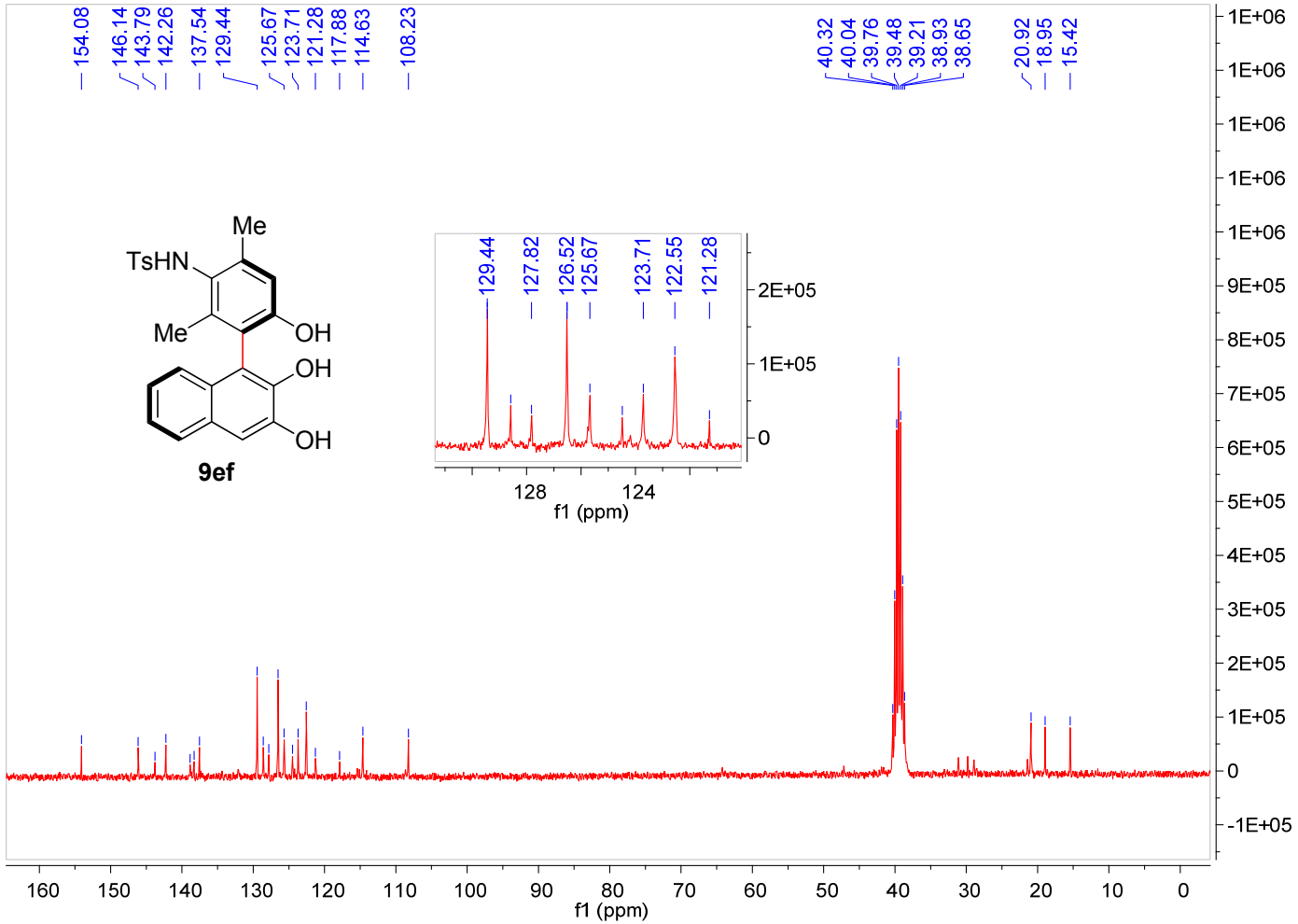
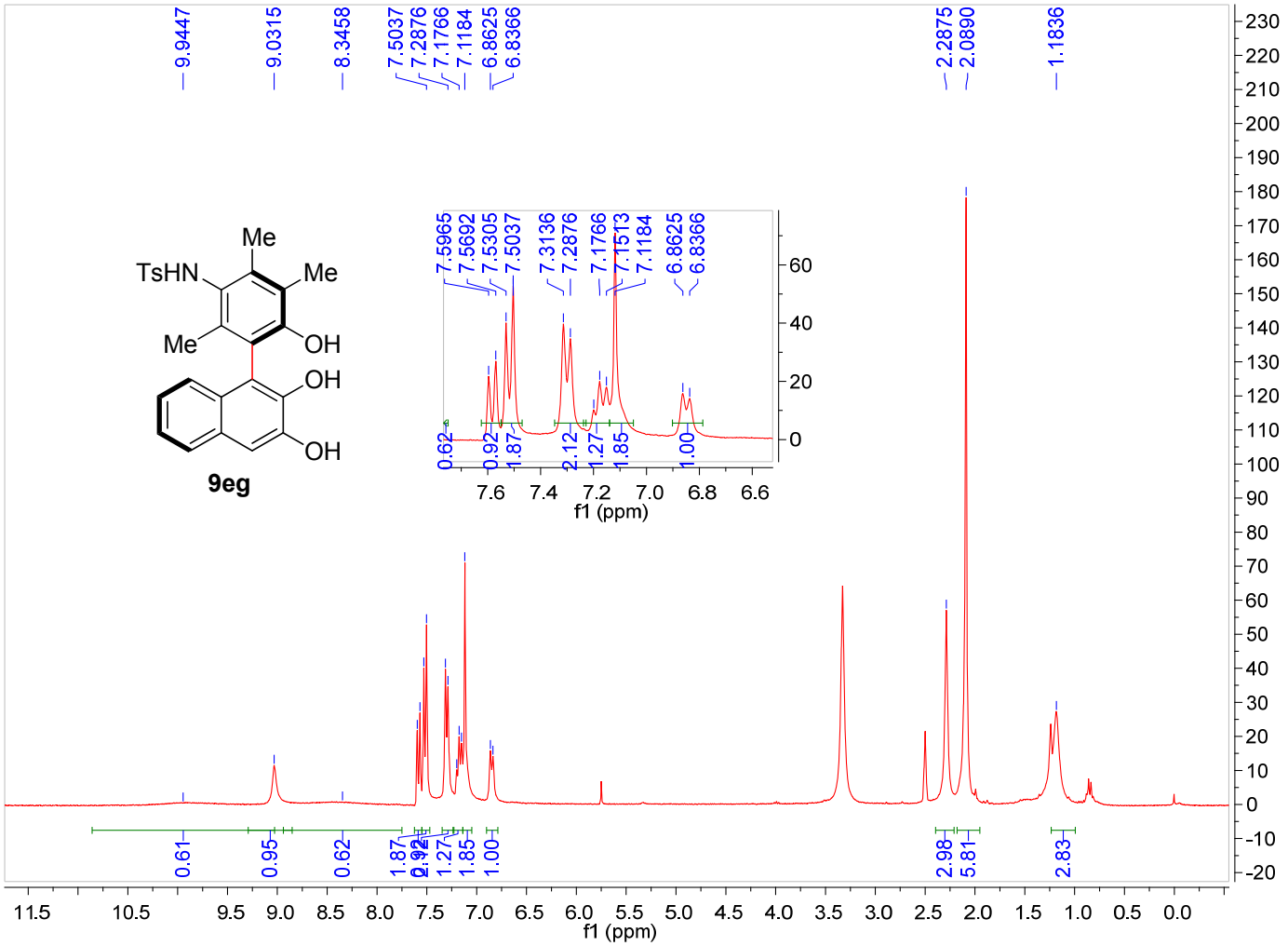
8.9879
8.7926
8.3152
7.5521
7.3335
7.1670
7.0952
6.8647
6.6058
2.3007
2.0846
1.2670
Me
TsHN
Me
OH
OH
OH
9ef
7.5840
7.5521
7.5235
7.3072
7.0952
6.8913
6.8647
6.6058
2.92
2.05
3.09
1.14
1.02
f1 (ppm)
1.00
1.03
0.91
1.01
2.92
2.05
3.09
1.14
1.02
2.87
3.14
3.29
f1 (ppm)


154.08
146.14
143.79
142.26
137.54
129.44
125.67
123.71
121.28
117.88
114.63
108.23
40.32
40.04
39.76
39.48
39.21
38.93
38.65
20.92
18.95
15.42
Me
TsHN
Me
OH
OH
OH
9ef
129.44
127.82
126.52
125.67
123.71
122.55
121.28
2E+05
1E+05
0
128
124
f1 (ppm)
1E+06
9E+05
8E+05
7E+05
6E+05
5E+05
4E+05
3E+05
2E+05
1E+05
0
-1E+05
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)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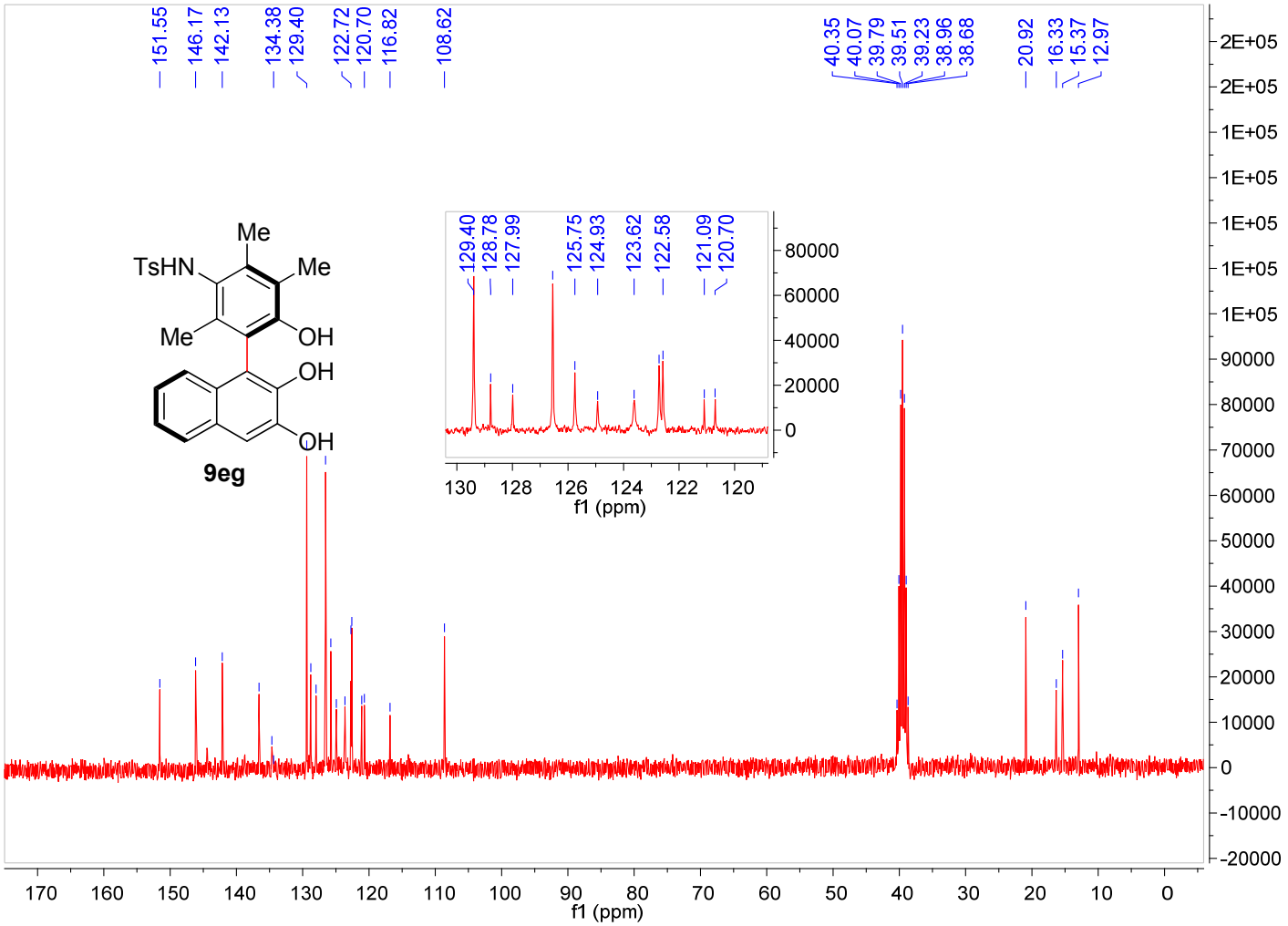
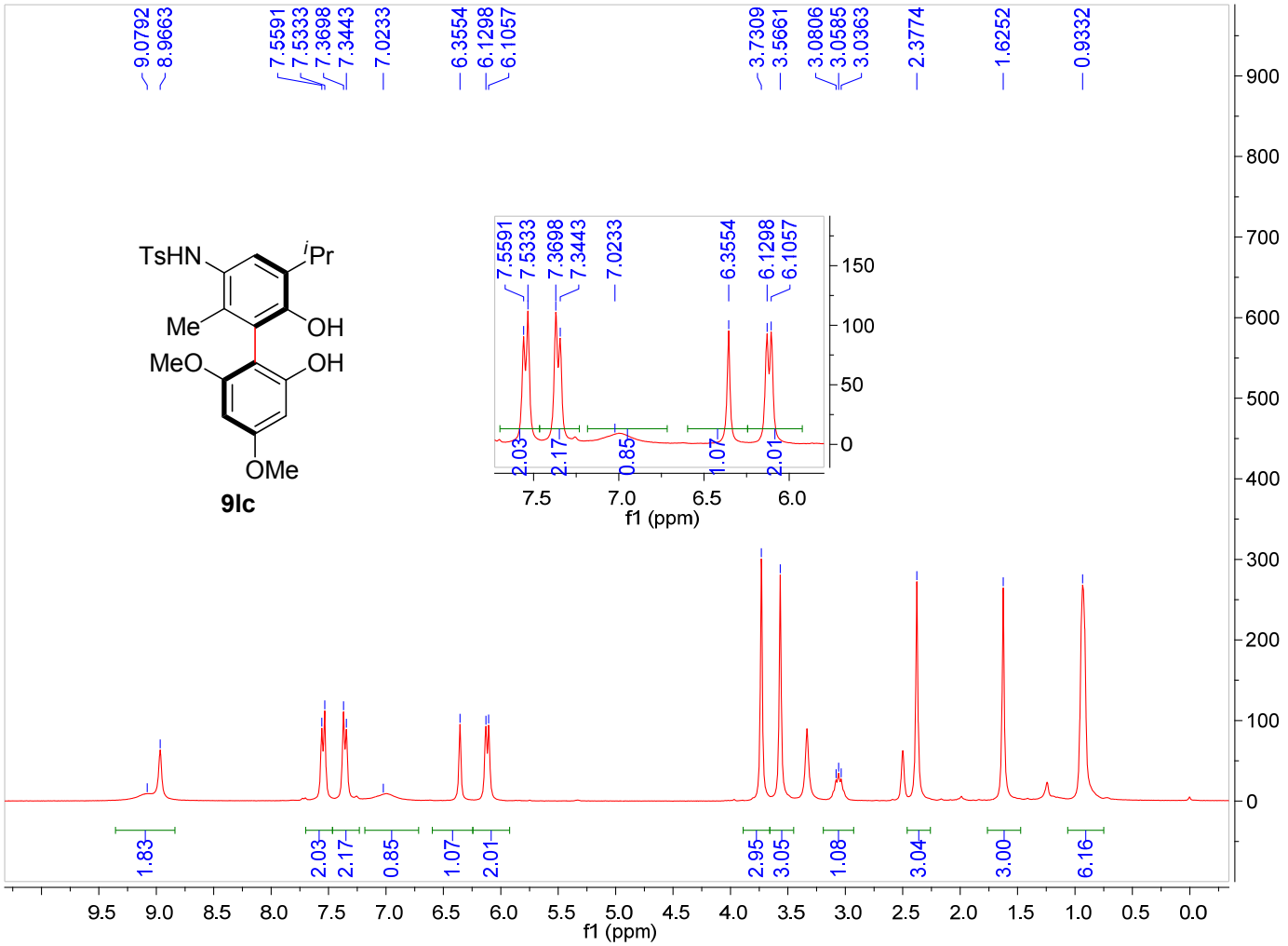
7.5037
7.2876
7.1766
7.1184
6.8625
6.8366
2.2875
2.0890
1.1836
Me
TsHN
Me
Me
OH
OH
OH
9eg
7.5965
7.5692
7.5305
7.5037
7.3136
7.2876
7.1766
7.1513
7.1184
6.8625
6.8366
0.62
0.92
1.87
2.12
1.27
1.85
1.00
f1 (ppm)
0.61
0.95
0.62
1.87
1.27
1.85
1.00
2.98
5.81
2.83
f1 (ppm)


