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Supporting Information

Friedel-Crafts Alkylation of Arenes with Epoxides Promoted by Fluorinated Alcohols or Water

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Table of Contents

General information: All reactions were carried out in aerial atmosphere. Water was purchased from Watson's or from Milli-Q® Ultrapure Water Purification System. 2,2,2-trifluoroethanol (TFE) and 1,1,1,3,3,3-hexafluoroisopropanol (HFIP) were used as received from Acros®. Substrates were synthesized according to the known procedures. Flash column chromatography was performed using the indicated solvent system on Qingdao–Haiyang® silica gel (200–300 mesh). All of the compounds were characterized by ^{1}H NMR and ^{13}C NMR. ^{1}H NMR spectra were recorded at 300 MHz, 400 MHz or 600 MHz NMR machine; ^{13}C NMR spectra were recorded at 75 MHz, 100 MHz or 150 MHz NMR machine. Peaks recorded are relative to the internal standards: TMS (δ = 0.00) for ^{1}H NMR and $CDCl_3$ (δ = 77.00) for ^{13}C NMR spectra. Optical rotations were measured on a Perkin Elmer 341 MC polarimeter. High resolution mass spectral analyses (HRMS) were performed on high resolution ESI–FTICR mass spectrometer (Varian 7.0 T).

General procedure for the preparation of starting materials.

(2*R*,3*R*)-2-((3,5-Dimethoxyphenoxy)methyl)-3-phenyloxirane (Table 2, entry 1, starting material 1a)[1]

A solution of 3,5-dimethoxyphenol (0.32 mmol, 49 mg) in DMF (2 mL) was added via syringe to a suspension of sodium hydride (0.53 mmol, 13 mg) in DMF (2 mL) at 0°C under N_2. The mixture was stirred until gas evolution ceased, and a solution of enantiomerically pure (ee > 99%) [(2*R*,3*R*)-3-phenyloxiran-2-yl]methyl 4-methylbenzenesulfonate] (0.35 mmol, 106 mg) in DMF (2 mL) was added via syringe to the mixture. The solution was stirred for ca. 48 h at 0ºC. The reaction mixture was suspended in MeOH (2.5 mL) and brine (30 mL) and extracted with Et_2O (4 × 8 mL). The residual oil was purified by column chromatography on silica gel using hexane: EtOAc (95:5) as eluent to afford the product (78 mg, 85%) as colorless oil. $[\alpha]_D^{20}$ = +54.0 (*c* = 1.0 in $CHCl_3$), liter.: $[\alpha]_D^{27}$ = +52.6 (*c* = 1.2 in $CHCl_3$); ^{1}H NMR (600 MHz, $CDCl_3$): δ = 3.42 (br s, 1H), 3.80 (s, 6H), 3.94 (d, *J* = 2.1 Hz, 1H), 4.11 (dd, *J* = 5.4, 10.8 Hz, 1H), 4.32 (dd, *J* = 2.4, 10.8 Hz, 1H), 6.16 (br s, 1H), 6.18 (br s, 2H), 7.33–7.39 (m, 5H); ^{13}C NMR (150 MHz, $CDCl_3$): δ = 55.2, 56.2, 60.0, 67.9, 93.4, 93.5, 125.6, 128.3, 128.4, 136.4, 160.2, 161.5; HRMS (ESI): *m/z* calcd for $C_{17}H_{19}O_4$: 287.1283; found: 287.1287 $[M+H]^+$.

Characterization data of aryloxymethyloxiranes in table 2

(2*R*,3*R*)-2-[(4-Methoxyphenoxy)methyl]-3-phenyloxirane (Table 2, entry 2, starting material 1b) [1]

The general procedure was applied to 4-methoxyphenol to afford the product (70 mg, 85%) as a white solid: m.p. = 100–101 °C; $[\alpha]_D^{20}$ = +47.5 (*c* = 1.0 in $CHCl_3$), liter.: $[\alpha]_D^{25}$ = +48.3 (*c* = 1.0 in $CHCl_3$); ^{1}H NMR (600 MHz, $CDCl_3$): δ = 3.35–3.39 (m, 1H), 3.76 (s, 3H), 3.88–3.90 (m, 1H), 4.08 (dd, *J* = 5.1, 11.0 Hz, 1H), 4.26 (dd, *J* = 3.1, 11.0 Hz, 1H), 6.81–6.91 (m, 4H), 7.26–7.38 (m, 5H); ^{13}C NMR (150 MHz, $CDCl_3$): δ = 55.7, 56.4, 60.4, 68.7, 114.7, 115.8, 125.7, 128.4, 128.6, 136.6, 152.7, 154.3; HRMS (ESI): *m/z* calcd for $C_{16}H_{16}NaO_3$: 279.0997; found: 279.0994 $[M+Na]^+$.

(2R,3R)-2-[(4-tert-butylphenoxy)methyl]-3-phenyloxirane (Table 2, entry 3, starting material 1c) [1]

The general procedure was applied to 4-tert-butylphenol to afford the product (72 mg, 80%) as a white solid: m.p. = 126–127 ^{o}C; $[\alpha]_D^{20}$ = +53.3 (*c* = 1.0 in $CHCl_3$), liter.: $[\alpha]_D^{27}$ = +54.2 (*c* = 0.8 in $CHCl_3$); ^{1}H NMR (600 MHz, $CDCl_3$): δ = 1.30 (s, 9H), 3.39—3.41 (m, 1H), 3.91 (d, *J* = 2.4 Hz, 1H), 4.14 (dd, *J* = 5.1, 11.1 Hz, 1H), 4.31 (dd, *J* = 3.3, 11.1 Hz, 1H), 6.88–6.90 (m, 2H) 7.29–7.37 (m, 7H); ^{13}C NMR (150 MHz, $CDCl_3$): δ = 31.5, 34.1, 56.4, 60.3, 68.0, 114.2, 125.7, 126.3, 128.4, 128.5, 136.6, 144.0, 156.2; HRMS (ESI): *m/z* calcd for $C_{19}H_{22}NaO_2$: 305.1517; found: 305.1520 $[M+Na]^+$.

(2R,3R)-2-(phenoxymethyl)-3-phenyloxirane (Table 2, entry 4, starting material 1d) [1]

The general procedure was applied to phenol to afford the product (58 mg, 80%) as a white solid: m.p. = 100–101 ^{o}C; $[\alpha]_D^{20}$ = +44.5 (*c* = 1.0 in $CHCl_3$), liter.: $[\alpha]_D^{24}$ = +45.6 (*c* = 1.0 in $CHCl_3$); ^{1}H NMR (400 MHz, $CDCl_3$): δ = 3.39–3.42 (m, 1H), 3.91 (d, *J* = 2.1 Hz, 1H), 4.14 (dd, *J* = 5.0, 11.1 Hz, 1H), 4.32 (dd, *J* = 3.3, 11.1 Hz, 1H), 6.94–7.0 (m, 3H), 7.27–7.38 (m, 7H); ^{13}C NMR (150 MHz, $CDCl_3$): δ = 56.4, 60.3, 67.9, 114.7, 121.3, 125.7, 128.4, 128.6, 129.6, 136.5, 158.5; HRMS (ESI): *m/z* calcd for $C_{15}H_{14}NaO_2$:249.0891; found: 249.0887 $[M+Na]^+$.

(2R,3R)-2-((4-bromophenoxy)methyl)-3-phenyloxirane (Table 2, entry 5, starting material 1e)

The general procedure was applied to 4-bromophenol to afford the product (86 mg, 89%) as a white solid: m.p. = 117–118 ^{o}C; $[\alpha]_D^{20}$ = +46.0 (*c* = 1.0 in $CHCl_3$); ^{1}H NMR (600 MHz, $CDCl_3$): δ = 3.39–3.41 (m, 1H), 3.92 (d, *J* = 2.4Hz, 1H), 4.10 (dd, *J* = 5.4, 10.8 Hz, 1H), 4.32 (dd, *J* = 3.0, 10.8 Hz, 1H), 6.83–6.86 (m, 2H), 7.34–7.40 (m, 5H); ^{13}C NMR (150 MHz, $CDCl_3$): δ = 56.2, 60.0, 68.1, 113.5, 116.5, 125.7, 128.5, 128.6, 132.3, 136.3, 157.6; HRMS (ESI): *m/z* calcd for $C_{15}H_{13}BrNaO_2$: 326.9997; found: 326.9991 $[M+Na]^+$.

(2R,3R)-2-((4-iodophenoxy)methyl)-3-phenyloxirane (Table 2, entry 6, starting material 1f) [1]

The general procedure was applied to 4-iodophenol to afford the product (84 mg, 75%) as a white solid: m.p. = 95–96 ^{o}C; $[\alpha]_D^{20}$ = +42.0 (*c* = 1.0 in $CHCl_3$), liter.: $[\alpha]_D^{27}$ = +41.1 (*c* = 1.1 in $CHCl_3$); ^{1}H NMR (600 MHz, $CDCl_3$): δ = 3.39 (br s, 1H), 3.91 (br s, 1H), 4.07 (dd, *J* = 4.8, 10.8 Hz, 1H), 4.31 (dd, *J* = 1.8, 10.8 Hz, 1H), 6.74 (d, *J* = 8.4 Hz, 2H), 7.30–7.37 (m, 5H) 7.58 (d, *J* = 3.6 Hz, 2H); ^{13}C NMR (150 MHz, $CDCl_3$): δ = 56.3, 60.0, 68.1, 83.5, 117.1, 125.7, 128.5, 128.6, 136.3, 138.3, 158.3; HRMS (ESI): *m/z* calcd for $C_{15}H_{13}INaO_2$: 374.9858; found: 374.9852 $[M+Na]^+$.

(2R,3R)-2-[(naphthalen-2-yloxy)methyl]-3-phenyloxirane (Table 2, entry 7, starting material 1g) [2]

The general procedure was applied naphthalene-2-ol to afford the product (71 mg, 80%) as a white solid: m.p. = 108–109 ^{o}C; $[\alpha]_D^{20}$ = +26.7 (c = 1.0 in $CHCl_3$); ^{1}H NMR (400 MHz, $CDCl_3$): δ = 3.48 (m, 1H), 3.99 (d, *J* = 3.0 Hz, 1H), 4.25 (dd, *J* = 7.8, 16.8 Hz, 1H), 4.46 (dd, *J* = 4.5, 16.5 Hz, 1H), 7.18–7.23 (m, 6H), 7.44–7.47 (m, 1H), 7.45 (m, 1H), 7.7–7.80(m, 3H);

^{13}C NMR (150 MHz, $CDCl_3$): δ = 56.4, 60.2, 67.9, 107.0, 118.8, 123.9, 125.7, 126.5, 126.8, 127.7, 128.4, 128.6, 129.2, 129.6, 134.4, 136.5, 156.4; HRMS (ESI): *m/z* calcd for $C_{19}H_{17}O_2$: 277.1229; found: 277.1233 $[M+H]^+$.

(2R,3R)-2-[(6-bromonaphthalen-2-yloxy)methyl]-3-phenyloxirane (Table 2, entry 8, starting material 1h)

The general procedure was applied to 6-bromonaphthalen-2-ol to afford the product (101 mg, 89%) as a white solid: m.p. = 123–124 ^{o}C; $[\alpha]_D^{20}$ = +31.1 (*c* = 1.0 in $CHCl_3$); ^{1}H NMR (600 MHz, $CDCl_3$): δ = 3.49 (m, 1H), 3.99 (br s, 1H), 4.26 (dd, *J* = 4.8, 11.1 Hz), 4.47 (dd, *J* = 2.4, 10.8 Hz, 1H), 7.17 (s, 1H), 7.25 (dd, *J* = 1.8, 8.7 Hz, 1H), 7.34–7.41 (m, 5H), 7.53 (d, *J* = 9.0 Hz, 1H), 7.62 (d, *J* = 8.4 Hz, 1H), 7.69 (d, *J* = 9.0 Hz, 1H), 7.95 (s, 1H); ^{13}C NMR (150 MHz, $CDCl_3$): δ = 56.4, 60.1. 68.1, 107.1, 117.4, 119.8, 125.7, 128.4, 128.5, 128.6, 128.7, 129.8, 129.7, 130.3, 132.9, 136.4, 156.7; HRMS (ESI): *m/z* calcd for $C_{19}H_{16}BrO_2$: 355.0334; found: 355.0326 $[M+H]^+$.

2-[(3,5-dimethoxyphenoxy)phenylmethyl]oxirane (Table 2, entry 9, starting material 1i) [3]

^{1}H NMR (400MHz, $CDCl_3$): δ = 2.79–2.84 (m, 2H), 3.31-3.34 (m, 1H), 3.70 (s, 6H), 5.10 (d, *J* = 6.0 Hz), 6.10 (d, *J* = 6.0 Hz), 6.03 (t, *J* = 3.0 Hz), 6.06 (d, *J* = 3.6 Hz), 7.30–7.42 (m, 5H); ^{13}C NMR (150 MHz, $CDCl_3$): δ = 45.0, 54.3, 55.2, 79.1, 93.5, 94.9, 126.7, 128.4, 128.7, 137.4, 159.4, 161.3; HRMS (ESI): *m/z* calcd for $C_{17}H_{19}O_4$: 287.1283; found: 287.1276 $[M+H]^+$.

3-[(3,5-dimethoxyphenoxy) methyl]-2,2-dimethyloxirane (Table 2, entry 10, starting material 1j)

The general procedure which using racemic (3,3-dimethyloxiran-2-yl)methyl 4-methylbenzenesulfonate [4, 5] was applied to 3,5-dimethoxyphenol afford the product (65 mg, 85%) as a white solid: ^{1}H NMR (400MHz, $CDCl_3$): δ = 1.35 (s, 3H), 1.38 (s, 3H), 3.12 (t, *J* = 1.8 Hz, 1H), 3.76 (s, 6H), 4.00–4.04 (m, 1H), 4.07–4.11 (m, 1H), 6.10–6.12 (m, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ = 18.9, 24.6, 55.3, 58.2, 61.1, 67.0, 93.3, 93.5, 160.4, 161.5; HRMS (ESI): *m/z* calcd for $C_{13}H_{19}O_4$: 239.1283; found: 239.1281 $[M+H]^+$.

General procedure for the preparation of product in hexafluoroisopropanol.

(3S,4R)-5,7-dimethoxy-4-phenylchroman-3-ol (Table 2, entry 1, product 2a) [1]

The starting material of (2*R*,3*R*)-2-((3,5-dimethoxyphenoxy)methyl)-3-phenyloxirane **1a** (43 mg, 0.15 mmol) was dissolved in 5mL of hexafluoroisopropanol and was refluxed under ambient pressure, The solvent of reaction mixture was removed under reduced pressure. The residue was underwent column chromatography on silica gel using hexane: EtOAc (80:20) as eluent to afford **2a** (43 mg, >99%) as a colorless oil. $[\alpha]_D^{20}$ = +53.0 (c = 1.0 in $CHCl_3$), liter.: $[\alpha]_D^{27}$ = +52.3 (c = 1.1 in $CHCl_3$); ^{1}H NMR (600 MHz, $CDCl_3$): δ = 2.26 (br s, 1H), 3.47 (s, 3H), 3.70 (s, 3H), 3.85–3.93 (m, 3H), 4.15 (br s, 1H), 6.00 (d, *J* = 1.2 Hz, 1H), 6.07 (d, *J* = 1.2 Hz, 1H), 7.00 (d, *J* = 7.2 Hz, 2H), 7.20 (t, *J* = 7.2 Hz, 1H), 7.17 (t, *J* = 7.2 Hz, 2H), ^{13}C NMR (150 MHz, $CDCl_3$): δ = 43.4, 55.2, 55.4, 65.3, 69.3 , 92.5, 93.0, 101.9, 126.3, 128.0, 128.3, 143.5, 155.1, 159.7, 160.3; HRMS (ESI): *m/z* calcd for $C_{17}H_{19}O_4$: 287.1283; found: 287.1287 $[M+H]^+$.

(3S,4R)-6-methoxy-4-phenylchroman-3-ol (Table 2, entry 2, product 2b) [1]

The general procedure was applied to **1b** to afford **2b** (37 mg, 96%) as a white solid: $[\alpha]_D^{20}$ = +3.5 (c = 1.0 in $CHCl_3$), liter.: $[\alpha]_D^{28}$ = +3.4 (c = 1.0 in $CHCl_3$); ^{1}H NMR (600 MHz, $CDCl_3$): δ = 2.15 (br s, 1H), 3.65 (s, 3H), 3.97 (m, 1H), 4.07–4.10 (m, 2H), 4.15 (dd, *J* = 1.2, 10.2 Hz, 1H), 6.41 (d, *J* = 2.4 Hz, 1H), 6.78 (dd, *J* = 3.0, 8.7 Hz, 1H), 6.88 (d, *J* = 9.0 Hz, 1H), 7.16–7.17 (m, 2H), 7.26–7.29 (m, 1H), 7.33–7.36 (m, 2H); ^{13}C NMR (150 MHz, $CDCl_3$): δ = 50.4, 55.6, 66.6, 69.9, 114.7, 115.4, 117.3, 122.6, 127.1, 128.7, 129.1, 142.5, 148.2, 154.1; HRMS (ESI): *m/z* calcd for $C_{16}H_{16}NaO_3$: 279.0997; found: 279.0997 $[M+Na]^+$.

(3S,4R)-6-tert-butyl-4-phenylchroman-3-ol (Table 2, entry 3, product 2c) [1]

The general procedure was applied to **1c** to afford **2c** (42mg, 99%) as a white solid: $[\alpha]_D^{20}$= +206.0 (c = 1.0 in $CHCl_3$), liter.: $[\alpha]_D^{26}$= +204.2 (c = 1.0 in $CHCl_3$); ^{1}H NMR (600 MHz, $CDCl_3$): δ = 1.20 (s, 9H), 1.85 (br s), 3.99–4.02 (m, 1H), 4.09–4.15 (m, 3H), 6.87 (d, *J* = 7.2 Hz, 1H), 6.88 (s, 1H), 7.12–7.15 (m, 2H), 7.21 (dd, *J* = 2.4, 9.0 Hz, 1H), 7.25–7.27 (m, 1H), 7.32–7.34 (m, 2H); ^{13}C NMR (150 MHz, $CDCl_3$): δ = 31.4, 34.0, 50.2, 66.4, 70.0, 115.9, 120.8, 125.3, 126.9, 128.1, 128.6, 129.1, 142.8, 144.0, 151.8; HRMS (ESI): *m/z* calcd for $C_{19}H_{22}NaO_2$: 305.1517; found: 305.1515 $[M+Na]^+$.

(3S,4R)-4-phenylchroman-3-ol (Table 2, entry 4, product 2d) [1]

The general procedure was applied to **1d** to afford **2d** (30 mg, 88%) as a white solid: $[\alpha]_D^{20}$= –34.0 (c = 1.0 in $CHCl_3$), liter.: $[\alpha]_D^{27}$= –33.9 (c = 1.0 in $CHCl_3$); ^{1}H NMR (600 MHz, $CDCl_3$): δ = 2.12 (br s, 1H), 4.03–4.06 (m, 1H), 4.12 (br s, 2H), 4.22 (dd, *J* = 1.2, 10.8 Hz, 1H), 6.89 (d, *J* = 4.2 Hz, 2H), 6.96 (d, *J* = 8.4 Hz, 1H), 7.16 (d, *J* = 7.2 Hz, 2H), 7.18–7.21 (m, 1H), 7.28–7.29 (m, 1H), 7.34–7.36 (m, 2H); ^{13}C NMR (150 MHz, $CDCl_3$): δ = 50.2, 66.8, 69.8, 116.6, 121.3, 122.1, 127.1, 128.2 , 128.8, 129.1, 131.3, 142.5, 154.1; HRMS (ESI): *m/z* calcd for $C_{15}H_{14}NaO_2$: 249.0891; found: 249.0887 $[M+Na]^+$.

(3S,4R)-6-bromo-4-phenylchroman-3-ol (Table 2, entry 5, product 2e)

The general procedure was applied to **1e** to afford **2e** (40 mg, 87%) as a white solid: m.p. = 120–121°C; $[\alpha]_D^{20}$ = +33.9 (c = 1.0 in $CHCl_3$); ^{1}H NMR (600 MHz, $CDCl_3$): δ = 1.50 (br s, 1H), 3.95 (m, 1H), 4.00 (d, *J* = 4.8 Hz, 1H), 4.04 (td, *J* = 2.4, 5.4 Hz, 1H), 4.11 (dd, *J* = 2.4, 10.8 Hz, 1H), 6.76 (d, *J* = 9.0 Hz, 1H), 7.05 (d, *J* = 7.2 Hz, 2H), 7.21–7.30 (m, 4H); ^{13}C NMR (150 MHz, $CDCl_3$): δ = 50.0, 66.8, 69.3, 113.3, 118.5, 124.3, 127.4, 128.9, 129.0, 131.2, 133.6, 141.7, 153.2; Chiral HPLC: AD-H (heptane/isopropanol = 85/15, 0.8 mL/min^{-1}, UV at 254 nm, t (major) = 9.1 min, t (minor) = 9.7 min, ee > 99%; HRMS (ESI): *m/z* calcd for $C_{15}H_{13}BrNaO_2$: 326.9997; found: 326.9991 $[M+H]^+$.

