Supporting Information for:

Silver-Assisted, Iridium-Catalyzed Allylation of Bis[(pinacolato)boryl]methane Allows the Synthesis of Enantioenriched Homoallylic Organoboronic Esters.

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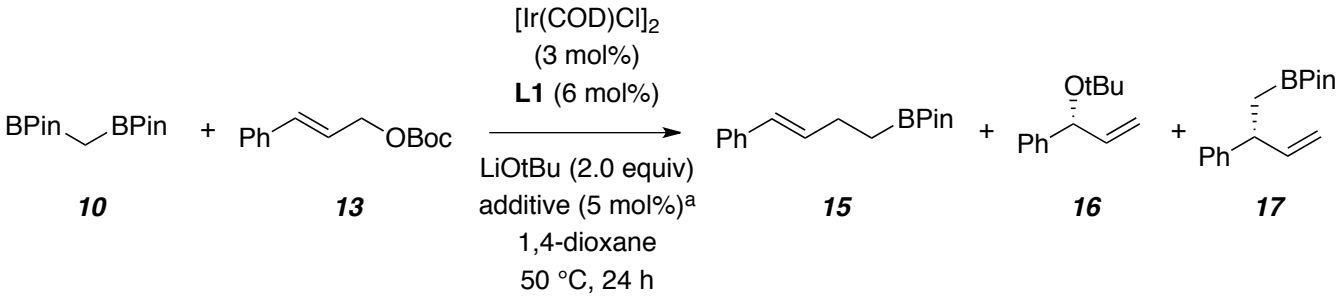
General Information

Flash column chromatography was performed using silica gel from Qindao Haiyang. Anhydrous solvents [tetrahydrofuran (THF), dichloromethane (DCM), and 1,4-dioxane] were purchased from Adamas, Energy Chemicals, or J&K, and used as received. $[Ir(COD)Cl]_2$ was purchased from Adamas and used as received. Commercial Ag_3PO_4 (Energy Chemicals), AgOMs (Adamas), and AgOTf (Aldrich) were used as received. Chiral ligands[1] and allylic carbonates used in this work were prepared according to literature procedures. Bis[(pinacolato)boryl]methane were prepared according to literature procedure[2] or purchased from TCI and used as received. NMR yields were determined by using 2-methyl naphthalene as an internal standard. All reported yields of the Ir/Ag-catalyzed allylation reactions are isolated yields following chromatography.

General Analytical Information

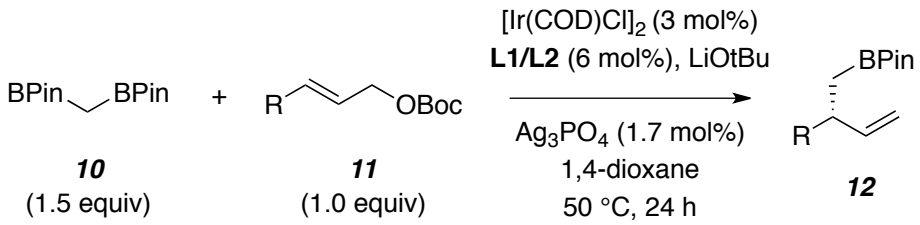
All new compounds were characterized by NMR spectroscopy, IR spectroscopy, high-resolution mass spectroscopy, and melting point (if solids). NMR spectra were recorded on a Bruker AMX 400 spectrometer and were calibrated using TMS or residual deuterated solvent as an internal reference ($CDCl_3$: 7.26 ppm for ^1H NMR and 77.16 ppm for ^{13}C NMR). All IR spectra were taken on a Thermo Scientific Nicolet iS5 spectrometer (iD5 ATR, diamond). HRMS spectra were recorded on a Shimadzu LCMS-IT-TOF. Melting points (M.p.) were recorded on an INESA SGW X-4 melting point apparatus. GC/MS analyses were performed on an Agilent 6890/5977 instrument. The enantiomeric excesses (ee) of the products were determined by high-performance liquid chromatography (HPLC) analysis performed on Agilent 1100 Series or Waters 2695 Series chromatographs using a Diacel® chiral column (25 cm), or by ultraperformance convergence chromatography (UPC^2) on Waters Acquity UPC^2 using Chiralpak IC-3 (10 cm). Optical rotations were measured on an INESA SGW-1 polarimeter with $[\alpha]_D$ values reported in degrees; concentration (c) is in g/100 mL.



additives	**15**:**16**:**17**	yield (ee) of **17**		additives	**15**:**16**:**17**	yield (ee) of **17**
CuCl	23:59:0	0 (na)	⟷	AgCl	0:10:74	74 (93)
CuBr	64:24:4	4 (na)	⟷	AgBr	0:5:81	81 (90)
Cu_2O	18:42:27	27 (na)	⟷	Ag_2O	0:7:81	81 (93)

Figure S1. Comparison of Three Pairs of Silver and Copper Salts in the Ir-Catalyzed Allylation Reactions of Bisborylated Methane.

General Procedure for Ir-catalyzed Allylation of Bis[(pinacolato)boryl]methane



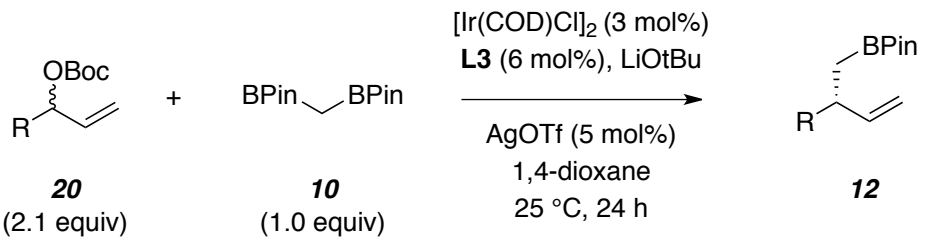
Procedure A:

$[Ir(COD)Cl]_2$ (60 mg, 0.090 mmol) and **L1** (97 mg, 0.18 mmol) were dissolved in anhydrous THF (0.5 mL) and propylamine (0.5 mL). The solution was heated at 50 °C for 20 min, after which all volatiles were removed. The resulting yellow solid was then diluted in anhydrous 1,4-dioxane (6.0 mL) to get a stock solution.

In a nitrogen-filled glove-box, to a screw-capped vial containing Ag_3PO_4 (2.1 mg, 0.0050 mmol, 1.7 mol%), bisborylmethane (**10**, 0.12 g, 0.45 mmol, 1.5 equiv), LiO^tBu (36 mg, 0.45 mmol, 1.5 equiv), linear allylic tert-butyl carbonate **11** (if solid, 0.30 mmol, 1.0 equiv), and a stir bar were added a stock solution of the catalyst prepared in the above step (0.6 mL, 0.009 mmol, 3 mol%). The vial was sealed with a cap containing a PTFE septum and removed from the glove box. Linear allylic tert-butyl carbonate, if liquid, was added via a syringe. The reaction was stirred at 50 °C for 24 h. EtOAc (10 mL) was then added. The mixture was then washed with saturated $NaHCO_3$ (5 mL) and brine (5 mL). The organic phase was then dried (Na_2SO_4), filtered, and concentrated under reduced pressure. Pure product was obtained after flash column chromatography.

Procedure B:

In a nitrogen-filled glove-box, anhydrous 1,4-dioxane (0.60 mL) was added to a screw-capped vial containing $[Ir(COD)Cl]_2$ (6.0 mg, 0.0090 mmol, 3.0 mol%) and **L2** (0.018 mmol, 6.0 mol%), Ag_3PO_4 (2.1 mg, 0.0050 mmol, 1.7 mol%), bisborylmethane (**10**, 0.12 g, 0.45 mmol, 1.5 equiv), LiO^tBu (36 mg, 0.45 mmol, 1.5 equiv), linear allylic tert-butyl carbonate **11** (if solid, 0.30 mmol, 1.0 equiv), and a stir bar. The vial was sealed with a cap containing a PTFE septum and removed from the glove box. Linear allylic tert-butyl carbonate, if liquid, was added via a syringe. The reaction was stirred at 50 °C for 24 h. EtOAc (10 mL) was then added. The mixture was then washed with saturated $NaHCO_3$ (5 mL) and brine (5 mL). The organic phase was then dried (Na_2SO_4), filtered, and concentrated under reduced pressure. Pure product was obtained after flash column chromatography.

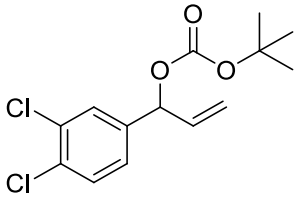


20 (2.1 equiv) ***10*** (1.0 equiv) ***12***

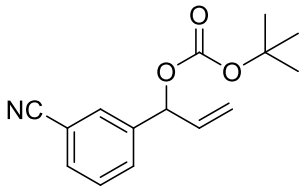
Procedure C:

In a nitrogen-filled glove-box, $[Ir(COD)Cl]_2$ (6.0 mg, 0.0090 mmol, 3.0 mol%) and **L3** (18 mg, 0.036 mmol, 12 mol%) were added to a screw-capped vial equipped with a stir bar. Anhydrous 1,4-dioxane (0.60 mL) was added. The mixture was stirred for 20 min at room temperature before AgOTf (3.9 mg, 0.015 mmol, 5.0 mol%), bisborylmethane (80 mg, 0.30 mmol, 1.0 equiv), LiOtBu (36 mg, 0.45 mmol, 1.5 equiv) and branched allylic tert-butyl carbonate **20** (0.63 mmol, 2.1 equiv) were added. The vial was then sealed with a cap containing a PTFE septum and removed from the glove box. The reaction was stirred at 25 ^{o}C for 24 h. EtOAc (10 mL) was then added. The resulting mixture was washed with saturated $NaHCO_3$ (5 mL) and brine (5 mL). The organic phase was then dried (Na_2SO_4), filtered, and concentrated under reduced pressure. Pure product was obtained after flash column chromatography.

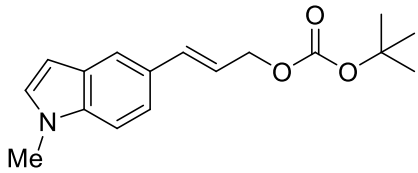
Characterization Data for Allyl Carbonates.



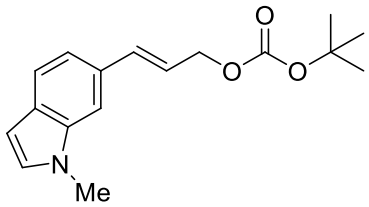
***tert*-Butyl 1-(3,4-dichlorophenyl)allyl carbonate. IR (thin film, cm^{-1})** 3085, 1644, 1740, 1592, 1160, 850 ; **^{1}H NMR (400 MHz, $CDCl_3$)** δ: 7.46 (d, *J* = 2.0 Hz, 1H), 7.43 (d, *J* = 8.3 Hz, 1H), 7.20 (dd, *J* = 8.3, 2.0 Hz, 1H), 6.01-5.90 (m, 2H), 5.38-5.25 (m, 2H), 1.48 (s, 9H); **^{13}C NMR (101 MHz, $CDCl_3$)** δ: 152.61, 139.16, 135.41, 132.87, 132.43, 130.71, 129.16, 126.48, 118.28, 83.01, 77.87, and 27.90; **HRMS (DART-TOF)** calculated for $C_{14}H_{16}Cl_2NaO_3$ $[M+Na]^+$ m/z 325.0369, found 325.0348.



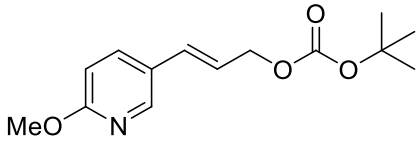
***tert*-Butyl 1-(3-cyanophenyl)allyl carbonate. IR (thin film, cm^{-1})** 3079, 2233, 1746, 1641, 1584, 1144, 852 ; **^{1}H NMR (400 MHz, $CDCl_3$)** δ: 7.67 (t, *J* = 1.7 Hz, 1H), 7.63-7.58 (m, 2H), 7.50-7.45 (m, 1H), 6.04-5.91 (m, 2H), 5.38-5.30 (m, 2H), 1.48 (s, 9H); **^{13}C NMR (101 MHz, $CDCl_3$)** δ: 152.58, 140.55, 135.28, 131.95, 131.51, 130.70, 129.55, 118.66, 118.62, 112.95, 83.15, 78.01, and 27.89. **HRMS (DART-TOF)** calculated for $C_{15}H_{17}NNaO_3$ $[M+Na]^+$ m/z 282.1104, found 282.1101.



(*E*)-*tert*-Butyl 3-(1-methyl-1*H*-indol-5-yl)allyl carbonate. IR (thin film, cm^{-1}) 2984, 1737, 1616, 1513, 1158, 857; **^{1}H NMR (400 MHz, $CDCl_3$)** δ: 7.61 (s, 1H), 7.34 (dd, *J* = 8.6, 1.4 Hz, 1H), 7.26 (d, *J* = 8.4 Hz, 1H), 7.03 (d, *J* = 3.1 Hz, 1H), 6.79 (d, *J* = 15.8 Hz, 1H), 6.46 (d, *J* = 3.0 Hz, 1H), 6.25 (dt, *J* = 15.7, 6.8 Hz, 1H), 4.73 (dd, *J* = 6.7, 0.8 Hz, 2H), 3.77 (s, 3H), 1.50 (s, 9H); **^{13}C NMR (101 MHz, $CDCl_3$)** δ: 153.60, 136.79, 136.49, 129.56, 128.68, 127.87, 120.28, 120.12, 119.74, 109.49, 101.47, 82.18, 68.30, 33.05, and 27.94. **HRMS (DART-TOF)** calculated for $C_{17}H_{21}NNaO_3$ $[M+Na]^+$ m/z 310.1414, found 310.1416.