151.55
146.17
142.13
134.38
129.40
122.72
120.70
116.82
108.62
40.35
40.07
39.79
39.51
39.23
38.96
38.68
20.92
16.33
15.37
12.97
Me
TsHN
Me
Me
OH
OH
OH
9eg
129.40
128.78
127.99
125.75
124.93
123.62
122.58
121.09
120.70
f1 (ppm)
f1 (ppm)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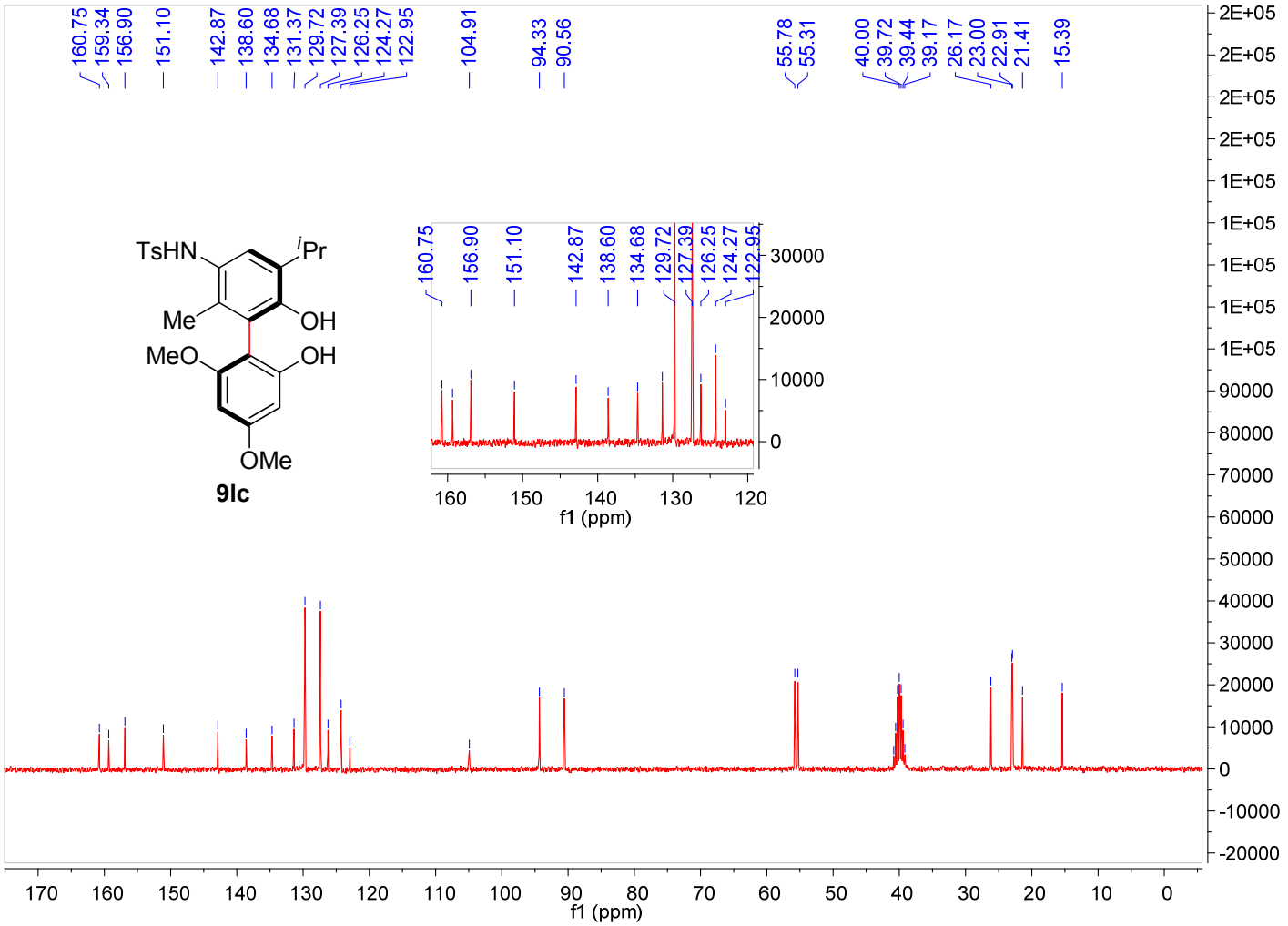
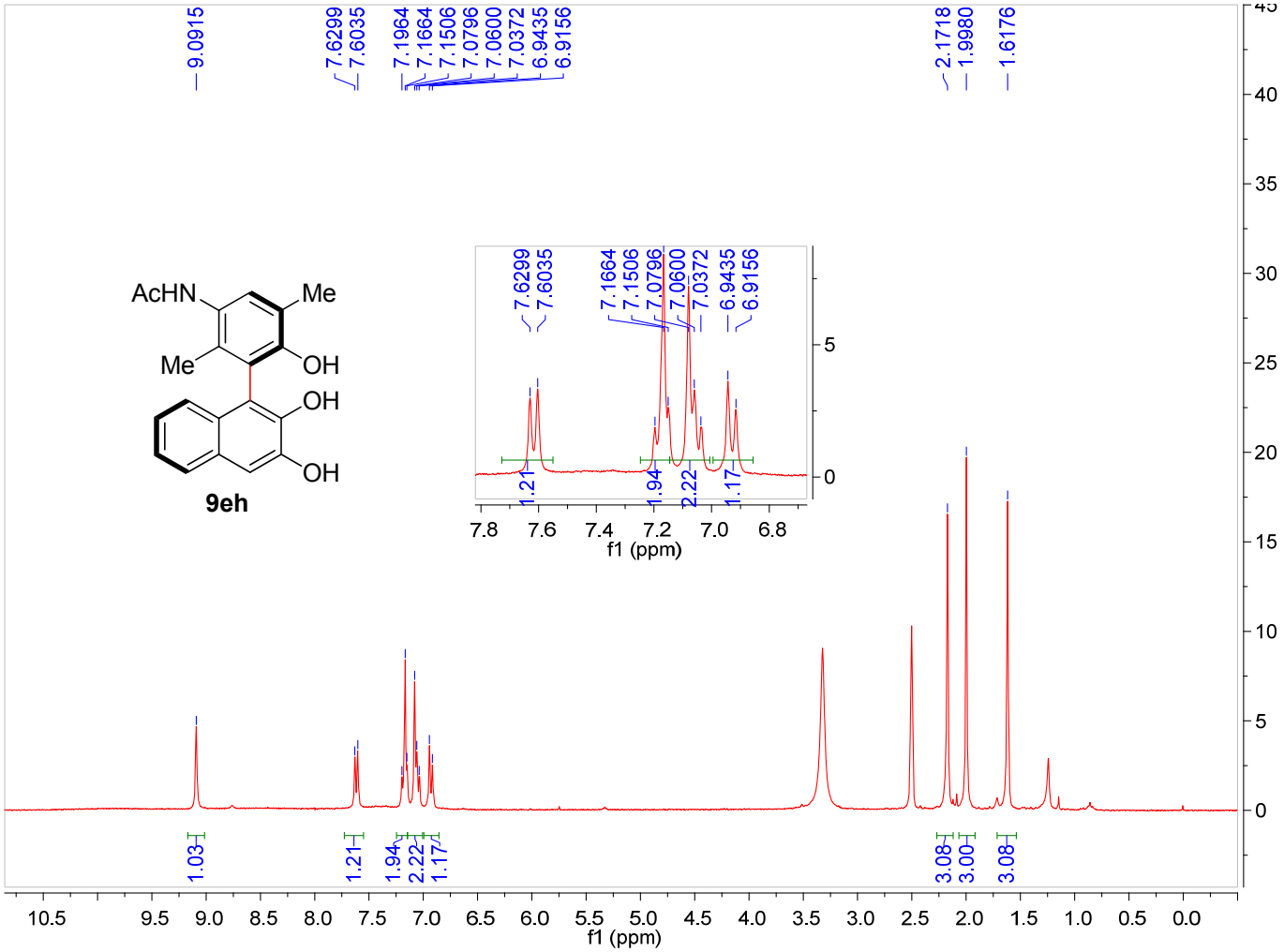
7.5333
7.3698
7.3443
7.0233
6.3554
6.1298
6.1057
3.7309
3.5661
3.0806
3.0585
3.0363
2.3774
1.6252
0.9332
TsHN
iPr
Me
OH
MeO
OH
OMe
9Ic
f1 (ppm)
f1 (ppm)


160.75
159.34
156.90
151.10
142.87
138.60
134.68
131.37
129.72
127.39
126.25
124.27
122.95
104.91
94.33
90.56
55.78
55.31
40.00
39.72
39.44
39.17
26.17
23.00
22.91
21.41
15.39
TsHN
iPr
Me
OH
MeO
OH
OMe
9Ic
f1 (ppm)
f1 (ppm)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7.6035
7.1964
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7.0796
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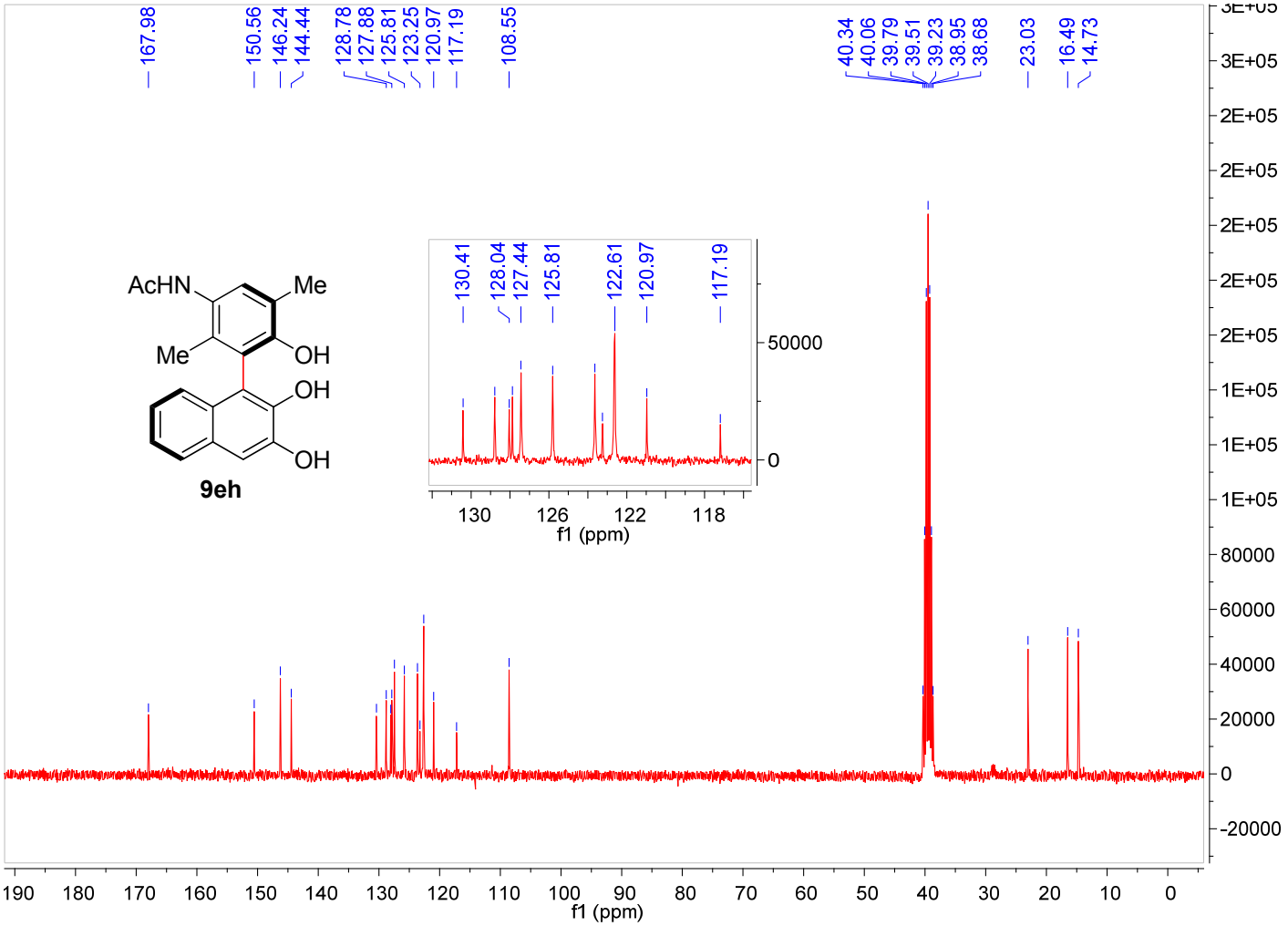
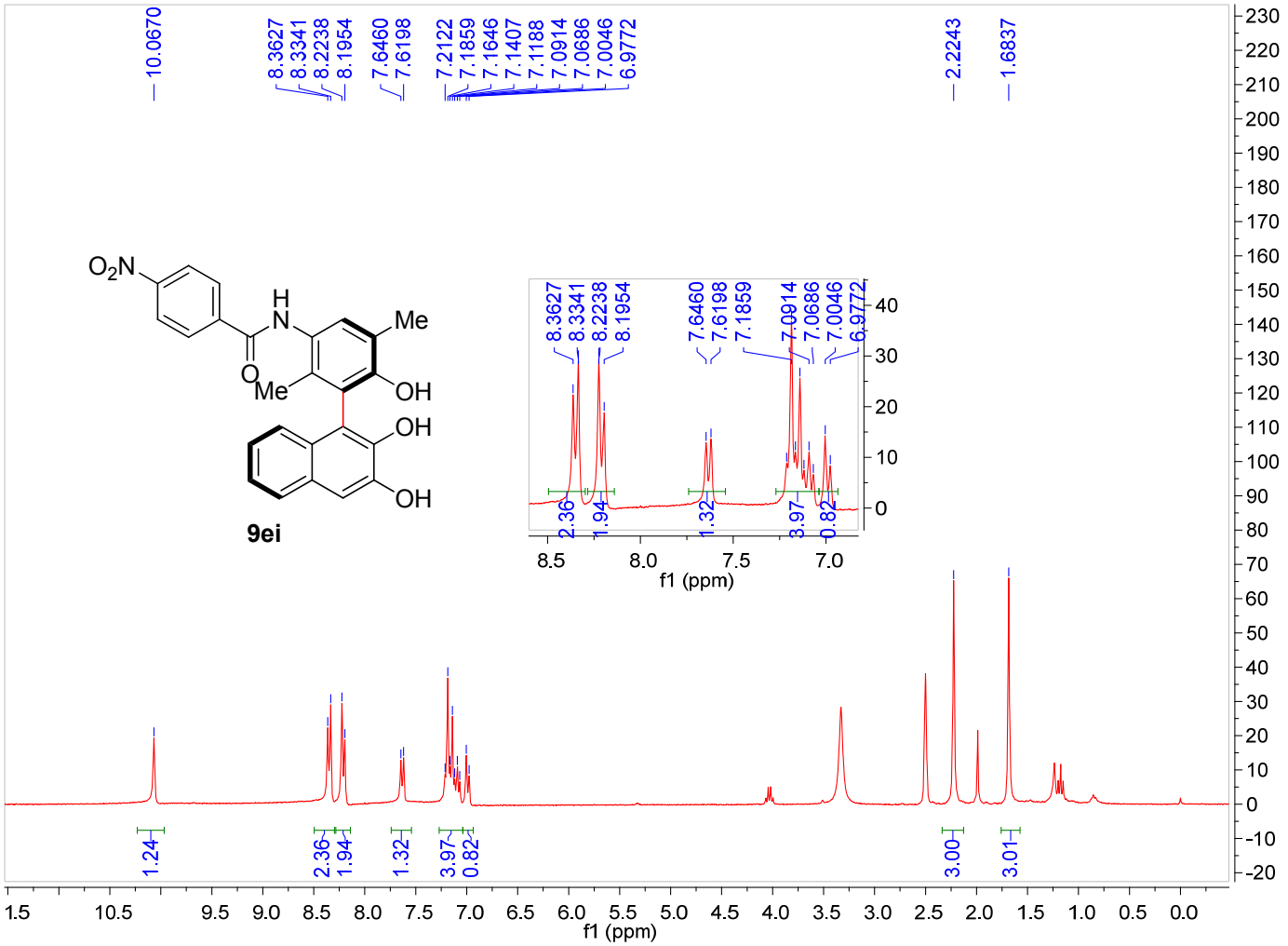
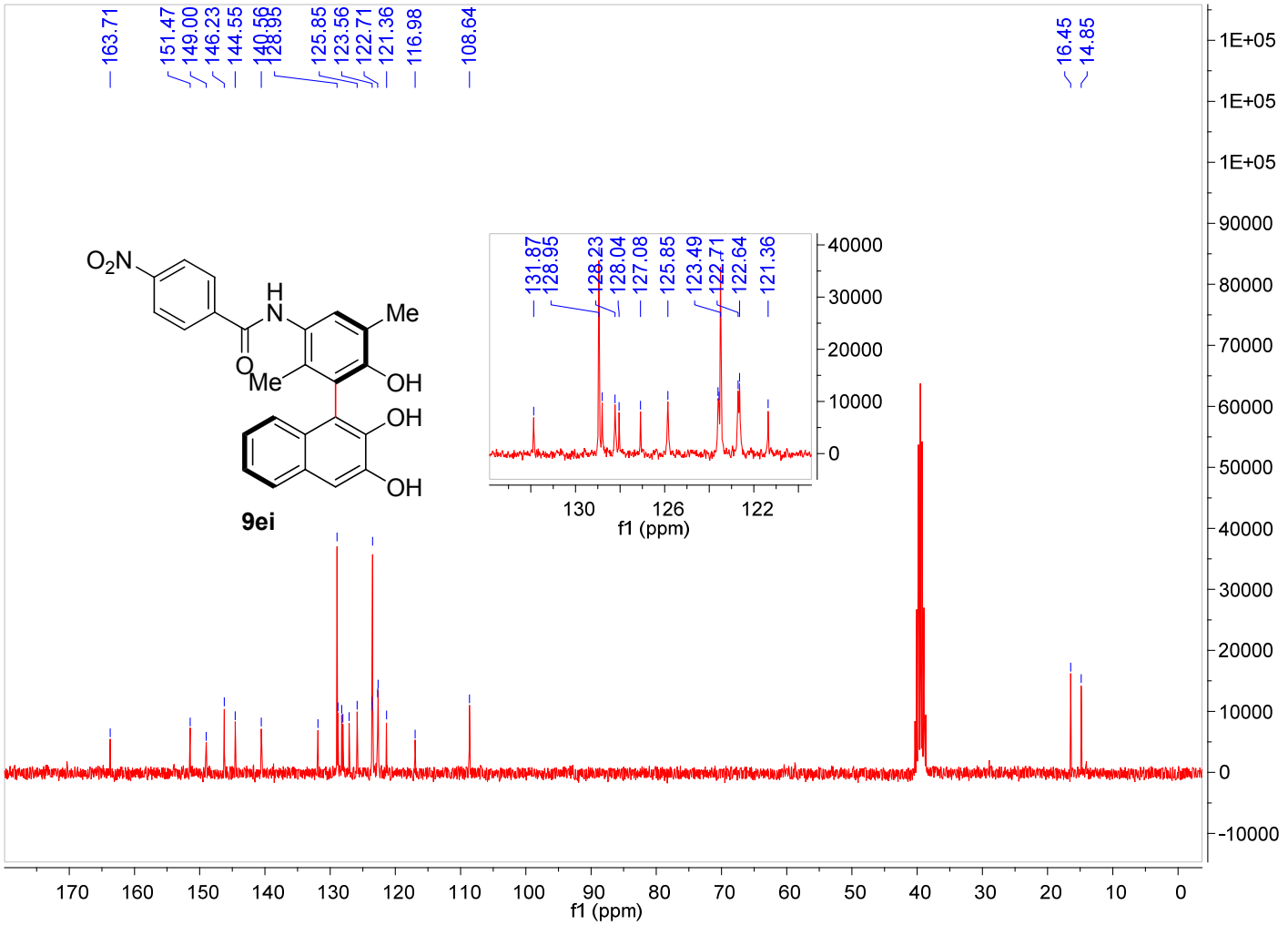
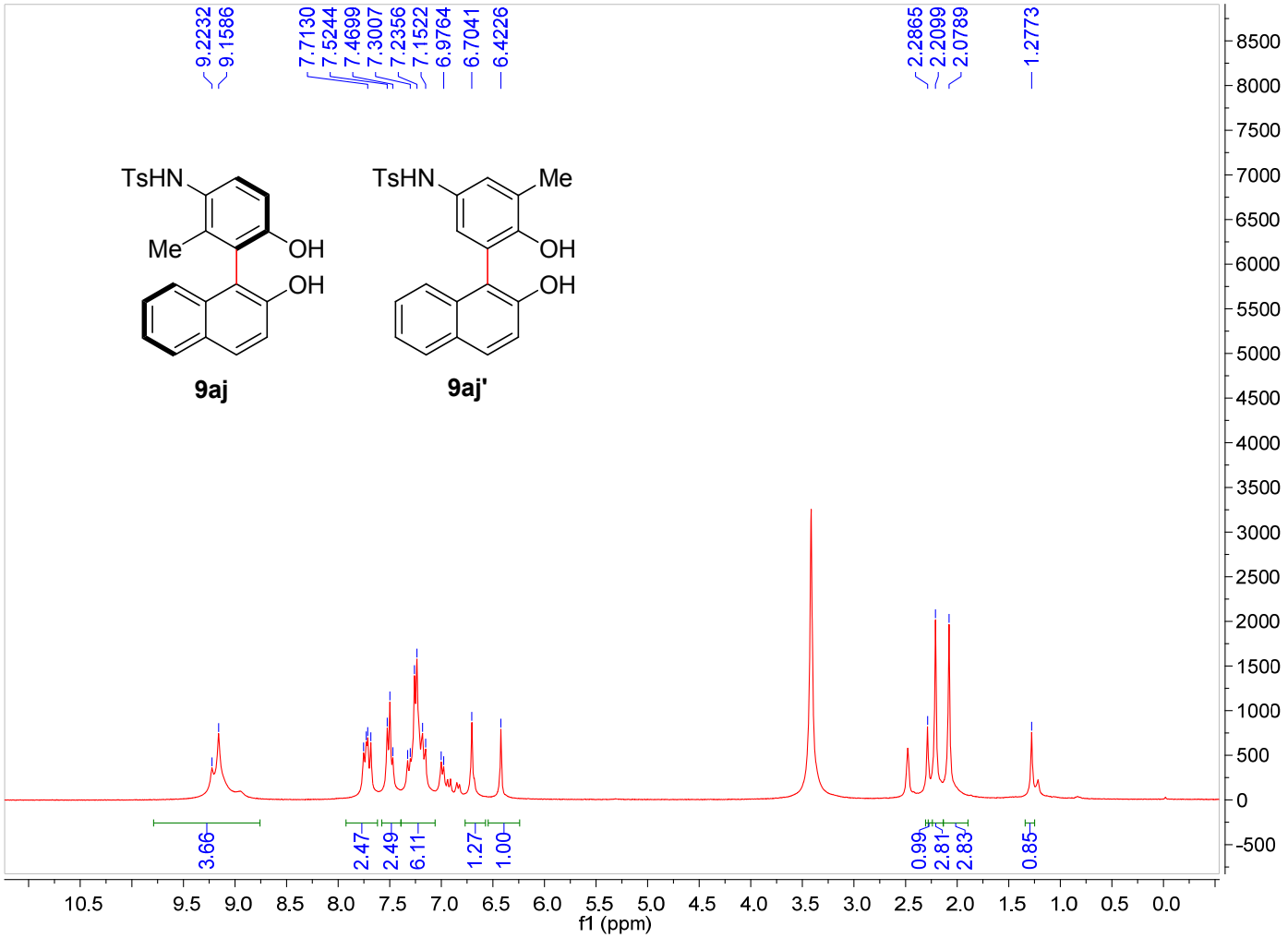
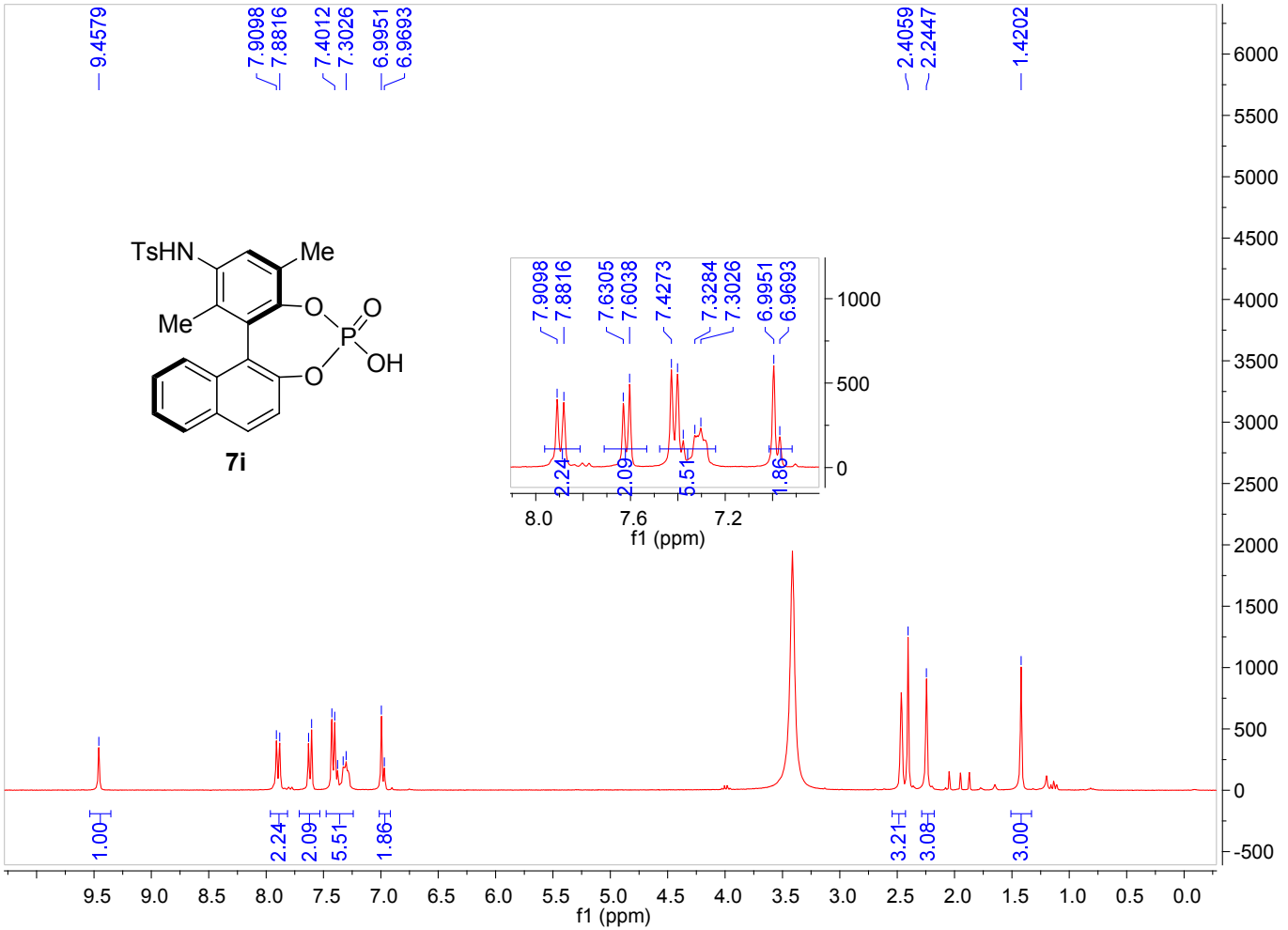
7.0372
6.9435
6.9156
2.1718
1.9980
1.6176
AcHN
Me
Me
OH
OH
OH
9eh
f1 (ppm)
1.03
1.21
1.94
2.22
1.17
3.08
3.00
3.08