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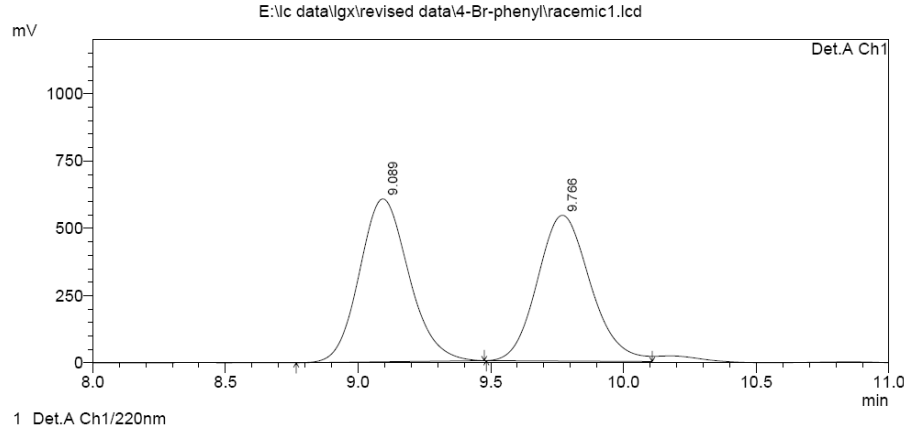

PeakTable

Detector A Ch1 220nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	9.089	7835850	605308	51.003	52.815
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Total		15363614	1146101	100.000	100.000

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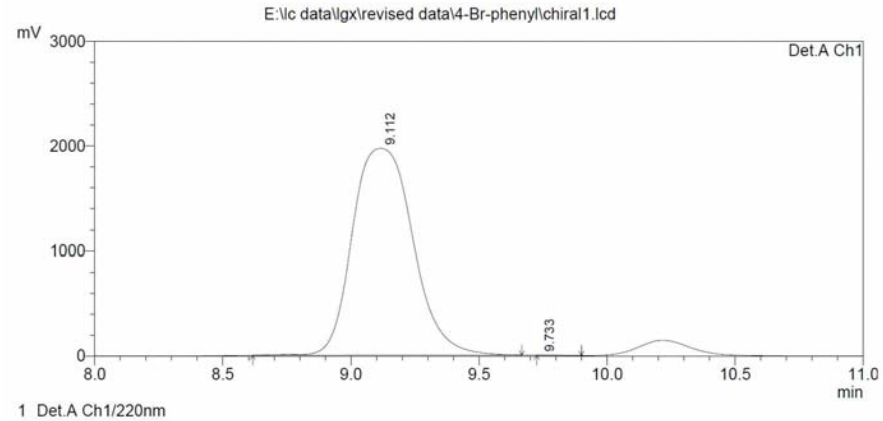

PeakTable

Detector A Ch1 220nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	9.112	32420968	1970998	99.999	99.997
2	9.733	293	56	0.001	0.003
Total		32421261	1971053	100.000	100.000

(3S,4R)-6-iodo-4-phenylchroman-3-ol (Table 2, entry 6, product 2f) [1]

The general procedure was applied to **1f** to afford **2f** (46 mg, 88%) as a white solid: $[\alpha]_D^{20}$= +14.9 (c = 1.0 in $CHCl_3$), liter.: $[\alpha]_D^{25}$= +15.04 (c = 0.9 in $CHCl_3$); ^{1}H NMR (600 MHz, $CDCl_3$): δ = 2.10 (br s, 1H), 4.01–4.04 (m, 1H), 4.07–4.10 (m, 2H), 4.18 (dd, *J* = 1.8, 10.8 Hz, 1H), 6.73 (d, *J* = 8.4 Hz, 1H), 7.13–7.48 (m, 7H); ^{13}C NMR (150 MHz, $CDCl_3$): δ = 49.8, 66.7, 69.3, 83.3, 119.0, 124.8, 127.4, 128.9, 129.0, 137.1, 139.7, 141.8, 154.1; HRMS (ESI): *m/z* calcd for $C_{15}H_{13}INaO_2$: 374.9858; found: 374.9852 $[M+Na]^+$.

(1R,2S)-1-phenyl-2,3-dihydro-1H-benzo[f]chromen-2-ol (Table 2, entry 7, product 2g) [2]

The general procedure was applied **1g** to afford **2g** (38 mg, 91%) as a white solid: $[\alpha]_D^{20}$ = –88.7 (*c* = 1.0 in $CHCl_3$); ^{1}H NMR (600 MHz, $CDCl_3$): δ = 2.00 (br s, 1H), 4.06–4.07 (m, 2H), 4.14–4.15 (m, 1H), 4.59 (br s, 1H), 7.08–7.14 (m, 4H), 7.18–7.22 (m, 4H), 7.38–7.40 (m, 1H),

7.66–7.69 (m, 2H); ^{13}C NMR (150 MHz, $CDCl_3$): δ = 45.9, 64.8, 69.7, 111.7, 118.5, 122.9, 123.5, 126.7, 126.8, 128.5, 129.3, 129.8, 133.4, 143.0, 151.7; HRMS (ESI): *m/z* calcd for $C_{19}H_{17}O_2$: 277.1229; found: 277.1233 $[M+H]^+$.

The observed optical rotation of compound **2g** can not match with the reported value. We performed the chiral HPLC analysis of this sample and the result indicated that the enantiomeric excess value of the product is 99%ee. Chiral HPLC: AD-H (heptane/isopropanol = 85/15, 0.8 mL/min^{-1}, UV at 254 nm, t (major) = 13.4 min, t (minor) = 23.3 min, ee > 99%

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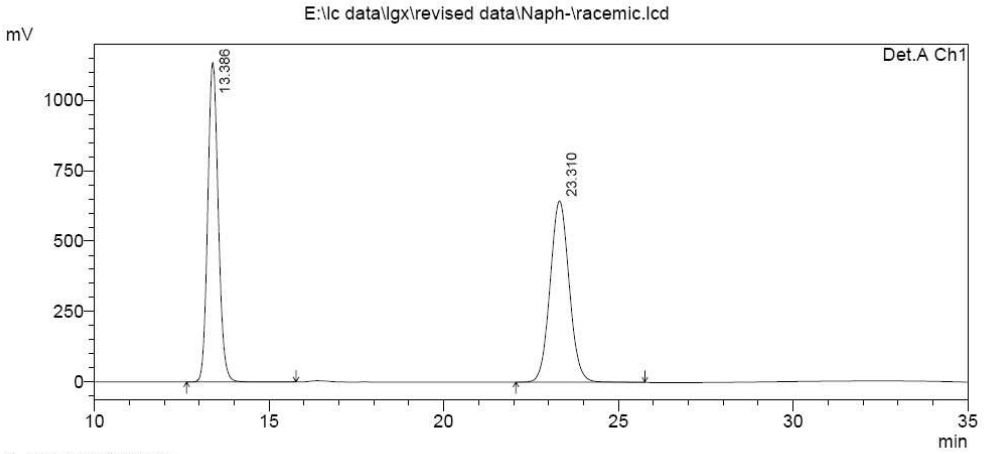

1 Det.A Ch1/220nm

PeakTable

Detector A Ch1 220nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	13.386	23818274	1135666	49.447	63.841
2	23.310	24351401	643227	50.553	36.159
Total		48169675	1778893	100.000	100.000

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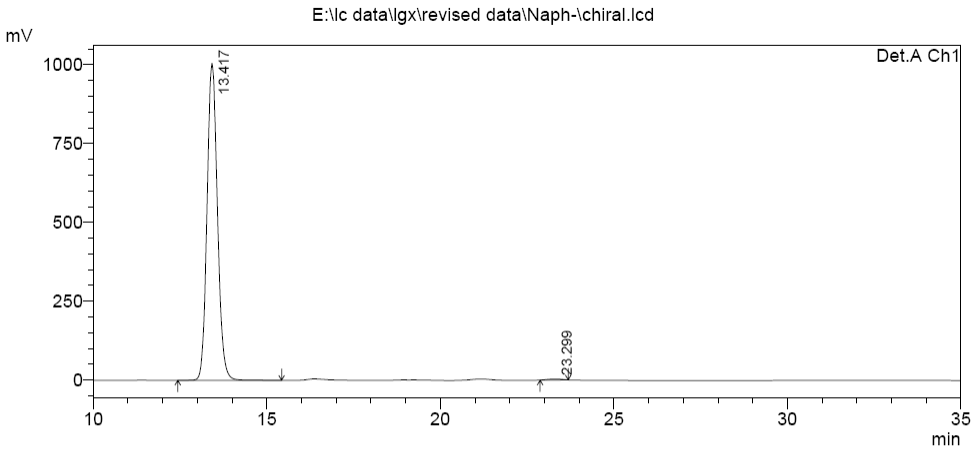


1 Det.A Ch1/220nm

PeakTable

Detector A Ch1 220nm

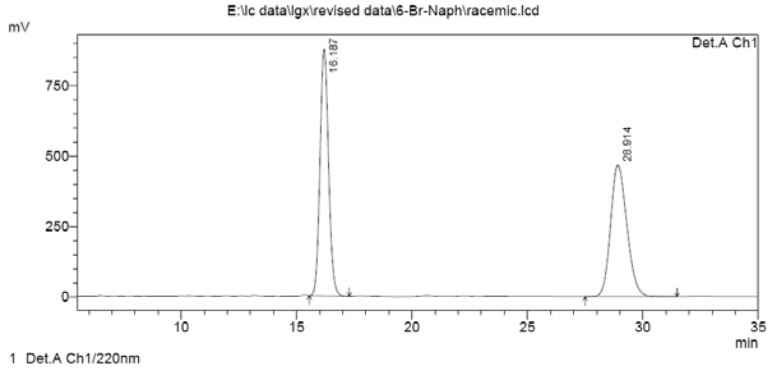
Peak#	Ret. Time	Area	Height	Area %	Height %
1	13.417	20967705	1004928	99.581	99.683
2	23.299	88305	3198	0.419	0.317
Total		21056010	1008125	100.000	100.000

(1R,2S)-8-bromo-1-phenyl-2, 3-dihydro-1H-benzo[f]chromen-2-ol (Table 2, entry 8,

product 2h)

The general procedure was applied **1h** to afford **2h** (51mg, 96%) as a white solid: m.p. = 138–139 ^{o}C; $[\alpha]_D^{20}$= –49.5 (c = 1.0 in $CHCl_3$); ^{1}H NMR (600 MHz, $CDCl_3$): δ = 2.30 (br s, 1H), 4.03 (br s, 2H), 4.09 (dd, *J* = 3.6, 6.6 Hz, 2H), 4.79 (d, *J* = 1.2, 1H), 7.02 (d, *J* = 10.8 Hz, 2H), 7.08–7.20 (m, 4H), 7.22 (s, 1H), 7.54 (d, *J* = 13 Hz, 1H), 7.81 (s, 1H); ^{13}C NMR (150 MHz, $CDCl_3$): δ = 45.8, 64.8, 69.5, 112.2, 117.2, 119.7, 124.7, 127.0, 128.3, 128.4, 128.9, 129.8, 130.4, 131.0. 131.9, 142.6, 151.9; Chiral HPLC: AD-H (heptane/isopropanol = 85/15, 0.8 mL/min^{-1}, UV at 254 nm, t (major) = 16.2 min, t (minor) = 29.2 min, ee > 99%; HRMS (ESI): *m/z* calcd for $C_{19}H_{16}BrO_2$: 355.0334; found: 355.0324 $[M+H]^+$.

<Chromatogram>



1 Det.A Ch1/220nm

PeakTable

Detector A Ch1 220nm

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2	28.914	22996456	468447	50.465	34.787
Total		45569431	1346614	100.000	100.000

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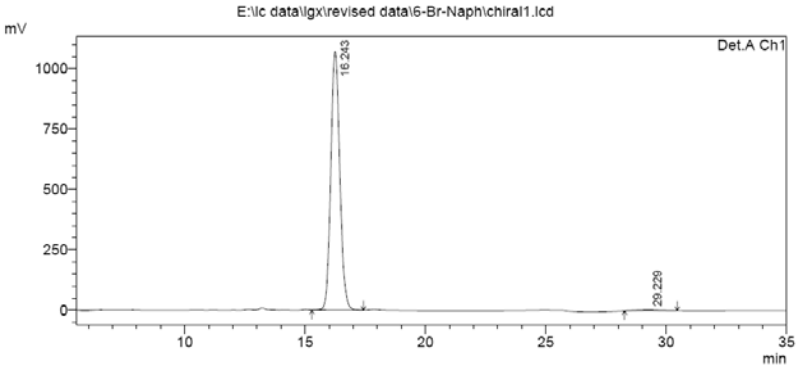

1 Det.A Ch1/220nm

PeakTable

Detector A Ch1 220nm

Peak#	Ret. Time	Area	Height	Area %	Height %
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2	29.229	116026	2421	0.413	0.225
Total		28071611	1074244	100.000	100.000

5,7-dimethoxy-2-phenylchroman-3-ol (Table 2, entry 9, product 2i) [3]

The general procedure was applied to **1i** to afford **2i** (22 mg, 51%) as a colorless oil: ^{1}H NMR (400 MHz, $CDCl_3$): δ = 1.73 (br s, 1H), 2.62 (dd, *J* = 8.4, 16.4 Hz, 1H), 2.99 (dd, *J* = 5.6, 16.4 Hz, 1H), 3.76 (s, 3H), 3.80 (s, 3H), 4.10 (dd, *J* = 8.0, 13.6 Hz, 1H), 4.78 (d, *J* = 8.0 Hz, 1H), 6.13 (dd, *J* = 2.0, 16.0 Hz, 2H), 7.36–7.44 (m, 5H); ^{13}C NMR (100 MHz, $CDCl_3$): δ = 27.2,

55.3, 55.4, 68.2, 81.7, 91.8, 93.0, 101.4, 127.0, 128.6, 128.8, 138.1, 155.1, 158.8, 159.7; HRMS (ESI): *m/z* calcd for $C_{17}H_{19}O_4$: 287.1283; found: 287.1272 $[M+H]^+$.

5,7-dimethoxy-4,4-dimethylchroman-3-ol (Table 2, entry 10, product 2j)

The general procedure was applied to **1j** to afford **2j** (19 mg, 52%) as a white solid: m.p. = 83–84 ^oC; ^1H NMR (400 MHz, $CDCl_3$): δ = 1.35 (s, 3H), 1.45 (s, 3H), 1.90 (br s, 1H), 3.56 (dd, *J* = 1.6, 4.4 Hz, 1H), 3.75 (s, 3H), 3.78 (s, 3H), 4.05–4.13 (m, 2H), 6.06 (d, *J* = 2.4 Hz, 1H), 6.10 (d, *J* = 2.4 Hz); ^{13}C NMR (100 MHz, $CDCl_3$): δ = 22.8, 27.5, 35.6, 55.1, 55.2, 66.4, 74.9, 99.4), 99.6, 110.6, 154.7, 159.2, 160.7; HRMS (ESI): *m/z* calcd for $C_{13}H_{19}O_4$: 239.1283; found: 239.1273 $[M+H]^+$.

General procedure for intermolecular ring-opening of epoxides

(R)-2-(2,4,6-trimethoxyphenyl)-2-phenylethanol (Table 3, product 3a)

1,3,5-Trimethoxybenzene (5 mmol, 840 mg) and (*R*)-styrene oxide (1 mmol, 120 mg) were dissolved in 5 mL of hexafluoroisopropanol and was refluxed at ambient pressure for 30 minutes. Purified the desired product by column chromatography on silica gel using hexane: EtOAc (90:20) as eluent to afford **3a** (176 mg, 61%) as a white solid: m.p. = 80–81 ^oC; $[\alpha]_D^{20}$= +19.3 (c = 1.0 in $CHCl_3$); ^1H NMR (400 MHz, $CDCl_3$): δ = 1.94 (br s, 1H), 3.71 (s, 6H), 3.77 (s, 3H), 4.27 (d, *J* = 7.2 Hz, 2H), 4.80 (t, *J* = 7.2 Hz, 1H), 6.13 (s, 2H), 7.11–7.31 (m, 5H); ^{13}C NMR (100 MHz, $CDCl_3$): δ = 43.1, 55.2, 55.6, 64.7, 91.1, 110.4, 125.6, 127.9, 128.0, 142.4, 159.3, 160.0; Chiral HPLC: OD-H (heptane/isopropanol = 90/10, 0.4 mL/min^{-1}, UV at 254 nm, t (minor) = 31.0 min, t (major) = 34.5 min, ee = 95%; HRMS (ESI): *m/z* calcd for $C_{12}H_{18}NaO_4$: 249.1103; found: 249.1105 $[M+Na]^+$.

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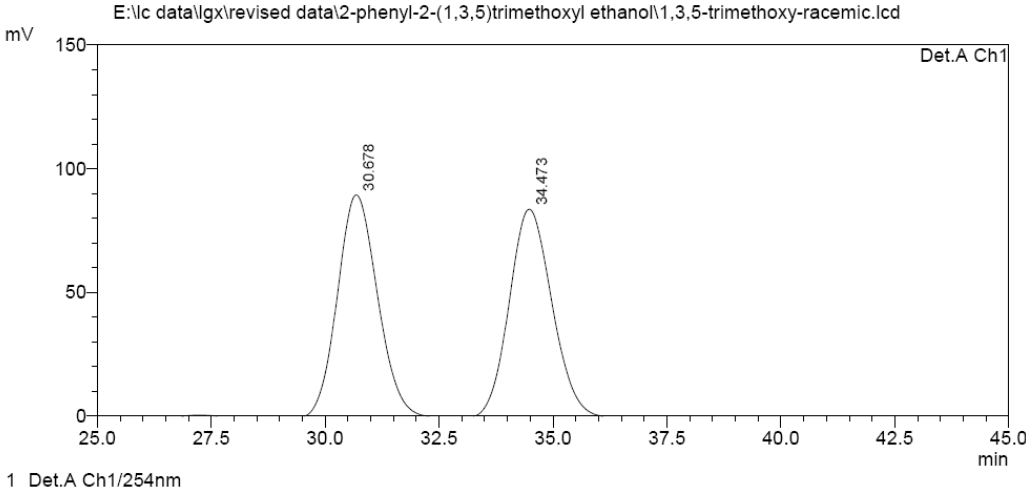

PeakTable

Detector A Ch1 254nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	30.678	5523934	89911	50.001	51.629
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Total		11047636	174149	100.000	100.000

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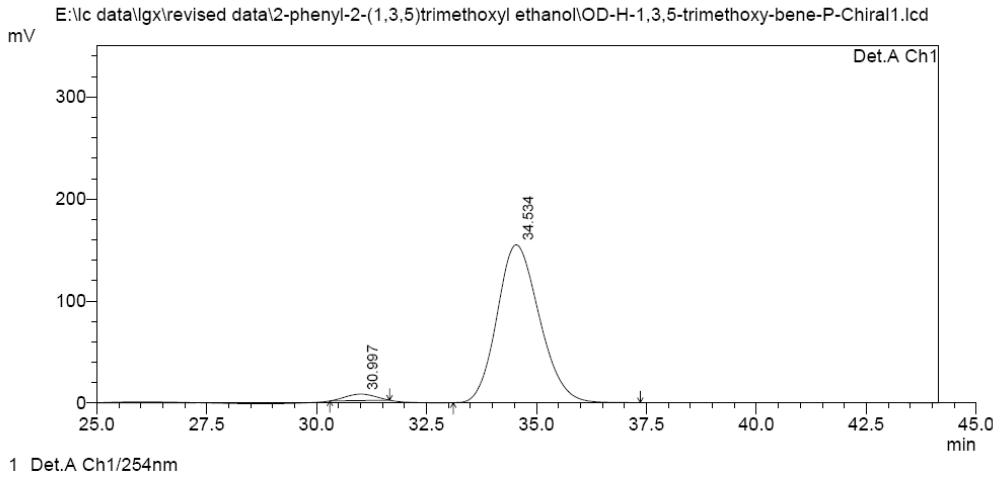


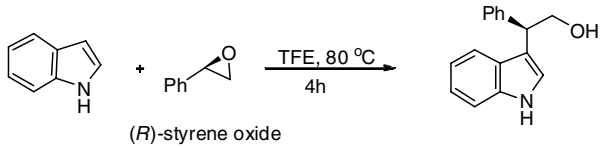
PeakTable

Detector A Ch1 254nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	30.997	290738	6321	2.731	3.927
2	34.534	10353527	154639	97.269	96.073
Total		10644265	160961	100.000	100.000

The observed enantiomeric excess value of the product is 94.5%. We think the enantiomeric purity of (*R*)-styrene oxide (purity>98.5%, purchased from Acros Organics Co.) we have could be lower than 98.5%. Because we do not have the special chiral GC column (Chiraldex ɣ-TA column) which is used to separate (*R*)- and (*S*)- styrene oxide. We did a parallel experiment to establish the real enantiomeric purity of this (*R*)-styrene oxide. The reaction between (*R*)-styrene oxide and indole in refluxing TFE is stereospecific as reported by Professor Mayr's group (Scheme 1). We carried this reaction using the (*R*)-styrene oxide we have at the identical reaction condition. The ee value of the reaction product is 94.3%, similar with our previous observation. This showed that the reaction between 1,3,5-trimethoxybenzene and (*R*)-styrene oxide is stereospecific. The observed 94.5% enantiomeric excess value of the product is because the enantiomeric excess value of (*R*)-styrene oxide we have is 94.5%.

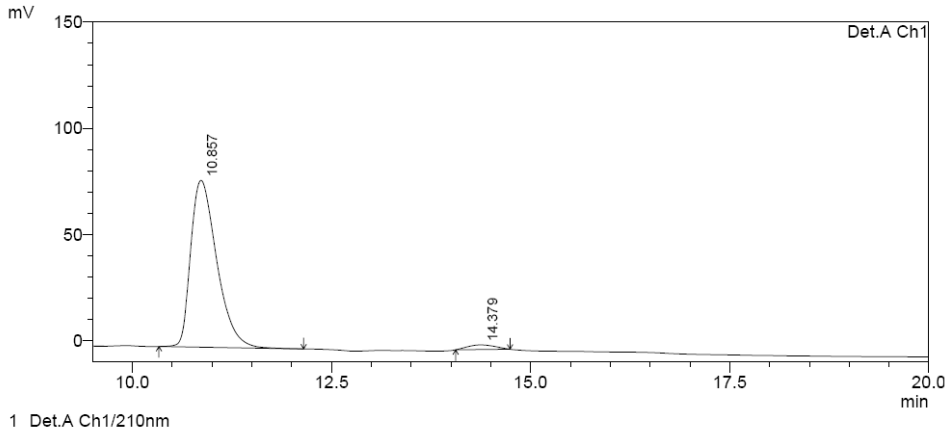
Scheme 1



(*R*)-styrene oxide

67 % (99 % ee)

Westmaier, M.; Mayr, H. *Chem. Eur. J.* **2008**, *14*, 1638.



PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	10.857	1787501	78463	97.171	97.313
2	14.379	52040	2167	2.829	2.687
Total		1839542	80629	100.000	100.000

2-(1,1,1,3,3,3-hexafluoropropan-2-yloxy)-2-phenylethanol[6]

Using hexane: EtOAc (90:10) as eluent to afford the byproduct (86 mg, 30%) as a colorless oil. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 2.35 (dd, *J* = 5.0 Hz, 1H), 3.66–3.72 (m, 1H), 3.89–3.95 (m, 1H), 4.10–4.21 (m, 1H), 4.85 (dd, *J* = 3.8 Hz, 1H), 7.32–7.35 (m, 2H), 7.39–7.41 (m, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ = 66.6, 72.5, 72.9, 73.2, 73.5, 73.8, 86.1, 119.6, 120.59, 122.35, 123.43, 127.7, 128.9, 129.6, 134.8; MS (ESI): *m/z* calcd for $C_{11}H_{10}F_6O_2$: 288.0; found: 286.8 $[M-H]^-$.

2-(2,3,4-trimethoxy-6-methylphenyl)-2-phenylethanol (Table 3, product 3b)

The general procedure was applied to 1,2,3-trimethoxy-5-methylbenzene to afford (76 mg, 50%) the product as a white solid: m.p. = 60–61 °C; ^{1}H NMR (400 MHz, $CDCl_3$): δ = 1.18 (br s. 1H), 2.22 (s, 3H), 3.33 (s, 3H), 3.74 (s, 3H), 3.77 (s, 3H), 4.21 (dd, *J* = 6.4, 10.6 Hz, 1H), 4.28 (dd, *J* = 6.4, 10.6 Hz, 1H), 4.43 (dd, *J* = 6.4, 10.6 Hz, 1H), 6.46 (s, 1H), 7.10 (t, *J* = 6.8 Hz, 1H), 7.16–7.23 (m, 5H); ^{13}C NMR (100 MHz, $CDCl_3$): δ = 21.1, 46.6, 55.8, 60.2, 60.5, 64.6, 109.8, 125.3, 125.9, 126.1, 127.6, 128.2, 129.0, 132.7, 140.6, 142.4, 151.9, 152.6; HRMS (ES+): *m/z* calcd for $C_{18}H_{22}NaO_4$: 325.1416; found: 325.1415 $[M+Na]^+$.

2-(2,5-dimethoxyphenyl)-2-phenylethanol (Table 3, product 3c)

The general procedure was applied to 1,4-dimethoxybenzene to afford the product (45 mg, 35%) as a colorless oil: ^{1}H NMR (400 MHz, $CDCl_3$): δ = 1.61 (br s, 1H), 3.66 (s, 3H), 3.67 (s, 3H), 4.05 (d, *J* = 4.8 Hz, 2H), 4.56 (t, *J* = 7.2 Hz, 1H), 6.64–6.74 (m, 3H), 7.14–7.23 (m, 5H),; ^{13}C NMR (100 MHz, $CDCl_3$): δ = 46.5, 55.6, 56.1, 65.4, 111.2, 111.8, 115.3, 126.6, 128.4, 128.5, 131.2, 141.1, 151.7, 153.6; HRMS (ESI): *m/z* calcd for $C_{16}H_{18}NaO_3$: 281.1154; found: 281.1156 $[M+Na]^+$.

2-(4-methoxyphenyl)-2-phenylethanol (Table 3, product 3d)

The general procedure was applied to anisole to afford the product (17 mg, 15%) as a colorless oil: ^{1}H NMR (400 MHz, $CDCl_3$): δ = 1.54 (br s, 1H), 3.70 (s, 3H), 4.04–4.11 (m, 3H), 6.79 (d, *J* = 8.0 Hz, 2H), 7.11 (d, *J* = 8.0 Hz, 2H), 7.13–7.18 (m, 3H), 7.23 (d, *J* = 7.2 Hz,

2H); ^{13}C NMR (100 MHz, $CDCl_3$): δ = 52.8, 55.2, 66.2, 114.1, 126.7, 128.2, 128.6, 129.2, 133.4, 141.7, 158.4; HRMS (ESI): *m/z* calcd for $C_{15}H_{16}NaO_2$: 251.1048; found: 251.1036 $[M+Na]^+$.

1-(2,4,6-trimethoxyphenyl)propan-2-ol (Table 3, product 3e)[2]

1,3,5-Trimethoxybenzene (1 mmol, 168 mg) and 2-methyloxirane (2 mmol, 116mg) were dissolved in 5 mL of hexafluoroisopropanol and was refluxed at ambient pressure for 48 hours. The solvent was removed under reduced pressure. The desired product was purified by column chromatography on silica gel using hexane: EtOAc (90: 20) as eluent to afford **4** (65 mg, 29%) as a colorless oil. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 1.19 (d, *J* = 6.0 Hz, 3H), 2.35 (br s, 1H), 2.72–2.84 (2H), 3.81 (s, 6H), 3.82 (s, 3H), 3.93–4.00 (m, 1H), 6.15 (s, 2H); ^{13}C NMR (100 MHz, $CDCl_3$): δ = 23.0, 32.0, 55.3, 55.6, 68.6, 90.6, 107.6, 159.0, 159.7.

References

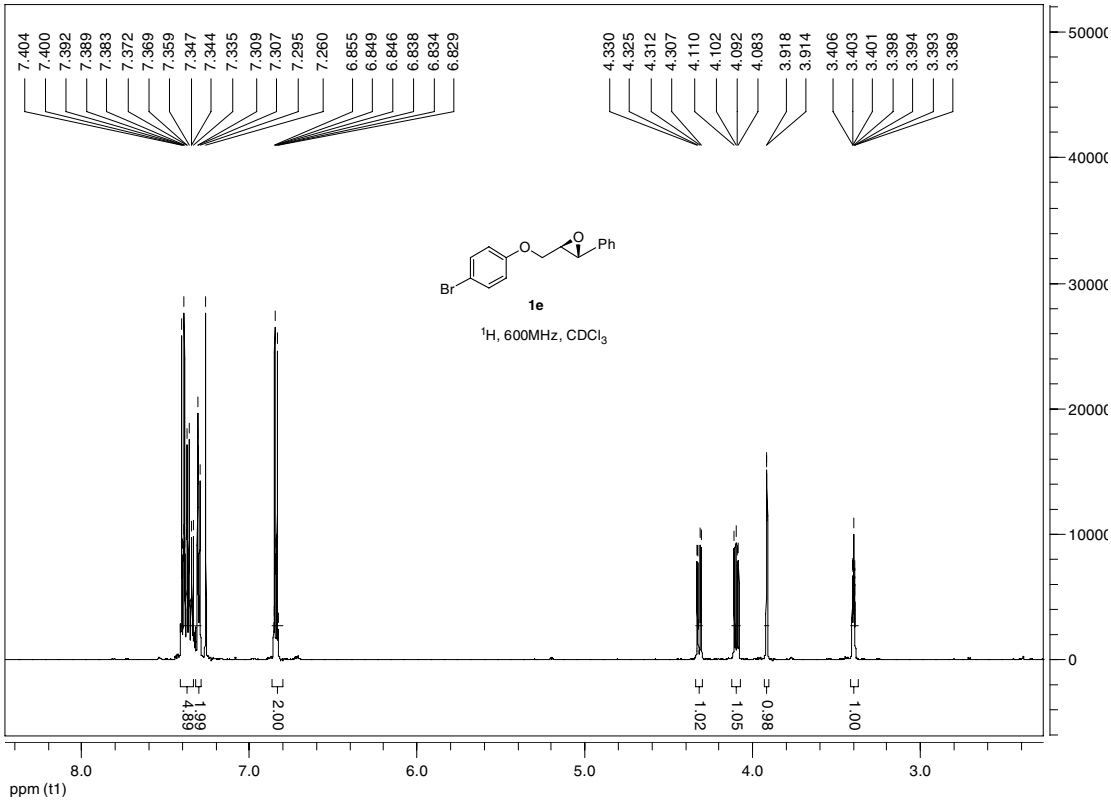
[1] R. Marcos, C. Rodríguez-Escrich, C. Herrerías, M. A. Pericàs, *J. Am. Chem. Soc.*, 2008, **130**, 16838-16839 (Note: enantiomer was synthesized).

[2] Z.-J. Shi, C. He, *J. Am. Chem. Soc.*, 2004, **126**, 5964-5965.

[3] Y. X. Liu, X. B. Li, G. Lin, Z. Xiang, J. Xiang, M. Z. Zhao, J. H. Chen, Z. Yang, *J. Org. Chem.*, 2008, **73**, 4625-4629.

[4] F. Fringuelli, R. Germani, F. Pizzo, F. Santinelli, G.. Savelli, *J. Org. Chem.*, 1992, **57**, 1198-1202.