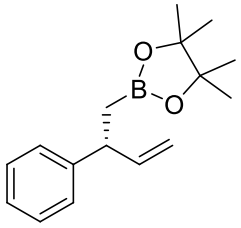


(*E*)-*tert*-butyl 3-(1-methyl-1*H*-indol-6-yl)allyl carbonate. IR (thin film, cm^{-1}) 2982, 1736, 1654, 1509, 1158, 856 ; **^{1}H NMR (400 MHz, CDCl$_3$)** δ: 7.55 (d, *J* = 8.2 Hz, 1H), 7.30 (s, 1H), 7.21 (dd, *J* = 8.2, 1.3 Hz, 1H), 7.04 (d, *J* = 3.1 Hz, 1H), 6.81 (d, *J* = 15.8 Hz, 1H), 6.44 (dd, J = 3.0, 0.6 Hz, 1H), 6.32 (dt, *J* = 15.8, 6.7 Hz, 1H), 4.75 (dd, *J* = 6.7, 1.0 Hz, 2H), 3.77 (s, 3H), 1.51 (s, 9H); **^{13}C NMR (101 MHz, CDCl$_3$)** δ: 153.50, 136.88, 136.26, 129.98, 129.81, 128.64, 120.91, 120.61, 118.20, 108.04, 101.09, 82.15, 68.04, 32.87, and 27.85. **HRMS (DART-TOF)** calculated for $C_{17}H_{21}NNaO_3$ $[M+Na]^+$ m/z 310.1414, found 310.1416.

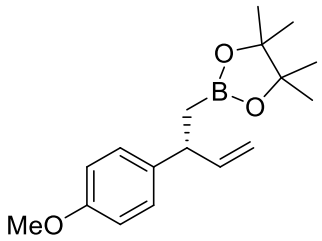


(*E*)-*tert*-Butyl 3-(6-methoxypyridin-3-yl)allyl carbonate. IR (thin film, cm^{-1}) 2983, 1739, 1603, 1159, 844 ; **^{1}H NMR (400 MHz, CDCl$_3$)** δ: 8.12 (d, *J* = 2.1 Hz, 1H), 7.67 (dd, *J* = 8.7, 2.3 Hz, 1H), 6.72 (d, *J* = 8.6 Hz, 1H), 6.61 (d, *J* = 15.9 Hz, 1H), 6.19 (dt, *J* = 15.9, 6.5 Hz, 1H), 4.71 (d, *J* = 6.5 Hz, 2H), 3.94 (s, 3H), 1.50 (s, 9H); **^{13}C NMR (101 MHz, CDCl$_3$)** δ: 164.06, 153.43, 146.07, 135.80, 130.87, 125.52, 122.24, 111.18, 82.48, 67.52, 53.69, and 27.90; **HRMS (DART-TOF)** calculated for $C_{14}H_{19}NO_3$ $[M+H]^+$ m/z 266.1392, found 266.1393.

Characterization Data for Compounds in Table 2.

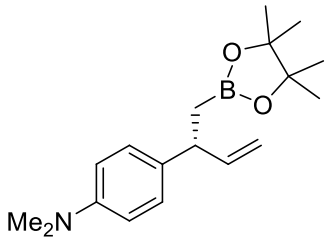


(*R*)-4,4,5,5-tetramethyl-2-(2-phenylbut-3-enyl)-1,3,2-dioxaborolane (17). Following the **General Procedure A** using *tert*-butyl cinnamyl carbonate[3] (1.0 g, 4.3 mmol, 1.0 equiv), Ag_3PO_4 (30 mg, 0.071 mmol, 1.7 mol%), bisborylmethane (**10**, 1.7 g, 6.4 mmol, 1.5 equiv), LiO^{t}Bu (0.51 g, 6.4 mmol, 1.5 equiv) and stock solution of iridium complex (8.5 mL, 0.13 mmol). The product was isolated as a yellow oil (1.0 g, 4.0 mmol, 94%). **IR (thin film, cm^{-1})** 3062, 3028, 1638, 1601, 847; **^{1}H NMR (400 MHz, $CDCl_3$)** δ: 7.34-7.19 (m, 4H), 7.19-7.09 (m, 1H), 6.01 (ddd, *J* = 17.1, 10.2, 6.9 Hz, 1H), 5.03 (dt, *J* = 17.1, 1.5 Hz, 1H), 4.97 (dt, *J* = 10.0, 1.2 Hz, 1H), 3.61 (ddd, *J* = 7.7, 7.7, 7.7 Hz, 1H), 1.30 (dd, *J* = 15.4, 8.4 Hz, 1H), 1.24 (dd, *J* = 15.4, 8.0 Hz, 1H),, and 1.14 (s, 12H); **^{13}C NMR (101 MHz, $CDCl_3$)** δ: 145.76, 143.84, 128.38, 127.58, 126.14, 112.90 , 83.21, 45.11, 24.87, and 24.81; **HRMS (DART-TOF)** calculated for $C_{16}H_{23}BFO_2^-$ $[M+F]^-$ m/z 277.1781, found 277.1774; **HPLC analysis** of the product after being oxidized to the corresponding alcohol by $NaBO_3 \cdot 4H_2O$ (AD-H, Hexanes: *i*PrOH = 99.6:0.4, 1 mL/min) indicated 93% ee: t_R (major) = 45.4 min, t_R (minor) = 39.2 min; **$[\alpha]_D^{13}$** = 50.8 (c = 0.1, $CHCl_3$).

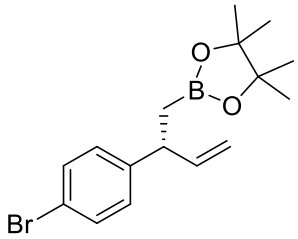


(*R*)-2-(2-(4-methoxyphenyl)but-3-enyl)-4,4,5,5-tetramethyl-1,3,2-dioxaborolane (12a). Following the **General Procedure A** using (*E*)-*tert*-butyl 3-(4-methoxyphenyl)allyl carbonate[3] (79 mg, 0.30 mmol, 1.0 equiv), Ag_3PO_4 (2.1 mg, 0.0050 mmol, 1.7 mol%), bisborylmethane (**10**, 0.12 g, 0.45 mmol, 1.5 equiv), LiO^{t}Bu (36 mg, 0.45 mmol, 1.5 equiv) and stock solution of iridium catalyst (0.6 mL, 0.009 mmol). The product was isolated as a yellow oil (61 mg, 0.21 mmol, 71%). **IR (thin film, cm^{-1})** 3078, 1636, 1511, 1145, 847; **^{1}H NMR (400 MHz, $CDCl_3$)** δ: 7.14 (d, *J* = 8.5 Hz, 2H), 6.82 (d, *J* = 8.7 Hz, 2H), 5.98 (ddd, *J* = 17.1, 10.2, 6.8 Hz, 1H), 5.01 (dt, *J* = 17.2, 1.5 Hz, 1H), 4.94 (dt, *J* = 10.4, 1.4 Hz, 1H), 3.77 (s, 3H), 3.56 (ddd, *J* = 8.0, 8.0, 8.0 Hz, 1H), 1.27 (dd, *J* = 15.3, 8.2 Hz, 1H), 1.21 (dd, *J* = 15.3, 7.9 Hz, 1H)., and 1.15 (s, 12H); **^{13}C NMR (101 MHz, $CDCl_3$)** δ: 158.01, 144.20, 137.96, 128.49, 113.78, 112.59, 83.22, 55.40, 44.26, 24.90, and 24.86; **HRMS (DART-TOF)** calculated for $C_{17}H_{25}BO_3$ $[M+H]^+$ m/z 289.1975, found 289.1985. **HPLC analysis** of the product after being oxidized to the

corresponding alcohol by $NaBO_3 \cdot 4H_2O$ (AD-H, Hexanes: *i*PrOH = 95: 5, 1 mL/min) indicated 93% ee: t_R (major) = 12.2 min, t_R (minor) = 14.2 min; $[\alpha]_D^{13}$ = 51.8 (c = 0.1, $CHCl_3$).

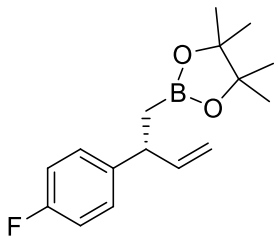


(*R*)-*N*,*N*-dimethyl-4-(1-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)but-3-en-2-yl)aniline (12b). Following the **General Procedure A** using (*E*)-*tert*-butyl 3-(4-(dimethylamino)phenyl)allyl carbonate (83 mg, 0.30 mmol, 1.0 equiv), Ag_3PO_4 (2.1 mg, 0.0050 mmol, 1.7 mol%), bisborylmethane (**10**, 0.12 g, 0.45 mmol, 1.5 equiv), LiO^tBu (36 mg, 0.45 mmol, 1.5 equiv) and stock solution of iridium catalyst (0.6 mL, 0.009 mmol). The reaction was stirred at 25 °C for 24 h. The product was isolated as a yellow oil (71 mg, 0.23 mmol, 78%). **IR (thin film, cm^{-1})** 2978, 1614, 1520, 1141, and 846; **^{1}H NMR (400 MHz, $CDCl_3$)** δ: 7.10 (d, *J* = 8.6 Hz, 2H), 6.68 (d, *J* = 8.7 Hz, 2H), 5.98 (ddd, *J* = 17.1, 10.2, 6.9 Hz, 1H), 5.01 (dt, *J* = 17.1, 1.5 Hz, 1H), 4.92 (dt, *J* = 10.4, 1.6 Hz, 1H), 3.53 (ddd, *J* = 7.6, 7.6, 7.6 Hz, 1H), 2.89 (s, 6H), 1.27 (dd, *J* = 15.2, 8.4 Hz, 1H), 1.21 (dd, *J* = 15.2, 7.6 Hz, 1H). (m, 2H), 1.16 (s, 6H), 1.16 (s, 6H); **^{13}C NMR (101 MHz, $CDCl_3$)** δ: 149.36, 144.45, 134.18, 128.07, 113.12, 112.23, 83.15, 44.14, 41.08, 24.94, and 24.87; **HRMS (DART-TOF)** calculated for $C_{18}H_{28}BO_2$ $[M+H]^+$ m/z 302.2291, found 302.2307. **HPLC analysis** of the product after being oxidized to the corresponding alcohol by $NaBO_3 \cdot 4H_2O$ (AD-H, Hexanes: *i*PrOH = 95: 5, 1 mL/min) indicated 93% ee: t_R (major) = 12.8 min, t_R (minor) = 15.3 min; $[\alpha]_D^{13}$ = 11.5 (c = 0.2, $CHCl_3$).

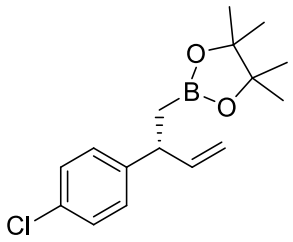


(*R*)-2-(2-(4-bromophenyl)but-3-enyl)-4,4,5,5-tetramethyl-1,3,2-dioxaborolane (12c). Following the **General Procedure A** using (*E*)-3-(4-bromophenyl)allyl *tert*-butyl carbonate[3] (94 mg, 0.30 mmol, 1.0 equiv), Ag_3PO_4 (3.5 mg, 0.0083 mmol, 2.8 mol%), bisborylmethane (**10**, 0.12 g, 0.45 mmol, 1.5 equiv), LiO^tBu (36 mg, 0.45 mmol, 1.5 equiv) and stock solution of the iridium catalyst (0.6 mL, 0.025 M, 0.015 mmol). The reaction was stirred at 50 °C for 36 h. The product was isolated as a yellow oil (81 mg, 0.24 mmol, 80%). **IR (thin film, cm^{-1})** 3078 , 1647, 1487, 1144, 847; **^{1}H NMR (400 MHz, $CDCl_3$)** δ: 7.39 (d, *J* = 8.4 Hz, 2H), 7.10 (d, *J* = 8.3 Hz, 2H), 5.95 (ddd, *J* = 17.0, 10.2, 6.8 Hz, 1H), 5.07-4.93 (m, 2H), 3.57 (ddd, *J* = 7.7, 7.7, 7.7 Hz, 1H), 1.28 (dd, *J* = 15.3, 8.1

Hz, 1H), 1.20 (dd, *J* = 15.5, 8.0 Hz, 1H), 1.15 (s, 12H). **^{13}C NMR (101 MHz, $CDCl_3$)** δ: 144.77, 143.23, 131.41, 129.43, 119.85, 113.40, 83.34, 44.51, 24.87, and 24.85; **HRMS (DART-TOF)** calculated for $C_{16}H_{22}BBrFO_2^-$ $[M+F]^-$ m/z 355.0886, found 355.0899; **HPLC analysis** of the product after being oxidized to the corresponding alcohol by $NaBO_3 \cdot 4H_2O$ (AD-H, Hexanes: *i*PrOH = 95: 5, 1 mL/min) indicated 93% ee: t_R (major) = 9.5 min, t_R (minor) = 11.1 min; **$[\alpha]_D^{13}$** = 36.6 (c = 0.1, $CHCl_3$).

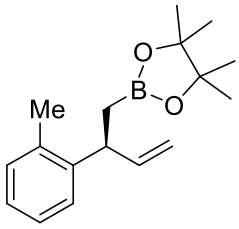


(*R*)-2-(2-(4-fluorophenyl)but-3-enyl)-4,4,5,5-tetramethyl-1,3,2-dioxaborolane (12d). Following the **General Procedure A** using (*E*)-*tert*-butyl 3-(4-fluorophenyl)allyl carbonate[4] (76 mg, 0.30 mmol, 1.0 equiv), Ag_3PO_4 (2.1 mg, 0.0050 mmol, 1.7 mol%), bisborylmethane (**10**, 0.12 g, 0.45 mmol, 1.5 equiv), LiO^{t}Bu (36 mg, 0.45 mmol, 1.5 equiv) and stock solution of the iridium catalyst (0.6 mL, 0.009 mmol). The product was isolated as a yellow oil (72 mg, 0.26 mmol, 87%). **IR (thin film, cm^{-1})** 3079, 3038, 1637, 1509, 1145, 847; **^{1}H NMR (400 MHz, $CDCl_3$)** δ: 7.23-7.13 (m, 2H), 6.99-6.90 (m, 2H), 5.97 (ddd, *J* = 17.0, 10.2, 6.7 Hz, 1H), 5.06-4.92 (m, 2H), 3.59 (ddd, *J* = 7.7, 7.7, 7.7 Hz, 1H), 1.28 (dd, *J* = 15.3, 7.9 Hz, 1H), 1.21 (dd, *J* = 15.4, 8.2 Hz, 1H), 1.14 (s, 12H). **^{13}C NMR (101 MHz, $CDCl_3$)** δ: 161.46 (d, *J* = 243.4 Hz), 143.75, 141.37 (d, *J* = 3.1 Hz), 129.02 (d, *J* = 7.8 Hz), 115.05 (d, *J* = 21.1 Hz), 113.03, 83.29 , 44.33 , 24.86 , and 24.84; **^{19}F NMR (376 MHz, $CDCl_3$)** δ: -117.6; **HRMS (DART-TOF)** calculated for $C_{16}H_{22}BF_2O_2^-$ $[M+F]^-$ m/z 295.1686, found 295.1683; **HPLC analysis** of the product after being oxidized to the corresponding alcohol by $NaBO_3 \cdot 4H_2O$ (AD-H, Hexanes: *i*PrOH = 99: 1, 1 mL/min) indicated 92% ee: t_R (major) = 19.2 min, t_R (minor) = 21.3 min; **$[\alpha]_D^{13}$** = 30.8 (c = 0.1, $CHCl_3$).