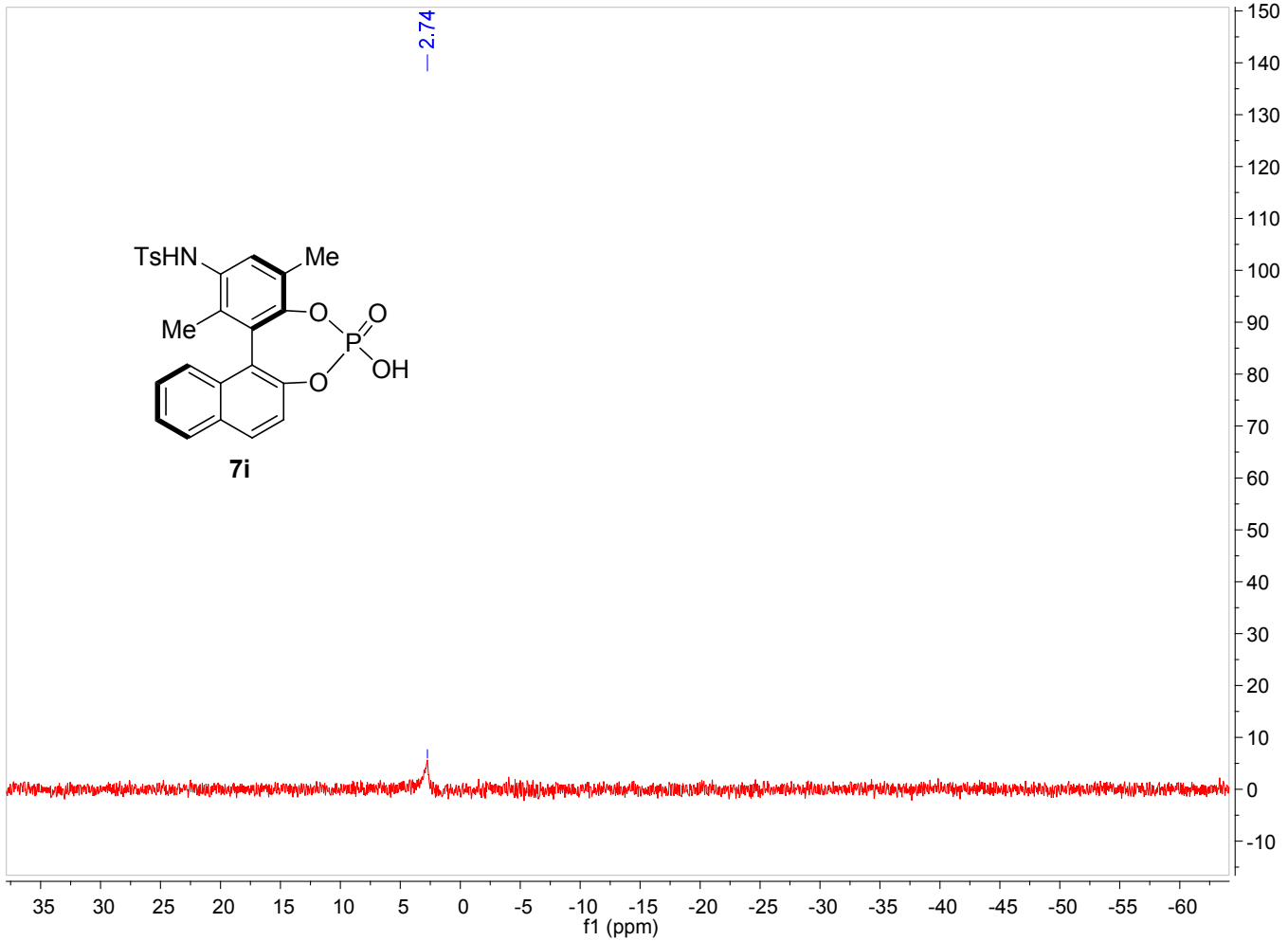

167.98
150.56
146.24
144.44
128.78
127.88
125.81
123.25
120.97
117.19
108.55
40.34
40.06
39.79
39.51
39.23
38.95
38.68
23.03
16.49
14.73
AcHN
Me
Me
OH
OH
OH
9eh
130.41
128.04
127.44
125.81
122.61
120.97
117.19
50000
0
130
126
122
118
f1 (ppm)
3E+05
2E+05
2E+05
2E+05
2E+05
2E+05
1E+05
1E+05
1E+05
80000
60000
40000
20000
0
-20000
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

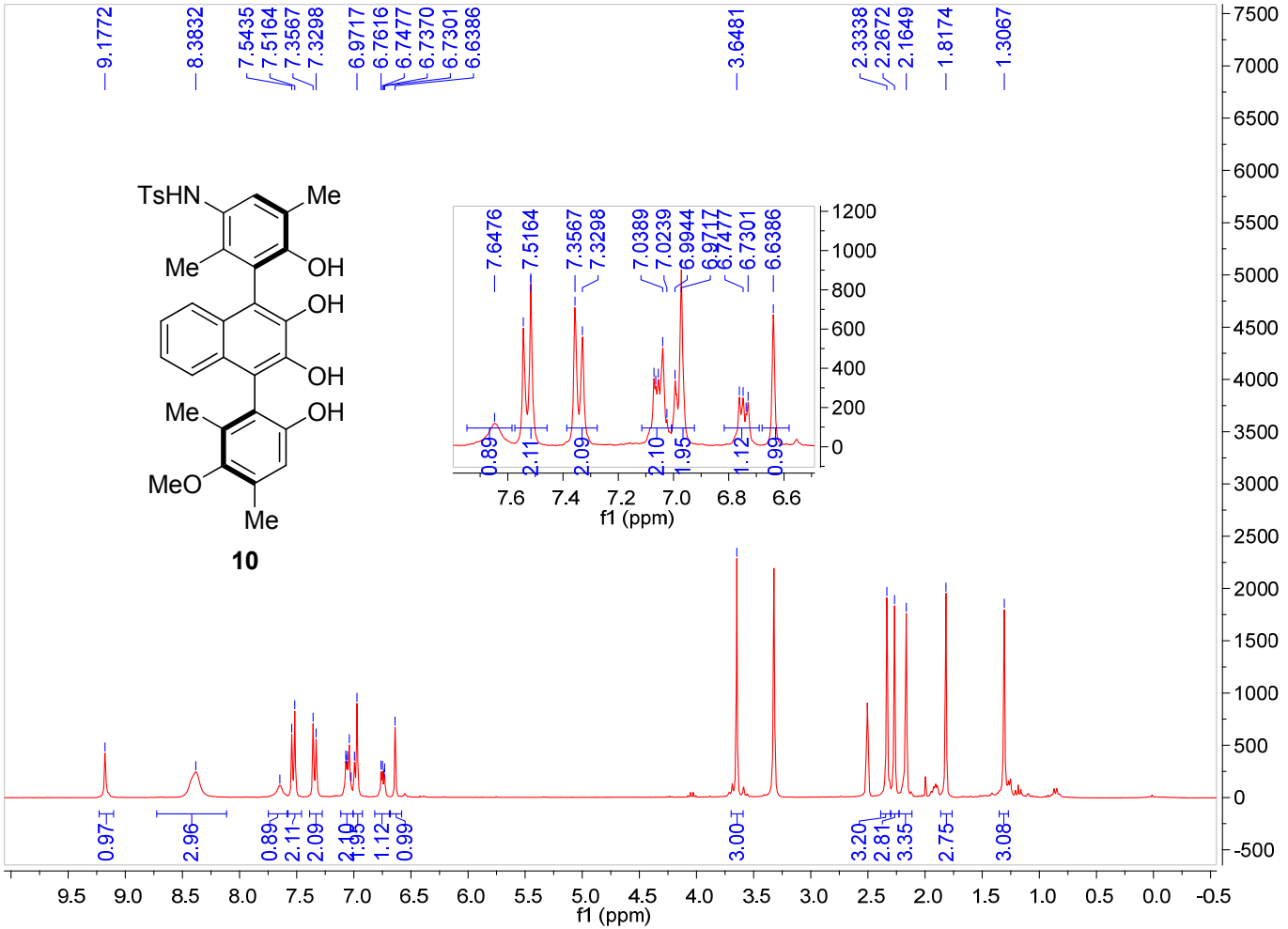

10.0670
8.3627
8.3341
8.2238
8.1954
7.6460
7.6198
7.2122
7.1859
7.1646
7.1407
7.1188
7.0914
7.0686
7.0046
6.9772
2.2243
1.6837
O2N
H
N
O
Me
Me
OH
OH
OH
9ei
f1 (ppm)
1.24
2.36
1.94
1.32
3.97
0.82
3.00
3.01


163.71
151.47
149.00
146.23
144.55
140.56
128.95
125.85
123.56
122.71
121.36
116.98
108.64
16.45
14.85
O2N
H
N
O
Me
Me
OH
OH
OH
9ei
131.87
128.95
128.23
128.04
127.08
125.85
123.49
122.71
122.64
121.36
40000
30000
20000
10000
0
130
126
122
f1 (ppm)
1E+05
1E+05
1E+05
90000
80000
70000
60000
50000
40000
30000
20000
10000
0
-10000
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)


9.2232
9.1586
7.7130
7.5244
7.4699
7.3007
7.2356
7.1522
6.9764
6.7041
6.4226
2.2865
2.2099
2.0789
1.2773
TsHN
Me
OH
OH
9aj
TsHN
Me
OH
OH
9aj'
3.66
2.47
2.49
6.11
1.27
1.00
0.99
2.81
2.83
0.85
f1 (ppm)


9.4579
7.9098
7.8816
7.4012
7.3026
6.9951
6.9693
2.4059
2.2447
1.4202
TsHN
Me
Me
O
O
P
OH
O
7i
7.9098
7.8816
7.6305
7.6038
7.4273
7.3284
7.3026
6.9951
6.9693
2.24
2.09
5.51
1.86
f1 (ppm)
1.00
2.24
2.09
5.51
1.86
3.21
3.08
3.00
f1 (ppm)


2.74
TsHN
Me
Me
O
O
P
OH
O
7i
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
35
30
25
20
15
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
-50
-55
-60
f1 (ppm)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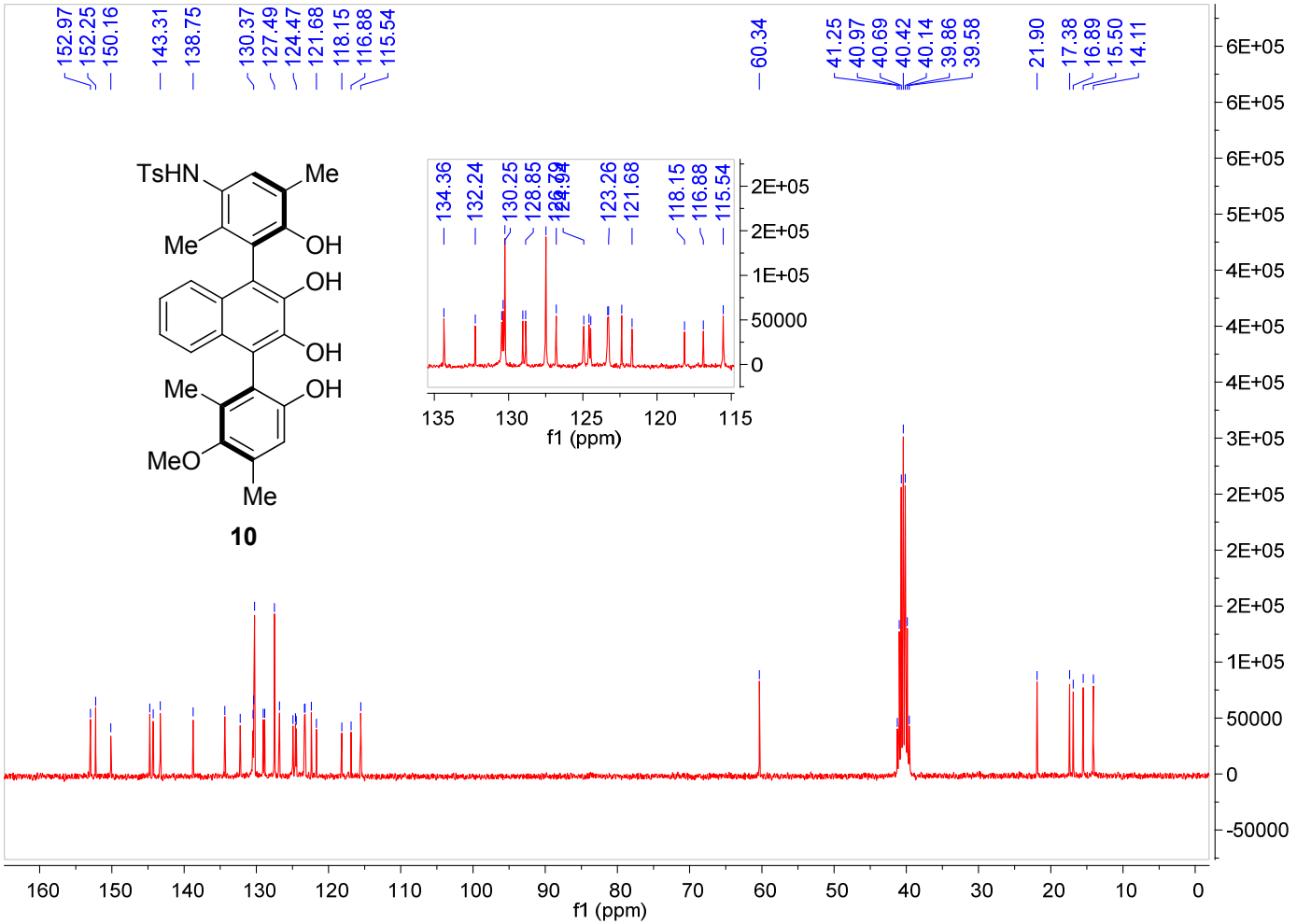
8.3832
7.5435
7.5164
7.3567
7.3298
6.9717
6.7616
6.7477
6.7370
6.7301
6.6386
3.6481
2.3338
2.2672
2.1649
1.8174
1.3067
TsHN
Me
Me
OH
OH
OH
Me
OH
MeO
Me
10
7.6476
7.5164
7.3567
7.3298
7.0389
7.0239
6.9944
6.9717
6.7477
6.7301
6.6386
0.89
2.11
2.09
2.10
1.95
1.12
0.99
f1 (ppm)
0.97
2.96
0.89
2.11
2.09
3.00
3.20
2.81
3.35
2.75
3.08
f1 (ppm)