[5] C. Lampard, J. A. Murphy, *Tetrahedron*, 1993, **49**, 3841-3848.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7.307
7.295
7.260
6.855
6.849
6.846
6.838
6.834
6.829
4.330
4.325
4.312
4.307
4.110
4.102
4.092
4.083
3.918
3.914
3.406
3.403
3.401
3.398
3.394
3.393
3.389
Br
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O
Ph
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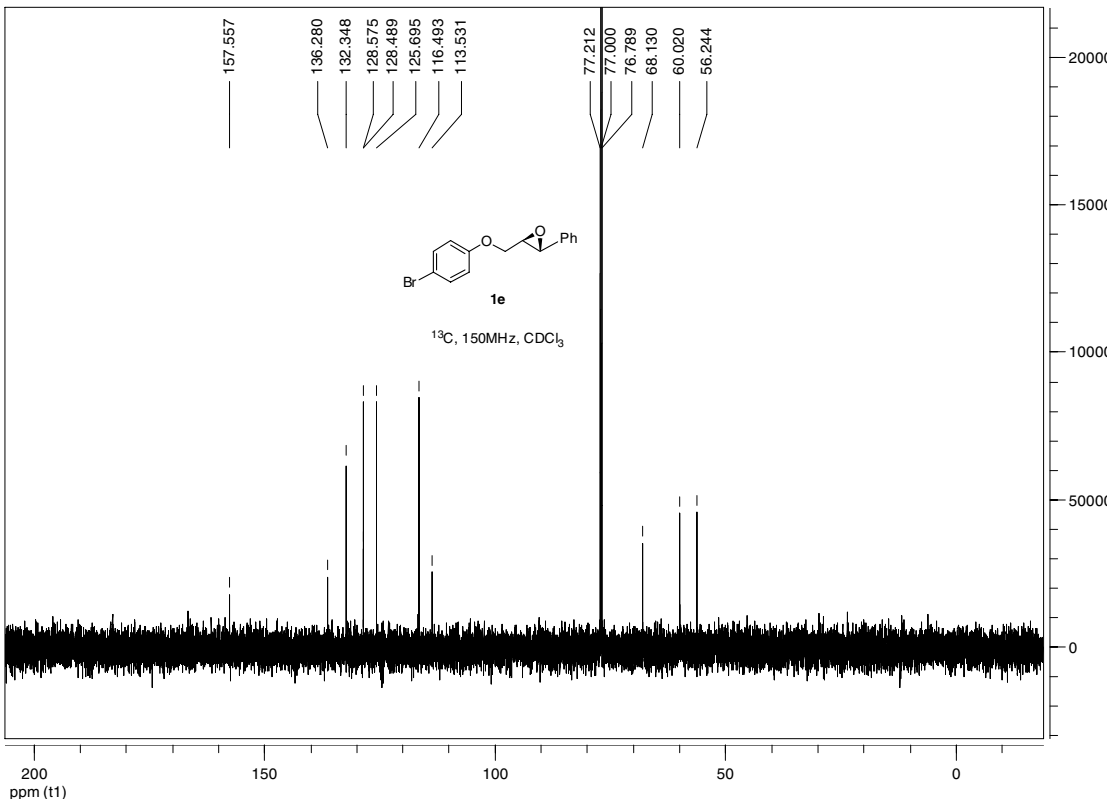
ppm (t1)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Ph
1e
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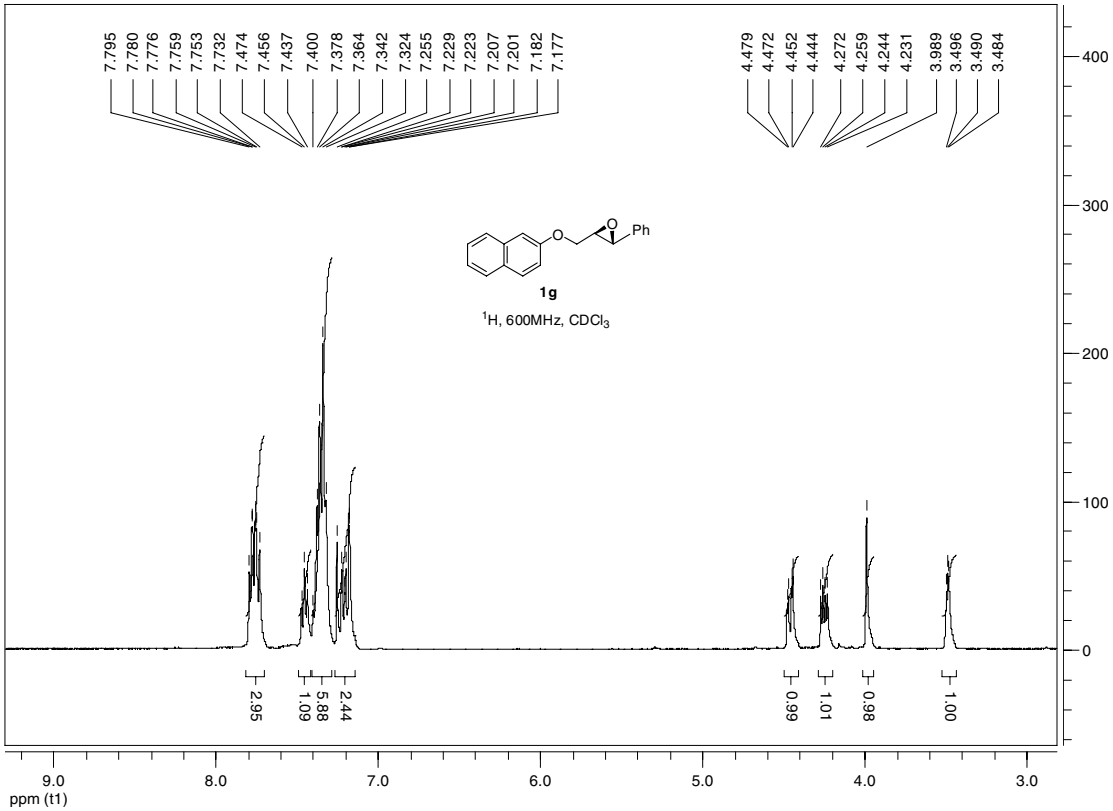
ppm (t1)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4.231
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Ph
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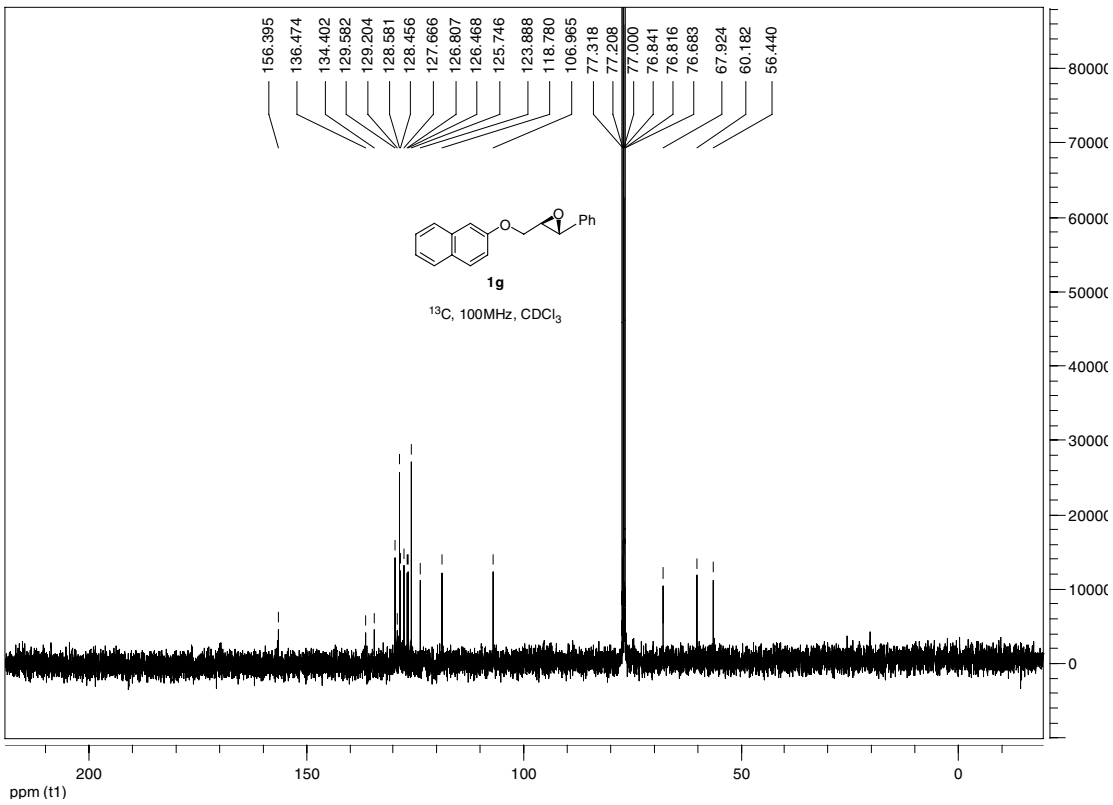
ppm (t1)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50
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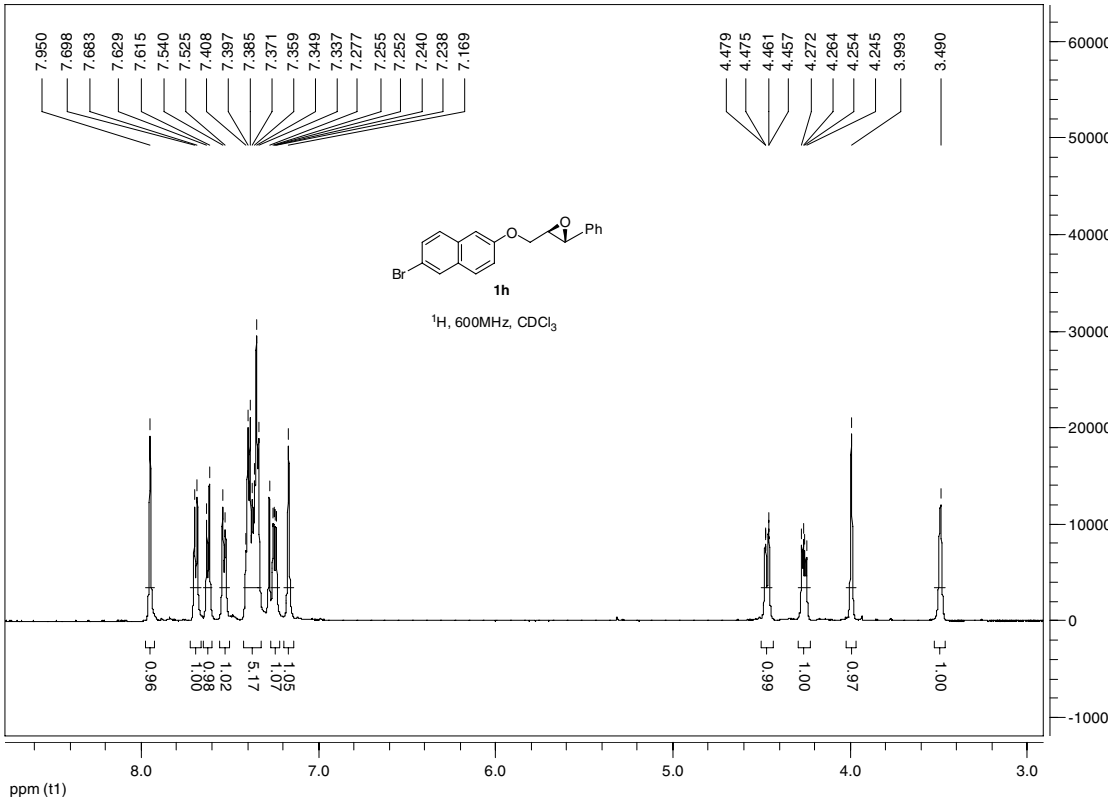
ppm (t1)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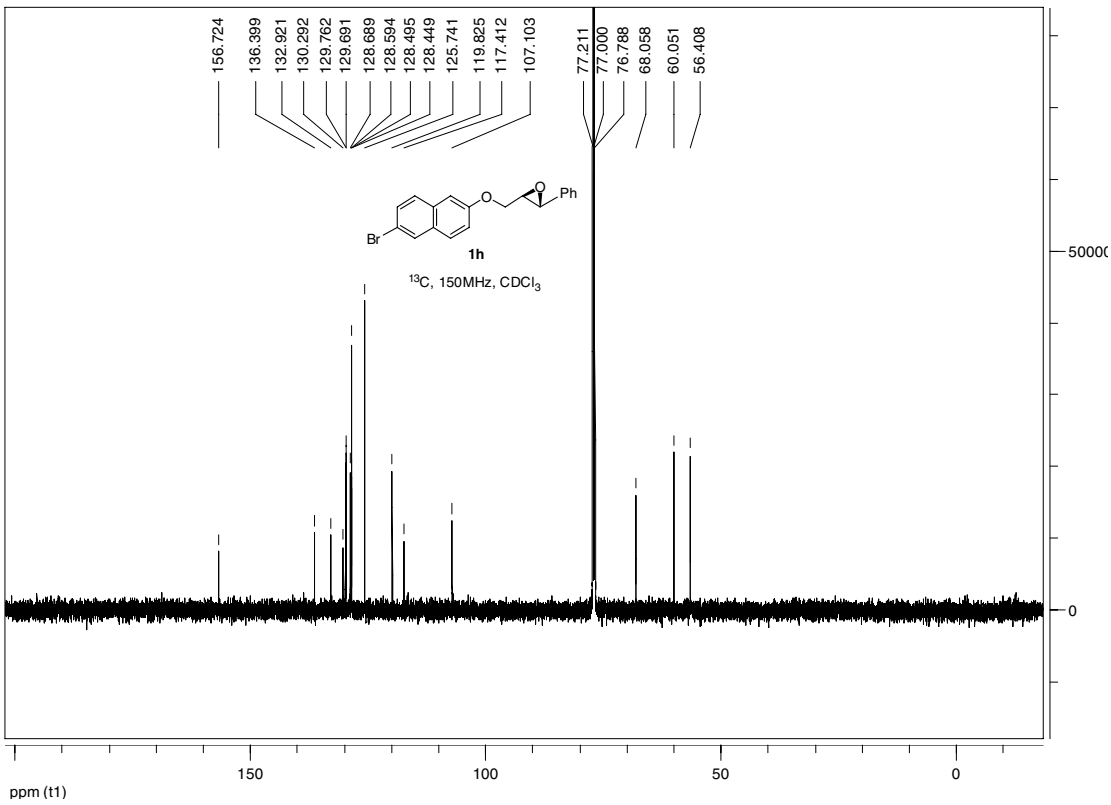
ppm (t1)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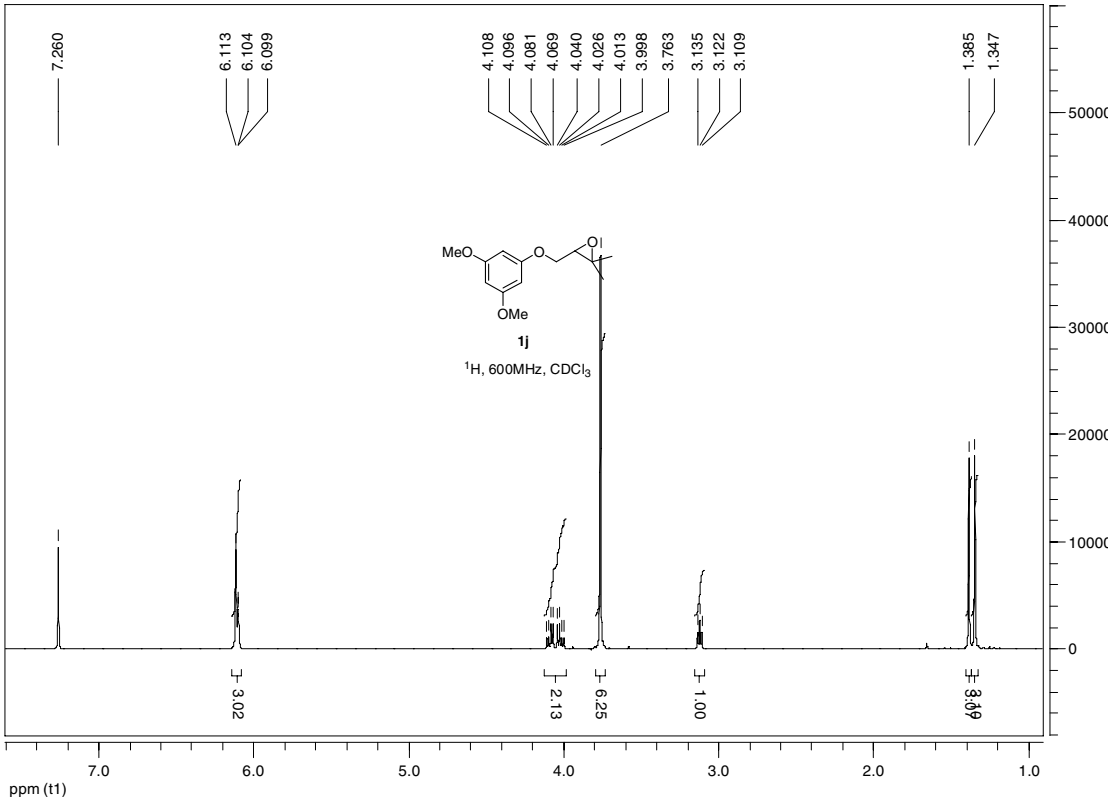
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3.135
3.122
3.109
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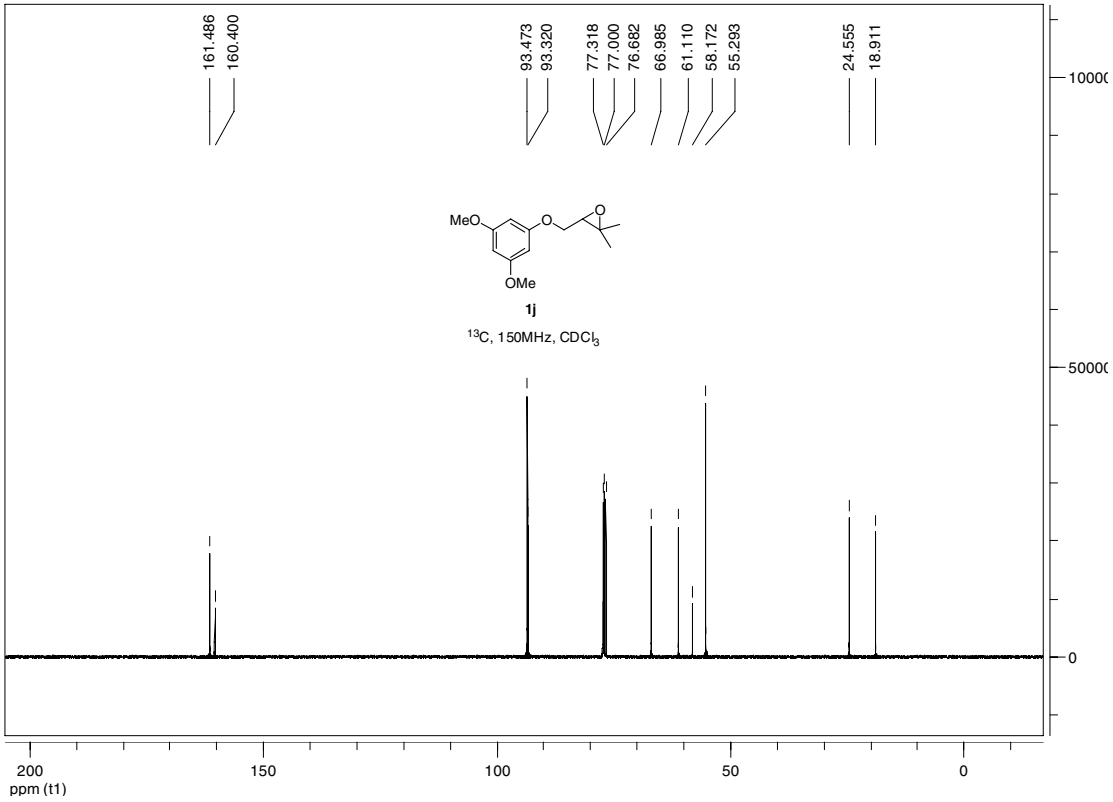
ppm (t1)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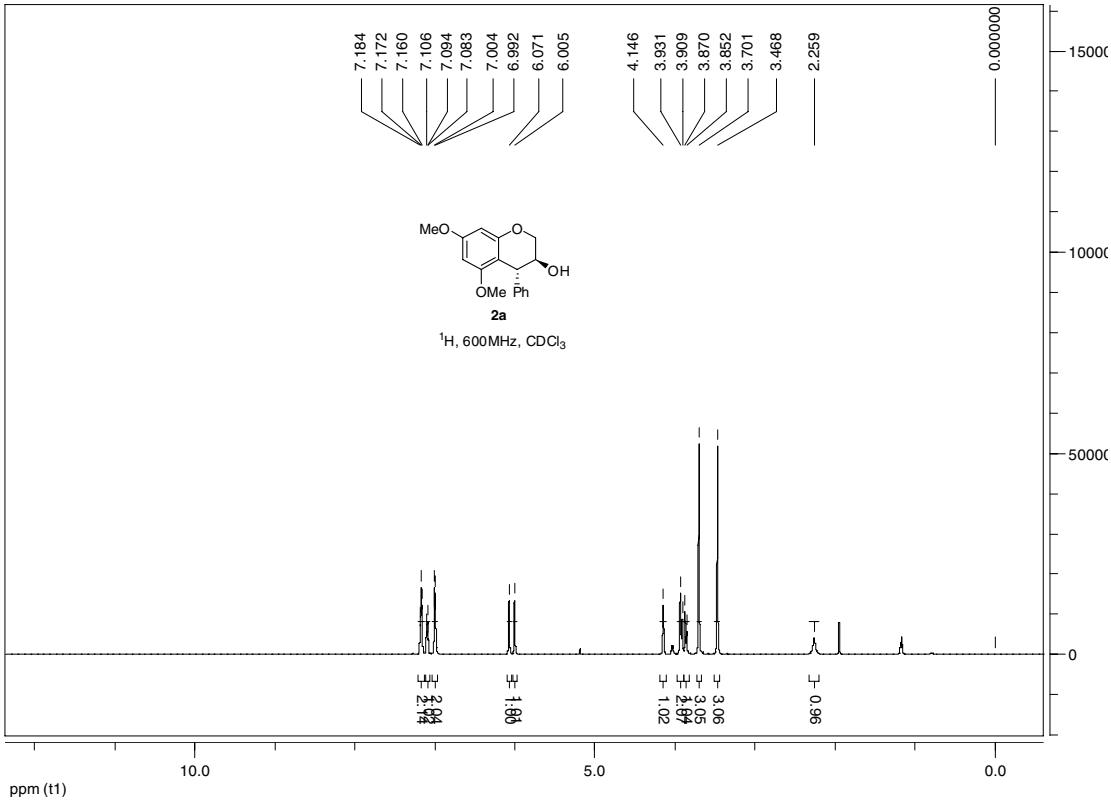
13C, 150MHz, CDCl3
ppm (t1)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3.852
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Ph
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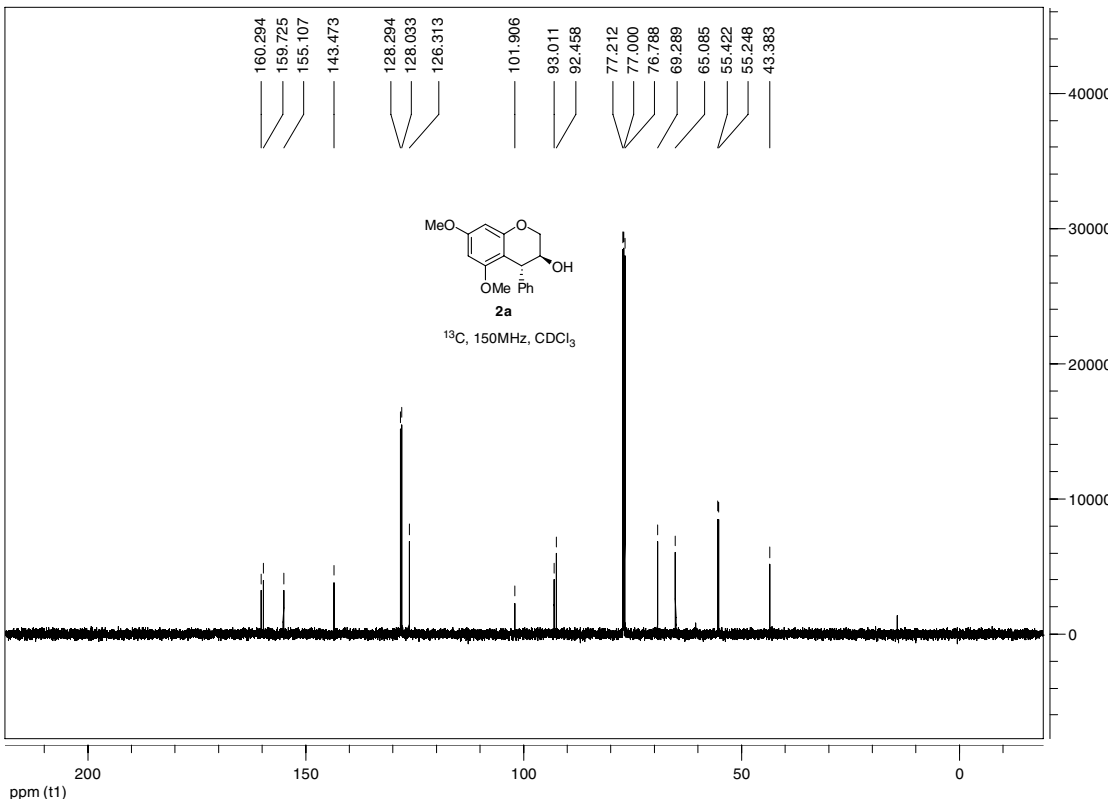
ppm (t1)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43.383
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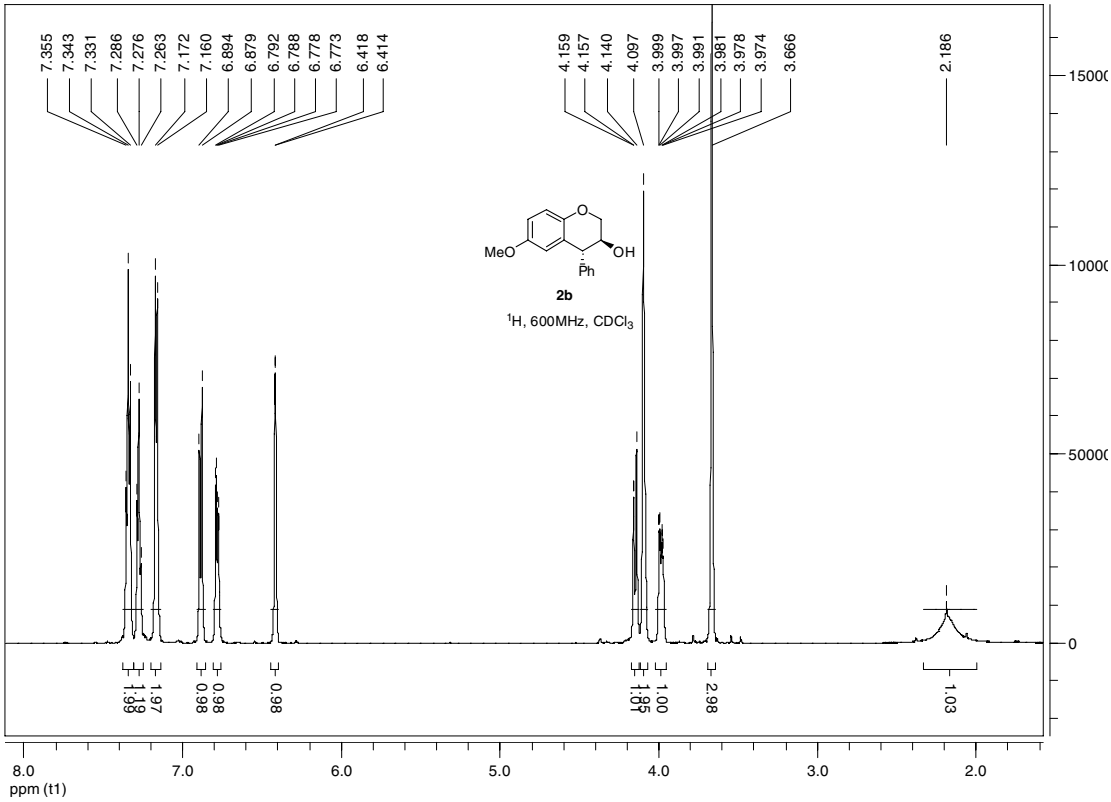
O
OH
OMe
Ph
2a
13C, 150MHz, CDCl3
200
150
100
50
0
ppm (t1)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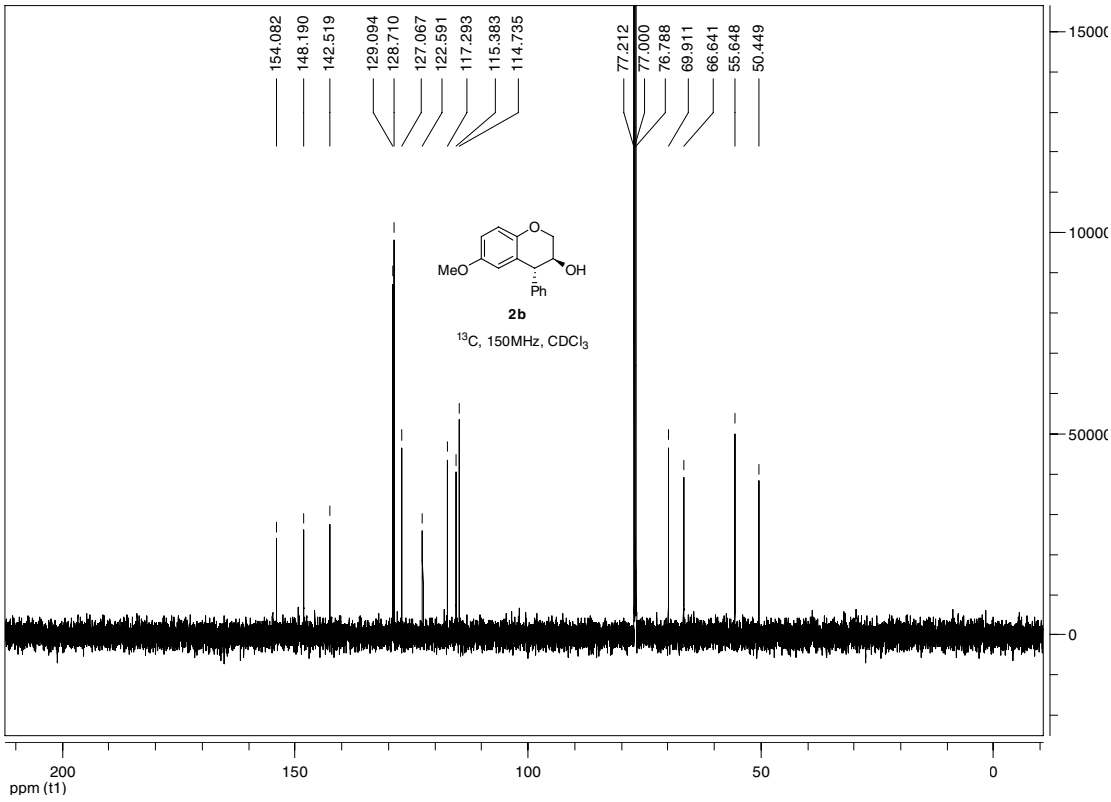
7.343
7.331
7.286
7.276
7.263
7.172
7.160
6.894
6.879
6.792
6.788
6.778
6.773
6.418
6.414
4.159
4.157
4.140
4.097
3.999
3.997
3.991
3.981
3.978