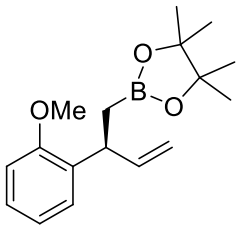


(*R*)-2-(2-(4-chlorophenyl)but-3-enyl)-4,4,5,5-tetramethyl-1,3,2-dioxaborolane (12e). Following the **General Procedure A** using (*E*)-*tert*-butyl 3-(4-chlorophenyl)allyl carbonate[5] (81 mg, 0.30 mmol, 1.0 equiv), Ag_3PO_4 (3.5 mg, 0.0083 mmol, 2.8 mol%), bisborylmethane (**10**, 0.12 g, 0.45 mmol, 1.5 equiv), LiO^{t}Bu (36 mg, 0.45 mmol, 1.5 equiv) and stock solution (0.6 mL, 0.015 mmol). The reaction was stirred at 50 °C for 36 h. The product was isolated as a yellow oil (62 mg, 0.21 mmol, 71%). **^{1}H NMR (400 MHz, $CDCl_3$)** δ: 7.23 (d, *J* = 8.5 Hz, 2H), 7.15

(d, *J* = 8.5 Hz, 2H), 5.96 (ddd, *J* = 17.0, 10.2, 6.8 Hz, 1H), 5.05–4.94 (m, 2H), 3.58 (ddd, *J* = 7.7, 7.7, 7.7 Hz, 1H), 1.28 (dd, *J* = 15.2, 8.0 Hz, 1H), 1.20 (dd, *J* = 14.7, 7.3 Hz, 1H), 1.15 (s, 12H). **^{13}C NMR (101 MHz, $CDCl_3$)** δ: 144.26, 143.36, 131.79, 129.02, 128.46, 113.34, 83.34, 44.46, 24.87, and 24.85; **HRMS (DART-TOF)** calculated for $C_{16}H_{22}BClFO_2^-$ $[M+F]^-$ m/z 311.1391, found 311.1397; **HPLC analysis** of the product after being oxidized to the corresponding alcohol by $NaBO_3 \cdot 4H_2O$ (AS-H, Hexanes: *i*PrOH = 95:5, 1 mL/min) indicated 92% ee: t_R (major) = 9.5 min, t_R (minor) = 8.8 min; **$[\alpha]_D^{13}$** = 69.7 (c = 0.2, $CHCl_3$).

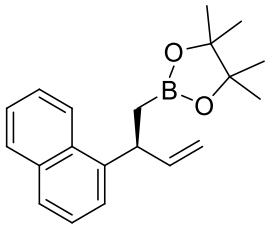


(*S*)-4,4,5,5-tetramethyl-2-(2-o-tolylbut-3-enyl)-1,3,2-dioxaborolane (12f). Following the **General Procedure B** using (*E*)-*tert*-butyl 3-*o*-tolylallyl carbonate[4] (75 mg, 0.30 mmol, 1.0 equiv), Ag_3PO_4 (2.1 mg, 0.0050 mmol, 1.7 mol%), bisborylmethane (**10**, 0.12 g, 0.45 mmol, 1.5 equiv), LiO^tBu (36 mg, 0.45 mmol, 1.5 equiv), $[Ir(COD)Cl]_2$ (6.0 mg, 0.0090 mmol, 3.0 mol%) and **L2** (8.3 mg, 0.018 mmol, 6.0 mol%). The product was isolated as a yellow oil (72 mg, 0.26 mmol, 88%). **IR (thin film, cm^{-1})** 3075, 3016, 1636, 1146, 847; **^{1}H NMR (400 MHz, $CDCl_3$)** δ: 7.21-7.02 (m, 4H), 5.94 (ddd, *J* = 17.0, 10.5, 6.6 Hz, 1H), 4.99-4.88 (m, 1H), 3.84 (ddd, *J* = 7.9, 7.9, 7.9 Hz, 1H), 2.36 (s, 3H), 1.30 (dd, *J* = 12.2, 5.0 Hz, 1H), 1.25 (dd, *J* = 12.6, 4.4 Hz, 1H), 1.11 (s, 6H), 1.09 (s, 6H); **^{13}C NMR (101 MHz, $CDCl_3$)** δ: 143.50, 143.47, 135.90, 130.22, 126.64, 126.18, 125.93, 112.76, 83.17, 40.42, 24.81, 24.75, and 19.75; **HRMS (DART-TOF)** calculated for $C_{17}H_{25}BFO_2^-$ $[M+F]^-$ m/z 291.1937, found 291.1946; **HPLC analysis** of the product after being oxidized to the corresponding alcohol by $NaBO_3 \cdot 4H_2O$ (AD-H, Hexanes: *i*PrOH = 99.6:0.4, 0.3 mL/min) indicated 92% ee: t_R (major) = 108.3 min, t_R (minor) = 133.4 min; **$[\alpha]_D^{13}$** = -14.831 (c = 0.2, $CHCl_3$).

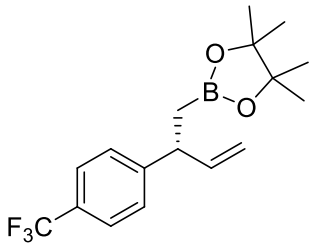


(*S*)-2-(2-(2-methoxyphenyl)but-3-enyl)-4,4,5,5-tetramethyl-1,3,2-dioxaborolane (12g). Following the **General Procedure B** using (*E*)-*tert*-butyl 3-(2-methoxyphenyl)allyl carbonate[6] (79 mg, 0.30 mmol, 1.0 equiv), Ag_3PO_4 (2.1 mg, 0.0050 mmol, 1.7 mol%), bisborylmethane (**10**, 0.12 g, 0.45 mmol, 1.5 equiv), LiO^tBu (36 mg, 0.45 mmol, 1.5 equiv), $[Ir(COD)Cl]_2$ (6.0 mg, 0.0090 mmol, 3.0 mol%) and **L2** (8.3 mg, 0.018 mmol, 6.0 mol%). The product was isolated as a yellow oil (74 mg, 0.26 mmol, 85%). **IR (thin film, cm^{-1})** 3077, 1637, 1599, 1145, 847;

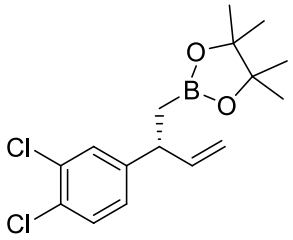
^{1}H NMR (400 MHz, $CDCl_3$) δ: 7.20-7.10 (m, 2H), 6.89 (td, *J* = 7.5, 0.9 Hz, 1H), 6.82 (d, *J* = 8.1 Hz, 1H), 6.05 (ddd, *J* = 17.0, 10.2, 6.7 Hz, 1H), 5.00 (dt, *J* = 17.2, 1.4 Hz, 1H), 4.93 (dt, *J* = 10.0, 1.2 Hz, 1H), 4.05 (ddd, *J* = 7.6, 7.6, 7.6 Hz, 1H), 3.81 (s, 3H), 1.30 (dd, *J* = 13.1, 6.6 Hz, 1H), 1.25 (dd, *J* = 13.1, 5.5 Hz, 1H), 1.14 (s, 6H), 1.13 (s, 6H); **^{13}C NMR (101 MHz, $CDCl_3$)** δ: 156.95, 143.30, 134.11, 127.89, 127.03, 120.62, 112.62, 110.72, 83.05, 55.55, 37.94, 24.86, and 24.77; **HRMS (DART-TOF)** calculated for $C_{17}H_{25}BO_3$ $[M+H]^+$ m/z 289.1975, found 289.1973. **HPLC analysis** of the product after being oxidized to the corresponding alcohol by $NaBO_3 \cdot 4H_2O$ (IA, Hexanes: *i*PrOH = 99.3:0.7, 1 mL/min) indicated 86% ee: t_R (major) = 28.2 min, t_R (minor) = 30.2 min; **$[\alpha]_D^{13}$** = -56.5 (c = 0.1, $CHCl_3$).



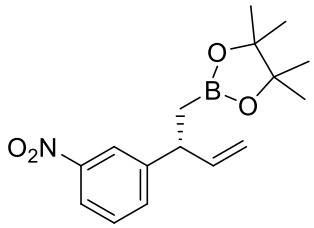
(*S*)-4,4,5,5-tetramethyl-2-(2-(naphthalen-1-yl)but-3-enyl)-1,3,2-dioxaborolane (12h). Following the **General Procedure B** using (*E*)-*tert*-butyl 3-(naphthalen-1-yl)allyl carbonate[5] (85 mg, 0.30 mmol, 1.0 equiv), Ag_3PO_4 (2.1 mg, 0.0050 mmol, 1.7 mol%), bisborylmethane (**10**, 0.12 g, 0.45 mmol, 1.5 equiv), LiO^{t}Bu (36 mg, 0.45 mmol, 1.5 equiv), $[Ir(COD)Cl]_2$ (6.0 mg, 0.0090 mmol, 3.0 mol%) and **L2** (8.3 mg, 0.018 mmol, 6.0 mol%). The product was isolated as a yellow oil (71 mg, 0.23 mmol, 77%). **IR (thin film, cm^{-1})** 3048, 1636, 1597, 1145, 847; **^{1}H NMR (400 MHz, $CDCl_3$)** δ: 8.21 (d, *J* = 8.4 Hz, 1H), 7.83 (d, *J* = 7.9 Hz, 1H), 7.69 (dd, *J* = 6.7, 2.6 Hz, 1H), 7.52-7.39 (m, 4H), 6.13 (ddd, *J* = 17.0, 10.3, 6.4 Hz, 1H), 5.08 (dt, *J* = 17.2, 1.4 Hz, 1H), 5.03 (dt, *J* = 10.3, 1.3 Hz, 1H), 4.47 (ddd, *J* = 7.6, 7.6, 7.6 Hz, 1H), 1.50-1.39 (m, 2H), 1.11 (s, 6H), 1.07 (s, 6H); **^{13}C NMR (101 MHz, $CDCl_3$)** δ: 143.46, 141.77, 134.06, 131.64, 128.83, 126.79, 125.69, 125.65, 125.38, 124.09, 124.05, 113.52, 83.24, 39.74, 24.85, and 24.74; **HRMS (DART-TOF)** calculated for $C_{20}H_{25}BFO_2^-$ $[M+F]^-$ m/z 327.1937, found 327.1940; **HPLC analysis** of the product after being oxidized to the corresponding alcohol by $NaBO_3 \cdot 4H_2O$ (AD-H, Hexanes: *i*PrOH = 95:5, 1 mL/min) indicated 90% ee: t_R (major) = 14.6 min, t_R (minor) = 13.2 min; **$[\alpha]_D^{13}$** = -28.3 (c = 0.1, $CHCl_3$).



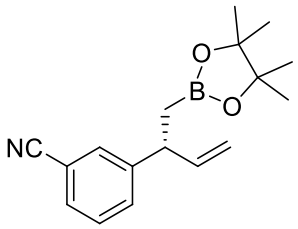
(*R*)-4,4,5,5-tetramethyl-2-(2-(4-(trifluoromethyl)phenyl)but-3-enyl)-1,3,2-dioxaborolane (12i). Following the **General Procedure C** using *tert*-butyl 1-(4-(trifluoromethyl)phenyl)allyl carbonate[3] (0.19 g, 0.63 mmol, 2.1 equiv), $[Ir(COD)Cl]_2$ (6.0 mg, 0.0090 mmol, 3.0 mol%) and **L3** (18 mg, 0.036 mmol, 12 mol%), AgOTf (3.9 mg, 0.015 mmol, 5.0 mol%), bisborylmethane (80 mg, 0.30 mmol, 1.0 equiv), LiOtBu (36 mg, 0.45 mmol, 1.5 equiv). The product was isolated as a yellow oil (77 mg, 0.24 mmol, 79%). **IR (thin film, cm^{-1})** 2925, 1618, 1409, 1162, 800; **^{1}H NMR (400 MHz, $CDCl_3$)** δ: 7.53 (d, *J* = 8.1 Hz, 2H), 7.34 (d, *J* = 8.1 Hz, 2H), 5.98 (ddd, *J* = 17.1, 10.2, 6.8 Hz, 1H), 5.08-4.98 (m, 2H), 3.67 (ddd, *J* = 7.6, 7.6, 7.6 Hz, 1H), 1.32 (dd, *J* = 15.4, 8.1 Hz, 1H), 1.24 (dd, *J* = 15.5, 7.9 Hz, 1H), 1.14 (s, 12H); **^{13}C NMR (101 MHz, $CDCl_3$)** δ: 149.92, 142.85, 128.52 (q, *J* = 32.3 Hz), 127.99, 125.34 (q, *J* = 3.8 Hz), 124.49 (q, *J* = 271.7 Hz), 113.84, 83.41, 44.95, 24.87, and 24.82; **^{19}F NMR (376 MHz, $CDCl_3$)** δ: -62.33; **HRMS (DART-TOF)** calculated for $C_{17}H_{22}BF_4O_2^-$ $[M+F]^-$ m/z 345.1654, found 345.1657; **HPLC analysis** of the product after being oxidized to the corresponding alcohol by $NaBO_3 \cdot 4H_2O$ (AD-H, Hexanes: *i*PrOH = 99:1, 1 mL/min) indicated 93% ee: t_R (major) = 20.6 min, t_R (minor) = 25.7 min; **$[\alpha]_D^{13}$** = 20.0 (c = 0.075, $CHCl_3$).