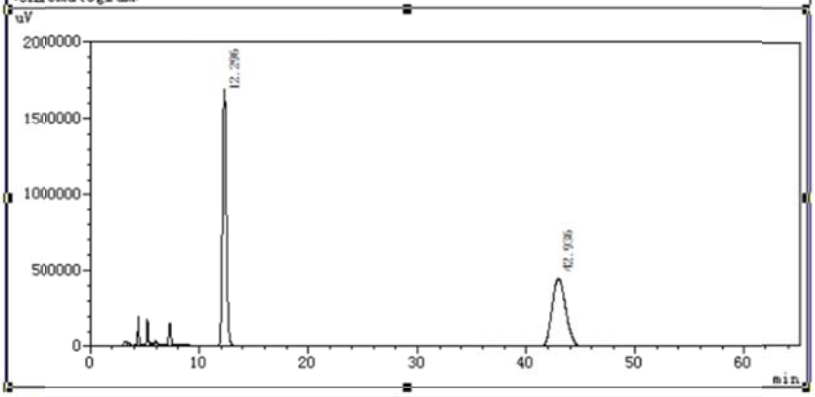

152.97
152.25
150.16
143.31
138.75
130.37
127.49
124.47
121.68
118.15
116.88
115.54
60.34
41.25
40.97
40.69
40.42
40.14
39.86
39.58
21.90
17.38
16.89
15.50
14.11
TsHN
Me
Me
OH
OH
OH
Me
OH
MeO
Me
10
134.36
132.24
130.25
128.85
123.26
121.68
118.15
116.88
115.54
f1 (ppm)
f1 (ppm)

SHIMADZU LabSolutions **Analysis Report**

<Sample information>

Sample	: wjz-f3-standard xiaoxuan		
ID	: wjz-f3-standard xiaoxuan		
Data Name	: wjz-f3-standard xiaoxuan.lcd		
Method Name	: fang.lcm		
Vial	: 1-1		
Inj.Volume	: 10 uL		
Acquisition Date	: 2015-11-14 17:45:22	Operator	: System Administrator
Modified Date	: 2015-11-14 18:32:34		

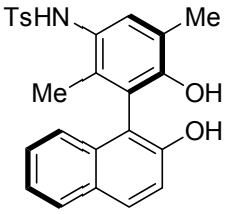
<Chromatogram>



<Peak table>

Detector A Ch1 230nm

Peak	Ret Time [min]	Area [mAU*s]	Height [mAU]	Area %	Unit	Mark	Compound Name
1	12.296	40600816	1691632	50.244			
2	42.936	40205699	456385	49.756		M	



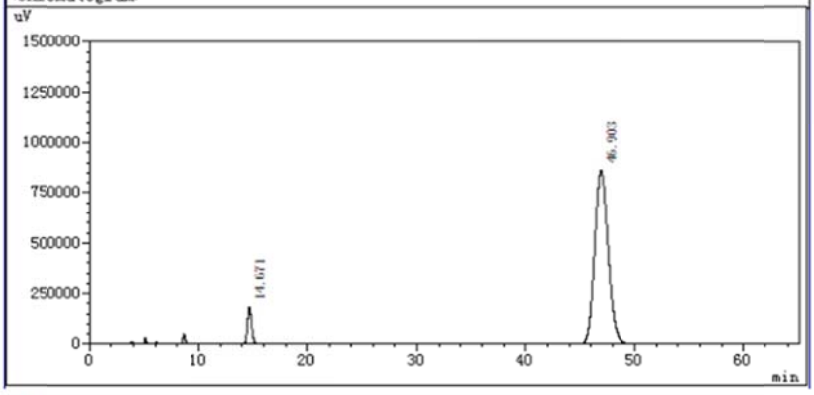
9aa

SHIMADZU LabSolutions **Analysis Report**

<Sample information>

Sample	: wjz-f2-rongji3		
ID	: wjz-f2-rongji3		
Data Name	: wjz-f2-rongji3.lcd		
Method Name	: 10d.lcm		
Vial	: 1-1		
Inj.Volume	: 15 uL		
Acquisition Date	: 2015-7-20 12:52:38	Operator	: System Administrator
Modified Date	: 2015-7-20 16:12:37		

<Chromatogram>



<Peak table>

Detector A Ch1 230nm

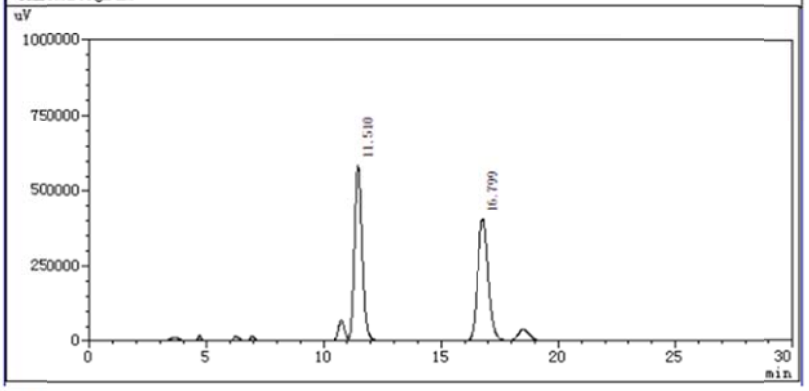
Peak	Ret Time [min]	Area [mAU*s]	Height [mAU]	Area %	Unit	Mark	Compound Name
1	14.671	4815894	183645	6.066			
2	46.903	74576787	858588	93.934			

SHIMADZU LabSolutions **Analysis Report**

<Sample information>

Sample	: wjz-f3-e xiaoxuan
ID	: wjz-f3-e xiaoxuan
Data Name	: wjz-f3-e xiaoxuan01.lcd
Method Name	: 7a.lcm
Vial	: 1-1
Inj.Volume	: 15 uL
Acquisition Date	: 2015-8-13 18:55:05 Operator : System Administrator
Modified Date	: 2015-11-13 14:05:01

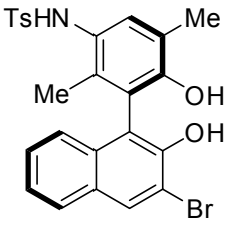
<Chromatogram>



<Peak table>

Detector A Ch1 230nm

Peak	Ret Time [min]	Area [mAU*s]	Height [mAU]	Area %	Unit	Mark	Compound Name
1	11.510	13001469	582111	49.991		M	
2	16.799	13006157	405987	50.009			



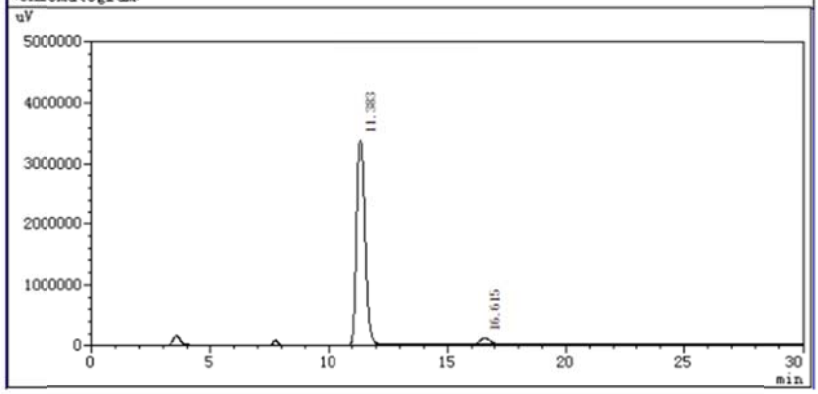
9ba

SHIMADZU LabSolutions **Analysis Report**

<Sample information>

Sample	: wjz-f3-e shouxing
ID	: wjz-f3-e shouxing
Data Name	: wjz-f3-e shouxing01.lcd
Method Name	: 7a.lcm
Vial	: 1-1
Inj.Volume	: 15 uL
Acquisition Date	: 2015-8-13 20:57:07 Operator : System Administrator
Modified Date	: 2015-11-13 14:05:37

<Chromatogram>



<Peak table>

Detector A Ch1 230nm

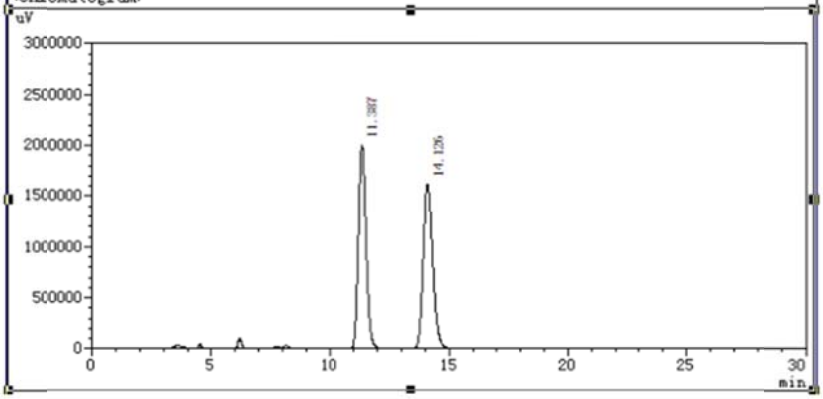
Peak	Ret Time [min]	Area [mAU*s]	Height [mAU]	Area %	Unit	Mark	Compound Name
1	11.383	83710618	3373429	96.121			
2	16.615	3378527	105275	3.879			

SHIMADZU LabSolutions **Analysis Report**

<Sample information>

Sample	: wjz-f3-b		
ID	: wjz-f3-b		
Data Name	: wjz-f3-b.lcd		
Method Name	: YW-1.lcm		
Vial	: 1-1		
Inj.Volume	: 15 uL		
Acquisition Date	: 2015-8-3 20:32:13	Operator	: System Administrator
Modified Date	: 2015-8-3 21:26:11		

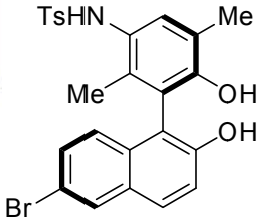
<Chromatogram>



<Peak table>

Detector A Ch1 230nm

Peak	Ret Time [min]	Area [mAU*s]	Height [mAU]	Area %	Unit	Mark	Compound Name
1	11.387	44991286	1998746	50.042			
2	14.126	44916049	1616695	49.958		V	



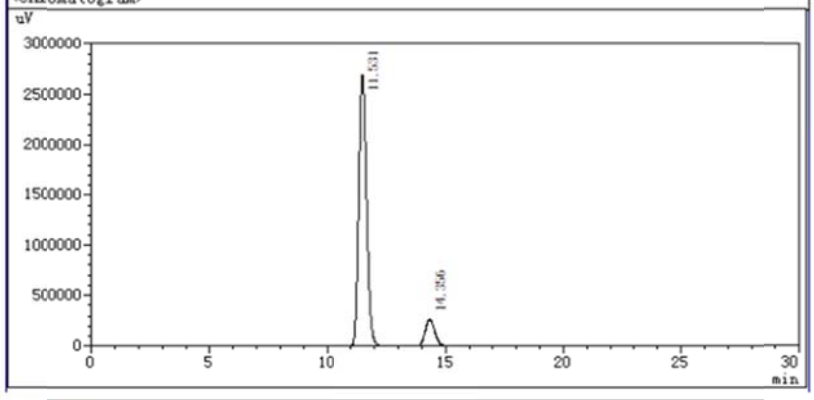
9ca

SHIMADZU LabSolutions **Analysis Report**

<Sample information>

Sample	: wjz-f3-b shouxing		
ID	: wjz-f3-b shouxing		
Data Name	: wjz-f3-b shouxing.lcd		
Method Name	: YW-1.lcm		
Vial	: 1-1		
Inj.Volume	: 15 uL		
Acquisition Date	: 2015-8-3 21:35:07	Operator	: System Administrator
Modified Date	: 2015-8-3 22:11:21		

<Chromatogram>



<Peak table>

Detector A Ch1 230nm

Peak	Ret Time [min]	Area [mAU*s]	Height [mAU]	Area %	Unit	Mark	Compound Name
1	11.531	61638534	2685302	88.960			
2	14.356	7649014	267606	11.040		SV	

SHIMADZU LabSolutions **Analysis Report**

<Sample information>

Sample	: wjr-f3-A		
ID	: wjr-f3-A		
Data Name	: wjr-f3-A.lcd		
Method Name	: YW-1.lcm		
Vial	: 1-1		
Inj.Volume	: 15 uL		
Acquisition Date	: 2015-8-3 17:00:46	Operator	: System Administrator
Modified Date	: 2015-8-3 23:28:29		

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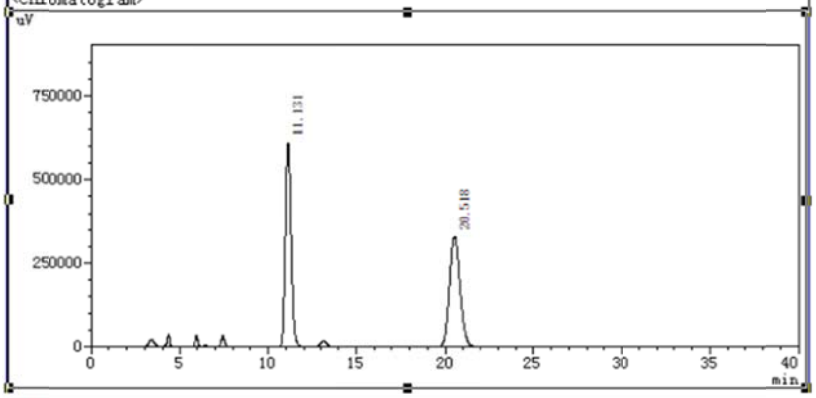
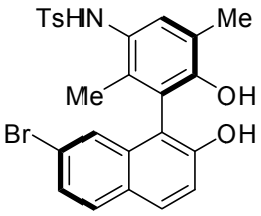


<Peak table>

Detector A Ch1 230nm

Peak	Ret Time [min]	Area [mAU*s]	Height [mAU]	Area %	Unit	Mark	Compound Name
1	11.131	13491431	609991	50.024			
2	20.518	13478388	329321	49.976			



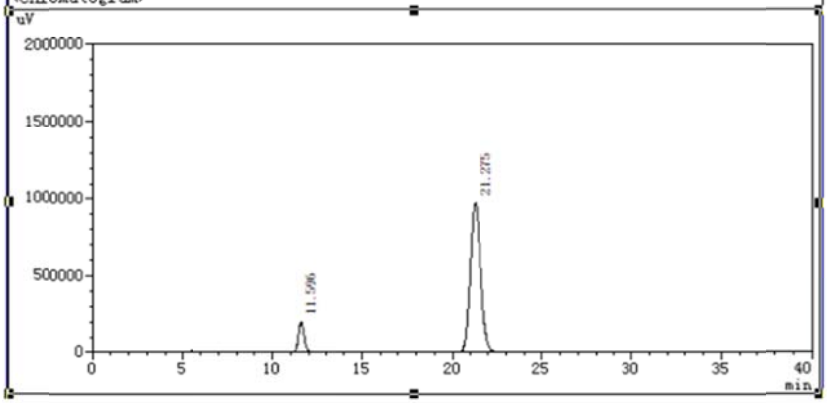
9da

SHIMADZU LabSolutions **Analysis Report**

<Sample information>

Sample	: wjr-f3-Ashouxing		
ID	: wjr-f3-Ashouxing		
Data Name	: wjr-f3-A shouxing.lcd		
Method Name	: YW-1.lcm		
Vial	: 1-1		
Inj.Volume	: 15 uL		
Acquisition Date	: 2015-8-3 19:34:07	Operator	: System Administrator
Modified Date	: 2015-11-13 23:59:03		

<Chromatogram>



<Peak table>

Detector A Ch1 230nm

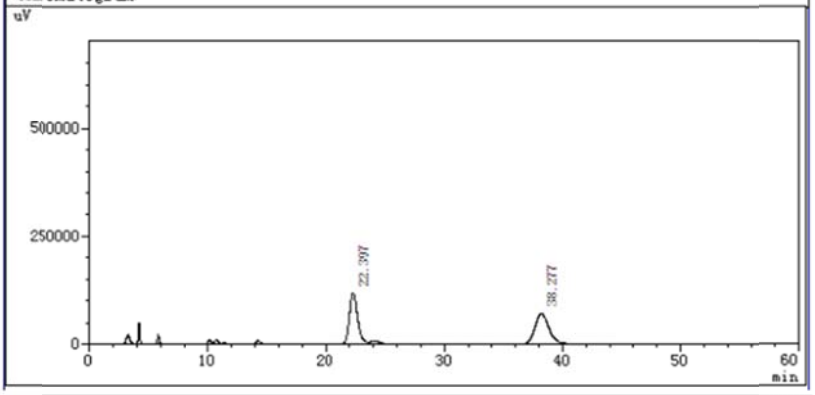
Peak	Ret Time [min]	Area [mAU*s]	Height [mAU]	Area %	Unit	Mark	Compound Name
1	11.596	4329529	197377	9.672		M	
2	21.275	40435627	973850	90.328		S	

SHIMADZU LabSolutions **Analysis Report**

<Sample information>

Sample : wjr-f3-c
ID : wjr-f3-c
Data Name : wjr-f3-c.lcd
Method Name : YH-1.lcm
Vial : 1-1
Inj.Volume : 15 uL
Acquisition Date : 2015-8-3 22:13:17 Operator : System Administrator
Modified Date : 2015-11-13 13:56:48

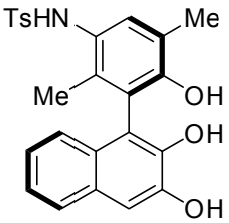
<Chromatogram>



<Peak table>

Detector A Ch1 230nm

Peak	Ret Time [min]	Area [mAU*s]	Height [mAU]	Area %	Unit	Mark	Compound Name
1	22.397	6007055	117383	49.960		M	
2	38.277	6016602	70898	50.040		S	



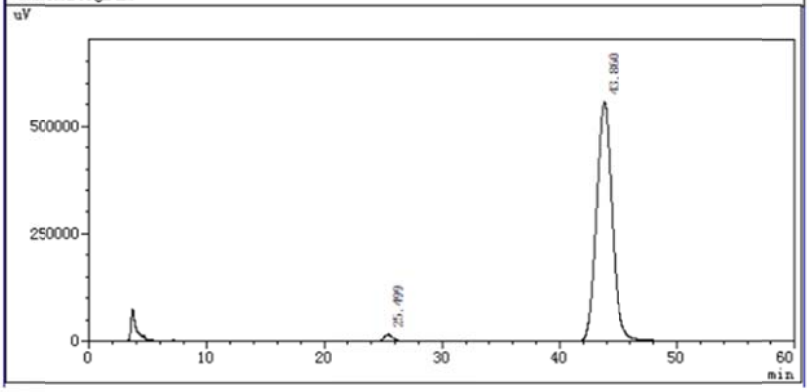
9ea

SHIMADZU LabSolutions **Analysis Report**

<Sample information>

Sample : wjr-f3-c shouxing rt
ID : wjr-f3-c shouxing rt
Data Name : wjr-f3-c shouxing rt01.lcd
Method Name : 7a.lcm
Vial : 1-1
Inj.Volume : 15 uL
Acquisition Date : 2015-8-13 16:17:45 Operator : System Administrator
Modified Date : 2015-8-13 22:37:23

<Chromatogram>



<Peak table>

Detector A Ch1 230nm

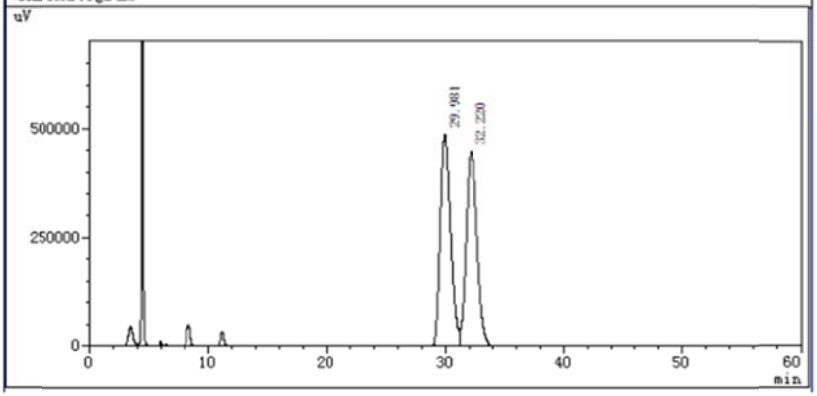
Peak	Ret Time [min]	Area [mAU*s]	Height [mAU]	Area %	Unit	Mark	Compound Name
1	25.499	909393	16103	1.696			
2	43.860	52705498	555597	98.304		SV	