3.974
3.666
2.186
MeO
OH
Ph
2b
1H, 600MHz, CDCl3
1.99
1.19
1.97
0.98
0.98
0.98
1.00
1.00
2.98
1.03
8.0
7.0
6.0
5.0
4.0
3.0
2.0
ppm (t1)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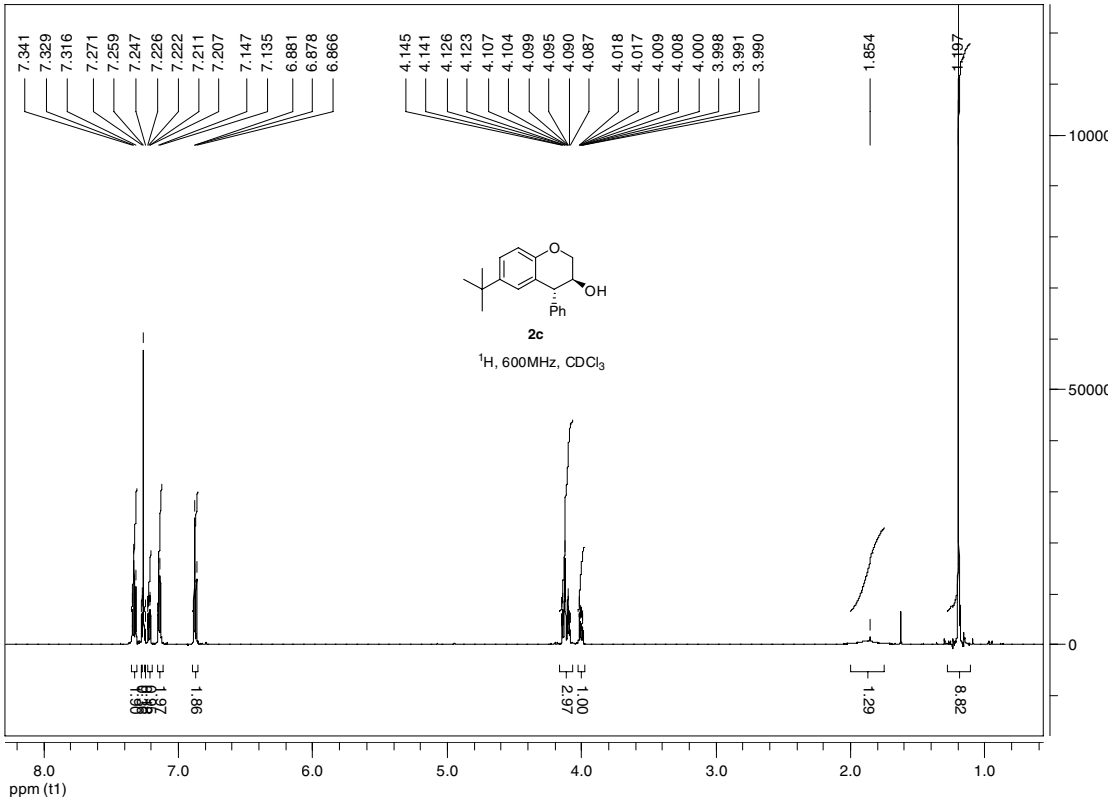
148.190
142.519
129.094
128.710
127.067
122.591
117.293
115.383
114.735
77.212
77.000
76.788
69.911
66.641
55.648
50.449
MeO
OH
Ph
2b
13C, 150MHz, CDCl3
200
150
100
50
0
ppm (t1)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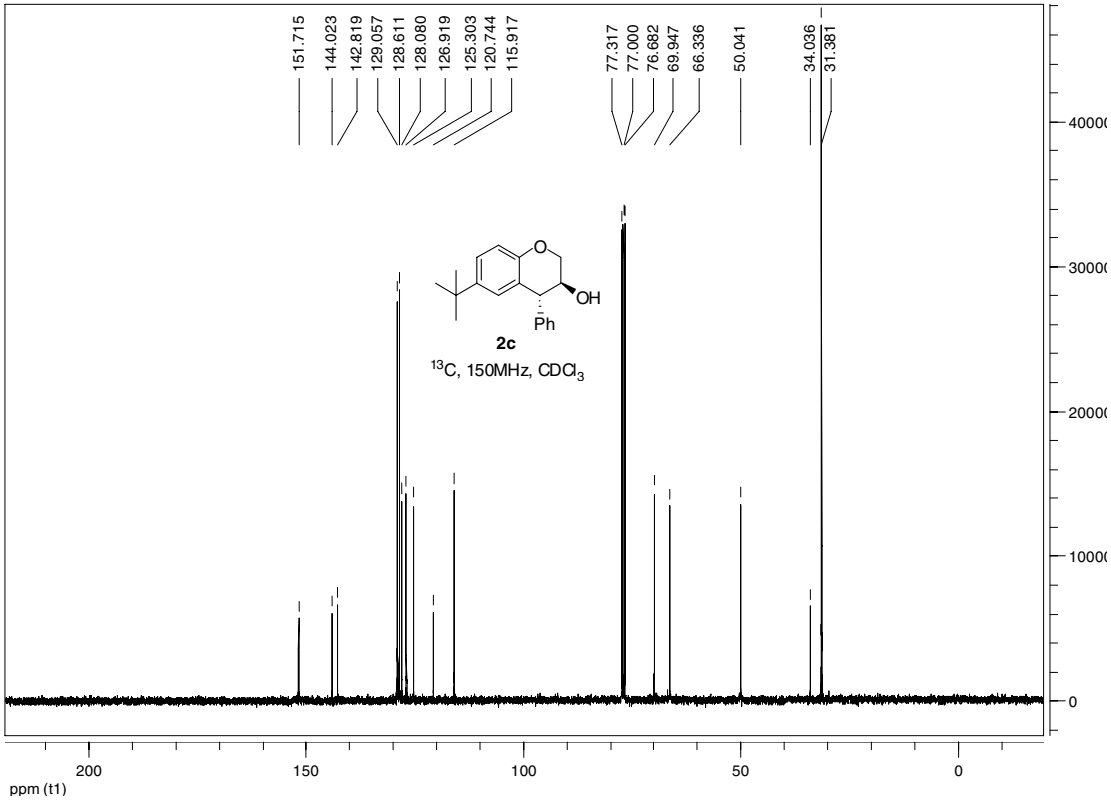
7.329
7.316
7.271
7.259
7.247
7.226
7.222
7.211
7.207
7.147
7.135
6.881
6.878
6.866
4.145
4.141
4.126
4.123
4.107
4.104
4.099
4.095
4.090
4.087
4.018
4.017
4.009
4.008
4.000
3.998
3.991
3.990
1.854
1.107
OH
Ph
2c
1H, 600MHz, CDCl3
1.86
2.97
1.00
1.29
8.82
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
ppm (t1)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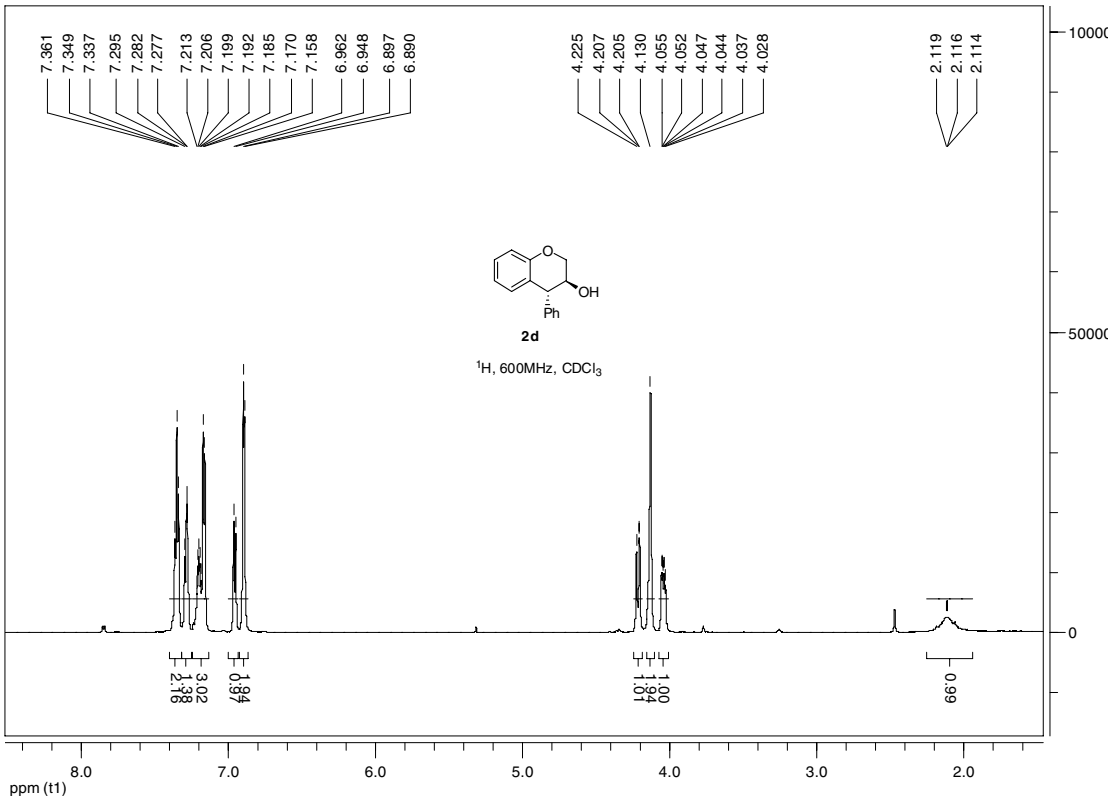
144.023
142.819
129.057
128.611
128.080
126.919
125.303
120.744
115.917
77.317
77.000
76.682
69.947
66.336
50.041
34.036
31.381
OH
Ph
2c
13C, 150MHz, CDCl3
200
150
100
50
0
ppm (t1)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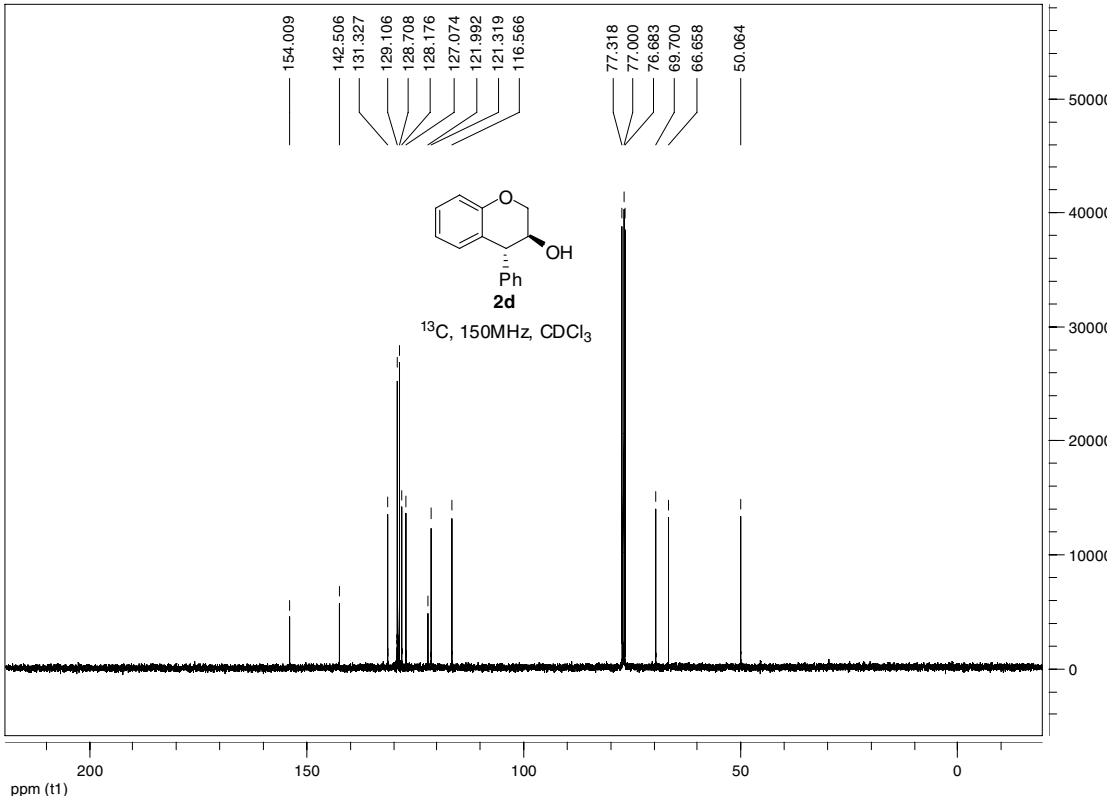
7.349
7.337
7.295
7.282
7.277
7.213
7.206
7.199
7.192
7.185
7.170
7.158
6.962
6.948
6.897
6.890
4.225
4.207
4.205
4.130
4.055
4.052
4.047
4.044
4.037
4.028
2.119
2.116
2.114
OH
Ph
2d
1H, 600MHz, CDCl3
2.16
1.38
3.02
0.97
1.94
1.01
1.94
1.00
0.99
ppm (t1)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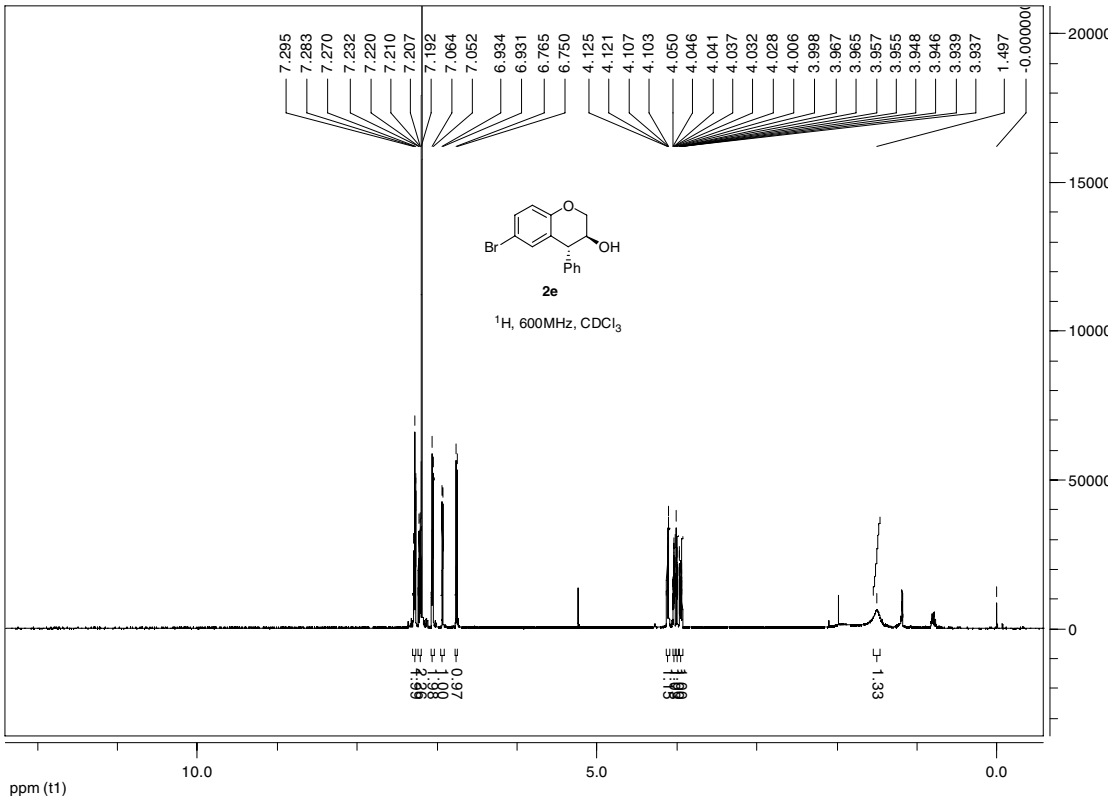
142.506
131.327
129.106
128.708
128.176
127.074
121.992
121.319
116.566
77.318
77.000
76.683
69.700
66.658
50.064
OH
Ph
2d
13C, 150MHz, CDCl3
ppm (t1)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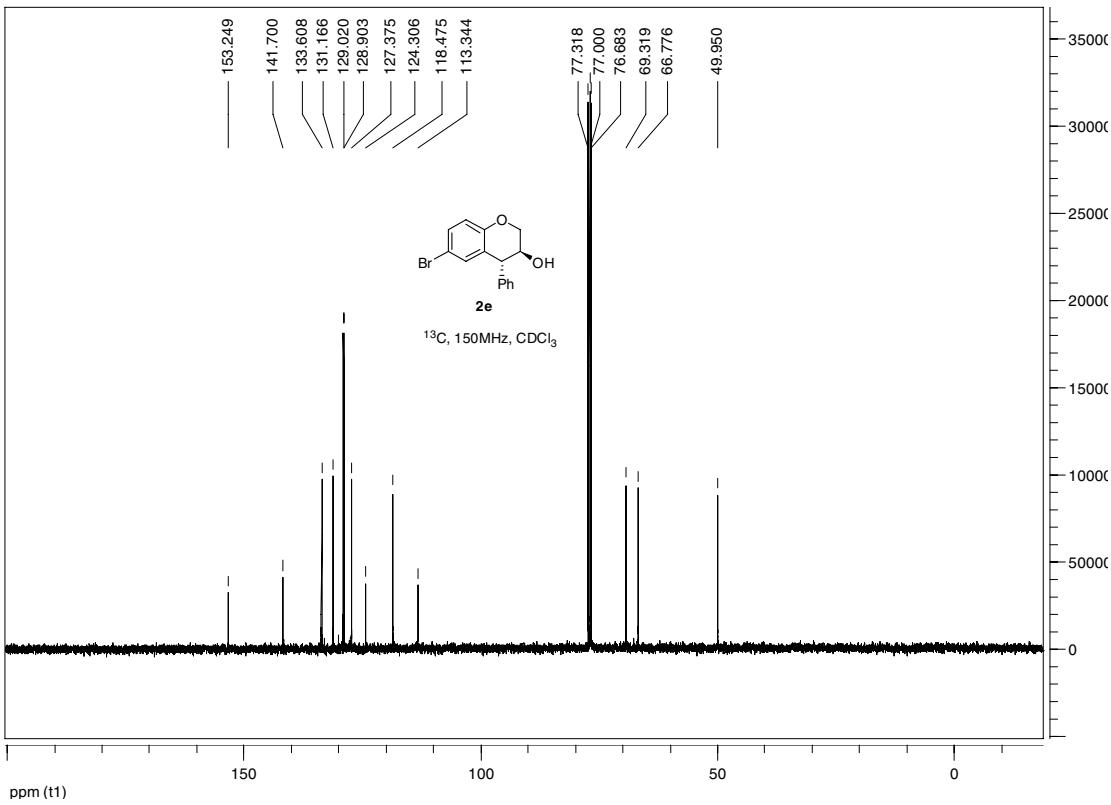
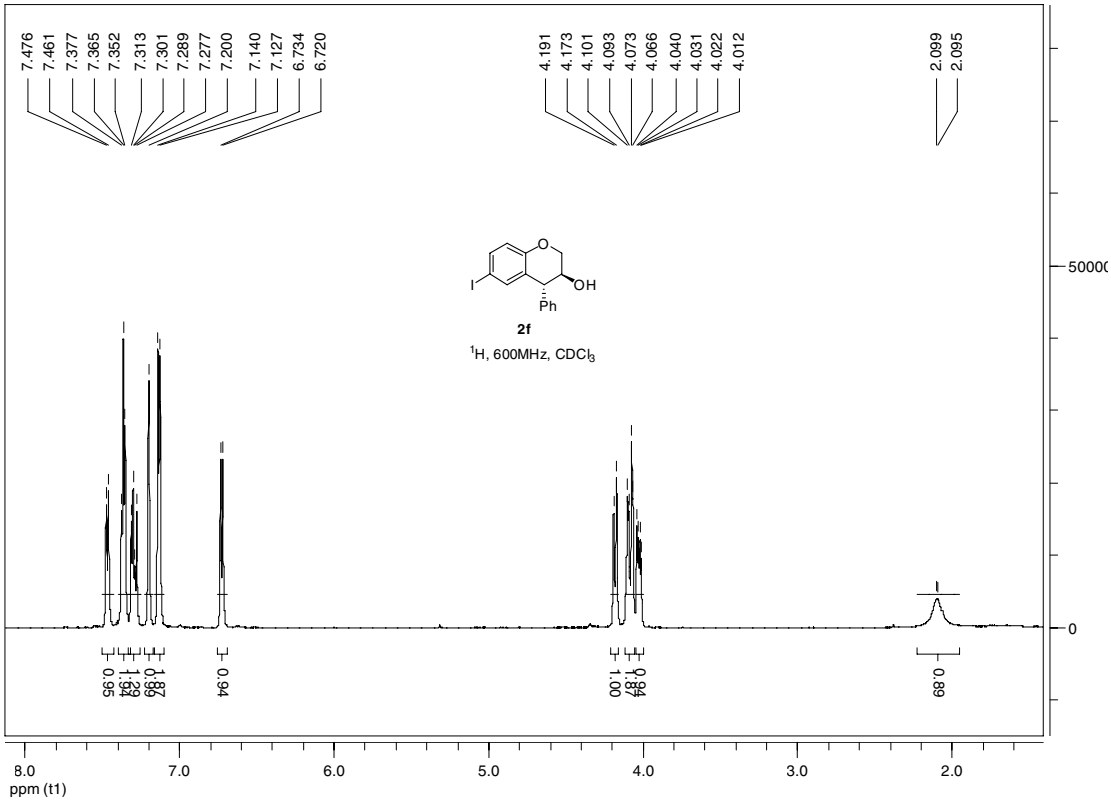
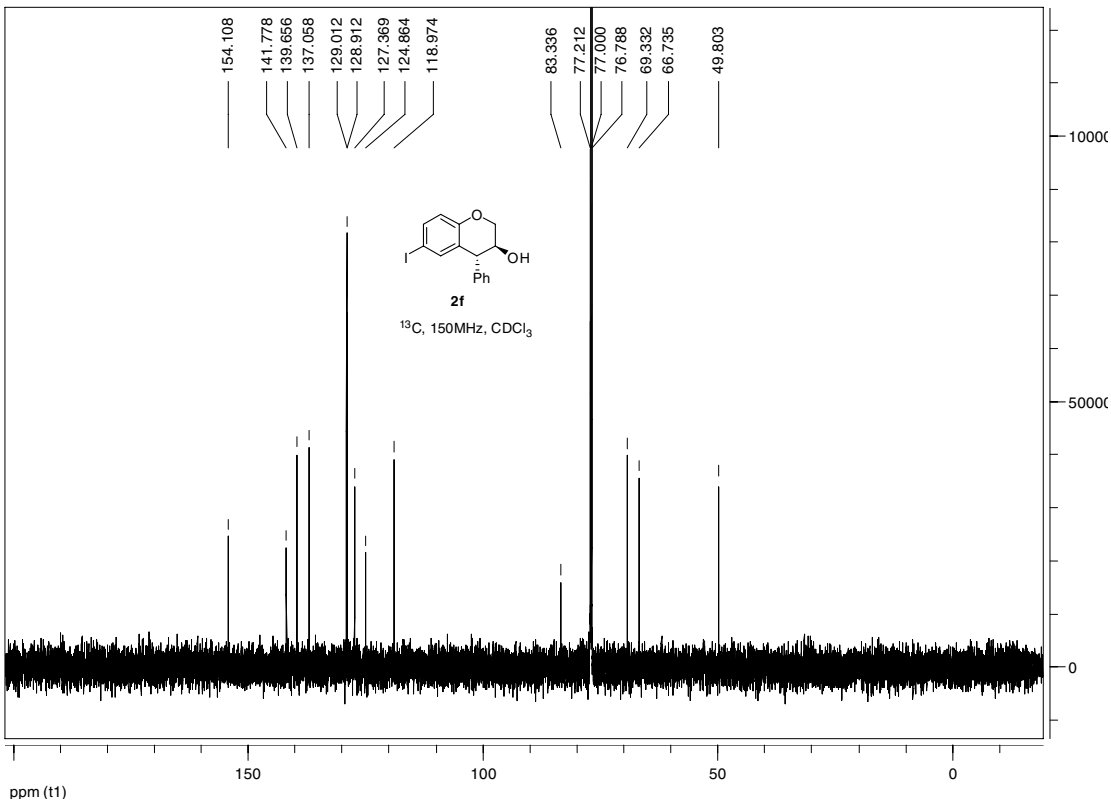
7.283
7.270
7.232
7.220
7.210
7.207
7.192
7.064
7.052
6.934
6.931
6.765
6.750
4.125
4.121
4.107
4.103
4.050
4.046
4.041
4.037
4.032
4.028
4.006
3.998
3.967
3.965
3.957
3.955
3.948
3.946
3.939
3.937
1.497
-0.000000
Br
OH
Ph
2e
1H, 600MHz, CDCl3
0.97
1.33
10.0
5.0
0.0
ppm (t1)