(*R*)-2-(2-(3,4-dichlorophenyl)but-3-enyl)-4,4,5,5-tetramethyl-1,3,2-dioxaborolane (12j). Following the **General Procedure C** using *tert*-butyl 1-(3,4-dichlorophenyl)allyl carbonate (0.19 g, 0.63 mmol, 2.1 equiv), $[Ir(COD)Cl]_2$ (6.0 mg, 0.0090 mmol, 3.0 mol%) **L3** (18 mg, 0.036 mmol, 12 mol%), AgOTf (3.9 mg, 0.015 mmol, 5.0 mol%), bisborylmethane (80 mg, 0.30 mmol, 1.0 equiv), and LiOtBu (36 mg, 0.45 mmol, 1.5 equiv). The product was isolated as a yellow oil (79 mg, 0.24 mmol, 81%). **IR (thin film, cm^{-1})** 3078, 1633, 1468, 1144, 847; **^{1}H NMR (400 MHz, $CDCl_3$)** δ: 7.34-7.32 (m, 2H), 7.06 (dd, *J* = 8.3, 2.0 Hz, 1H), 5.94 (ddd, *J* = 17.0, 10.2, 6.8 Hz, 1H), 5.08-4.99 (m, 2H), 3.57 (ddd, *J* = 7.7, 7.7, 7.7 Hz, 1H), 1.29 (dd, *J* = 18.2, 10.4 Hz, 1H), 1.24-1.18 (overlapping m, 1H), 1.16 (s, 12H); **^{13}C NMR (101 MHz, $CDCl_3$)** δ: 146.14, 142.56, 132.19, 130.29, 129.95, 129.81, 127.13, 113.98, 83.45, 44.23, and 24.88; **HRMS (DART-TOF)** calculated for $C_{16}H_{21}BCl_2FO_2^-$ $[M+F]^-$ m/z 345.1001, found 345.0993; **HPLC analysis** of the product after being oxidized to the corresponding alcohol by $NaBO_3 \cdot 4H_2O$ (AD-H, Hexanes: *i*PrOH = 99:1, 1 mL/min) indicated 90% ee: t_R (major) = 31.0 min, t_R (minor) = 34.7 min; **$[\alpha]_D^{13}$** = 15.5 (c = 0.1, $CHCl_3$).

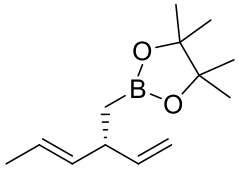


(*R*)-4,4,5,5-tetramethyl-2-(2-(3-nitrophenyl)but-3-enyl)-1,3,2-dioxaborolane (12k). Following the **General Procedure C** using *tert*-butyl 1-(3-nitrophenyl)allyl carbonate[7] (0.18 g, 0.63 mmol, 2.1 equiv), $[Ir(COD)Cl]_2$ (6.0 mg, 0.0090 mmol, 3.0 mol%), **L3** (18 mg, 0.036 mmol, 12 mol%), AgOTf (3.9 mg, 0.015 mmol, 5.0 mol%), bisborylmethane (80 mg, 0.30 mmol, 1.0 equiv), and LiOtBu (36 mg, 0.45 mmol, 1.5 equiv). The product was isolated as a yellow oil (75 mg, 0.25 mmol, 82%). **IR (thin film, cm^{-1})** 3080, 1638, 1530, 1143, 801; **^{1}H NMR (400 MHz, $CDCl_3$)** δ: 8.12 (t, *J* = 1.8 Hz, 1H), 8.04 (ddd, *J* = 8.1, 2.2, 0.9 Hz, 1H), 7.57 (d, *J* = 7.7 Hz, 1H), 7.44 (t, *J* = 7.9 Hz, 1H), 6.00 (ddd, *J* = 17.0, 10.3, 6.8 Hz, 1H), 5.13-5.03 (m, 2H), 3.73 (ddd, *J* = 7.6, 7.6, 7.6 Hz, 1H), 1.35 (dd, *J* = 15.5, 7.8 Hz, 1H), 1.25 (dd, *J* = 15.5, 7.9 Hz, 1H), 1.150 (s, 6H), 1.147 (s, 6H); **^{13}C NMR (101 MHz, $CDCl_3$)** δ: 148.26, 147.84, 142.12, 133.89, 129.11, 122.66, 121.23, 114.31, 83.36, 44.55, 24.723, and 24.719; **HRMS (DART-TOF)** calculated for $C_{16}H_{22}BNFO_4^-$ $[M+F]^-$ m/z 322.1631, found 322.1645; **HPLC analysis** of the product after being oxidized to the corresponding alcohol by $NaBO_3 \cdot 4H_2O$ (AD-H, Hexanes: *i*PrOH = 99: 1, 1 mL/min) indicated 91% ee: t_R (major) = 96.3 min, t_R (minor) = 91.3 min; $[\alpha]_D^{13}$ = 38.6 (c = 0.1, $CHCl_3$).

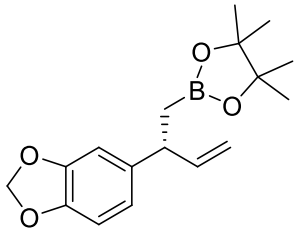


(*R*)-3-(1-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)but-3-en-2-yl)benzonitrile (12l). Following the **General Procedure C** using *tert*-butyl 1-(3-cyanophenyl)allyl carbonate (0.16 g, 0.63 mmol, 2.1 equiv), $[Ir(COD)Cl]_2$ (6.0 mg, 0.0090 mmol, 3.0 mol%), **L3** (18 mg, 0.036 mmol, 12 mol%), AgOTf (3.9 mg, 0.015 mmol, 5.0 mol%), bisborylmethane (80 mg, 0.30 mmol, 1.0 equiv), and LiOtBu (36 mg, 0.45 mmol, 1.5 equiv). The product was isolated as a yellow oil (72 mg, 0.26 mmol, 85%). **IR (thin film, cm^{-1})** 3081, 2230, 1637, 1600, 1144, 847; **^{1}H NMR (400 MHz, $CDCl_3$)** δ: 7.53 (s, 1H), 7.49-7.45 (m, 2H), 7.37 (dd, *J* = 8.3, 7.1 Hz, 1H), 5.96 (ddd, *J* = 17.6, 9.8, 6.7 Hz, 1H), 5.10-5.00 (m, 2H), 3.64 (ddd, *J* = 7.7, 7.7, 7.7 Hz, 1H), 1.31 (dd, *J* = 15.5, 7.8 Hz, 1H), 1.21 (dd, *J* = 15.5, 8.0 Hz, 1H), 1.15 (s, 6H), 1.14 (s, 6H); **^{13}C NMR (101 MHz, $CDCl_3$)** δ: 147.10, 142.27, 132.20, 131.39, 129.85, 129.04, 119.07, 114.09, 112.19, 83.33, 44.46, and 24.71; **HRMS (DART-TOF)** calculated for $C_{17}H_{22}BNO_2^-$ $[M+F]^-$ m/z 302.1733, found 302.1738; **HPLC analysis** of the product after being oxidized to the

corresponding alcohol by $NaBO_3 \cdot 4H_2O$ (AD-H, Hexanes: *i*PrOH = 99:1, 1 mL/min) indicated 92% ee: t_R (major) = 117.2 min, t_R (minor) = 112.0 min; $[\alpha]_D^{13}$ = 20.7 (c = 0.1, $CHCl_3$).

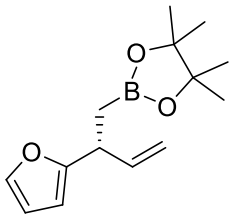


(*R*,*E*)-4,4,5,5-tetramethyl-2-(2-vinylpent-3-enyl)-1,3,2-dioxaborolane (12m). Following the **General Procedure A** using *tert*-butyl (2*E*,4*E*)-hexa-2,4-dienyl carbonate[3] (60 mg, 0.30 mmol, 1.0 equiv), Ag_3PO_4 (3.5 mg, 0.0083 mmol, 2.8 mol%), bisborylmethane (**10**, 0.12 g, 0.45 mmol, 1.5 equiv), LiO^{t}Bu (36 mg, 0.45 mmol, 1.5 equiv) and the stock solution of iridium catalyst (0.6 mL, 0.015 mmol). The reaction was stirred at 50 °C for 36 h. The product was isolated as a yellow oil (54 mg, 0.24 mmol, 80%). **IR (thin film, cm^{-1})** 3079, 2978, 1636, 1146, 848; **^{1}H NMR (400 MHz, $CDCl_3$)** δ: 5.80 (ddd, *J* = 17.2, 10.2, 7.0 Hz, 1H), 5.48-5.34 (m, 2H), 4.98 (dt, *J* = 17.2, 1.6 Hz, 1H), 4.90 (dt, *J* = 10.4, 1.2 Hz, 1H), 2.96 (dddd, *J* = 7.1, 7.1, 7.1, 7.1 Hz, 1H), 1.64 (d, *J* = 5.4 Hz, 3H), 1.23 (s, 12H), 0.96 (dd, *J* = 12.3, 4.4 Hz, 1H), 0.91 (dd, *J* = 12.3, 4.9 Hz, 1H); **^{13}C NMR (101 MHz, $CDCl_3$)** δ: 143.66, 135.43, 123.87, 112.44, 83.17, 42.42, 25.00, 24.95, and 17.99; **HRMS (DART-TOF)** calculated for $C_{13}H_{23}BFO_2^-$ $[M+F]^-$ m/z 241.1781, found 241.1788; **HPLC analysis** of the product after being treated with a hydroboration/oxidation/dibenzoylation sequence (OD-H, Hexanes: *i*PrOH = 99:1, 1 mL/min) indicated 93% ee: t_R (major) = 16.5 min, t_R (minor) = 18.9 min； $[\alpha]_D^{13}$ = 47.6 (c = 0.1, $CHCl_3$).

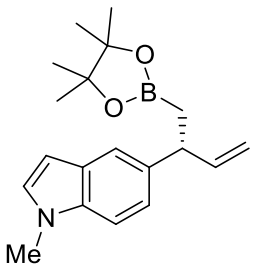


(*R*)-2-(2-(benzo[*d*][1,3]dioxol-5-yl)but-3-enyl)-4,4,5,5-tetramethyl-1,3,2-dioxaborolane (12n). Following the **General Procedure A** using (*E*)-3-(benzo[*d*][1,3]dioxol-5-yl)allyl *tert*-butyl carbonate[5] (84 mg, 0.30 mmol, 1.0 equiv), Ag_3PO_4 (2.1 mg, 0.0050 mmol, 1.7 mol%), bisborylmethane (**10**, 0.12 g, 0.45 mmol, 1.5 equiv), LiO^{t}Bu (36 mg, 0.45 mmol, 1.5 equiv) and stock solution (0.6 mL, 0.009 mmol). The product was isolated as a yellow oil (58 mg, 0.19 mmol, 64%). **IR (thin film, cm^{-1})** 3076, 1637, 1504, 1145, 848; **^{1}H NMR (400 MHz, $CDCl_3$)** δ: 6.75-6.66 (m, 3H), 5.95 (ddd, *J* = 11.0, 8.9, 3.7 Hz, 1H), 5.90 (s, 2H), 5.02 (dt, *J* = 17.1, 1.5 Hz, 1H), 4.96 (dt, *J* = 10.4, 1.2 Hz, 1H), 3.53 (ddd, *J* = 7.8, 7.8, 7.8 Hz, 1H), 1.25 (dd, *J* = 15.3, 8.2 Hz, 1H), 1.21-1.15 (m, 1H), 1.16 (s, 12H) ; **^{13}C NMR (101 MHz, $CDCl_3$)** δ: 147.58, 145.79, 143.84, 139.89, 120.37, 112.84, 108.16, 108.10, 100.84, 83.25, 44.78, 24.90, and 24.86; **HRMS (DART-TOF)** calculated for $C_{17}H_{23}BFO_4^-$ $[M+F]^-$ m/z 321.1679, found 321.1692; **HPLC analysis** of the product after being oxidized to the corresponding alcohol by $NaBO_3 \cdot 4H_2O$ (AS-

H, Hexanes: *i*PrOH = 90:10, 1 mL/min) indicated 92% ee: t_R (major) = 16.6 min, t_R (minor) = 13.3 min; $[\alpha]_D^{13}$ = 10.5 (c = 0.1, $CHCl_3$).

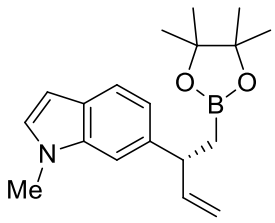


(*R*)-2-(2-(furan-2-yl)but-3-enyl)-4,4,5,5-tetramethyl-1,3,2-dioxaborolane (12o). Following the **General Procedure B** using (*E*)-*tert*-butyl 3-(furan-2-yl)allyl carbonate[3] (67 mg, 0.30 mmol, 1.0 equiv), Ag_3PO_4 (2.1 mg, 0.0050 mmol, 1.7 mol%), bisborylmethane (**10**, 0.12 g, 0.45 mmol, 1.5 equiv), LiO^tBu (36 mg, 0.45 mmol, 1.5 equiv), $[Ir(COD)Cl]_2$ (6.0 mg, 0.0090 mmol, 3.0 mol%) and (11b*S*)-*N*-benzhydryl-*N*-phenyldinaphtho[2,1-*d*:1',2'-*f*][1,3,2]dioxaphosphepin-4-amine[1] as ligand (10 mg, 0.018 mmol, 6.0 mol%). The product was isolated as a yellow oil (63 mg, 0.25 mmol, 84%). **IR (thin film, cm^{-1})** 2980, 1505, 1366, 1144, 848; **^{1}H NMR (400 MHz, $CDCl_3$)** δ: 7.30 (dd, *J* = 1.8, 0.7 Hz, 1H), 6.26 (dd, *J* = 3.1, 1.9 Hz, 1H), 6.01 (d, *J* = 3.2 Hz, 1H), 5.93 (ddd, *J* = 17.3, 10.1, 7.4 Hz, 1H), 5.08 (dt, *J* = 17.1, 1.3 Hz, 1H), 5.04-5.00 (m, 1H), 3.67 (ddd, *J* = 7.7, 7.7, 7.7 Hz, 1H), 1.30 (dd, *J* = 15.4, 7.6 Hz, 1H), 1.25-1.22 (m, 1H), 1.21 (s, 6H), 1.20 (s, 6H); **^{13}C NMR (101 MHz, $CDCl_3$)** δ: 158.71, 141.10, 140.87, 114.29, 110.06, 104.35, 83.33, 38.98, 24.92, and 24.87; **HRMS (DART-TOF)** calculated for $C_{14}H_{21}BO_3$ $[M+H]^+$ m/z 249.1662, found 249.1669. **HPLC analysis** of the product after being oxidized to the corresponding alcohol by $NaBO_3 \cdot 4H_2O$ (AS-H, Hexanes: *i*PrOH = 99: 1, 1 mL/min) indicated 92% ee: t_R (major) = 25.1 min, t_R (minor) = 24.0 min; $[\alpha]_D^{13}$ = -34.5 (c = 0.1, $CHCl_3$).