SHIMADZU LabSolutions **Analysis Report**

<Sample information>

Sample	: wjr-f3-d xiaoxuan
ID	: wjr-f3-d xiaoxuan
Data Name	: wjr-f3-d xiaoxuan01.lcd
Method Name	: 7a.lcm
Vial	: 1-1
Inj.Volume	: 15 uL
Acquisition Date	: 2015-8-14 17:20:38 Operator : System Administrator
Modified Date	: 2015-11-13 14:02:13

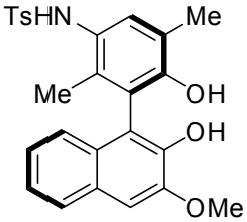
<Chromatogram>



<Peak table>

Detector A Ch1 230nm

Peak	Ret Time [min]	Area [mAU*s]	Height [mAU]	Area %	Unit	Mark	Compound Name
1	29.981	29995006	492212	49.619			
2	32.220	30455909	454072	50.381		SV	



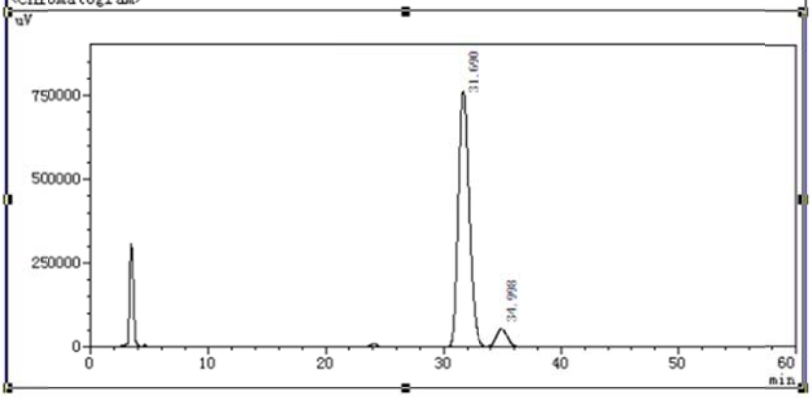
9fa

SHIMADZU LabSolutions **Analysis Report**

<Sample information>

Sample	: wjr-f3-d shouxing
ID	: wjr-f3-d shouxing
Data Name	: wjr-f3-d shouxing 01.lcd
Method Name	: 7a.lcm
Vial	: 1-1
Inj.Volume	: 20 uL
Acquisition Date	: 2015-9-17 10:41:57 Operator : System Administrator
Modified Date	: 2015-9-17 11:25:06

<Chromatogram>



<Peak table>

Detector A Ch1 230nm

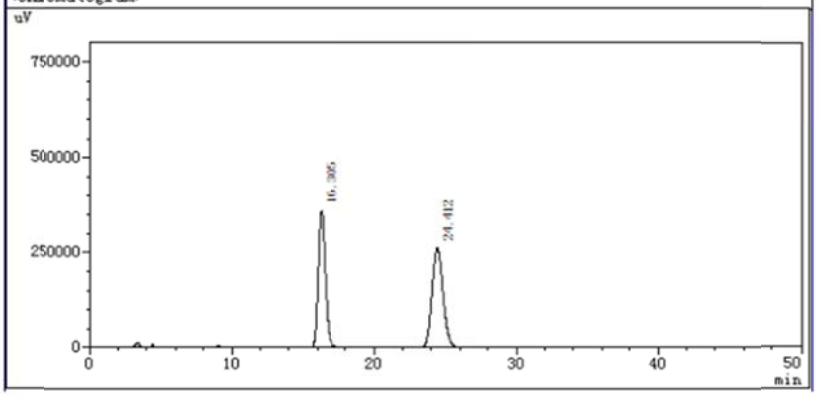
Peak	Ret Time [min]	Area [mAU*s]	Height [mAU]	Area %	Unit	Mark	Compound Name
1	31.690	49210218	763828	92.473		V	
2	34.998	4005322	55227	7.527		SV	

SHIMADZU LabSolutions **Analysis Report**

<Sample information>

Sample	: wjr-f3-J xiaoxuan		
ID	: wjr-f3-J xiaoxuan		
Data Name	: wjr-f3-J01 xiaoxuan01.lcd		
Method Name	: 7a.lcm		
Vial	: 1-1		
Inj.Volume	: 15 uL		
Acquisition Date	: 2015-9-11 18:35:09	Operator	: System Administrator
Modified Date	: 2015-11-13 14:20:38		

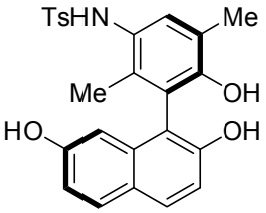
<Chromatogram>



<Peak table>

Detector A Ch1 230nm

Peak	Ret Time [min]	Area [mAU*s]	Height [mAU]	Area %	Unit	Mark	Compound Name
1	16.305	13889619	367158	50.011		M	
2	24.412	13883289	260167	49.989		M	



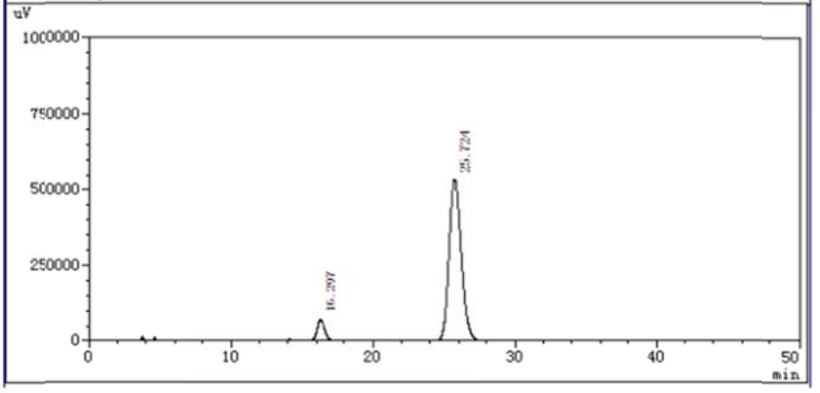
9ga

SHIMADZU LabSolutions **Analysis Report**

<Sample information>

Sample	: wjr-f3-j shouxing		
ID	: wjr-f3-j shouxing		
Data Name	: wjr-f3-j shouxing01.lcd		
Method Name	: 7a.lcm		
Vial	: 1-1		
Inj.Volume	: 3 uL		
Acquisition Date	: 2015-9-12 16:26:13	Operator	: System Administrator
Modified Date	: 2015-9-12 16:59:23		

<Chromatogram>



<Peak table>

Detector A Ch1 230nm

Peak	Ret Time [min]	Area [mAU*s]	Height [mAU]	Area %	Unit	Mark	Compound Name
1	16.297	2651285	70857	7.698		S	
2	25.724	31788824	535414	92.302		S	

SHIMADZU LabSolutions **Analysis Report**

<Sample information>

Sample	: wjz-f3-fxiaoxuan
ID	: wjz-f3-f xiaoxuan
Data Name	: wjz-f3-fxiaoxuan01.lcd
Method Name	: 7a.lcm
Vial	: 1-1
Inj.Volume	: 12 uL
Acquisition Date	: 2015-9-5 17:15:13 Operator : System Administrator
Modified Date	: 2015-11-13 14:07:18

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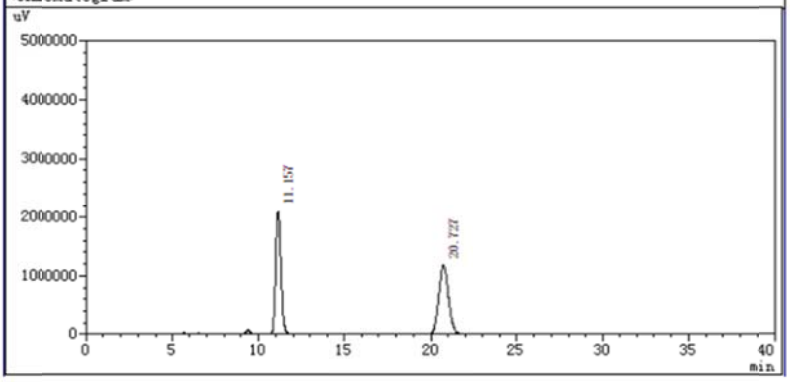
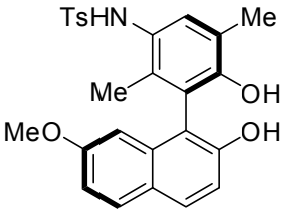


<Peak table>

Detector A Ch1 230nm

Peak	Ret Time [min]	Area [mAU*s]	Height [mAU]	Area %	Unit	Mark	Compound Name
1	11.157	45785530	2118290	49.909		M	
2	20.727	45952860	1172845	50.091		M	



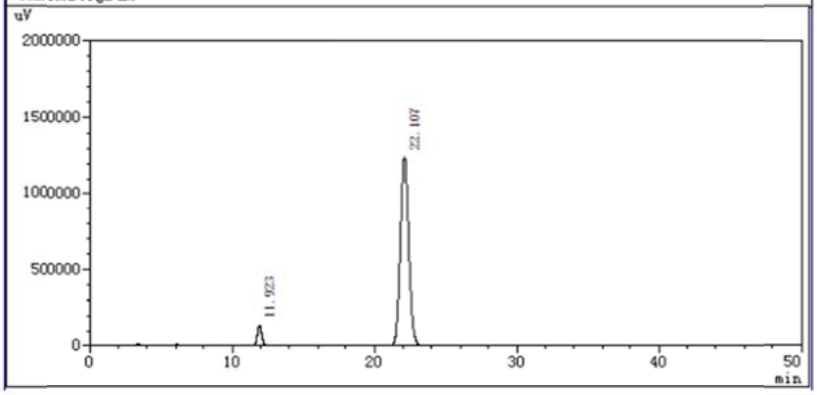
9ha

SHIMADZU LabSolutions **Analysis Report**

<Sample information>

Sample	: wjz-f3-f shouxing
ID	: wjz-f3-f shouxing
Data Name	: wjz-f3-f shouxing01.lcd
Method Name	: 7a.lcm
Vial	: 1-1
Inj.Volume	: 12 uL
Acquisition Date	: 2015-9-5 19:13:54 Operator : System Administrator
Modified Date	: 2015-10-11 17:17:17

<Chromatogram>



<Peak table>

Detector A Ch1 230nm

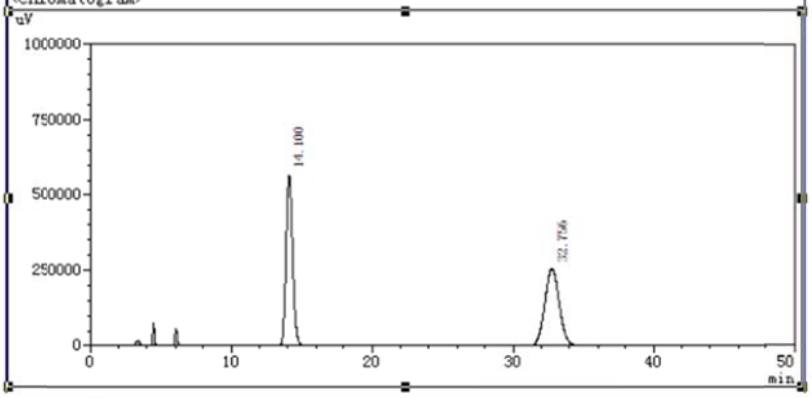
Peak	Ret Time [min]	Area [mAU*s]	Height [mAU]	Area %	Unit	Mark	Compound Name
1	11.923	2886610	135419	5.363		M	
2	22.107	50935775	1241832	94.637		S M	

SHIMADZU LabSolutions **Analysis Report**

<Sample information>

Sample	: wjr-f3-6ph xiaoxuan		
ID	: wjr-f3-6ph xiaoxuan		
Data Name	: wjr-f3-7ph xiaoxuan.lcd		
Method Name	: 7a.lcm		
Vial	: 1-1		
Inj.Volume	: 15 uL		
Acquisition Date	: 2015-9-26 17:03:10	Operator	: System Administrator
Modified Date	: 2015-9-26 19:28:27		

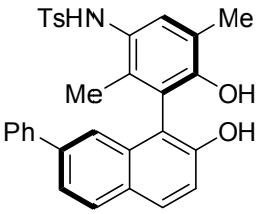
<Chromatogram>



<Peak table>

Detector A Ch1 230nm

Peak	Ret Time [min]	Area [mAU*s]	Height [mAU]	Area %	Unit	Mark	Compound Name
1	14.100	18281360	566517	50.033		S	
2	32.756	18257218	255521	49.967		S	



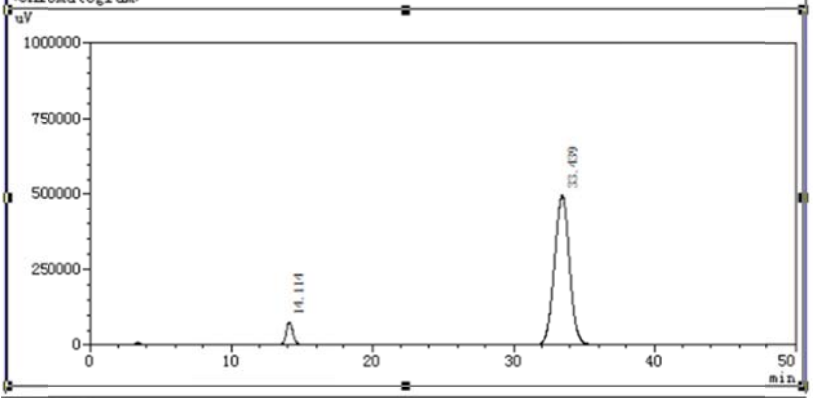
9ia

SHIMADZU LabSolutions **Analysis Report**

<Sample information>

Sample	: wjr-f3-6ph shouxing		
ID	: wjr-f3-6ph shouxing		
Data Name	: wjr-f3-7ph shouxing.lcd		
Method Name	: 7a.lcm		
Vial	: 1-1		
Inj.Volume	: 15 uL		
Acquisition Date	: 2015-9-26 19:47:51	Operator	: System Administrator
Modified Date	: 2015-9-27 00:03:04		

<Chromatogram>



<Peak table>

Detector A Ch1 230nm

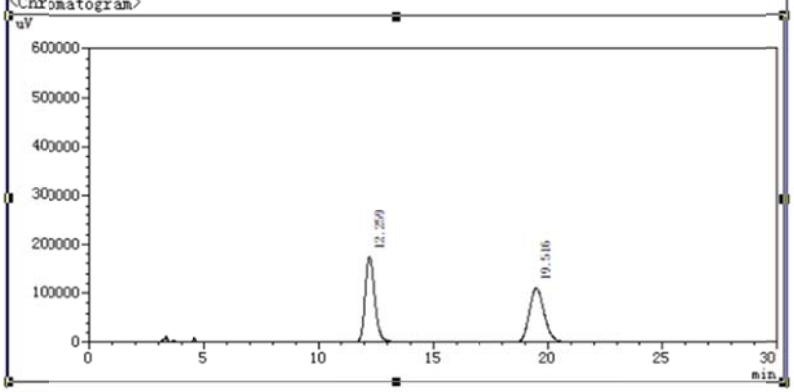
Peak	Ret Time [min]	Area [mAU*s]	Height [mAU]	Area %	Unit	Mark	Compound Name
1	14.114	2475467	75413	6.315		SV	
2	33.439	36723094	495563	93.685		SV	

SHIMADZU LabSolutions **Analysis Report**

<Sample information>

Sample	: wjz-f3-g xiaoxuan new
ID	: wjz-f3-g xiaoxuan new
Data Name	: wjz-f3-g xiaoxuan new.lcd
Method Name	: GY.lcm
Vial	: 1-1
Inj.Volume	: 15 uL
Acquisition Date	: 2015-11-8 13:21:15 Operator : System Administrator
Modified Date	: 2015-11-9 19:29:37

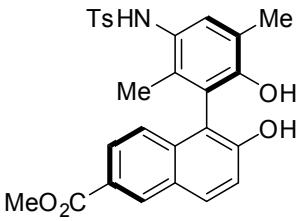
<Chromatogram>



<Peak table>

Detector A Ch1 230nm

Peak	Ret Time [min]	Area [mAU*s]	Height [mAU]	Area %	Unit	Mark	Compound Name
1	12.259	5115067	174602	50.152		S	
2	19.516	5084083	109924	49.848		S	



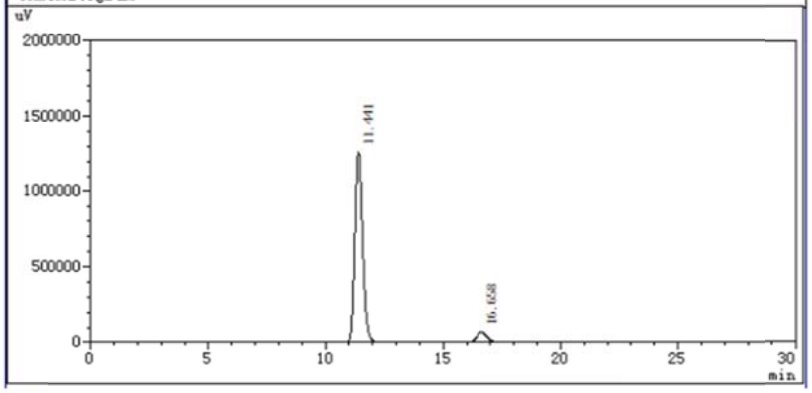
9ja

SHIMADZU LabSolutions **Analysis Report**

<Sample information>

Sample	: wjz-f3-g shouxing
ID	: wjz-f3-g shouxing
Data Name	: wjz-f3-g shouxing01.lcd
Method Name	: Ta.lcm
Vial	: 1-1
Inj.Volume	: 12 uL
Acquisition Date	: 2015-9-5 21:25:49 Operator : System Administrator
Modified Date	: 2015-9-5 22:16:33

<Chromatogram>



<Peak table>

Detector A Ch1 230nm

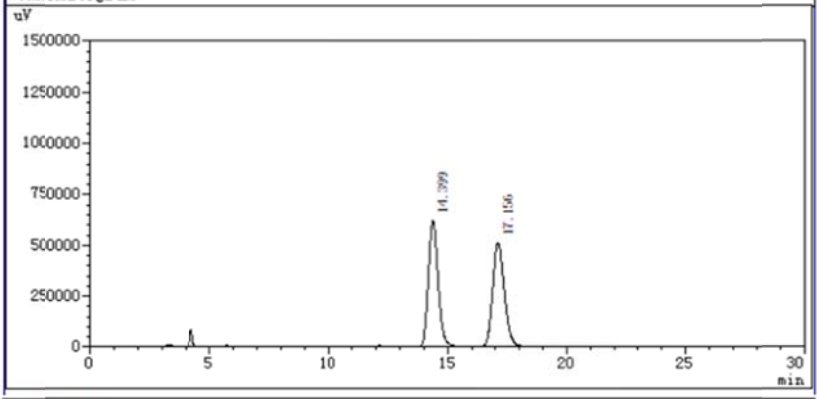
Peak	Ret Time [min]	Area [mAU*s]	Height [mAU]	Area %	Unit	Mark	Compound Name
1	11.441	28709721	1262966	92.666			
2	16.658	2272261	69070	7.334		S	

SHIMADZU LabSolutions **Analysis Report**

<Sample information>

Sample : wjr-f3-z xiaoxuan
ID : wjr-f3-z xiaoxuan
Data Name : wjr-f3-z xiaoxuan.lcd
Method Name : lc.lcd
Vial : 1-1
Inj.Volume : 15 uL
Acquisition Date : 2015-10-24 22:42:11 Operator : System Administrator
Modified Date : 2015-10-24 23:33:45

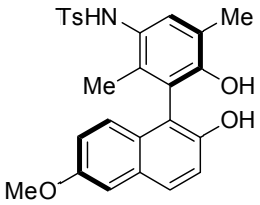
<Chromatogram>



<Peak table>

Detector A Ch1 230nm

Peak	Ret Time [min]	Area [mAU*s]	Height [mAU]	Area %	Unit	Mark	Compound Name
1	14.399	17712234	619873	50.189			
2	17.156	17579156	511669	49.811		SV	