153.249
141.700
133.608
131.166
129.020
128.903
127.375
124.306
118.475
113.344
77.318
77.000
76.683
69.319
66.776
49.950
Br
OH
Ph
2e
13C, 150MHz, CDCl3
150
100
50
0
ppm (t1)


7.476
7.461
7.377
7.365
7.352
7.313
7.301
7.289
7.277
7.200
7.140
7.127
6.734
6.720
4.191
4.173
4.101
4.093
4.073
4.066
4.040
4.031
4.022
4.012
2.099
2.095
I
O
OH
Ph
2f
1H, 600MHz, CDCl3
0.96
1.94
1.63
0.99
1.87
0.94
1.00
0.89
8.0
7.0
6.0
5.0
4.0
3.0
2.0
ppm (t1)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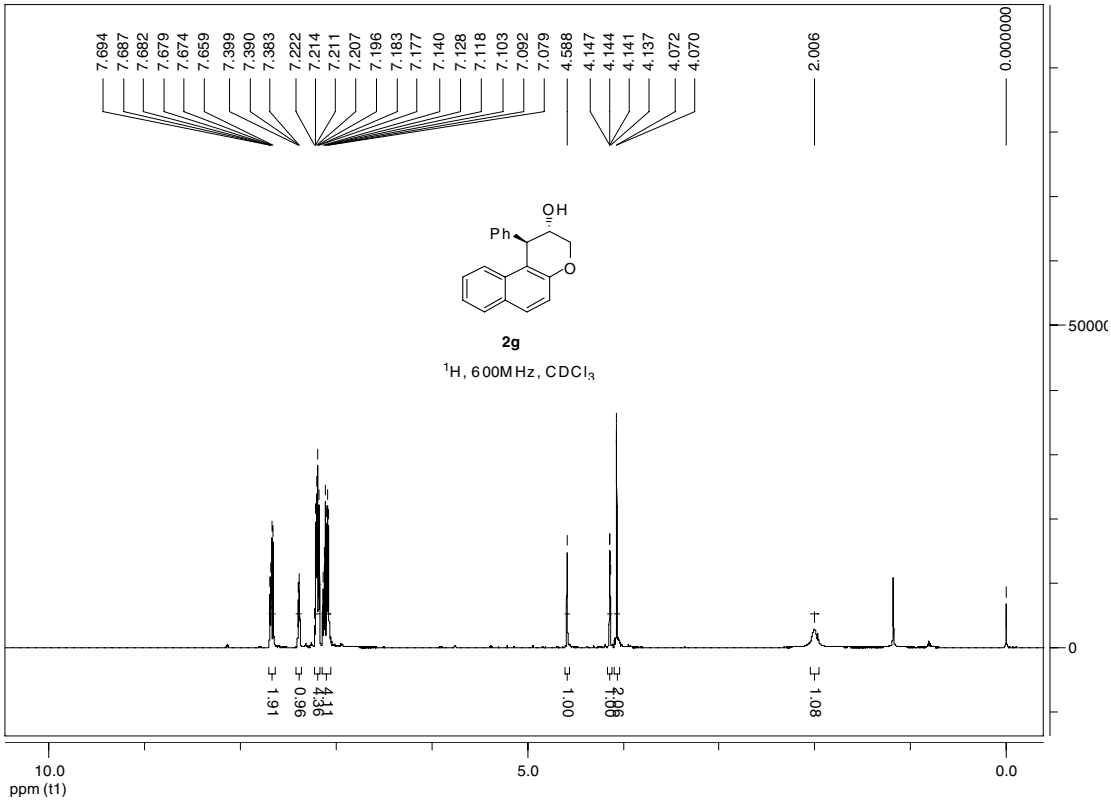
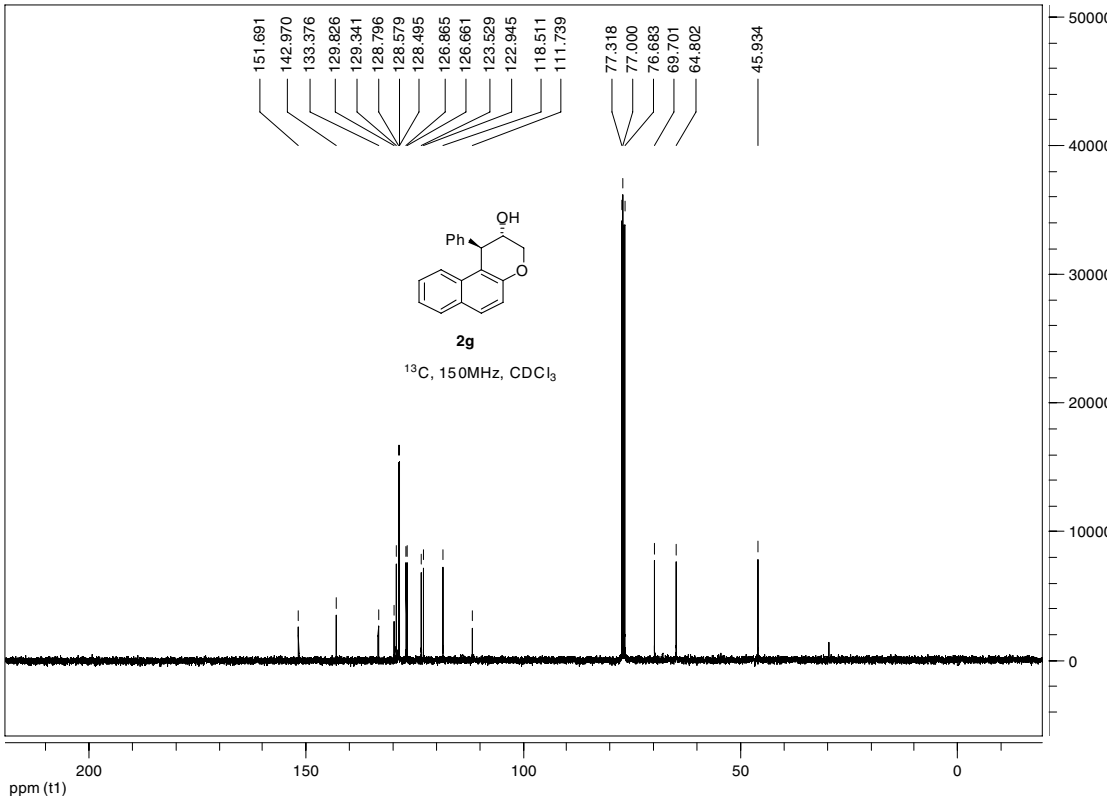
141.778
139.656
137.058
129.012
128.912
127.369
124.864
118.974
83.336
77.212
77.000
76.788
69.332
66.735
49.803
I
O
OH
Ph
2f
13C, 150MHz, CDCl3
150
100
50
0
ppm (t1)


7.694
7.687
7.682
7.679
7.674
7.659
7.399
7.390
7.383
7.222
7.214
7.211
7.207
7.196
7.183
7.177
7.140
7.128
7.118
7.103
7.092
7.079
4.588
4.147
4.144
4.141
4.137
4.072
4.070
2.006
0.000000
OH
Ph
O
2g
1H, 600MHz, CDCl3
1.91
0.96
4.11
1.00
2.06
1.08
50000
0
10.0
5.0
0.0
ppm (t1)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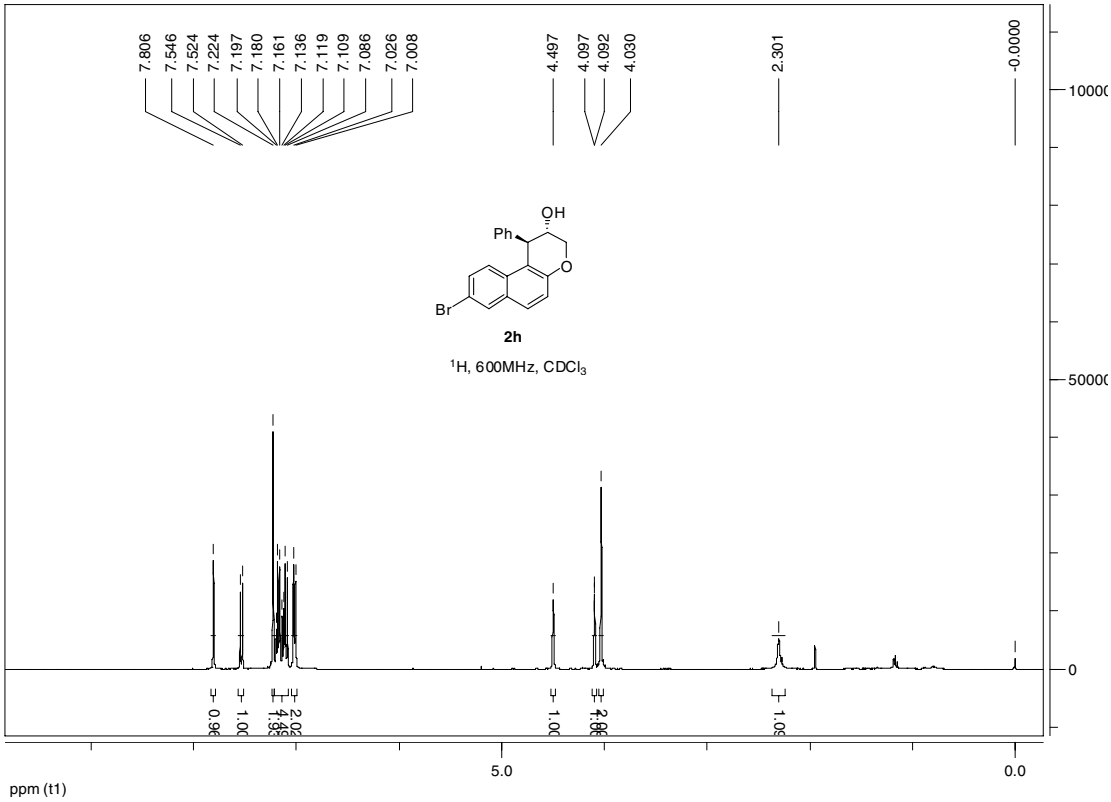
142.970
133.376
129.826
129.341
128.796
128.579
128.495
126.865
126.661
123.529
122.945
118.511
111.739
77.318
77.000
76.683
69.701
64.802
45.934
OH
Ph
O
2g
13C, 150MHz, CDCl3
50000
40000
30000
20000
10000
0
200
150
100
50
0
ppm (t1)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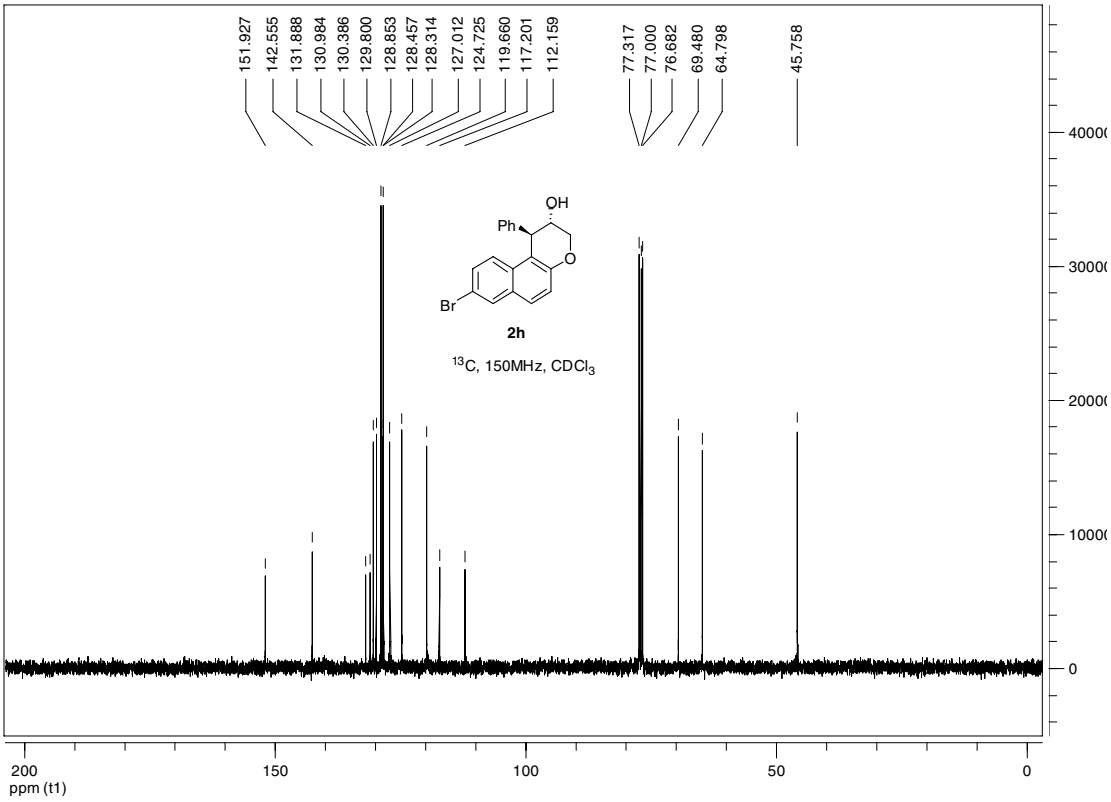
7.546
7.524
7.224
7.197
7.180
7.161
7.136
7.119
7.109
7.086
7.026
7.008
4.497
4.097
4.092
4.030
2.301
-0.0000
OH
Ph
O
Br
2h
1H, 600MHz, CDCl3
0.96
1.00
1.98
2.02
1.00
2.06
1.00
5.0
0.0
ppm (t1)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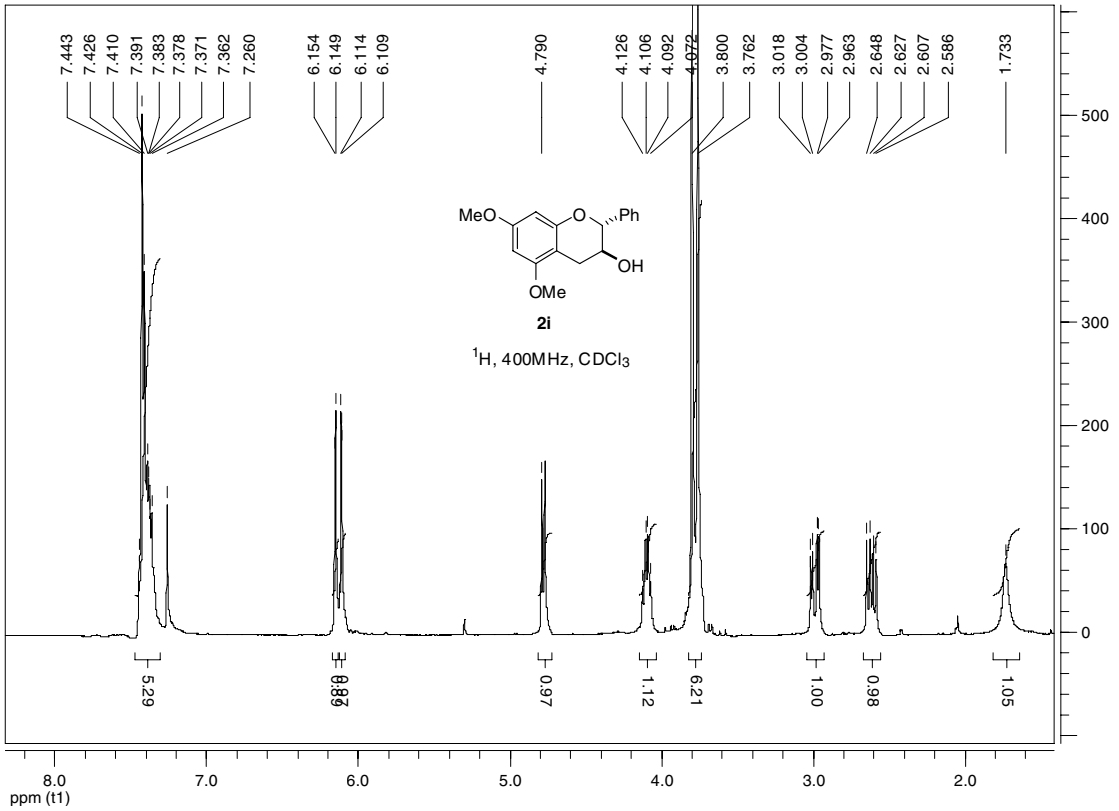
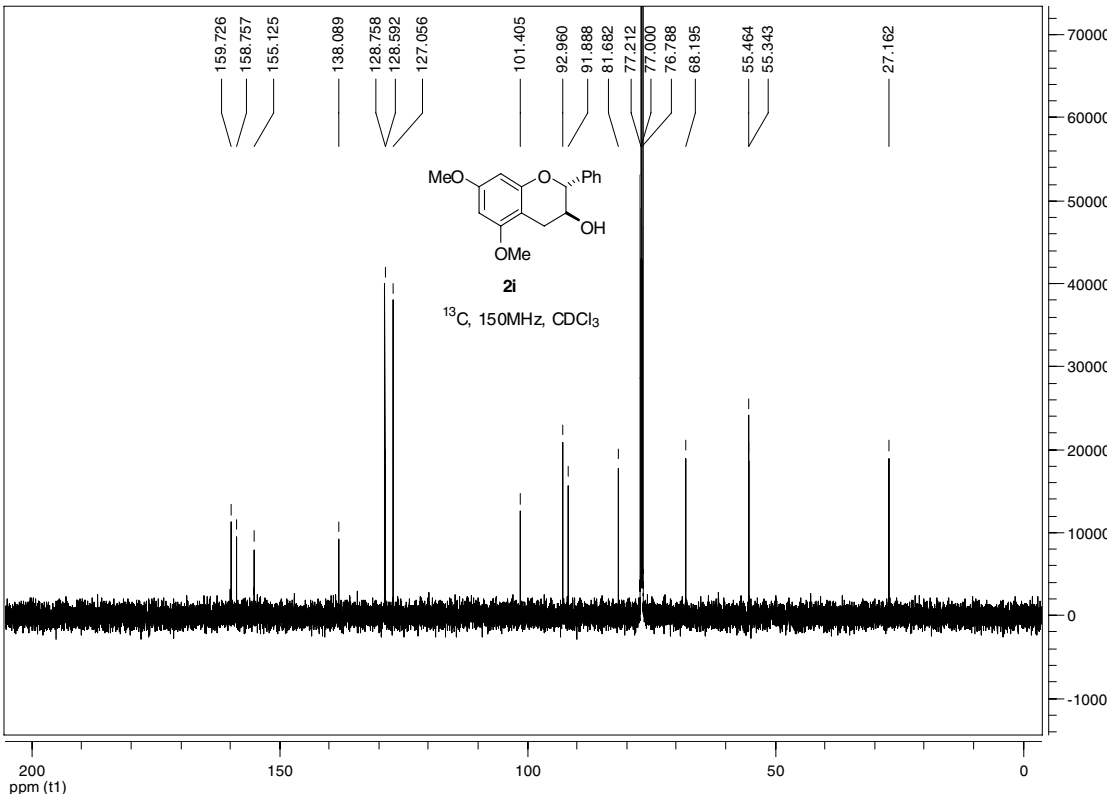
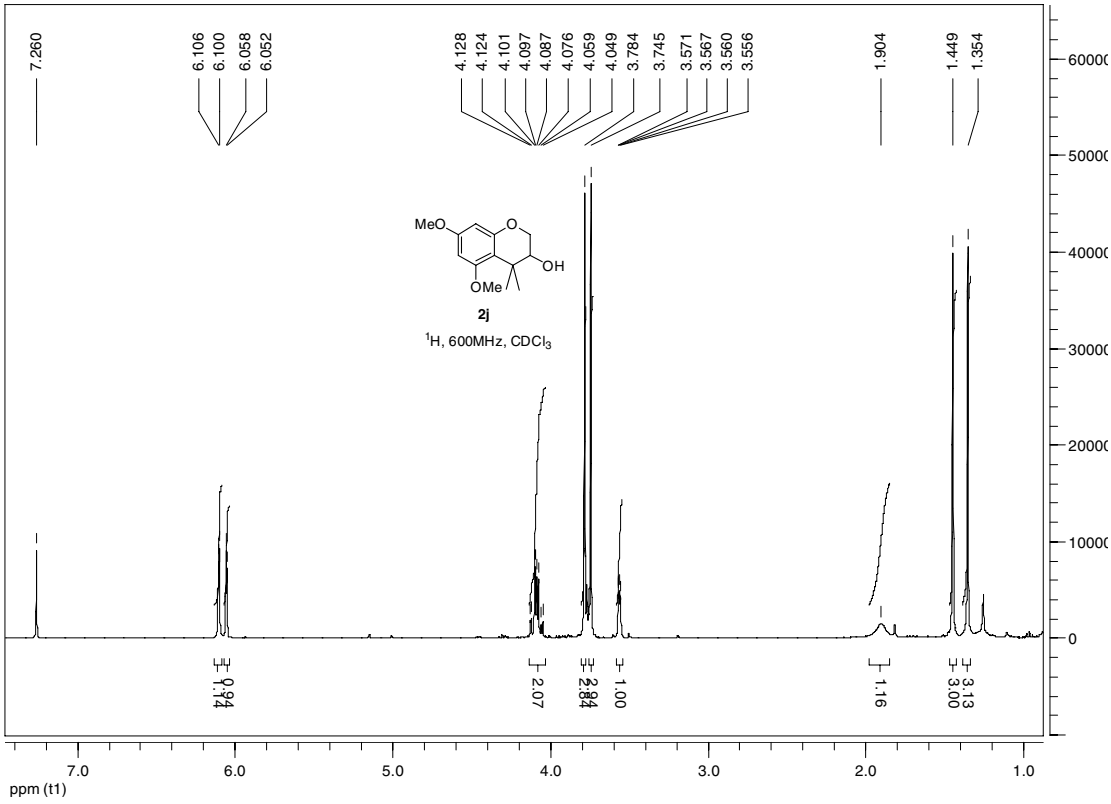
142.555
131.888
130.984
130.386
129.800
128.853
128.457
128.314
127.012
124.725
119.660
117.201
112.159
77.317
77.000
76.682
69.480
64.798
45.758
OH
Ph
O
Br
2h
13C, 150MHz, CDCl3
200
150
100
50
0
ppm (t1)