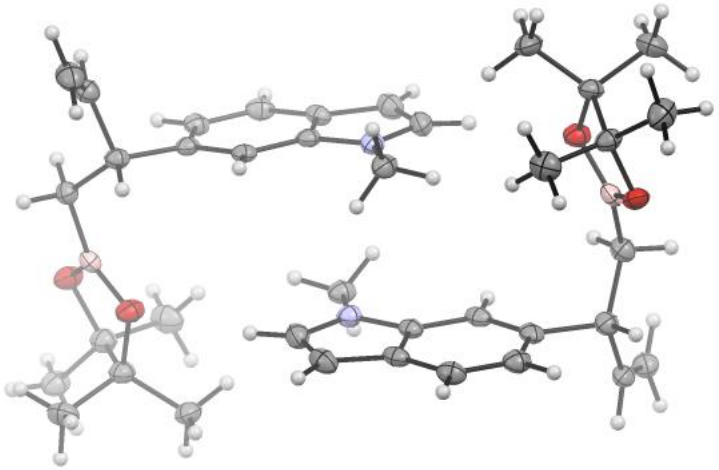
(*R*)-1-methyl-5-(1-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)but-3-en-2-yl)-1H-indole (12p). Following the **General Procedure A** using (*E*)-*tert*-butyl 3-(1-methyl-1*H*-indol-5-yl)allyl carbonate (86 mg, 0.30 mmol, 1.0 equiv), Ag_3PO_4 (2.1 mg, 0.0050 mmol, 1.7 mol%), bisborylmethane (**10**, 0.12 g, 0.45 mmol, 1.5 equiv), LiO^tBu (36 mg, 0.45 mmol, 1.5 equiv) and stock solution (0.6 mL, 0.009 mmol). The product was isolated as a yellow oil (78 mg, 0.25 mmol, 84%). **IR (thin film, cm^{-1})** 2977, 1636, 1514, 1143, 848; **^{1}H NMR (400 MHz, $CDCl_3$)** δ: 7.46 (d, *J* = 1.2 Hz, 1H), 7.22 (d, *J* = 8.5 Hz, 1H), 7.10 (dd, *J* = 8.5, 1.6 Hz, 1H), 6.99 (d, *J* = 3.1 Hz, 1H), 6.40 (d, *J* = 2.6 Hz, 1H), 6.07 (ddd, *J* = 17.1, 10.2, 6.8 Hz, 1H), 5.05 (dt, *J* = 17.1, 1.5 Hz, 1H), 4.95 (dt, *J* = 10.4, 1.2 Hz,

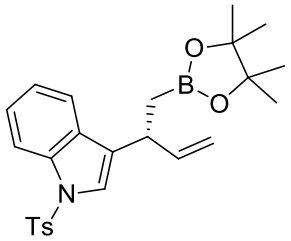
1H), 3.75 (s, 3H), 3.72 (ddd, *J* = 7.4, 7.4, 7.4 Hz, 1H) 1.36 (dd, *J* = 15.2, 8.6 Hz, 1H), 1.30 (dd, *J* = 15.8, 8.0 Hz, 1H), 1.15 (s, 6H), 1.14 (s, 6H); **^{13}C NMR (101 MHz, $CDCl_3$)** δ: 144.78, 136.85, 135.65, 128.88, 128.66, 121.75, 119.18, 112.24, 109.05, 100.83, 83.15, 45.09, 32.95, 24.93, and 24.88; **HRMS (DART-TOF)** calculated for $C_{19}H_{26}BNO_2$ $[M+H]^+$ m/z 312.2135, found 312.2149. **HPLC analysis** (AD-H, Hexanes: *i*PrOH = 99:1, 1 mL/min) indicated 95% ee: t_R (major) = 5.4 min, t_R (minor) = 4.8 min; **$[\alpha]_D^{13}$** = 29.155 (c = 0.2, $CHCl_3$).



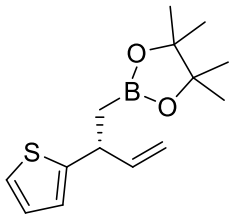
(*R*)-1-methyl-6-(1-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)but-3-en-2-yl)-1H-indole (12q). Following the **General Procedure A** using (*E*)-*tert*-butyl 3-(1-methyl-1*H*-indol-6-yl)allyl carbonate (86 mg, 0.30 mmol, 1.0 equiv), Ag_3PO_4 (2.1 mg, 0.0050 mmol, 1.7 mol%), bisborylmethane (**10**, 0.12 g, 0.45 mmol, 1.5 equiv), Li*O*^{t}Bu (36 mg, 0.45 mmol, 1.5 equiv) and stock solution (0.6 mL, 0.009 mmol). The product was isolated as a light yellow solid (86 mg, 0.28 mmol, 92%). **Melting point**: 67-68 °C; **IR (thin film, cm^{-1})** 2977, 1637, 1606, 1143, 846; **^{1}H NMR (400 MHz, $CDCl_3$)** δ: 7.51 (d, *J* = 8.2 Hz, 1H), 7.17 (s, 1H), 7.00 (dd, *J* = 8.2, 1.4 Hz, 1H), 6.97 (d, *J* = 3.1 Hz, 1H), 6.41 (dd, *J* = 3.1, 0.6 Hz, 1H), 6.09 (ddd, *J* = 17.1, 10.2, 6.8 Hz, 1H), 5.08 (dt, *J* = 17.1, 1.5 Hz, 1H), 4.98 (dt, *J* = 10.4, 1.6 Hz, 1H), 3.753 (ddd, *J* = 7.5, 7.5, 7.5 Hz, 1H), 3.746 (s, 3H), 1.43-1.27 (m, 2H), 1.15 (s, 6H), 1.14 (s, 6H); **^{13}C NMR (101 MHz, $CDCl_3$)** δ: 144.42, 139.63, 137.01, 128.56, 126.92, 120.66, 119.62, 112.53, 107.65, 100.66, 83.17, 45.44, 32.86, 24.93, and 24.85; **HRMS (DART-TOF)** calculated for $C_{19}H_{26}BNO_2$ $[M+H]^+$ m/z 312.2135, found 312.2142. **HPLC analysis** (AD-H, Hexanes: *i*PrOH = 99:1, 1 mL/min) indicated 93% ee: t_R (major) = 4.5 min, t_R (minor) = 4.0 min; **$[\alpha]_D^{13}$** = 32.0 (c = 0.2, $CHCl_3$).

ORTEP rendering for 12q



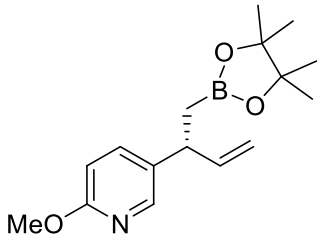


(*R*)-3-(1-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)but-3-en-2-yl)-1-tosyl-1H-indole (12r). Following the **General Procedure A** using (*E*)-*tert*-butyl 3-(1-tosyl-1*H*-indol-3-yl)allyl carbonate (0.13 g, 0.30 mmol, 1.0 equiv), Ag_3PO_4 (2.1 mg, 0.0050 mmol, 1.7 mol%), bisborylmethane (**10**, 0.12 g, 0.45 mmol, 1.5 equiv), LiO^{t}Bu (36 mg, 0.45 mmol, 1.5 equiv) and stock solution (0.6 mL, 0.009 mmol). The product was isolated as a yellow oil (103 mg, 0.228 mmol, 76%). **IR (thin film, cm^{-1})** 3069, 1638, 1597, 1144, 848; **^{1}H NMR (400 MHz, $CDCl_3$)** δ: 7.95 (d, *J* = 8.3 Hz, 1H), 7.73 (d, *J* = 8.3 Hz, 2H), 7.54 (d, *J* = 7.8 Hz, 1H), 7.36 (s, 1H), 7.30-7.24 (m, 1H), 7.21-7.15 (m, 3H), 5.95 (ddd, *J* = 17.2, 10.1, 7.1 Hz, 1H), 5.05 (br d, *J* = 17.1 Hz, 1H), 4.99 (br d, *J* = 10.1 Hz, 1H), 3.79 (ddd, *J* = 7.5, 7.5, 7.5 Hz, 1H), 2.32 (s, 3H), 1.36 (dd, *J* = 14.0, 5.8 Hz, 1H), 1.31 (dd, *J* = 13.9, 6.9 Hz, 1H), 1.17 (s, 6H), and 1.15 (s, 6H); **^{13}C NMR (101 MHz, $CDCl_3$)** δ: 144.76, 142.02, 135.64, 135.60, 130.47, 129.88, 127.09, 126.86, 124.57, 122.90, 122.57, 120.58, 114.02, 113.76, 83.39, 36.31, 24.93, 24.81, and 21.65; **HRMS (DART-TOF)** calculated for $C_{25}H_{30}BNO_4S$ $[M+NH_4]^+$ m/z 469.2332, found 469.2359. **HPLC analysis** (AD-H, Hexanes: *i*PrOH = 95:5, 1 mL/min) indicated 86% ee: t_R (major) = 10.9 min, t_R (minor) = 8.4 min; **$[\alpha]_D^{13}$** = -17.2 (c = 0.1, $CHCl_3$).



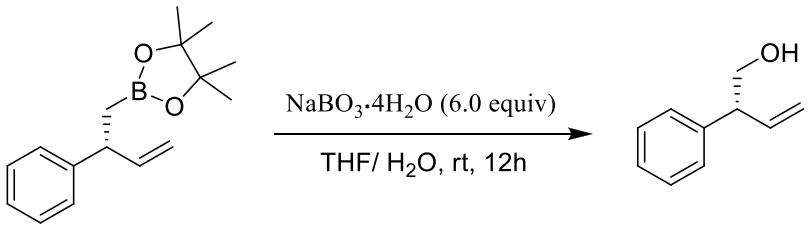
(*R*)-4,4,5,5-tetramethyl-2-(2-(thiophen-2-yl)but-3-enyl)-1,3,2-dioxaborolane (12s). Following the **General Procedure A** using (*E*)-*tert*-butyl 3-(thiophen-2-yl)allyl carbonate[8] (72 mg, 0.30 mmol, 1.0 equiv), Ag_3PO_4 (2.1 mg, 0.0050 mmol, 1.7 mol%), bisborylmethane (**10**, 0.12 g, 0.45 mmol, 1.5 equiv), LiO^{t}Bu (36 mg, 0.45 mmol, 1.5 equiv) and stock solution (0.6 mL, 0.009 mmol). The product was isolated as a yellow oil (79 mg, 0.30 mmol, 99%). **IR (thin film, cm^{-1})** 3078, 1638, 1479, 1145, 847; **^{1}H NMR (400 MHz, $CDCl_3$)** δ: 7.11 (dd, *J* = 5.1, 1.2 Hz, 1H), 6.90 (dd, *J* = 5.1, 3.5 Hz, 1H), 6.82 (dt, *J* = 3.6, 0.8 Hz, 1H), 5.99 (ddd, *J* = 17.3, 10.1, 7.4 Hz, 1H), 5.09 (dt, *J* = 17.0, 1.3 Hz, 1H), 4.99 (dt, *J* = 10.0, 1.2 Hz, 1H), 3.88 (ddd, *J* = 7.4, 7.4, 7.4 Hz, 1H), 1.37 (dd, *J* = 14.8, 6.8 Hz, 1H), 1.31 (dd, *J* = 14.8, 7.6 Hz, 1H), 1.18 (s, 12H); **^{13}C NMR (101 MHz, $CDCl_3$)** δ: 150.09, 143.18, 126.60, 123.23, 123.22, 113.51, 83.35, 40.63, 24.94, and 24.82; **HRMS (DART-TOF)** calculated for $C_{14}H_{21}BO_2S$ $[M+H]^+$ m/z 265.1434, found 265.1421. HPLC analysis of the product after being oxidized to the corresponding

alcohol by $NaBO_3 \cdot 4H_2O$ (AS-H, Hexanes: *i*PrOH = 99: 1, 1 mL/min) indicated 98% ee: t_R (major) = 25.5 min, t_R (minor) = 23.7 min; $[\alpha]_D^{13}$ = -29.2 (c = 0.1, $CHCl_3$).



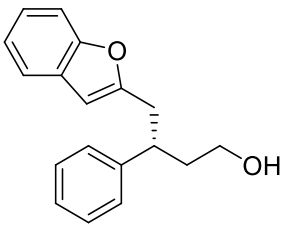
(*R*)-2-methoxy-5-(1-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)but-3-en-2-yl)pyridine (12t). Following the **General Procedure A** using (*E*)-*tert*-butyl 3-(6-methoxypyridin-3-yl)allyl carbonate (80 mg, 0.30 mmol, 1.0 equiv), Ag_3PO_4 (2.1 mg, 0.0050 mmol, 1.7 mol%), bisborylmethane (**10**, 0.12 g, 0.45 mmol, 1.5 equiv), Li*O*^{t}Bu (36 mg, 0.45 mmol, 1.5 equiv) and stock solution (0.6 mL, 0.009 mmol). The product was isolated as a yellow oil (78 mg, 0.27 mmol, 90%). **IR (thin film, cm^{-1})** 2977, 1513, 1468, 1144, 848; **^{1}H NMR (400 MHz, $CDCl_3$)** δ: 8.02 (d, *J* = 2.4 Hz, 1H), 7.43 (dd, *J* = 8.5, 2.5 Hz, 1H), 6.67 (d, *J* = 8.5 Hz, 1H), 5.96 (ddd, *J* = 17.0, 10.2, 6.6 Hz, 1H), 5.06-4.95 (m, 2H), 3.91 (s, 3H), 3.57 (ddd, *J* = 7.8, 7.8, 7.8 Hz, 1H), 1.29 (dd, *J* = 15.4, 8.1 Hz, 1H), 1.21 (dd, *J* = 15.6, 7.6 Hz, 1H), 1.16 (s, 12H); **^{13}C NMR (101 MHz, $CDCl_3$)** δ: 162.92, 145.73, 143.29, 138.10, 133.65, 113.41, 110.53, 83.37, 53.45, 41.64, and 24.88; **HRMS (DART-TOF)** calculated for $C_{16}H_{24}BNO_3$ $[M+H]^+$ m/z 290.1927, found 290.1928. **HPLC analysis** of the product after being oxidized to the corresponding alcohol by $NaBO_3 \cdot 4H_2O$ (AS-H, Hexanes: *i*PrOH = 90:10, 1 mL/min) indicated 94% ee: t_R (major) = 16.2 min, t_R (minor) = 9.1 min; $[\alpha]_D^{13}$ = -16.2 (c = 0.2, $CHCl_3$).