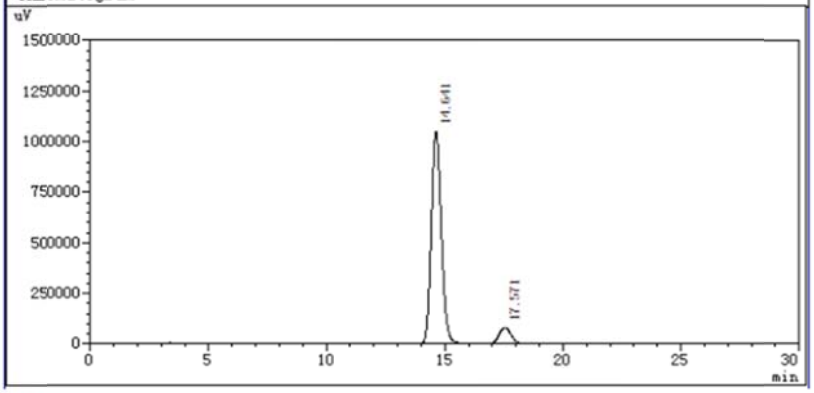
9ka

SHIMADZU LabSolutions **Analysis Report**

<Sample information>

Sample : wjr-f3-z shouxing
ID : wjr-f3-z shouxing
Data Name : wjr-f3-z shouxing.lcd
Method Name : lc.lcm
Vial : 1-1
Inj.Volume : 15 uL
Acquisition Date : 2015-10-25 11:25:10 Operator : System Administrator
Modified Date : 2015-10-25 12:14:56

<Chromatogram>



<Peak table>

Detector A Ch1 230nm

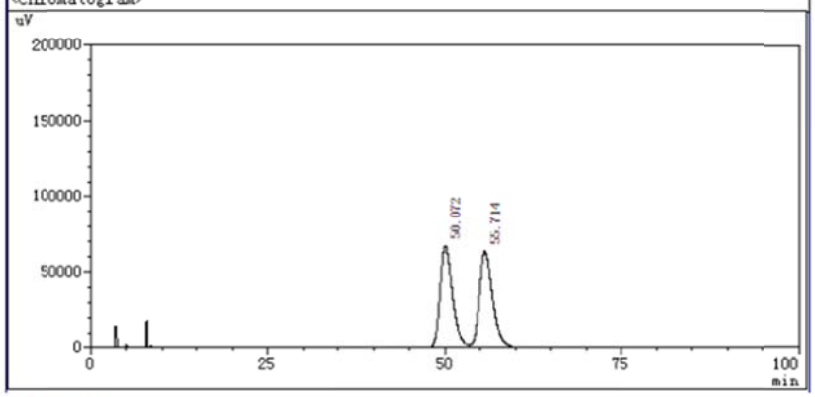
Peak	Ret Time [min]	Area [mAU*s]	Height [mAU]	Area %	Unit	Mark	Compound Name
1	14.641	30571939	1050288	91.233			
2	17.571	2937773	81707	8.767		SV	

SHIMADZU LabSolutions **Analysis Report**

<Sample information>

Sample : wjr-f3-k xiaoxuan IC
ID : wjr-f3-k xiaoxuan IC
Data Name : wjr-f3-k xiaoxuan IC04.lcd
Method Name : 7a.lcm
Vial : 1-1
Inj.Volume : 15 uL
Acquisition Date : 2015-9-16 14:11:10 Operator : System Administrator
Modified Date : 2015-9-17 00:20:01

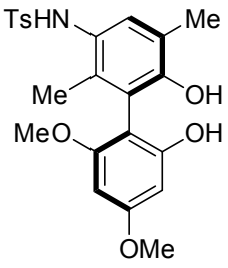
<Chromatogram>



<Peak table>

Detector A Ch1 230nm

Peak	Ret Time [min]	Area [mAU*s]	Height [mAU]	Area %	Unit	Mark	Compound Name
1	50.072	8237848	66976	49.121		V	
2	55.714	8532814	63768	50.879		V	



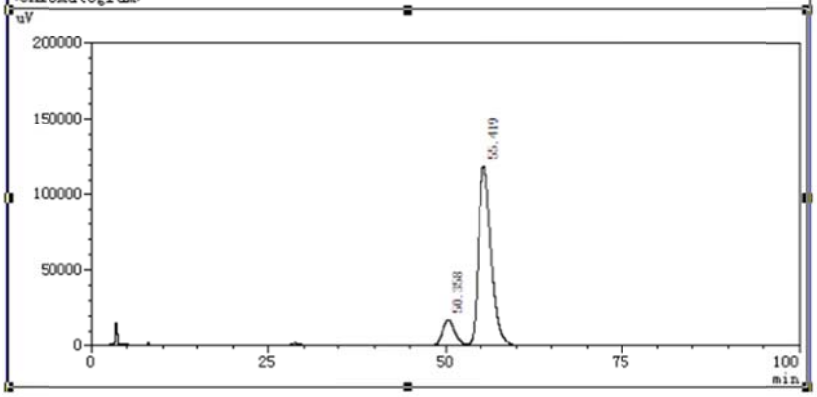
9la

SHIMADZU LabSolutions **Analysis Report**

<Sample information>

Sample : wjr-f3-k shouxing IC
ID : wjr-f3-k shouxing IC
Data Name : wjr-f3-k shouxing IC01.lcd
Method Name : 7a.lcm
Vial : 1-1
Inj.Volume : 15 uL
Acquisition Date : 2015-9-16 15:14:52 Operator : System Administrator
Modified Date : 2015-9-17 00:19:57

<Chromatogram>



<Peak table>

Detector A Ch1 230nm

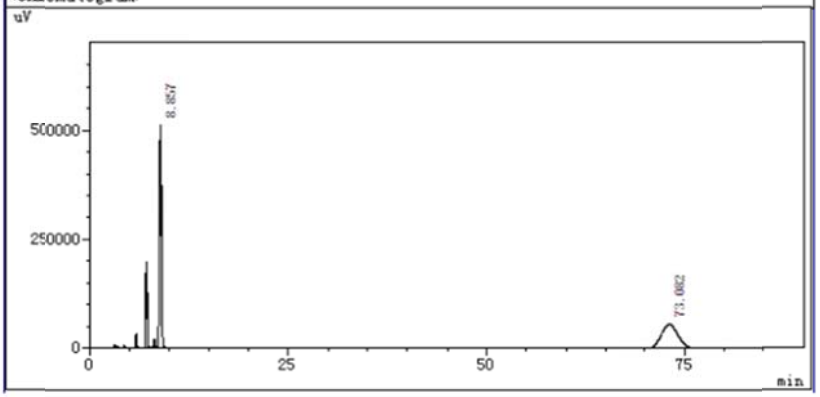
Peak	Ret Time [min]	Area [mAU*s]	Height [mAU]	Area %	Unit	Mark	Compound Name
1	50.358	2087904	17246	12.012		V	
2	55.419	15294360	119247	87.988		V	

SHIMADZU LabSolutions **Analysis Report**

<Sample information>

Sample	: wjz-f3-r xiaoxuan
ID	: wjz-f3-r xiaoxuan
Data Name	: wjz-f3-r xiaoxuan.lcd
Method Name	: fang.lcm
Vial	: 1-1
Inj.Volume	: 15 uL
Acquisition Date	: 2015-11-15 13:56:05 Operator : System Administrator
Modified Date	: 2015-11-15 15:16:49

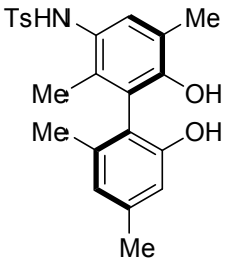
<Chromatogram>



<Peak table>

Detector A Ch1 230nm

Peak	Ret Time [min]	Area [mAU*s]	Height [mAU]	Area %	Unit	Mark	Compound Name
1	8.857	8523348	512845	49.772			
2	73.082	8601570	56320	50.228		SV	



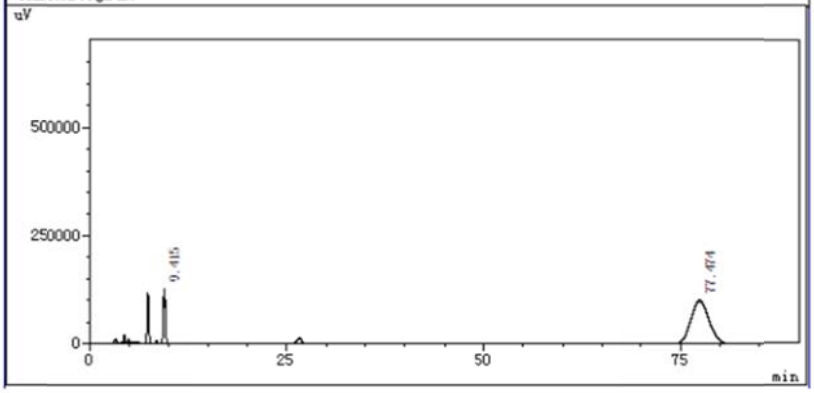
9ma

SHIMADZU LabSolutions **Analysis Report**

<Sample information>

Sample	: wjz-f3-r 1114
ID	: wjz-f3-r 1114
Data Name	: wjz-f3-r 1114 ad7-3.lcd
Method Name	: fang.lcm
Vial	: 1-1
Inj.Volume	: 15 uL
Acquisition Date	: 2015-11-14 20:05:10 Operator : System Administrator
Modified Date	: 2015-11-14 22:11:47

<Chromatogram>



<Peak table>

Detector A Ch1 230nm

Peak	Ret Time [min]	Area [mAU*s]	Height [mAU]	Area %	Unit	Mark	Compound Name
1	9.415	2349337	128185	12.590			
2	77.474	16311645	100176	87.410		SV	

SHIMADZU LabSolutions **Analysis Report**

<Sample information>

Sample	: wjr-f3-y xiaoxuan		
ID	: wjr-f3-y xiaoxuan		
Data Name	: wjr-f3-y xiaoxuan.lcd		
Method Name	: lc.lcm		
Vial	: 1-1		
Inj.Volume	: 15 uL		
Acquisition Date	: 2015-10-25 14:34:19	Operator	: System Administrator
Modified Date	: 2015-10-26 10:10:58		

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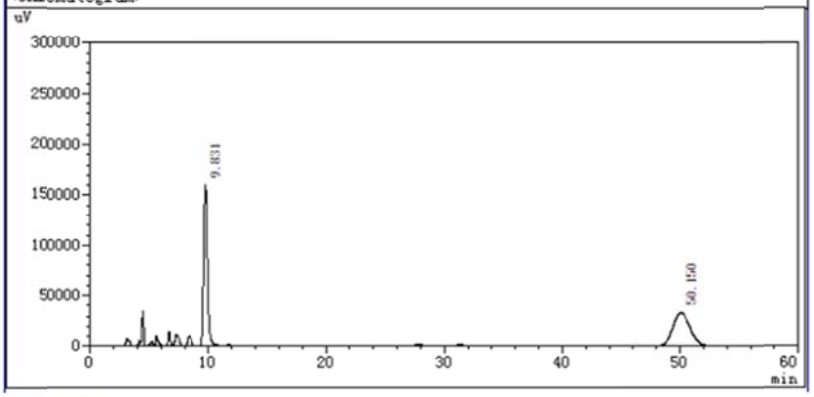
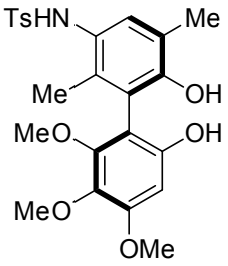


<Peak table>

Detector A Ch1 230nm

Peak	Ret Time [min]	Area [mAU*s]	Height [mAU]	Area %	Unit	Mark	Compound Name
1	9.831	3526164	159904	50.299			
2	50.150	3484296	33737	49.701		SV	



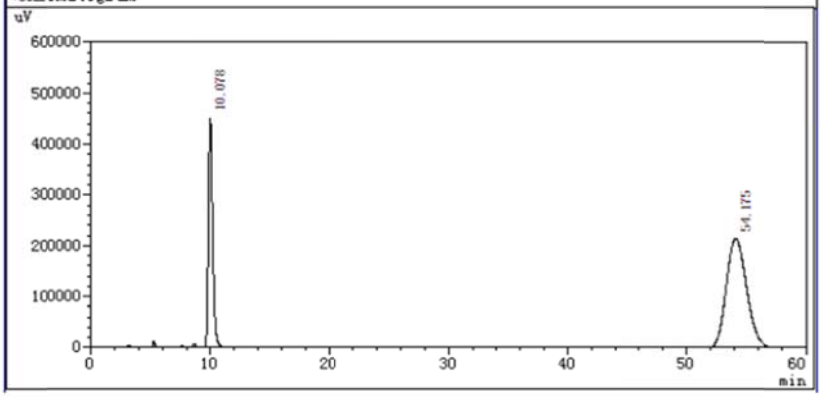
9na

SHIMADZU LabSolutions **Analysis Report**

<Sample information>

Sample	: wjr-f3-y 25		
ID	: wjr-f3-y 25		
Data Name	: wjr-f3-y 25.lcd		
Method Name	: 11.lcm		
Vial	: 1-1		
Inj.Volume	: 15 uL		
Acquisition Date	: 2016-1-26 10:56:37	Operator	: System Administrator
Modified Date	: 2016-1-26 13:21:02		

<Chromatogram>



<Peak table>

Detector A Ch1 230nm

Peak	Ret Time [min]	Area [mAU*s]	Height [mAU]	Area %	Unit	Mark	Compound Name
1	10.078	11087055	449342	30.228			
2	54.175	25590441	216102	69.772		S	

SHIMADZU LabSolutions **Analysis Report**

<Sample information>

Sample	: wjz-f3-h xiaoxuan chun ic		
ID	: wjz-f3-h xiaoxuan chun ic		
Data Name	: wjz-f3-h xiaoxuan chun ic6-4(2).lcd		
Method Name	: GY.lcm		
Vial	: 1-1		
Inj.Volume	: 15 uL		
Acquisition Date	: 2015-10-29 12:45:16	Operator	: System Administrator
Modified Date	: 2015-10-29 20:40:05		

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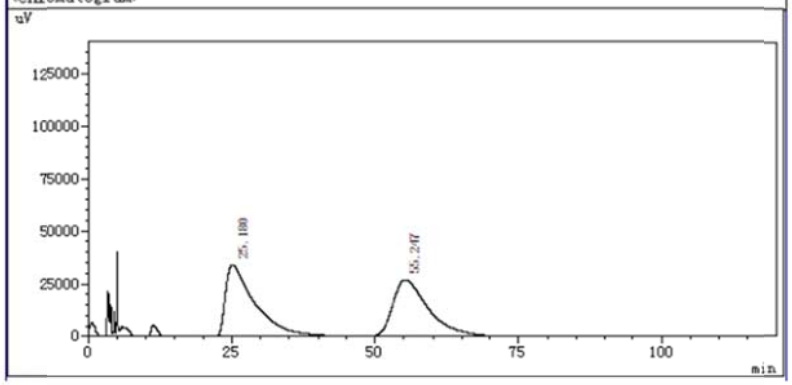
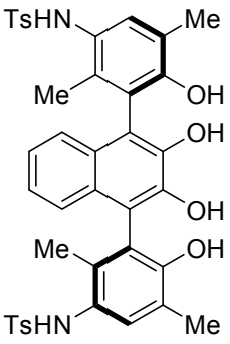


<Peak table>

Detector A Ch1 230nm

Peak	Ret Time [min]	Area [mAU*s]	Height [mAU]	Area %	Unit	Mark	Compound Name
1	25.180	12431027	34580	50.636		M	
2	55.247	12118816	26944	49.364		M	



9ea'

SHIMADZU LabSolutions **Analysis Report**

<Sample information>

Sample	: wjz-f3-h shouxing chun ic6-4		
ID	: wjz-f3-h shouxing chun ic6-4		
Data Name	: wjz-f3-h shouxing chun ic6-4.lcd		
Method Name	: GY.lcm		
Vial	: 1-1		
Inj.Volume	: 15 uL		
Acquisition Date	: 2015-11-10 09:11:39	Operator	: System Administrator
Modified Date	: 2015-11-10 12:03:11		

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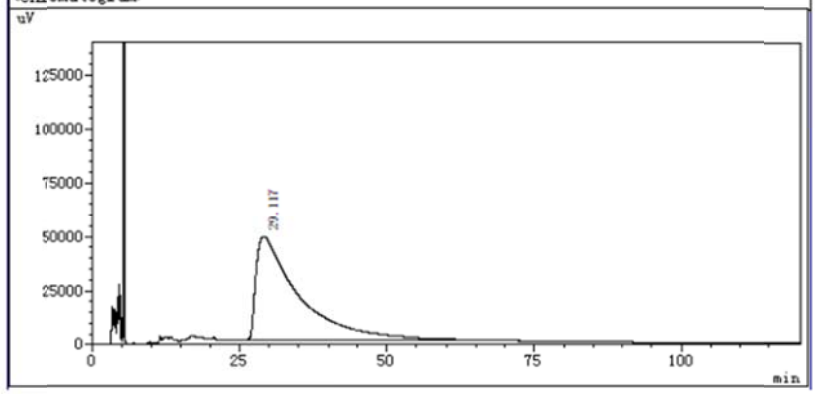


<Peak table>

Detector A Ch1 230nm

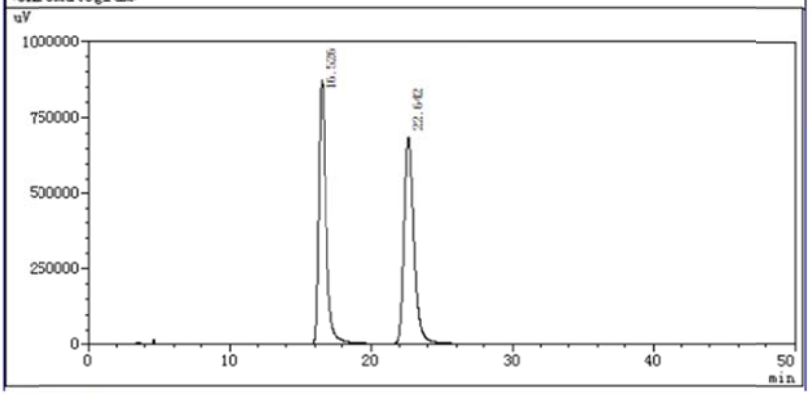
Peak	Ret Time [min]	Area [mAU*s]	Height [mAU]	Area %	Unit	Mark	Compound Name
1	29.117	24479780	47788	100.000		M	
		24479780	47788				

SHIMADZU LabSolutions **Analysis Report**

<Sample information>

Sample	: wjz-f3-q xiaoxuan		
ID	: wjz-f3-q xiaoxuan		
Data Name	: wjz-f3-q xiaoxuan01.lcd		
Method Name	: 7a.lcm		
Vial	: 1-1		
Inj Volume	: 15 uL		
Acquisition Date	: 2015-9-17 21:08:00	Operator	: System Administrator
Modified Date	: 2015-9-17 22:20:45		

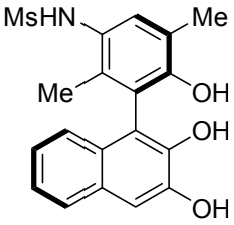
<Chromatogram>



<Peak table>

Detector A Ch1 230nm

Peak	Ret Time [min]	Area [mAU*s]	Height [mAU]	Area %	Unit	Mark	Compound Name
1	16.526	33526723	872956	49.589			
2	22.642	34082075	686436	50.411		SV	