7.443
7.426
7.410
7.391
7.383
7.378
7.371
7.362
7.260
6.154
6.149
6.114
6.109
4.790
4.126
4.106
4.092
4.072
3.800
3.762
3.018
3.004
2.977
2.963
2.648
2.627
2.607
2.586
1.733
MeO
O
Ph
OH
OMe
2i
1H, 400MHz, CDCl3
5.29
2.00
0.97
1.12
1.21
1.00
0.98
1.05
8.0
7.0
6.0
5.0
4.0
3.0
2.0
ppm (t1)


159.726
158.757
155.125
138.089
128.758
128.592
127.056
101.405
92.960
91.888
81.682
77.212
77.000
76.788
68.195
55.464
55.343
27.162
MeO
O
Ph
OH
OMe
2i
13C, 150MHz, CDCl3
200
150
100
50
0
ppm (t1)


7.260
6.106
6.100
6.058
6.052
4.128
4.124
4.101
4.097
4.087
4.076
4.059
4.049
3.784
3.745
3.571
3.567
3.560
3.556
1.904
1.449
1.354
MeO
O
OH
OMe
2j
1H, 600MHz, CDCl3
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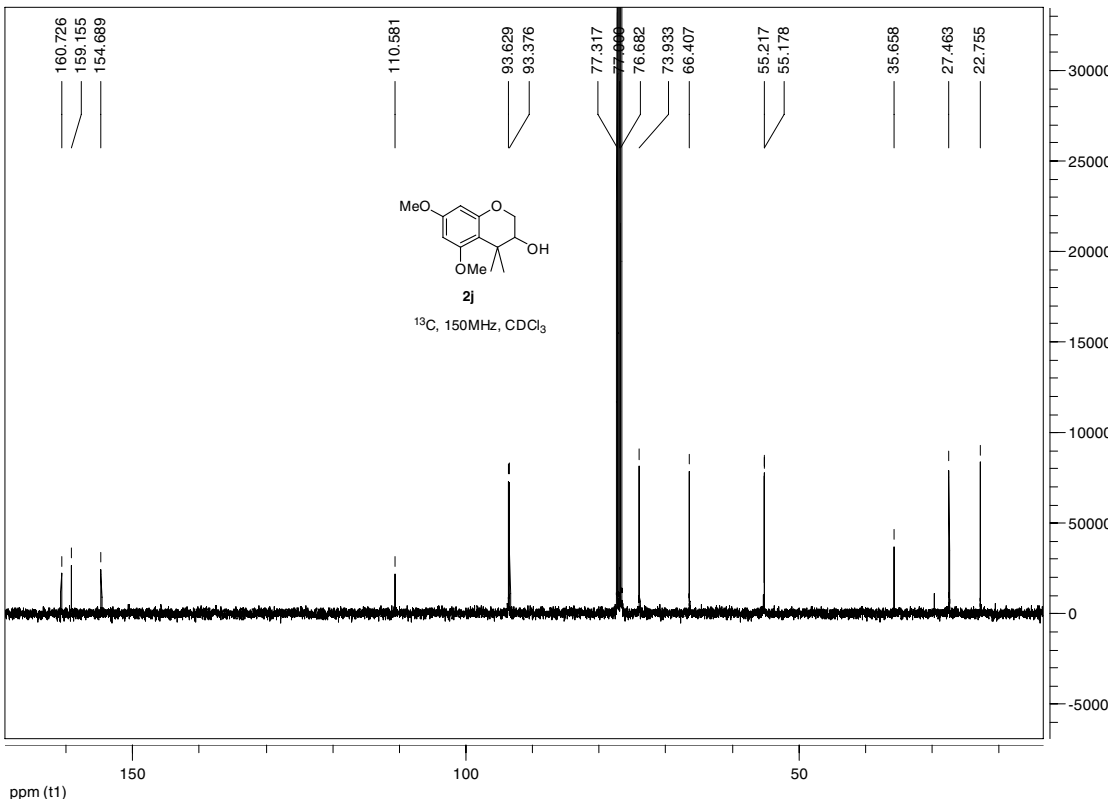
0.94
2.07
2.84
2.84
1.00
1.16
3.13
3.00
ppm (t1)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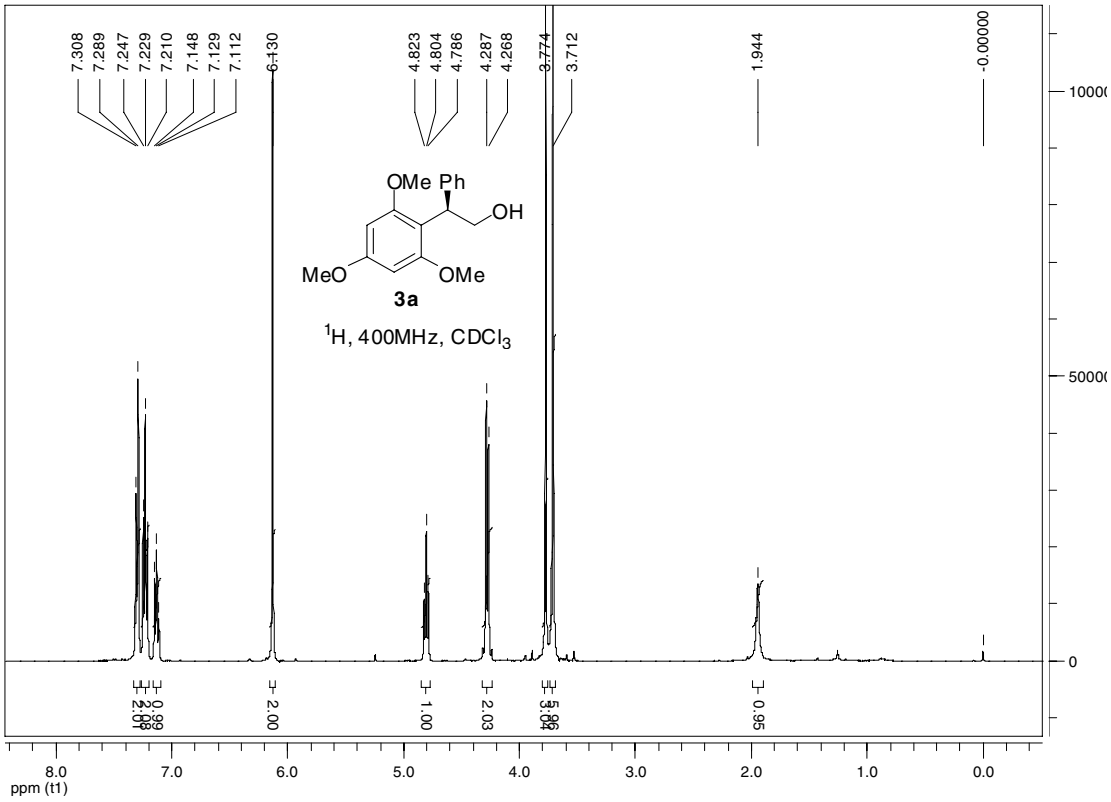
159.155
154.689
110.581
93.629
93.376
77.317
77.000
76.682
73.933
66.407
55.217
55.178
35.658
27.463
22.755
MeO
O
OH
OMe
2j
13C, 150MHz, CDCl3
ppm (t1)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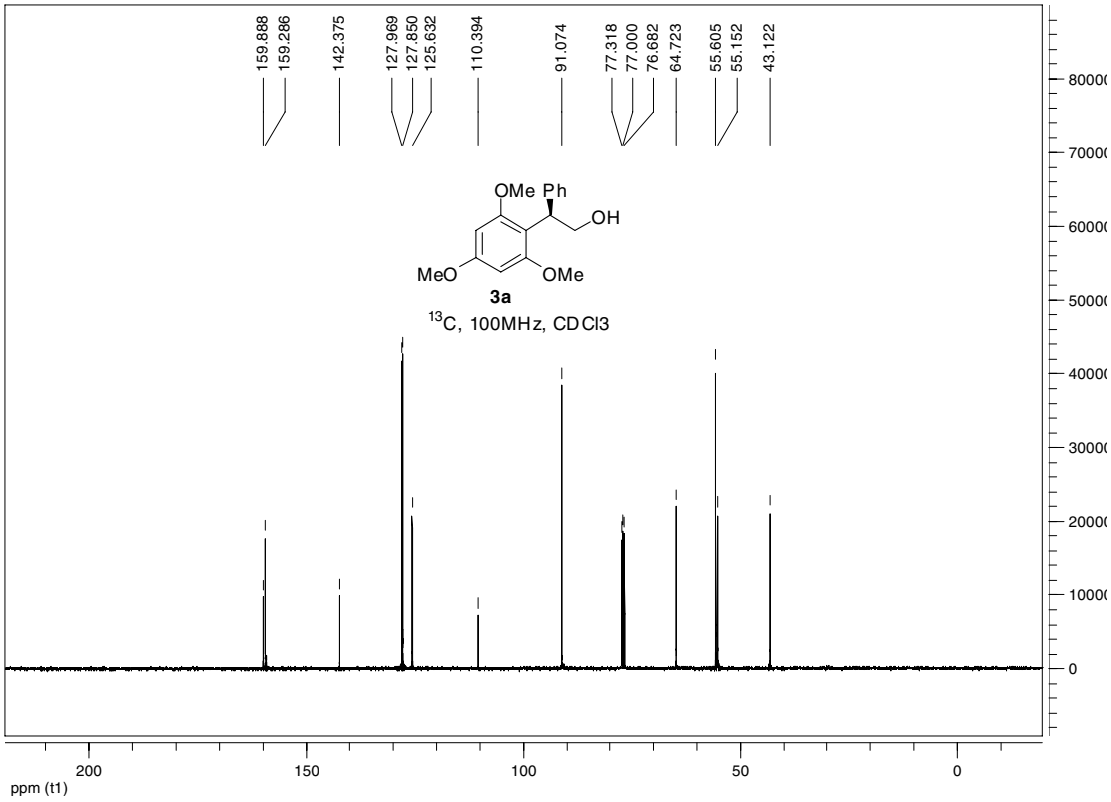
7.289
7.247
7.229
7.210
7.148
7.129
7.112
6.130
4.823
4.804
4.786
4.287
4.268
3.774
3.712
1.944
-0.00000
OMe Ph
OH
MeO
OMe
3a
1H, 400MHz, CDCl3
2.01
0.99
2.08
2.00
1.00
2.03
3.04
5.86
0.95
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
ppm (t1)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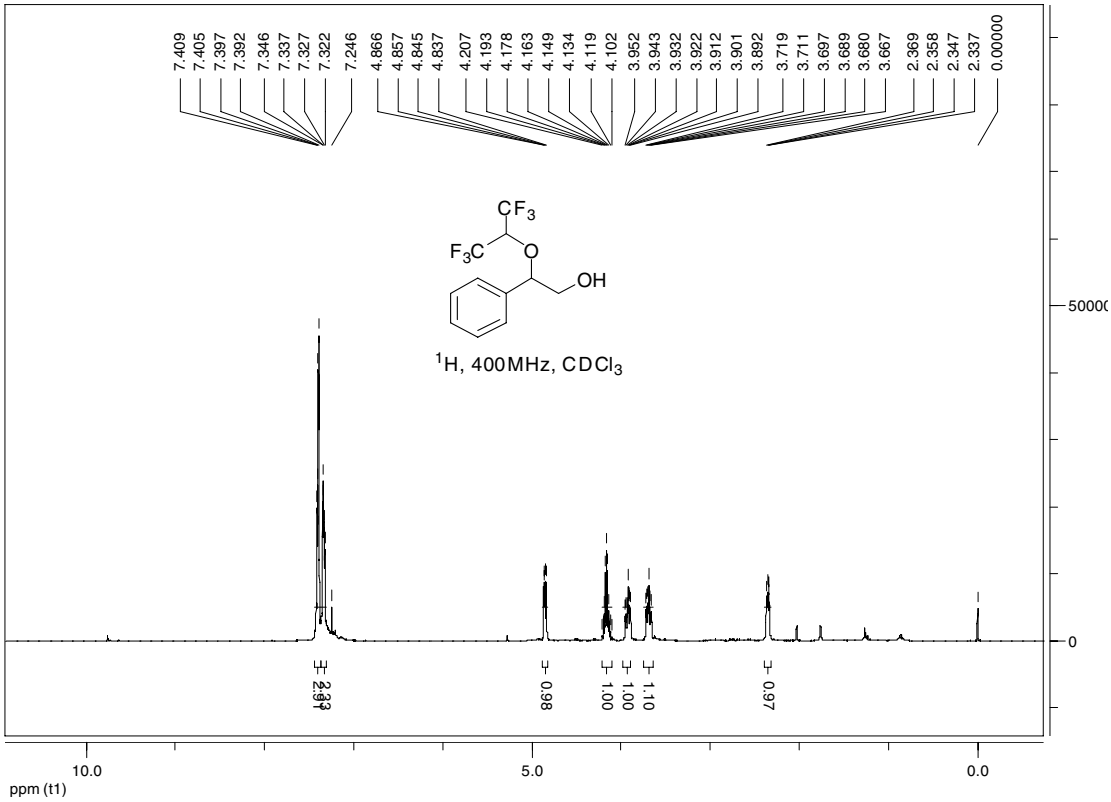
159.286
142.375
127.969
127.850
125.632
110.394
91.074
77.318
77.000
76.682
64.723
55.605
55.152
43.122
OMe Ph
OH
MeO
OMe
3a
13C, 100MHz, CDCl3
200
150
100
50
0
ppm (t1)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7.405
7.397
7.392
7.346
7.337
7.327
7.322
7.246
4.866
4.857
4.845
4.837
4.207
4.193
4.178
4.163
4.149
4.134
4.119
4.102
3.952
3.943
3.932
3.922
3.912
3.901
3.892
3.719
3.711
3.697
3.689
3.680
3.667
2.369
2.358
2.347
2.337
0.00000
CF3
F3C
O
OH
1H, 400MHz, CDCl3
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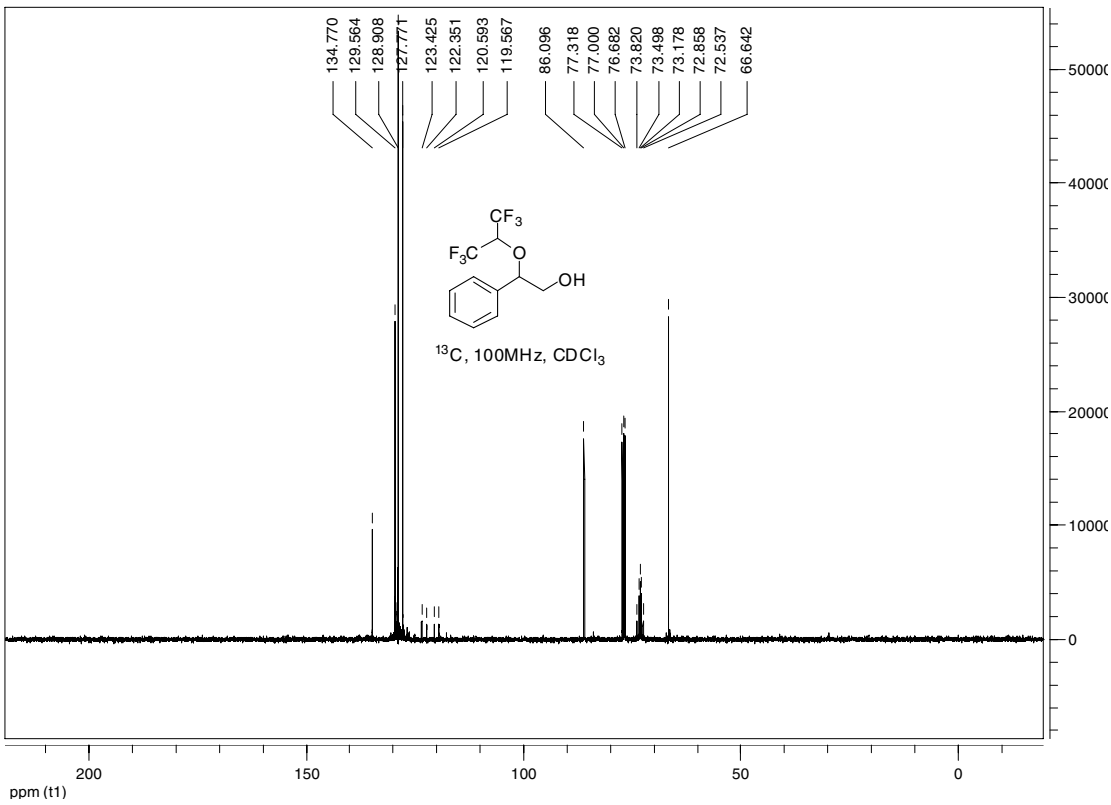
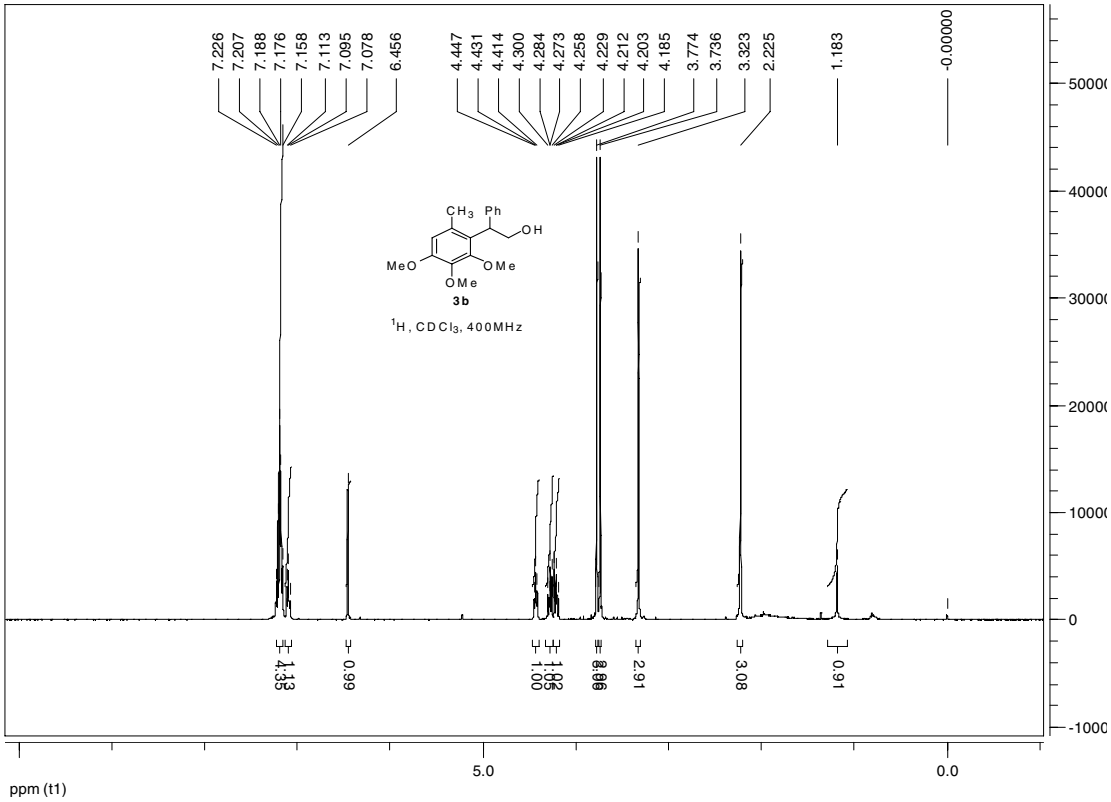
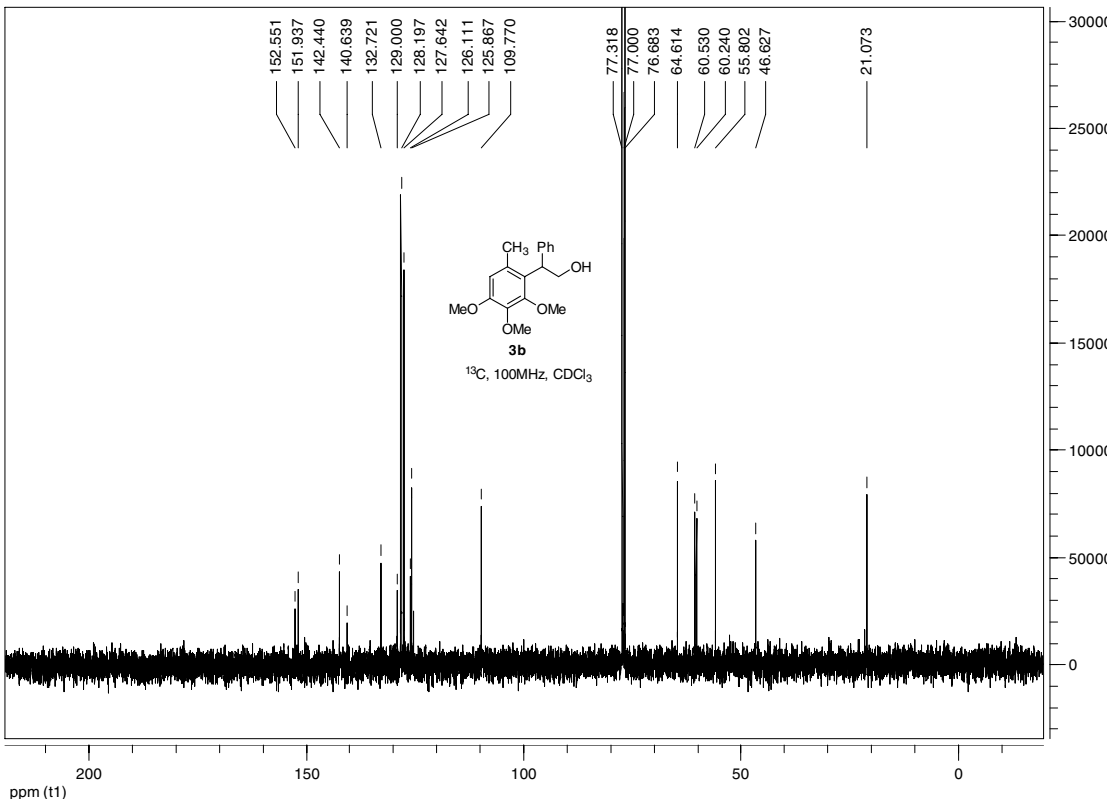
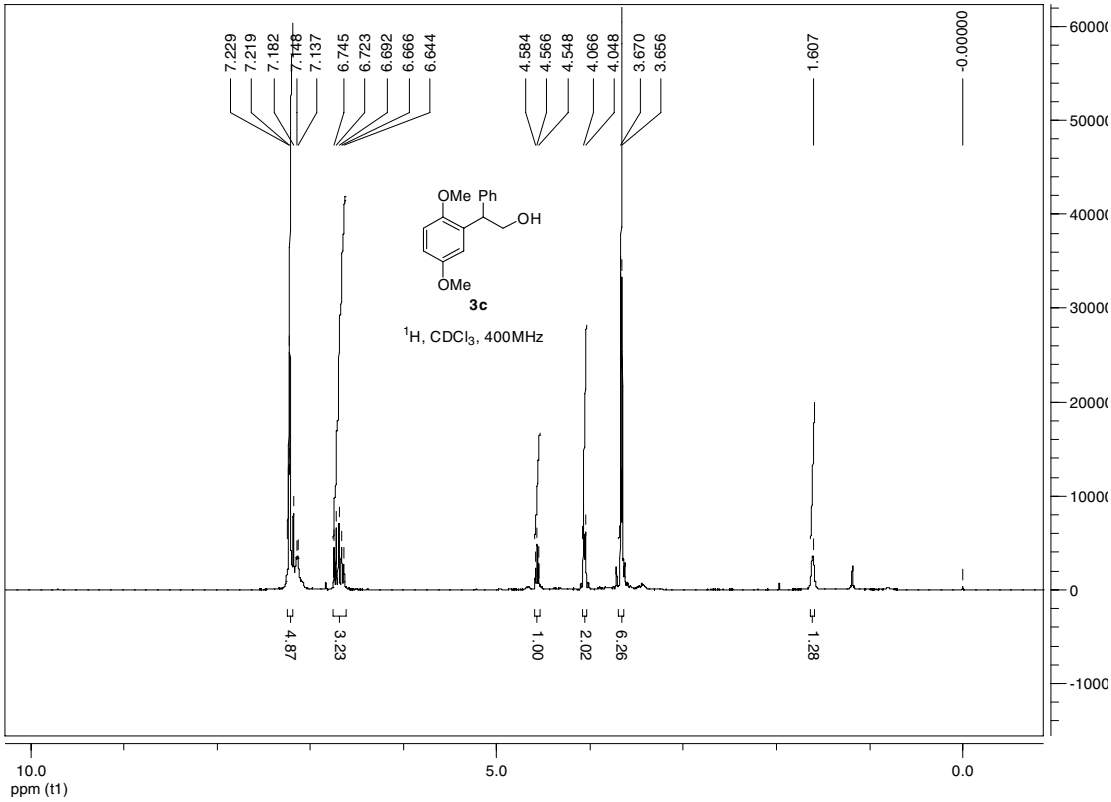
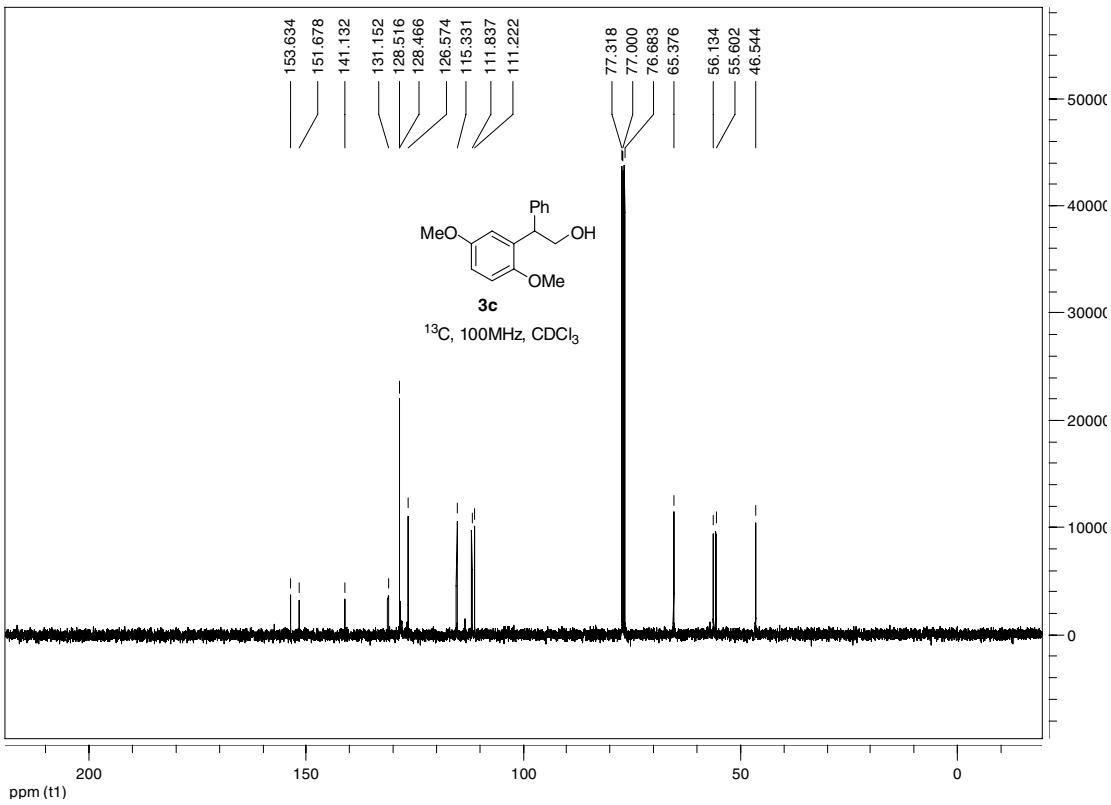
1.00
1.00
1.10
0.97
50000
0
10.0
5.0
0.0
ppm (t1)