Characterization Data for Products in Scheme 2.



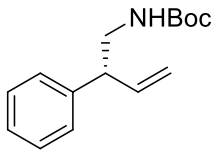
17 **21**

(*R*)-2-phenylbut-3-en-1-ol (21).[9] A solution of **17** (78 mg, 0.30 mmol) in THF (2.0 mL) and H_2O (2.0 mL) was added $NaBO_3 \cdot 4H_2O$ (0.28 g, 1.8 mmol, 6.0 equiv) at room temperature. The reaction mixture was stirred for 12 h and quenched by addition of saturated aq. $Na_2S_2O_3$ (5.0 mL). The mixture was extracted with ethyl acetate (3 X 10 mL). The combined organic layers were washed with water and brine, dried (Na_2SO_4) and concentrated in vacuo to give a crude product. Purification by flash column chromatography (silica gel, eluting with petroleum ether/ethyl acetate, 20:1 to 10:1) afforded the known (*R*)-2-phenylbut-3-en-1-ol (**21**) as a light yellow solid (40 mg, 0.27 mmol, 89%). Melting point: 40-43 °C. **^{1}H NMR (400 MHz, $CDCl_3$)** δ: 7.33 (t, *J* = 7.4 Hz, 2H), 7.27-7.19 (m, 3H), 6.00 (ddd, *J* = 17.7, 10.4, 7.7 Hz, 1H), 5.24-5.13 (m, 2H), 3.80 (d, *J* = 7.0 Hz, 2H), 3.52 (q, *J* = 7.3 Hz, 1H); **^{13}C NMR (101 MHz, $CDCl_3$)** δ: 140.66, 138.26, 128.79, 128.00 , 126.98, 117.14, 66.08, and 52.54; **HPLC analysis** (AD-H, Hexanes: *i*PrOH = 99.6:0.4, 1 mL/min) indicated 93% ee: t_R (major) = 45.4 min, t_R (minor) = 39.2 min.

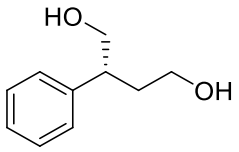


(*S*)-4-(benzofuran-2-yl)-3-phenylbutan-1-ol (23). To a solution of benzofuran (36 mg, 0.30 mmol, 1.5 equiv) in THF (1 mL) cooled at -78 °C was added nBuLi (2.5 M in hexanes, 0.12 mL, 0.30 mmol, 1.5 equiv). The resulting solution was warmed to rt and stirred for 1 h. The solution was cooled at -78 °C again, and a solution of **17** (52 mg, 0.2 mmol, 1.0 equiv) in THF (0.5 mL) was added slowly. The resulting solution was stirred at -78 °C for 1 h, at which time NBS (50 mg, 0.30 mmol, 1.5 equiv) in THF (1.0 mL) was added. After 1 h at -78 °C, saturated aqueous $Na_2S_2O_3$ was added. The resulting mixture was warmed to rt, and separated with between H_2O and EtOAc. The aqueous layer was extracted once with EtOAc. The combined organic layers were dried, concentrated, and passed through a short pad of silica gel to give a colorless oil, which was used in the next step without further

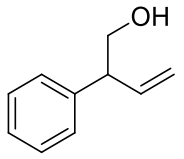
purification. To the product obtained was added THF (0.5 mL) and 9-BBN (0.5 M, 0.9 mL). The resulting solution was left at rt for 4 h. H_2O_2 and NaOH was added, and the resulting mixture was stirred at rt overnight. After extractive workup and column chromatography, compound **23** was isolated as a colorless oil (31 mg, 59% from **17**). **IR (thin film, cm^{-1})** 3327, 2925, 1602, 1454, 750; **^{1}H NMR (400 MHz, $CDCl_3$)** δ: 7.41 (t, J = 8.7 Hz, 2H), 7.32-7.13 (m, 7H), 6.26 (s, 1H), 3.59-3.52 (m, 1H), 3.50-3.44 (m, 1H), 3.34-3.24 (m, 1H), 3.08 (d, J = 7.5 Hz, 2H), 2.09-2.00 (m, 1H), 1.97-1.86 (m, 1H); **^{13}C NMR (101 MHz, $CDCl_3$)** δ: 157.33, 154.73, 143.87, 128.92, 128.75, 127.60, 126.79, 123.35, 122.54, 120.45, 110.89, 103.61, 61.06, 41.28, 38.59, and 36.28; **HPLC analysis** (OD-H, Hexanes: *i*PrOH = 70:30, 1 mL/min) indicated 92% ee: t_R (major) = 5.5 min, t_R (minor) = 6.5 min; **$[\alpha]_D^{13}$** = 94.3 (c = 0.1, $CHCl_3$).



(*R*)-tert-butyl 2-phenylbut-3-enylcarbamate (24).[10] To a flame-dried test tube equipped with a magnetic stir bar and septum was added O-methylhydroxylamine solution[11] (0.25 mL, 3.9 M in THF as determined by ^{1}H NMR using 1,3,5-trimethoxybenzene as internal standard) and THF (2 mL) under N_2 atomsphere. The flask was cooled to -78 °C. *n*BuLi (0.4 mL, 1.0 mmol, 2.5 M in hexanes) was added to the test tube dropwise and the solution was allowed to stir at -78° C for 30 min. Then, a solution of **17** (78 mg, 0.30 mmol) in THF (1.0 mL) was added dropwise to the test tube, which was then allowed to warm to rt, and further to 60 °C. The test tube was kept at 60 °C for 12 h. The volatiles in the reaction was then removed under vacuum. To the residue was added $CHCl_3$ (1 mL) and Boc_2O (0.3 mL, 1.3 mmol) at rt. After stirring for 1 h the reaction mixture was concentrated and subjected to column chromatography (hexanes:EtOAc = 3:1) to give known **24** (53 mg, 0.21 mmol, 71%) as a colorless oil. **^{1}H NMR (400 MHz, $CDCl_3$)** δ: 7.36-7.29 (m, 2H), 7.26-7.19 (m, 3H), 5.96 (ddd, *J* = 17.4, 10.4, 7.1 Hz, 1H), 5.19-5.08 (m, 2H), 3.53-3.32 (m, 3H), 1.42 (s, 9H); **^{13}C NMR (101 MHz, $CDCl_3$)** δ: 155.95, 141.40, 139.06, 128.85, 127.93, 126.97, 116.50, 49.95, 45.03, 28.52, and 27.56; **HPLC analysis** (OD-H, Hexanes: *i*PrOH = 99: 1, 1 mL/min) indicated 92% ee: t_R (major) = 18.8 min, t_R (minor) = 17.5 min; **$[\alpha]_D^{13}$** = 29.9 (c = 0.1, $CHCl_3$).



(*R*)-2-phenylbutane-1,4-diol (26).[12] To a solution of **17** (0.13 g, 0.50 mmol) in THF (1 mL) was added 9-BBN (0.5 M in hexanes, 1.5 mL) dropwise under N_2 atomsphere. The mixture was stirred at room temperature until all starting material was consumed (ca. 4 h), as indicated by TLC. Then, 3 M NaOH (1.0 mL) and 30% H_2O_2 (0.9 mL) was added, and the mixture was heated at 50 °C for 1.5 h. After cooling to room temperature, the reaction was quenched by saturated aq. $Na_2S_2O_3$ (2.0 mL). The mixture was extracted with EtOAc (3 X 15 mL). The combined organic layer was washed with brine, dried (Na_2SO_4), and concentrated. The residue was purified by column chromatography (20:1 DCM/MeOH) to afford known compound **26** as a colorless oil (61 mg, 74% yield). **^{1}H NMR (400 MHz, $CDCl_3$)** δ: 7.37-7.29 (m, 2H), 7.27-7.20 (m, 3H), 3.78 (d, *J* = 6.7 Hz, 2H), 3.72-3.67 (m, 1H), 3.61-3.55 (m, 1H), 2.96 (dddd, *J* = 6.6, 6.6, 6.6, 6.6 Hz, 1H), 2.07-1.97 (m, 1H), 1.94-1.85 (m, 1H); **^{13}C NMR (101 MHz, $CDCl_3$)** δ: 142.33, 128.91, 127.97, 127.03, 67.69, 61.28, 46.04, and 35.88; **UPC^2 analysis** (IC-3, supercritical CO_2:*i*PrOH = 80:20, 2.0 mL/min) indicated 93% ee: t_R (major) = 2.7 min, t_R (minor) = 2.3 min; **$[\alpha]_D^{13}$** = -40.6 (c = 0.067, $CHCl_3$).



From (±)-17

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进样日期 : 2015/12/26 18:47:05　　进样次数 : 1
进样量 : 5.000 µl
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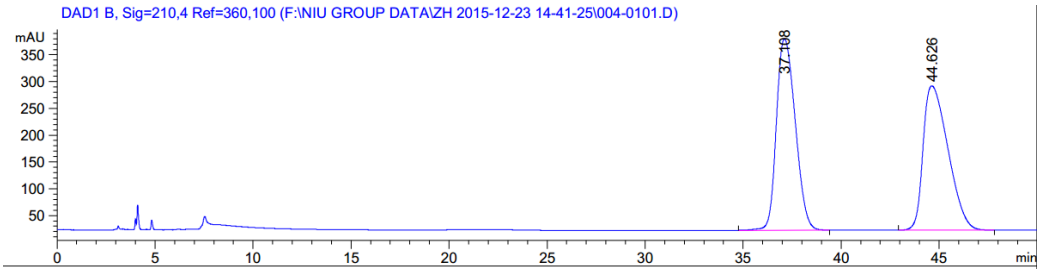
最后修改 : 2015/12/22 14:19:43
分析方法 : F:\NIU GROUP METHODS\ZM\D996-04-55.M
最后修改 : 2016/1/31 13:13:24
(调用后修改)



信号 2: DAD1 B, Sig=210,4 Ref=360,100

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1	37.108	BB	1.0661	2.38821e4	357.14273	50.1218
2	44.626	BB	1.3596	2.37660e4	269.30917	49.8782

总量 : 4.76481e4 626.45190

操作者 :　　序列行 : 2
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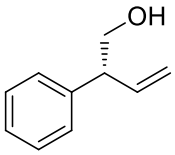
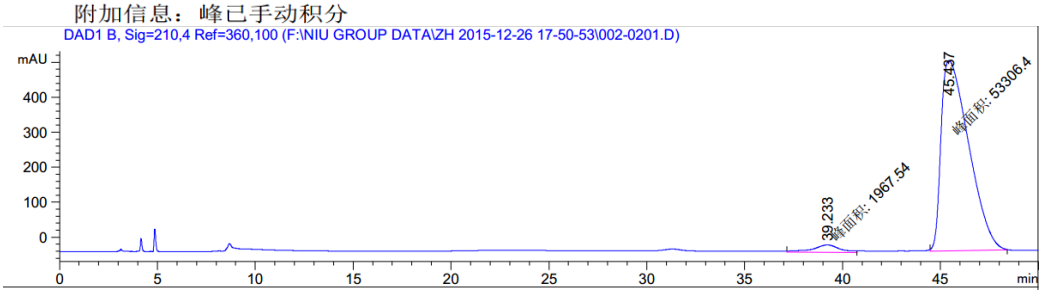
进样日期 : 2015/12/26 18:47:05　　进样次数 : 1
进样量 : 5.000 µl
采集方法 : F:\NIU GROUP DATA\ZH 2015-12-26 17-50-53\A996B04-55.M
最后修改 : 2015/12/22 14:19:43
分析方法 : F:\NIU GROUP METHODS\ZM\D996-04-55.M
最后修改 : 2016/1/31 13:13:24
(调用后修改)
附加信息：峰已手动积分



From 17



信号 2: DAD1 B, Sig=210,4 Ref=360,100

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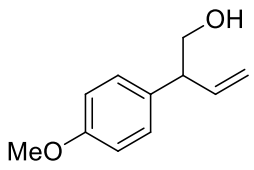
1	39.233	MM	1.5906	1967.53674	20.61661	3.5596
2	45.437	MM	1.6342	5.33064e4	543.64563	96.4404

总量 : 5.52740e4 564.26224



From (±)-12a

操作者 :
仪器 : 仪器 1
进样日期 : 2016/1/27 12:52:24

序列行 : 1
位置 : 样品瓶 11
进样次数 : 1
进样量 : 5.0 µl

来自于序列的不同进样量！实际进样量：10.0 µl
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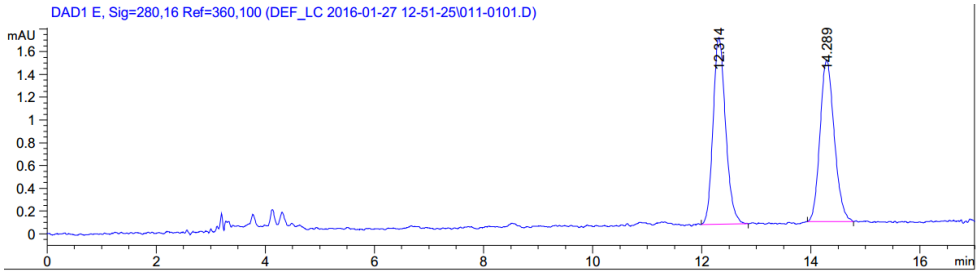
最后修改 : 2016/1/27 12:57:25
(调用后修改)
分析方法 : F:\NIU GROUP METHODS\ZM\D996-04-55.M
最后修改 : 2016/1/31 11:46:21
(调用后修改)