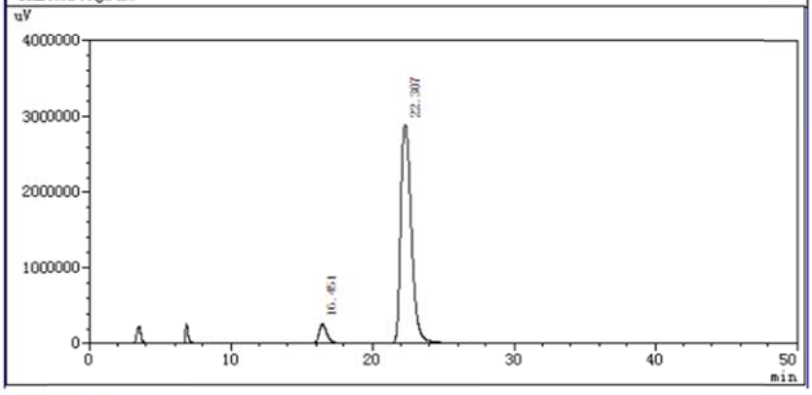
9eb

SHIMADZU LabSolutions **Analysis Report**

<Sample information>

Sample	: wjz-f3-q shouxing		
ID	: wjz-f3-q shouxing		
Data Name	: wjz-f3-q shouxing01.lcd		
Method Name	: 7a.lcm		
Vial	: 1-1		
Inj Volume	: 15 uL		
Acquisition Date	: 2015-9-17 22:20:40	Operator	: System Administrator
Modified Date	: 2015-9-17 22:54:53		

<Chromatogram>



<Peak table>

Detector A Ch1 230nm

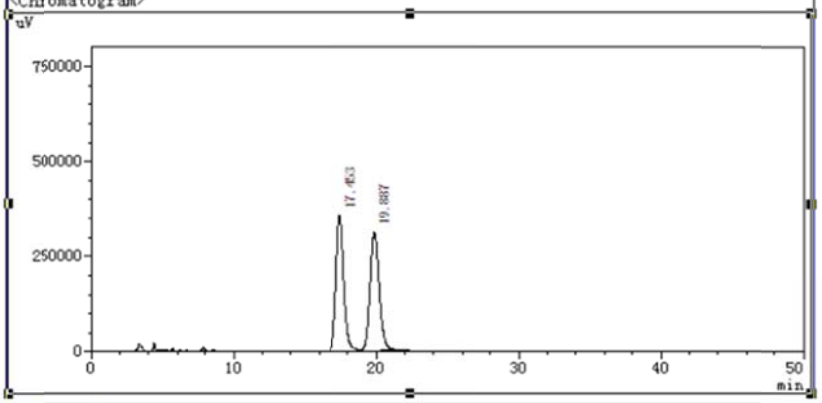
Peak	Ret Time [min]	Area [mAU*s]	Height [mAU]	Area %	Unit	Mark	Compound Name
1	16.451	10595043	259571	6.506			
2	22.307	152258287	2881612	93.494			

SHIMADZU LabSolutions **Analysis Report**

<Sample information>

Sample	: wjr-f3-n xiaoxuan		
ID	: wjr-f3-n xiaoxuan		
Data Name	: wjr-f3-n xiaoxuan01.lcd		
Method Name	: 7a.lcm		
Vial	: 1-1		
Inj.Volume	: 15 uL		
Acquisition Date	: 2015-9-17 11:21:49	Operator	: System Administrator
Modified Date	: 2015-11-13 14:12:46		

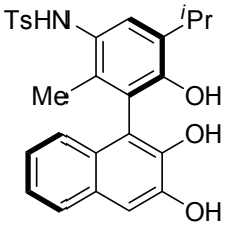
<Chromatogram>



<Peak table>

Detector A Ch1 230nm

Peak	Ret Time [min]	Area [mAU*s]	Height [mAU]	Area %	Unit	Mark	Compound Name
1	17.453	13718035	356532	50.074			
2	19.887	13677459	308525	49.926		V M	



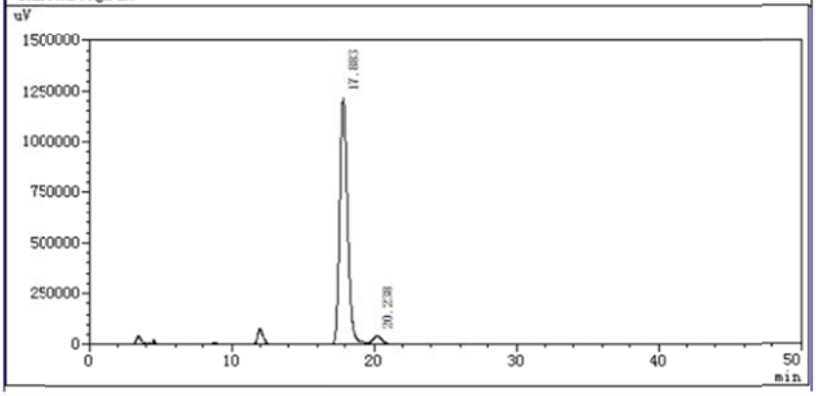
9ec

SHIMADZU LabSolutions **Analysis Report**

<Sample information>

Sample	: wjr-f3-n shouxing		
ID	: wjr-f3-n shouxing		
Data Name	: wjr-f3-n shouxing01.lcd		
Method Name	: 7a.lcm		
Vial	: 1-1		
Inj.Volume	: 15 uL		
Acquisition Date	: 2015-9-17 12:34:45	Operator	: System Administrator
Modified Date	: 2015-9-17 13:59:25		

<Chromatogram>



<Peak table>

Detector A Ch1 230nm

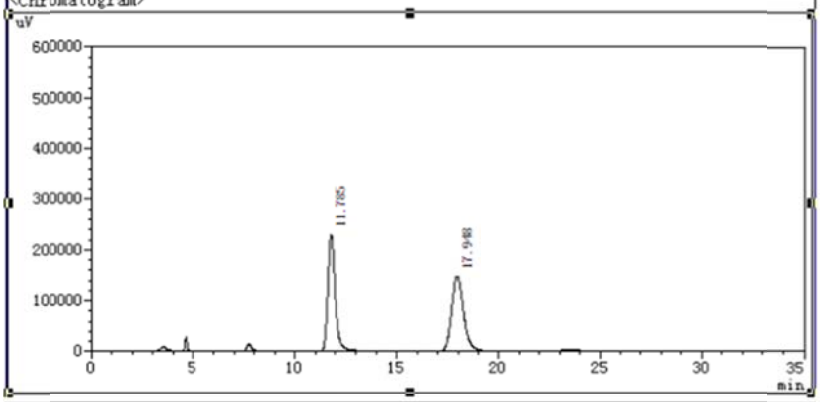
Peak	Ret Time [min]	Area [mAU*s]	Height [mAU]	Area %	Unit	Mark	Compound Name
1	17.883	46626596	1210784	95.506			
2	20.238	2194007	42535	4.494		V	

SHIMADZU LabSolutions **Analysis Report**

<Sample information>

Sample	: wjz-f3-o xiaoxuan		
ID	: wjz-f3-o xiaoxuan		
Data Name	: wjz-f3-o xiaoxuan01.lcd		
Method Name	: 7a.lcm		
Vial	: 1-1		
Inj.Volume	: 15 uL		
Acquisition Date	: 2015-9-17 14:02:02	Operator	: System Administrator
Modified Date	: 2015-9-17 14:36:55		

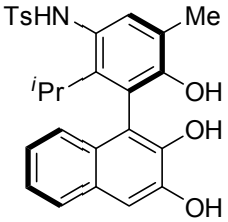
<Chromatogram>



<Peak table>

Detector A Ch1 230nm

Peak	Ret Time [min]	Area [mAU*s]	Height [mAU]	Area %	Unit	Mark	Compound Name
1	11.785	6084166	228171	49.546			
2	17.948	6195769	147302	50.454		S	



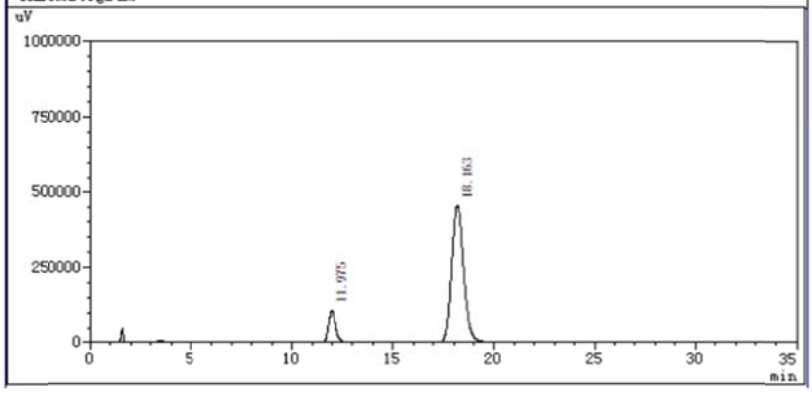
9ed

SHIMADZU LabSolutions **Analysis Report**

<Sample information>

Sample	: wjz-f3-o shouxing		
ID	: wjz-f3-o shouxing		
Data Name	: wjz-f3-o shouxing02.lcd		
Method Name	: 7a.lcm		
Vial	: 1-1		
Inj.Volume	: 15 uL		
Acquisition Date	: 2015-9-17 15:29:25	Operator	: System Administrator
Modified Date	: 2015-9-18 01:30:27		

<Chromatogram>



<Peak table>

Detector A Ch1 230nm

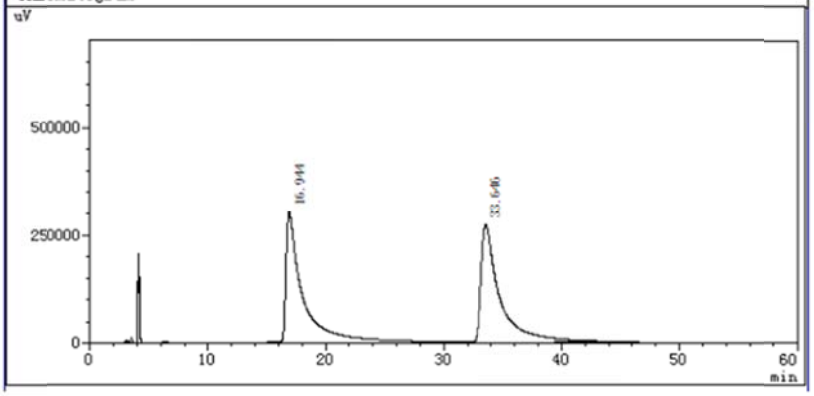
Peak	Ret Time [min]	Area [mAU*s]	Height [mAU]	Area %	Unit	Mark	Compound Name
1	11.975	2959823	107358	13.560		S	
2	18.163	18867009	457852	86.440			

SHIMADZU LabSolutions **Analysis Report**

<Sample information>

Sample	: wjr-f3-p ia xiaoxuan		
ID	: wjr-f3-p ia xiaoxuan		
Data Name	: wjr-f3-p ia xiaoxuan02.lcd		
Method Name	: 7a.lcm		
Vial	: 1-1		
Inj.Volume	: 20 uL		
Acquisition Date	: 2015-9-18 16:20:30	Operator	: System Administrator
Modified Date	: 2015-9-18 17:09:03		

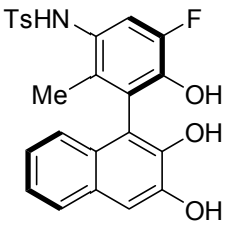
<Chromatogram>



<Peak table>

Detector A Ch1 230nm

Peak	Ret Time [min]	Area [mAU*s]	Height [mAU]	Area %	Unit	Mark	Compound Name
1	16.944	31249922	300070	50.350		SV	
2	33.646	30815848	270879	49.650		V	



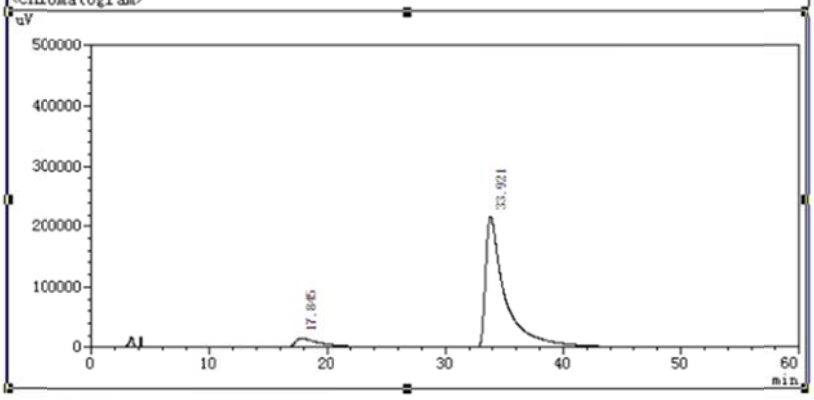
9ee

SHIMADZU LabSolutions **Analysis Report**

<Sample information>

Sample	: wjr-f3-p ia shouxing		
ID	: wjr-f3-p ia shouxing		
Data Name	: wjr-f3-p ia shouxing01.lcd		
Method Name	: 7a.lcm		
Vial	: 1-1		
Inj.Volume	: 20 uL		
Acquisition Date	: 2015-9-18 17:09:03	Operator	: System Administrator
Modified Date	: 2015-9-18 18:16:36		

<Chromatogram>



<Peak table>

Detector A Ch1 230nm

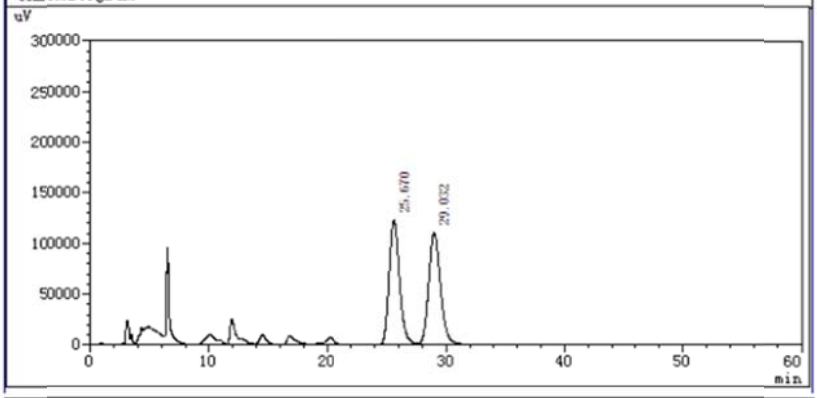
Peak	Ret Time [min]	Area [mAU*s]	Height [mAU]	Area %	Unit	Mark	Compound Name
1	17.845	3361594	16804	11.030		S	
2	33.921	27114589	218677	88.970		S	

SHIMADZU LabSolutions **Analysis Report**

<Sample information>

Sample : wjr-f3-1 ad xiaoxuan
ID : wjr-f3-1 ad xiaoxuan
Data Name : wjr-f3-1 ad xiaoxuan1113.lcd
Method Name : GY.lcm
Vial : 1-1
Inj.Volume : 15 uL
Acquisition Date : 2015-11-13 19:14:33 Operator : System Administrator
Modified Date : 2015-11-13 19:52:46

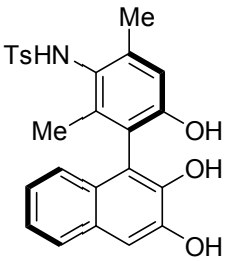
<Chromatogram>



<Peak table>

Detector A Ch1 230nm

Peak	Ret Time [min]	Area [mAU*s]	Height [mAU]	Area %	Unit	Mark	Compound Name
1	25.670	7396168	122616	49.603			
2	29.032	7514511	110133	50.397		V	



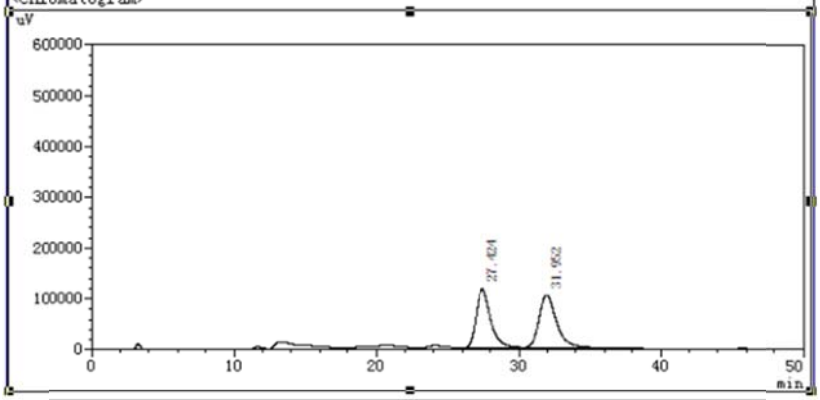
9ef

SHIMADZU LabSolutions **Analysis Report**

<Sample information>

Sample : wjr-f3-1 shouxing 1108
ID : wjr-f3-1 shouxing 1108
Data Name : wjr-f3-1 shouxing 1108.lcd
Method Name : GY.lcm
Vial : 1-1
Inj.Volume : 15 uL
Acquisition Date : 2015-11-8 20:36:59 Operator : System Administrator
Modified Date : 2015-11-8 22:01:53

<Chromatogram>



<Peak table>

Detector A Ch1 230nm

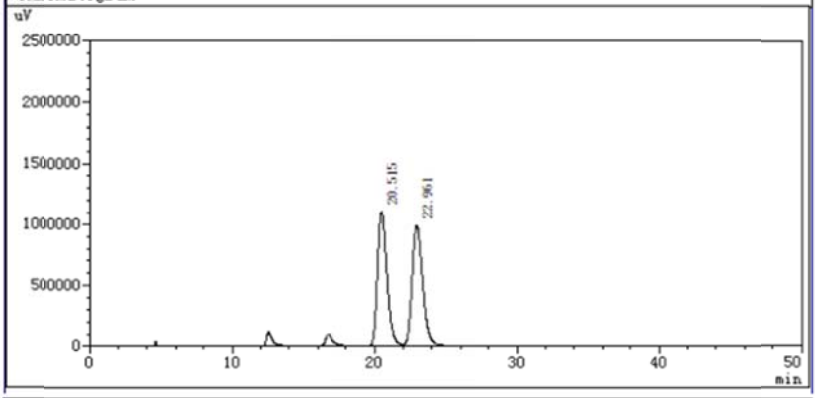
Peak	Ret Time [min]	Area [mAU*s]	Height [mAU]	Area %	Unit	Mark	Compound Name
1	27.424	8615226	114929	47.983			
2	31.952	9339574	103819	52.017		SV	

SHIMADZU LabSolutions **Analysis Report**

<Sample information>

Sample	: wjz-f3-m xiaoxuan		
ID	: wjz-f3-m xiaoxuan		
Data Name	: wjz-f3-m xiaoxuan01.lcd		
Method Name	: Ta.lcm		
Vial	: 1-1		
Inj.Volume	: 15 uL		
Acquisition Date	: 2015-9-17 16:27:08	Operator	: System Administrator
Modified Date	: 2015-11-13 14:10:55		

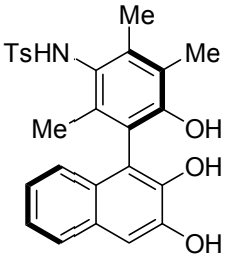
<Chromatogram>



<Peak table>

Detector A Ch1 230nm

Peak	Ret Time [min]	Area [mAU*s]	Height [mAU]	Area %	Unit	Mark	Compound Name
1	20.515	50549490	1102185	49.407			
2	22.961	51783322	992420	50.593		SV	



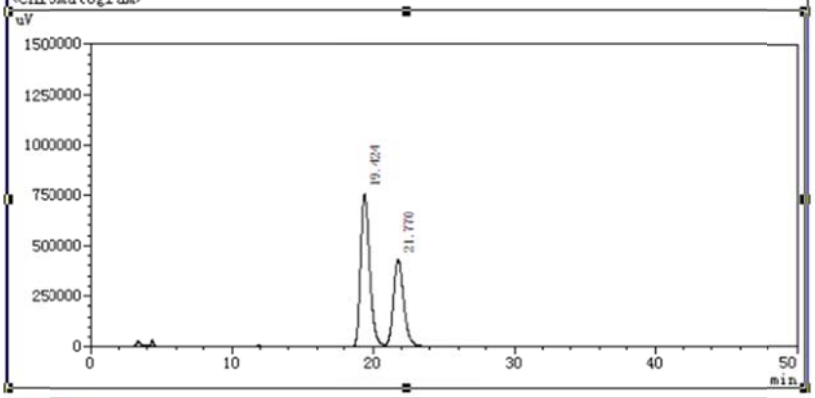
9eg

SHIMADZU LabSolutions **Analysis Report**

<Sample information>

Sample	: wjz-f3-m shouxing		
ID	: wjz-f3-m shouxing		
Data Name	: wjz-f3-m shouxing01.lcd		
Method Name	: Ta.lcm		
Vial	: 1-1		
Inj.Volume	: 15 uL		
Acquisition Date	: 2015-9-17 17:00:21	Operator	: System Administrator
Modified Date	: 2015-9-17 17:26:31		