134.770
129.564
128.908
127.771
123.425
122.351
120.593
119.567
86.096
77.318
77.000
76.682
73.820
73.498
73.178
72.858
72.537
66.642
CF3
F3C
O
OH
13C, 100MHz, CDCl3
50000
40000
30000
20000
10000
0
200
150
100
50
0
ppm (t1)


7.226
7.207
7.188
7.176
7.158
7.113
7.095
7.078
6.456
4.447
4.431
4.414
4.300
4.284
4.273
4.258
4.229
4.212
4.203
4.185
3.774
3.736
3.323
2.225
1.183
-0.00000
CH3 Ph
OH
MeO
OMe
OMe
3b
1H, CDCl3, 400MHz
4.33
0.99
1.00
2.91
3.08
0.91
5.0
0.0
ppm (t1)


152.551
151.937
142.440
140.639
132.721
129.000
128.197
127.642
126.111
125.867
109.770
77.318
77.000
76.683
64.614
60.530
60.240
55.802
46.627
21.073
CH3 Ph
OH
MeO
OMe
OMe
3b
13C, 100MHz, CDCl3
200
150
100
50
0
ppm (t1)


7.229
7.219
7.182
7.148
7.137
6.745
6.723
6.692
6.666
6.644
4.584
4.566
4.548
4.066
4.048
3.670
3.656
1.607
-0.00000
OMe Ph
OH
OMe
3c
1H, CDCl3, 400MHz
4.87
3.23
1.00
2.02
9.29
1.28
10.0
5.0
0.0
ppm (t1)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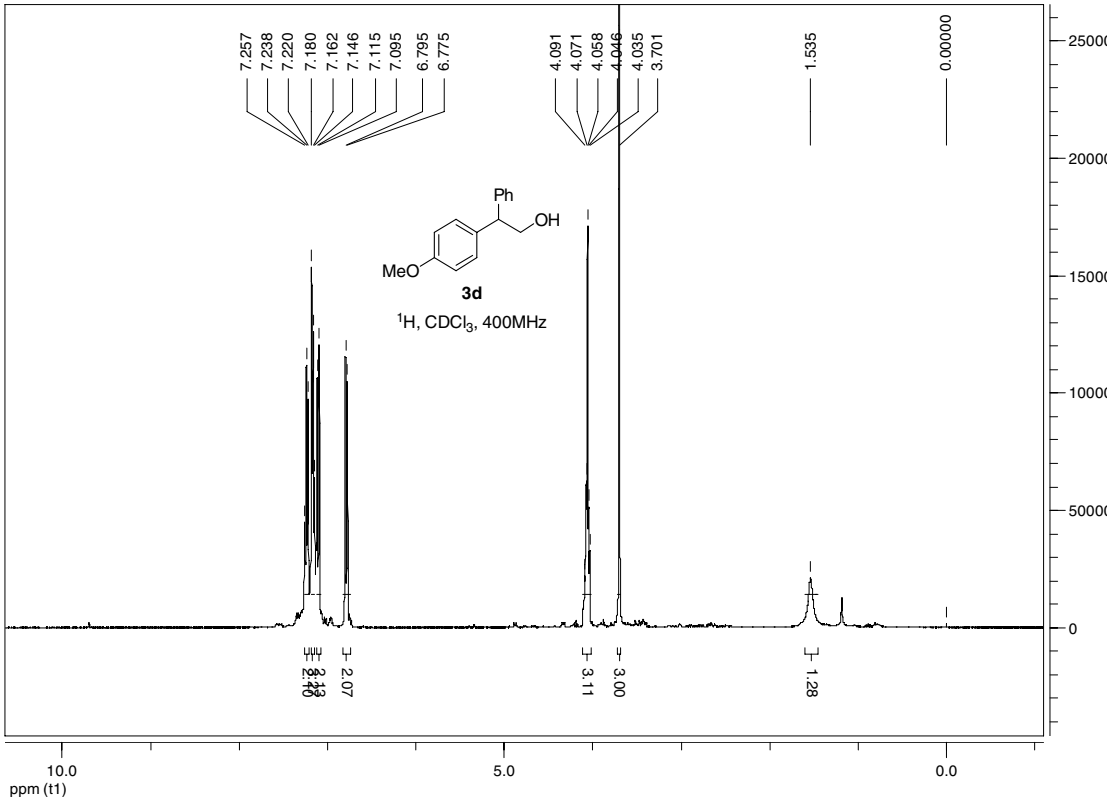
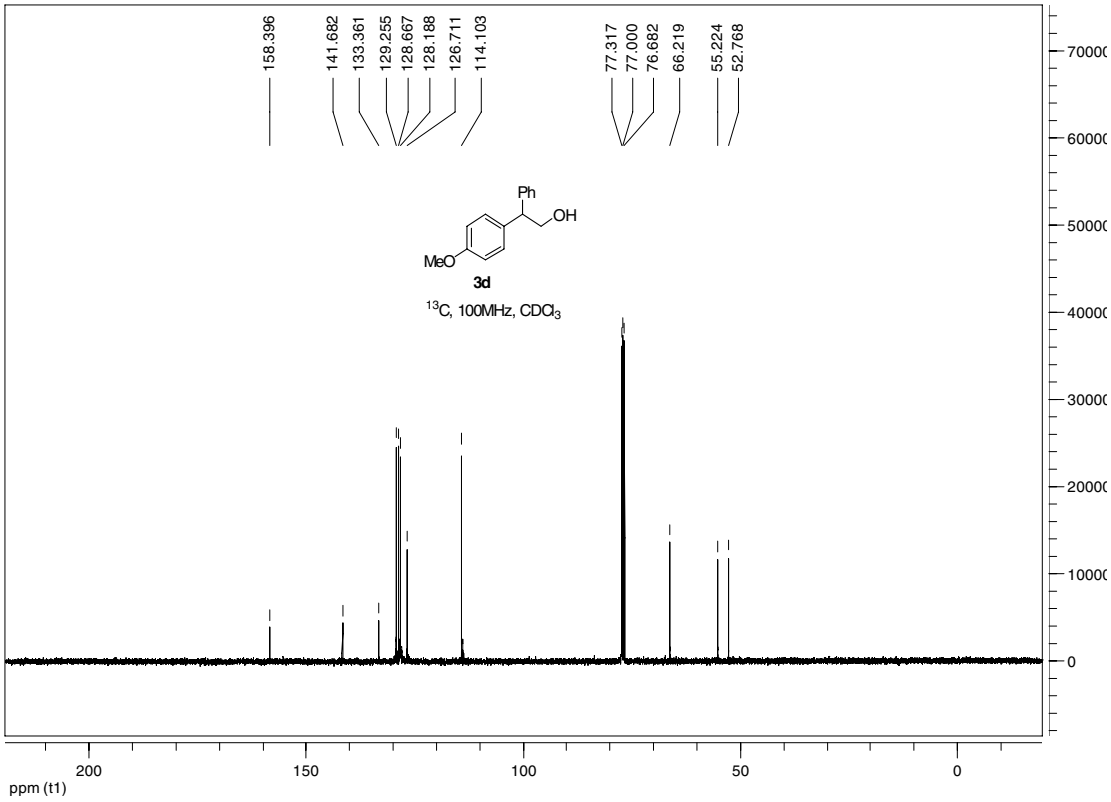
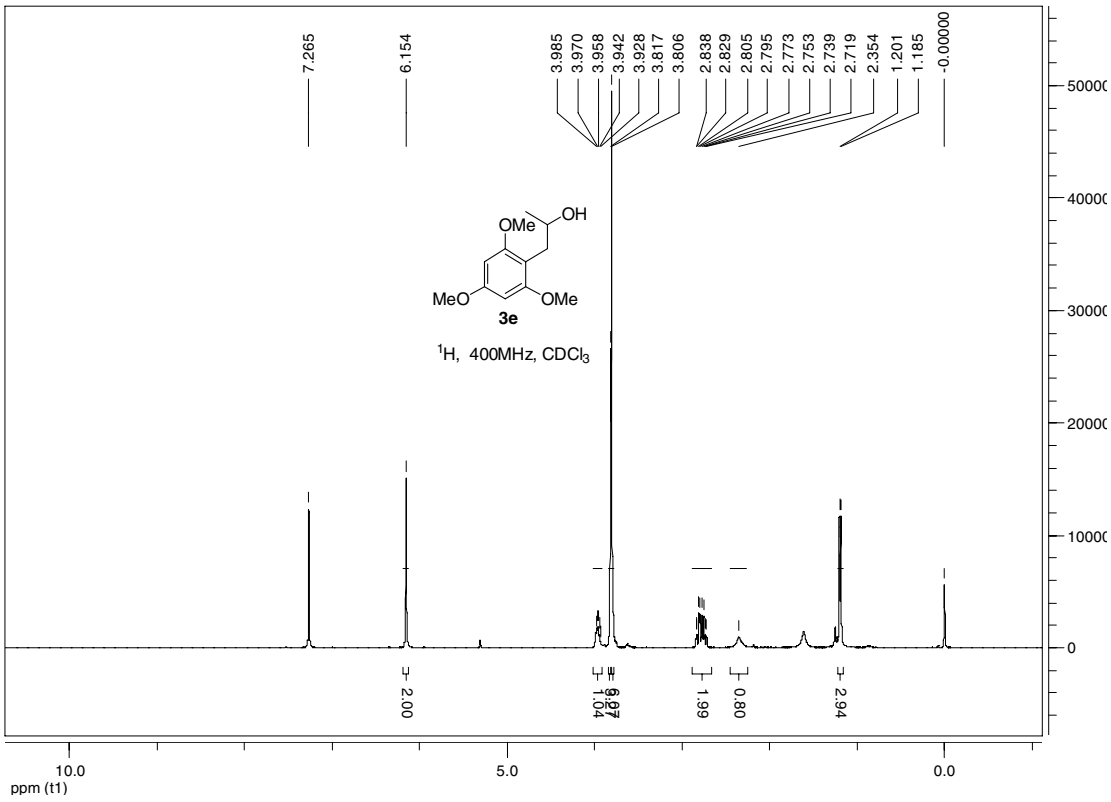
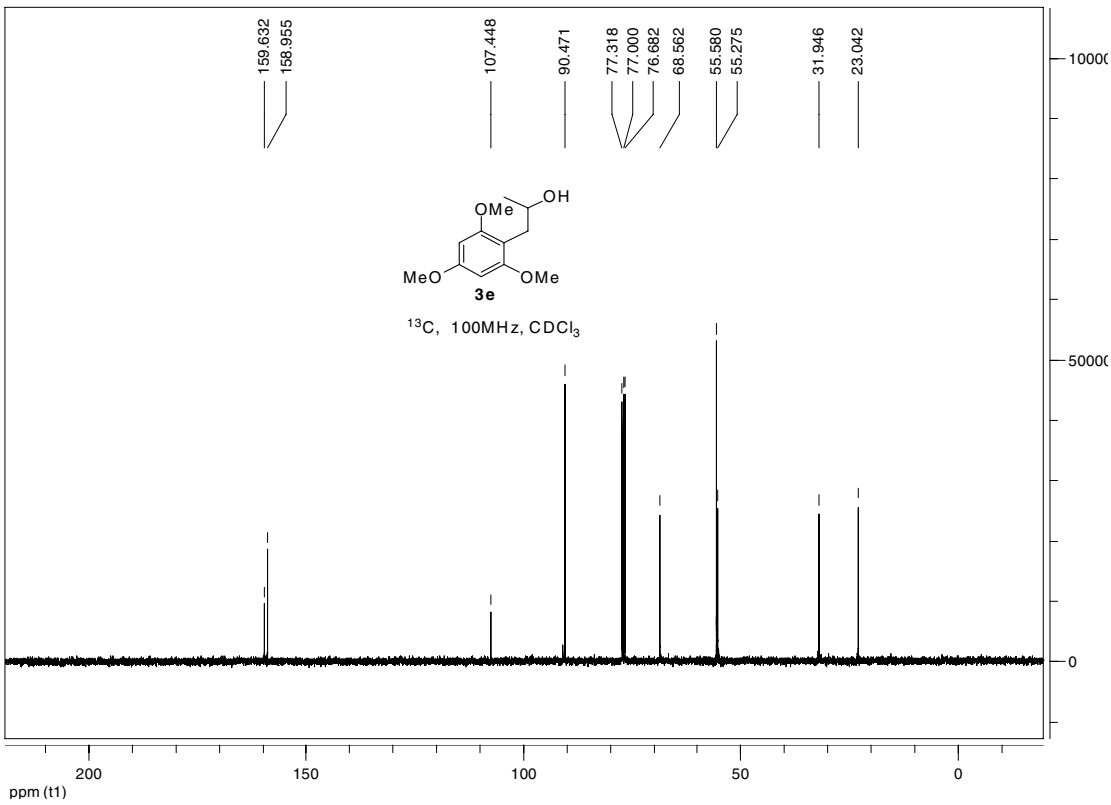
151.678
141.132
131.152
128.516
128.466
126.574
115.331
111.837
111.222
77.318
77.000
76.683
65.376
56.134
55.602
46.544
Ph
MeO
OH
OMe
3c
13C, 100MHz, CDCl3
200
150
100
50
0
ppm (t1)


7.257
7.238
7.220
7.180
7.162
7.146
7.115
7.095
6.795
6.775
4.091
4.071
4.058
4.046
4.035
3.701
1.535
0.00000
Ph
OH
MeO
3d
1H, CDCl3, 400MHz
2.10
2.13
2.07
3.11
3.00
1.28
10.0
5.0
0.0
ppm (t1)


158.396
141.682
133.361
129.255
128.667
128.188
126.711
114.103
77.317
77.000
76.682
66.219
55.224
52.768
Ph
OH
MeO
3d
13C, 100MHz, CDCl3
200
150
100
50
0
ppm (t1)


7.265
6.154
3.985
3.970
3.958
3.942
3.928
3.817
3.806
2.838
2.829
2.805
2.795
2.773
2.753
2.739
2.719
2.354
1.201
1.185
-0.00000
OMe
OH
MeO
OMe
3e
1H, 400MHz, CDCl3
2.00
10.14
1.99
0.80
2.94
10.0
5.0
0.0
ppm (t1)


159.632
158.955
107.448
90.471
77.318
77.000
76.682
68.562
55.580
55.275
31.946
23.042
OMe
OH
MeO
OMe
3e
13C, 100MHz, CDCl3
200
150
100
50
0
ppm (t1)