信号 5: DAD1 E, Sig=280,16 Ref=360,100

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1	12.314	BB	0.2437	26.10950	1.64001	50.3478
2	14.289	BB	0.2655	25.74883	1.42012	49.6522
总量 :				51.85833	3.06013	

操作者 :
仪器 : 仪器 1
进样日期 : 2016/1/27 13:23:45

序列行 : 2
位置 : 样品瓶 12
进样次数 : 1
进样量 : 5.0 µl

来自于序列的不同进样量！实际进样量：10.0 µl
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最后修改 : 2016/1/27 13:47:41
(调用后修改)
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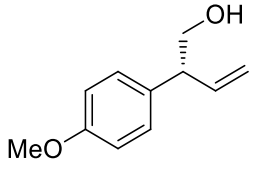
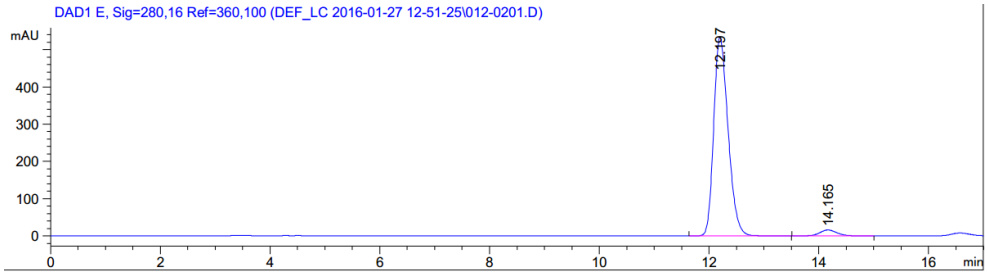
最后修改 : 2016/1/31 11:46:21
(调用后修改)

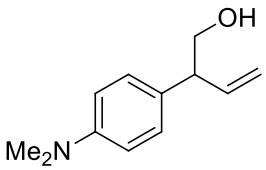


From 12a



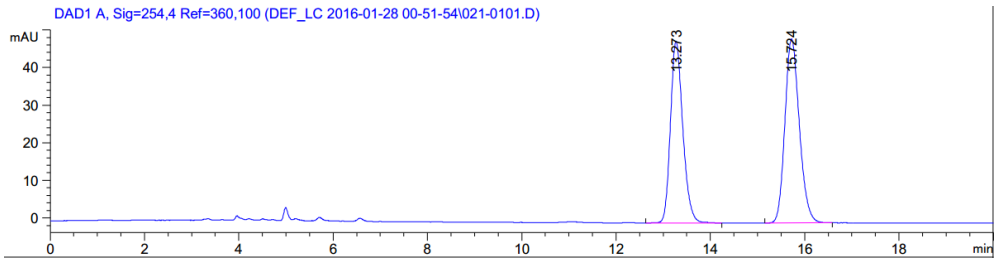
信号 5: DAD1 E, Sig=280,16 Ref=360,100

峰 #	保留时间 [min]	类型	峰宽 [min]	峰面积 [mAU*s]	峰高 [mAU]	峰面积 %
1	12.197	BB	0.2824	9690.23730	532.36285	96.5711
2	14.165	BB	0.3330	344.06680	15.86533	3.4289
总量 :				1.00343e4	548.22819	



From (±)-12b

操作者 :
仪器 : 仪器 1
进样日期 : 2016/1/28 0:52:51
序列行 : 1
位置 : 样品瓶 21
进样次数 : 1
进样量 : 5.0 µl
来自于序列的不同进样量！ 实际进样量: 10.0 µl
采集方法 : C:\CHEM32\1\DATA\DEF_LC 2016-01-28 00-51-54\A995B5-55.M
最后修改 : 2016/1/28 0:47:05
(调用后修改)
分析方法 : F:\NIU GROUP METHODS\ZM\D996-04-55.M
最后修改 : 2016/1/31 14:06:53
(调用后修改)



信号 1: DAD1 A, Sig=254,4 Ref=360,100

峰 #	保留时间 [min]	类型	峰宽 [min]	峰面积 [mAU*s]	峰高 [mAU]	峰面积 %
1	13.273	BB	0.2811	881.16748	48.24551	45.8558
2	15.724	BB	0.3279	1040.43970	48.96917	54.1442
总量 :				1921.60718	97.21468	

操作者 :
仪器 : 仪器 1
进样日期 : 2016/1/28 1:24:06
序列行 : 2
位置 : 样品瓶 22
进样次数 : 1
进样量 : 5.0 µl
采集方法 : C:\CHEM32\1\DATA\DEF_LC 2016-01-28 00-51-54\A995B5-55.M
最后修改 : 2016/1/28 0:47:05
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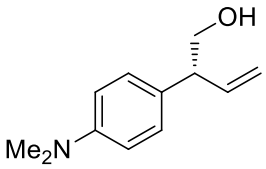
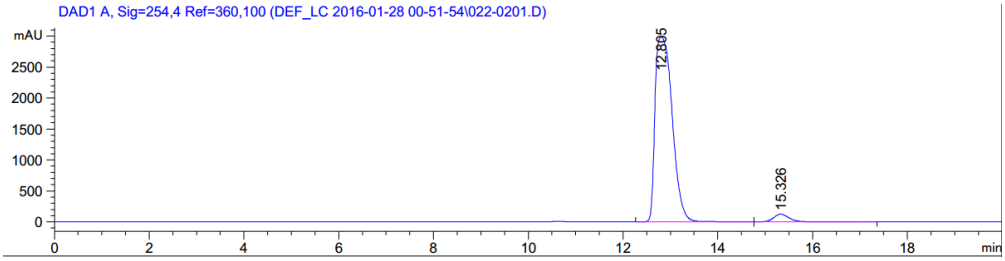
最后修改 : 2016/1/31 14:06:53
(调用后修改)

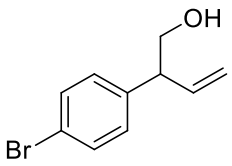


From 12b



信号 1: DAD1 A, Sig=254,4 Ref=360,100

峰 #	保留时间 [min]	类型	峰宽 [min]	峰面积 [mAU*s]	峰高 [mAU]	峰面积 %
1	12.805	BB	0.4005	7.48791e4	2986.48340	96.5190
2	15.326	BB	0.3392	2700.51196	122.51337	3.4810
总量 :				7.75796e4	3108.99677	



From (±)-12c

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进样日期        : 2016/1/27 13:49:04                 进样次数 :   1
                                                     进样量 : 5.0 µl
来自于序列的不同进样量！实际进样量：10.0 µl
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最后修改        : 2016/1/27 14:04:58
                  (调用后修改)
分析方法        : F:\NIU GROUP METHODS\ZM\D996-04-55.M
最后修改        : 2016/1/31 11:54:47
                  (调用后修改)
附加信息：峰已手动积分
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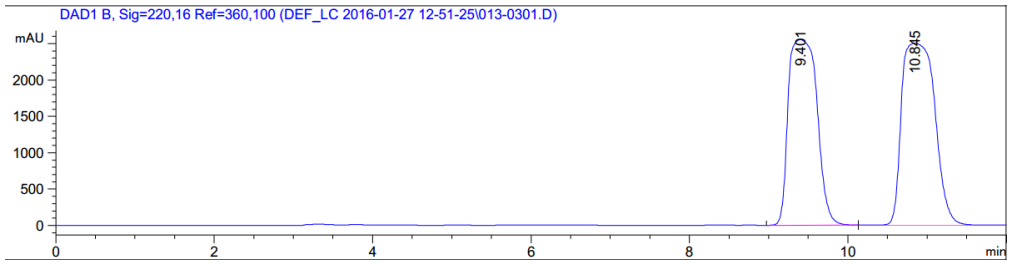

信号 2: DAD1 B, Sig=220,16 Ref=360,100

峰 #	保留时间 [min]	类型	峰宽 [min]	峰面积 [mAU*s]	峰高 [mAU]	峰面积 %
1	9.401	BB	0.4091	6.40900e4	2551.02393	46.8763
2	10.845	BB	0.4727	7.26315e4	2501.68750	53.1237
总量 :				1.36722e5	5052.71143	

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操作者          :                                    序列行 :   2
仪器            : 仪器 1                               位置 : 样品瓶 32
进样日期        : 2016/1/27 16:55:29                 进样次数 :   1
                                                     进样量 : 5.0 µl
来自于序列的不同进样量！实际进样量：2.0 µl
采集方法        : C:\CHEM32\1\DATA\DEF_LC 2016-01-27 16-41-18\A995B5-55.M
最后修改        : 2016/1/27 16:41:51
                  (调用后修改)
分析方法        : F:\NIU GROUP METHODS\ZM\D996-04-55.M
最后修改        : 2016/1/31 11:54:47
                  (调用后修改)
附加信息：峰已手动积分
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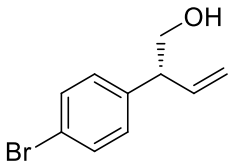
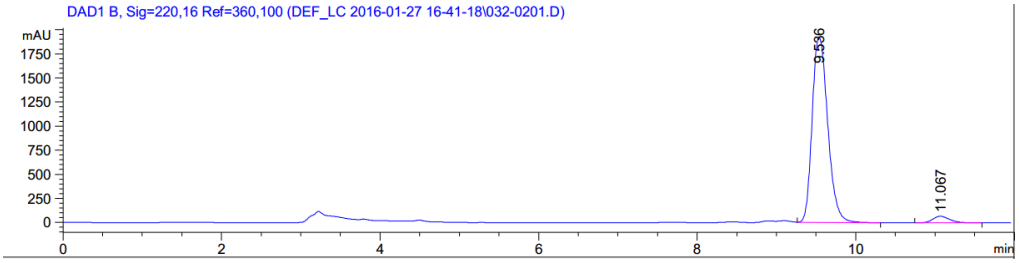


From 12c



信号 2: DAD1 B, Sig=220,16 Ref=360,100

峰 #	保留时间 [min]	类型	峰宽 [min]	峰面积 [mAU*s]	峰高 [mAU]	峰面积 %
1	9.536	BB	0.2128	2.61955e4	1923.99585	96.3360
2	11.067	BB	0.2245	996.31268	68.18327	3.6640
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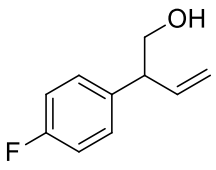
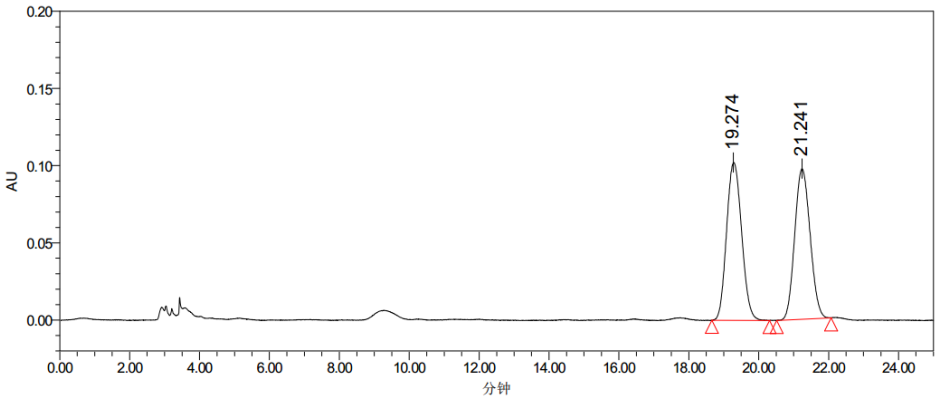


From (±)-12d

样品名称：	LRZ-62B	采集者：	System
样品类型：	未知	采集时间：	2016/1/27 4:34:59 CST
瓶号：	11	采集方法组：	c01d99
进样次数：	1	处理日期：	2016/1/31 13:34:38 CST
进样体积：	5.00 ul	处理方法：	15
运行时间：	40.0 Minutes	通道名称：	215.0 纳米
样品组名称：	lrz	处理通道注释：	PDA 215.0 纳米



处理通道: PDA 215.0 纳米

	处理通道	保留时间 (分钟)	面积	% 面积	峰高
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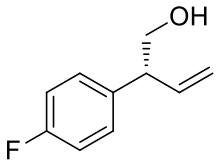
2	PDA 215.0 纳米	21.241	2983556	49.37	97559



From 12d

样品名称：	ZM264	采集者：	System
样品类型：	未知	采集时间：	2016/1/27 5:15:37 CST
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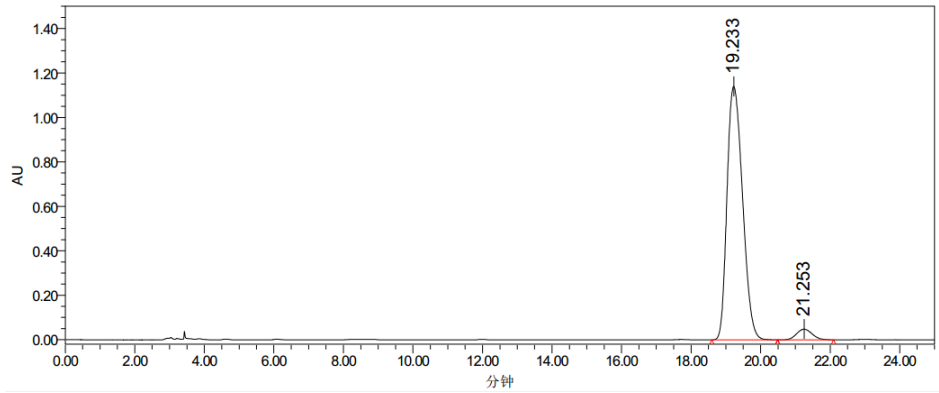
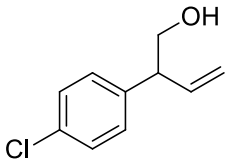
进样次数：	1	处理日期：	2016/1/31 13:32:18 CST
进样体积：	5.00 ul	处理方法：	14
运行时间：	40.0 Minutes	通道名称：	215.0 纳米
样品组名称：	lrz	处理通道注释：	PDA 215.0 纳米