<Chromatogram>



<Peak table>

Detector A Ch1 230nm

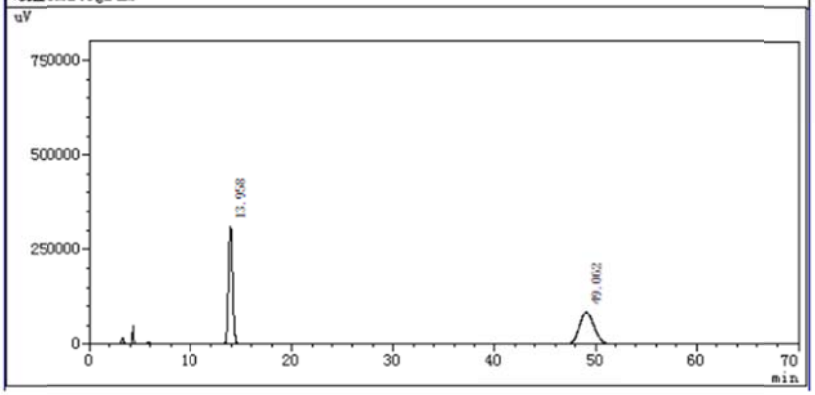
Peak	Ret Time [min]	Area [mAU*s]	Height [mAU]	Area %	Unit	Mark	Compound Name
1	19.424	33989712	757563	60.509		V	
2	21.770	22183232	431063	39.491		V	

SHIMADZU LabSolutions **Analysis Report**

<Sample information>

Sample : wjr-f3-t xiaoxuan
ID : wjr-f3-t xiaoxuan
Data Name : wjr-f3-t xiaoxuan.lcd
Method Name : GY.lcm
Vial : 1-1
Inj.Volume : 15 uL
Acquisition Date : 2015-10-27 16:16:34 Operator : System Administrator
Modified Date : 2015-11-13 14:22:05

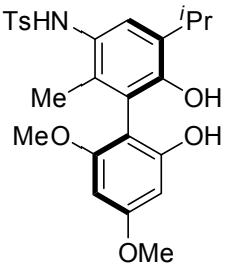
<Chromatogram>



<Peak table>

Detector A Ch1 230nm

Peak	Ret Time [min]	Area [mAU*s]	Height [mAU]	Area %	Unit	Mark	Compound Name
1	13.958	8608450	310491	49.931		M	
2	49.062	8632345	84628	50.069		SV	



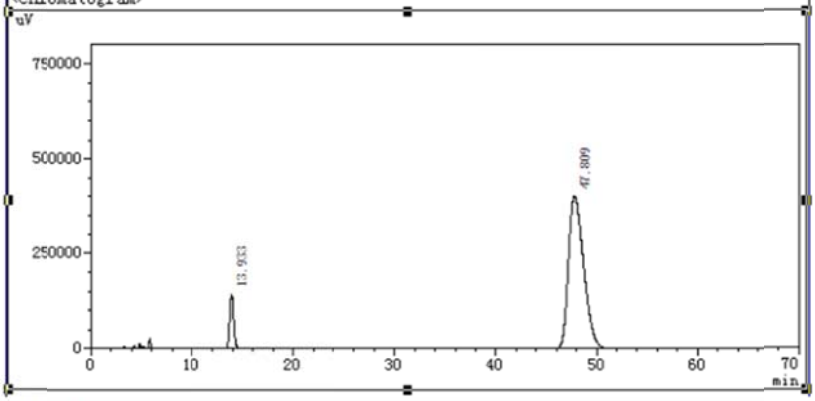
9lc

SHIMADZU LabSolutions **Analysis Report**

<Sample information>

Sample : wjr-f3-t shouxing
ID : wjr-f3-t shouxing
Data Name : wjr-f3-t shouxing.lcd
Method Name : GY.lcm
Vial : 1-1
Inj.Volume : 15 uL
Acquisition Date : 2015-10-27 17:43:40 Operator : System Administrator
Modified Date : 2015-10-27 19:42:55

<Chromatogram>



<Peak table>

Detector A Ch1 230nm

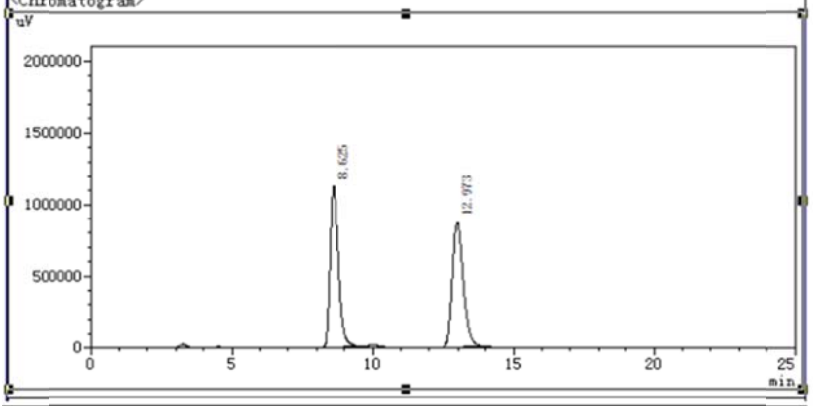
Peak	Ret Time [min]	Area [mAU*s]	Height [mAU]	Area %	Unit	Mark	Compound Name
1	13.933	3853958	140778	8.459			
2	47.809	41708258	403066	91.541		SV	

SHIMADZU LabSolutions **Analysis Report**

<Sample information>

Sample : wjr-f4-yixianji lvben xiaoxuan
ID : wjr-f4-yixianji lvben xiaoxuan
Data Name : wjr-f4-yixianji lvben xiaoxuan001.lcd
Method Name : 7a.lcm
Vial : 1-1
Inj.Volume : 15 uL
Acquisition Date : 2015-10-7 21:51:14 Operator : System Administrator
Modified Date : 2015-11-13 14:56:27

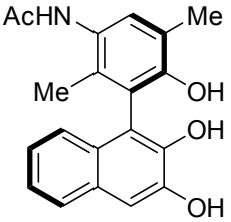
<Chromatogram>



<Peak table>

Detector A Ch1 230nm

Peak	Ret Time [min]	Area [mAU*s]	Height [mAU]	Area %	Unit	Mark	Compound Name
1	8.625	23677882	1126896	50.006		M	
2	12.973	23672325	865618	49.994		M	



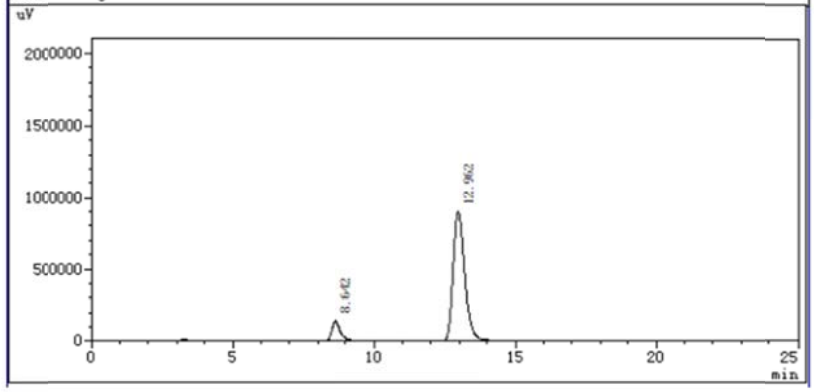
9eh

SHIMADZU LabSolutions **Analysis Report**

<Sample information>

Sample : wjr-f4-yixianji lvben shouxing
ID : wjr-f4-yixianji lvben shouxing
Data Name : wjr-f4-yixianji lvben shouxing.lcd
Method Name : 7a.lcm
Vial : 1-1
Inj.Volume : 15 uL
Acquisition Date : 2015-10-7 22:09:24 Operator : System Administrator
Modified Date : 2015-11-13 14:57:05

<Chromatogram>



<Peak table>

Detector A Ch1 230nm

Peak	Ret Time [min]	Area [mAU*s]	Height [mAU]	Area %	Unit	Mark	Compound Name
1	8.642	3570662	145182	12.000			
2	12.962	26184696	897833	88.000			

SHIMADZU LabSolutions **Analysis Report**

<Sample information>

Sample	: wjr-f3-v
ID	: wjr-f3-v
Data Name	: wjr-f4-v1.lcd
Method Name	: lc.lcd
Vial	: 1-1
Inj.Volume	: 15 uL
Acquisition Date	: 2015-10-24 17:22:39 Operator : System Administrator
Modified Date	: 2015-11-13 14:54:21

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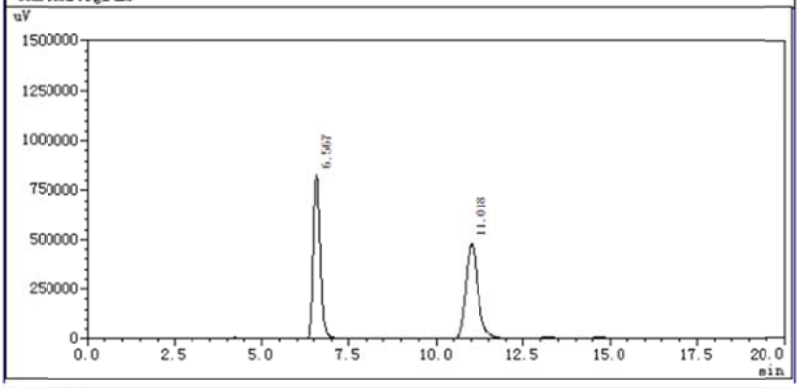
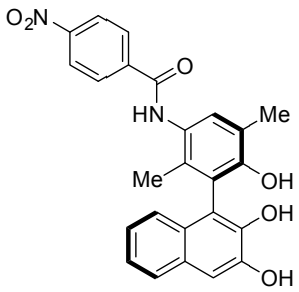


<Peak table>

Detector A Ch1 230nm

Peak	Ret Time [min]	Area [mAU*s]	Height [mAU]	Area %	Unit	Mark	Compound Name
1	6.567	11652234	833467	49.882			
2	11.018	11707166	477065	50.118		M	



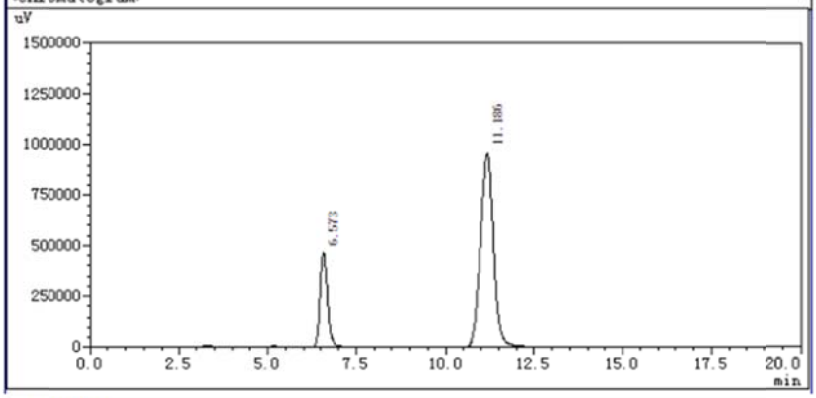
9ei

SHIMADZU LabSolutions **Analysis Report**

<Sample information>

Sample	: wjr-f3-v shouxing
ID	: wjr-f3-v shouxing
Data Name	: wjr-f3-v shouxing.lcd
Method Name	: lc.lcd
Vial	: 1-1
Inj.Volume	: 15 uL
Acquisition Date	: 2015-10-24 20:20:05 Operator : System Administrator
Modified Date	: 2015-10-24 20:42:41

<Chromatogram>



<Peak table>

Detector A Ch1 230nm

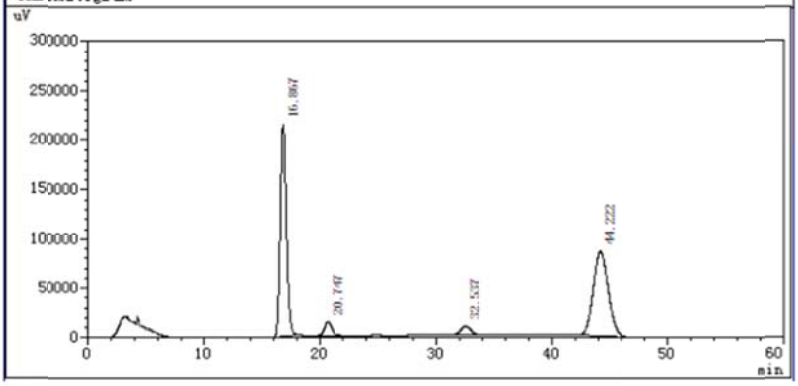
Peak	Ret Time [min]	Area [mAU*s]	Height [mAU]	Area %	Unit	Mark	Compound Name
1	6.573	6847927	464027	21.705			
2	11.186	24701965	954965	78.295			

SHIMADZU LabSolutions **Analysis Report**

<Sample information>

Sample	: wjz-f3-w chun xiaoxuan		
ID	: wjz-f3-w chun xiaoxuan		
Data Name	: wjz-f3-w chun xiaoxuan.lcd		
Method Name	: lc.lcm		
Vial	: 1-1		
Inj. Volume	: 15 uL		
Acquisition Date	: 2015-10-25 10:12:57	Operator	: System Administrator
Modified Date	: 2015-11-14 18:37:33		

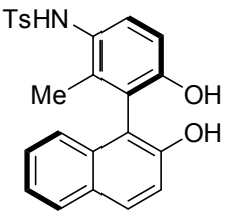
<Chromatogram>



<Peak table>

Detector A Ch1 230nm

Peak	Ret Time [min]	Area [mAU*s]	Height [mAU]	Area %	Unit	Mark	Compound Name
1	16.867	7700196	214099	46.852		M	
2	20.747	597240	13886	3.634			
3	32.537	564178	8663	3.433		S	
4	44.222	7573541	85046	46.081		V	



9aj

SHIMADZU LabSolutions **Analysis Report**

<Sample information>

Sample	: wjz-f3-w shouxing		
ID	: wjz-f3-w shouxing		
Data Name	: wjz-f3-w shouxing.lcd		
Method Name	: lc.lcm		
Vial	: 1-1		
Inj. Volume	: 15 uL		
Acquisition Date	: 2015-10-24 21:42:25	Operator	: System Administrator
Modified Date	: 2015-11-14 18:37:29		

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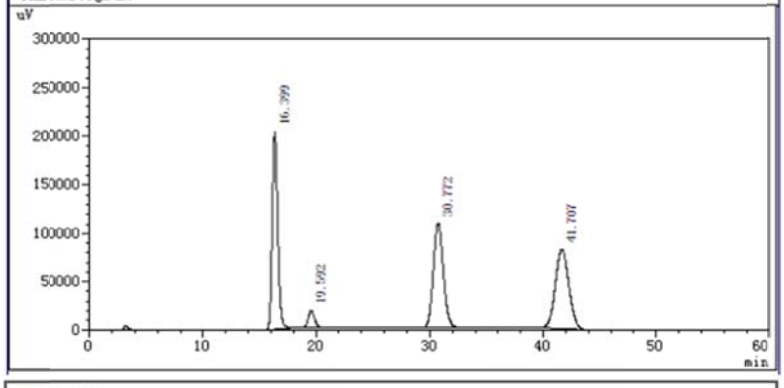


<Peak table>

Detector A Ch1 230nm

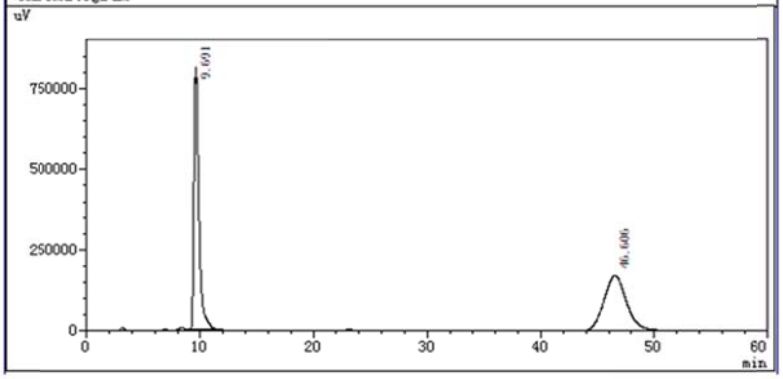
Peak	Ret Time [min]	Area [mAU*s]	Height [mAU]	Area %	Unit	Mark	Compound Name
1	16.399	6902582	203325	33.141			
2	19.592	615548	16500	2.955		M	
3	30.772	6507723	107811	31.245		M	
4	41.707	6802365	81909	32.659		V	

SHIMADZU LabSolutions **Analysis Report**

<Sample information>

Sample	: wjz-f5-c for anotherad7-3		
ID	: wjz-f5-c for anotherad7-3		
Data Name	: wjz-f5-c for anotherad7-03.lcd		
Method Name	: lc.lcm		
Vial	: 1-1		
Inj.Volume	: 15 uL		
Acquisition Date	: 2016-3-29 22:20:37	Operator	: System Administrator
Modified Date	: 2016-3-29 23:22:11		

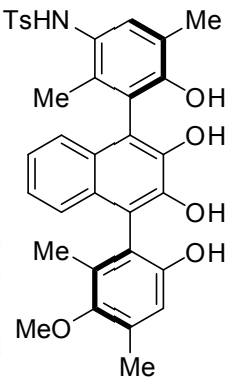
<Chromatogram>



<Peak table>

Detector A Ch1 230nm

Peak	Ret Time [min]	Area [mAU*s]	Height [mAU]	Area %	Unit	Mark	Compound Name
1	9.691	24856178	812108	49.938			
2	46.606	24918138	172003	50.062		M	



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SHIMADZU LabSolutions **Analysis Report**

<Sample information>

Sample	: wjz-f5-c for anotherad7-3shouxing		
ID	: wjz-f5-c for anotherad7-3shouxi		
Data Name	: wjz-f5-c for anotherad7-3shouxing01.lcd		
Method Name	: lc.lcm		
Vial	: 1-1		
Inj.Volume	: 15 uL		
Acquisition Date	: 2016-3-29 23:23:59	Operator	: System Administrator
Modified Date	: 2016-3-30 01:54:26		

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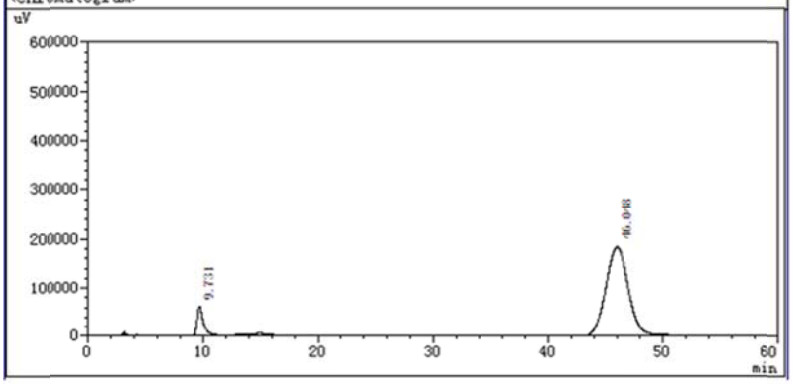

<Peak table>

Detector A Ch1 230nm

Peak	Ret Time [min]	Area [mAU*s]	Height [mAU]	Area %	Unit	Mark	Compound Name
1	9.731	2432141	61654	8.511			
2	46.048	26143220	184808	91.489			