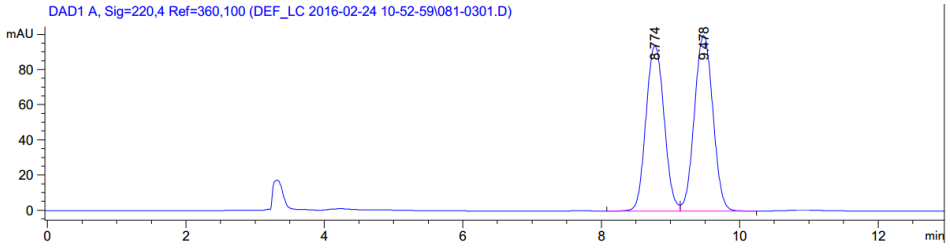
处理通道: PDA 215.0 纳米

	处理通道	保留时间 (分钟)	面积	% 面积	峰高
1	PDA 215.0 纳米	19.233	35272073	95.94	1140717
2	PDA 215.0 纳米	21.253	1491778	4.06	48031



From (±)-12e

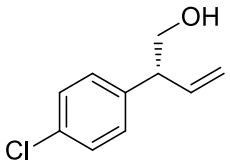
操作者 :
仪器 : 仪器 1
进样日期 : 2016/2/24 11:22:30
序列行 : 3
位置 : 样品瓶 81
进样次数 : 1
进样量 : 10.0 µl
来自于序列的不同进样量！实际进样量：20.0 µl
采集方法 : C:\CHEM32\1\DATA\DEF_LC 2016-02-24 10-52-59\A95B5-20.M
最后修改 : 2016/2/24 11:06:52
(调用后修改)
分析方法 : F:\NIU GROUP METHODS\LRZ\A92B8-40.M
最后修改 : 2016/2/21 14:26:26



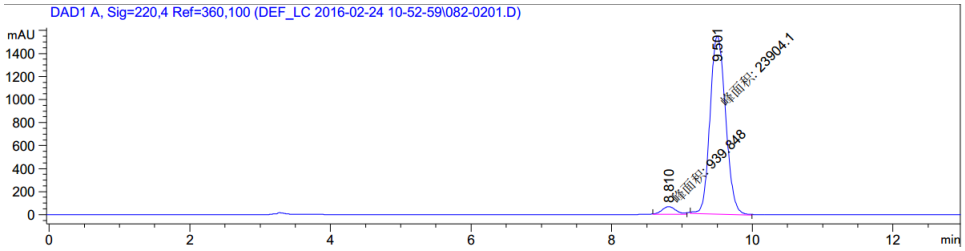
信号 1: DAD1 A, Sig=220,4 Ref=360,100

峰 #	保留时间 [min]	类型	峰宽 [min]	峰面积 [mAU*s]	峰高 [mAU]	峰面积 %
1	8.774	BV	0.2909	1714.98962	93.99152	47.9854
2	9.478	VB	0.2969	1858.99341	100.01302	52.0146
总量 :				3573.98303	194.00453	

操作者 :
仪器 : 仪器 1
进样日期 : 2016/2/24 11:08:10
序列行 : 2
位置 : 样品瓶 82
进样次数 : 1
进样量 : 10.0 µl
来自于序列的不同进样量！实际进样量：5.0 µl
采集方法 : C:\CHEM32\1\DATA\DEF_LC 2016-02-24 10-52-59\A95B5-20.M
最后修改 : 2016/2/24 11:06:52
(调用后修改)
分析方法 : F:\NIU GROUP METHODS\LRZ\A92B8-40.M
最后修改 : 2016/2/21 14:26:26

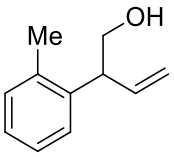


From 12e



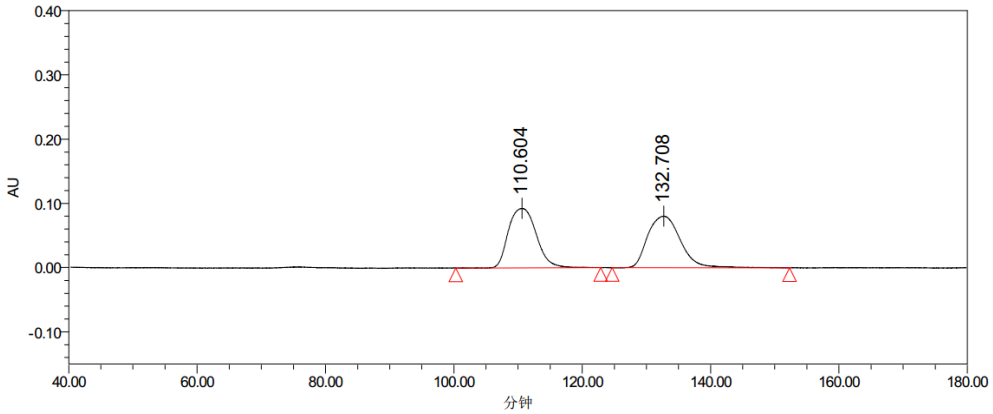
信号 1: DAD1 A, Sig=220,4 Ref=360,100

峰 #	保留时间 [min]	类型	峰宽 [min]	峰面积 [mAU*s]	峰高 [mAU]	峰面积 %
1	8.810	MM	0.2327	939.84784	67.31380	3.7830
2	9.501	MM	0.2580	2.39041e4	1544.38037	96.2170
总量 :				2.48439e4	1611.69418	



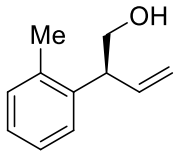
From (±) - 12f

样品名称：	LRZ-66A-2	采集者：	System
样品类型：	标准样	采集时间：	2016/4/16 1:13:21 CST
瓶号：	70	采集方法组：	C004D996L
进样次数：	1	处理日期：	2016/4/21 23:13:02 CST
进样体积：	5.00 ul	处理方法：	Default
运行时间：	180.0 Minutes	通道名称：	210.0 纳米
样品组名称：	lrz	处理通道注释：	PDA 210.0 纳米



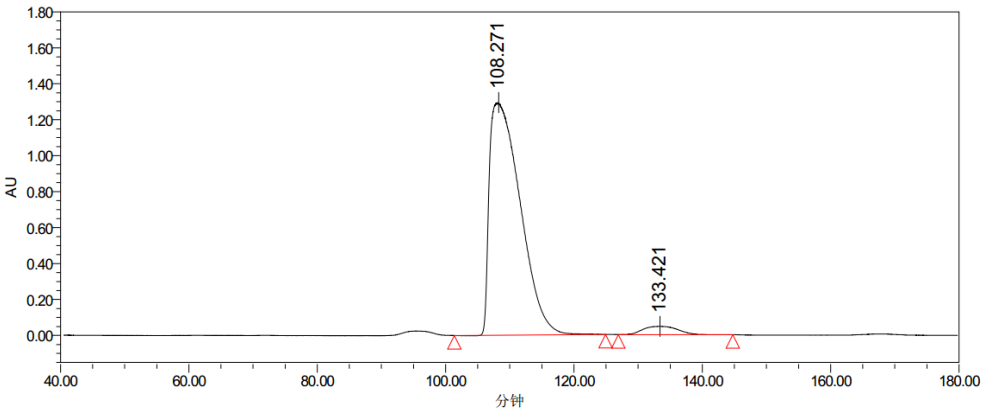
处理通道: PDA 210.0 纳米

	处理通道	保留时间 (分钟)	面积	% 面积	峰高
1	PDA 210.0 纳米	110.604	28105945	49.57	92747
2	PDA 210.0 纳米	132.708	28592103	50.43	80582



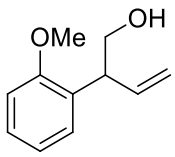
From 12f

样品名称：	38b-1	采集者：	System
样品类型：	标准样	采集时间：	2016/4/15 22:12:27 CST
瓶号：	71	采集方法组：	C004D996L
进样次数：	1	处理日期：	2016/4/21 23:16:59 CST
进样体积：	5.00 ul	处理方法：	1234
运行时间：	180.0 Minutes	通道名称：	209.9 纳米
样品组名称：	lrz	处理通道注释：	PDA 209.9 纳米



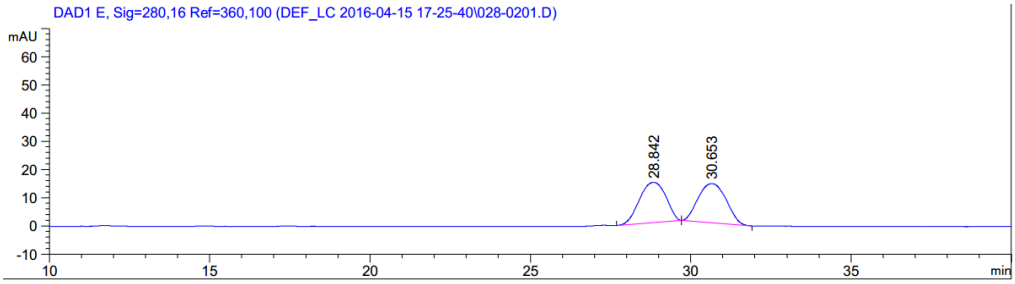
处理通道: PDA 209.9 纳米

	处理通道	保留时间 (分钟)	面积	% 面积	峰高
1	PDA 209.9 纳米	108.271	433035887	96.13	1294735
2	PDA 209.9 纳米	133.421	17411839	3.87	46272



From (±)-12g

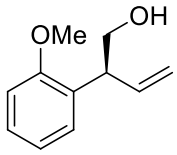
操作者 :
仪器 : 仪器 1
进样日期 : 2016/4/15 17:58:04
序列行 : 2
位置 : 样品瓶 28
进样次数 : 1
进样量 : 5.0 µl
来自于序列的不同进样量！实际进样量：10.0 µl
采集方法 : C:\CHEM32\1\DATA\DEF_LC 2016-04-15 17-25-40\100.M
最后修改 : 2016/4/15 18:08:05
(调用后修改)
分析方法 : F:\NIU GROUP METHODS\ZM\A100-30MIN.M
最后修改 : 2016/4/21 22:57:14



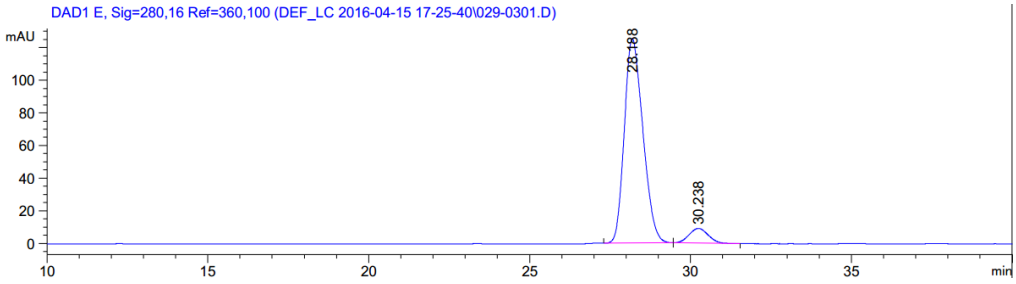
信号 5: DAD1 E, Sig=280,16 Ref=360,100

峰 #	保留时间 [min]	类型	峰宽 [min]	峰面积 [mAU*s]	峰高 [mAU]	峰面积 %
1	28.842	BB	0.8593	819.01581	14.27663	49.2527
2	30.653	BB	0.8060	843.87067	13.90514	50.7473
总量 :				1662.88647	28.18177	

操作者 :
仪器 : 仪器 1
进样日期 : 2016/4/15 18:49:20
序列行 : 3
位置 : 样品瓶 29
进样次数 : 1
进样量 : 5.0 µl
来自于序列的不同进样量！实际进样量：4.0 µl
采集方法 : C:\CHEM32\1\DATA\DEF_LC 2016-04-15 17-25-40\100.M
最后修改 : 2016/4/15 18:08:05
(调用后修改)
分析方法 : F:\NIU GROUP METHODS\ZM\A100-30MIN.M
最后修改 : 2016/4/21 22:46:33

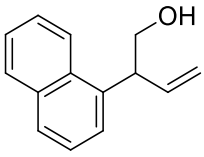


From 12g



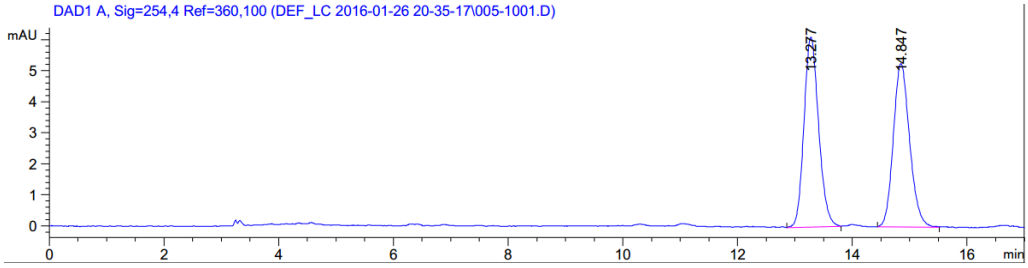
信号 5: DAD1 E, Sig=280,16 Ref=360,100

峰 #	保留时间 [min]	类型	峰宽 [min]	峰面积 [mAU*s]	峰高 [mAU]	峰面积 %
1	28.188	BB	0.6211	5020.29541	125.38090	93.0855
2	30.238	BB	0.6313	372.91107	9.00275	6.9145
总量 :				5393.20648	134.38365	



From (±)-12h

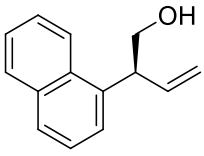
```
操作者          :                                   序列行 :  10
仪器            : 仪器 1                            位置 : 样品瓶 5
进样日期        : 2016/1/26 23:36:56                进样次数 :  1
                                                    进样量 : 5.0 µl
来自于序列的不同进样量！实际进样量：10.0 µl
采集方法        : C:\CHEM32\1\DATA\DEF_LC 2016-01-26 20-35-17\A995B5-55.M
最后修改        : 2016/1/26 22:53:16
                  (调用后修改)
分析方法        : F:\NIU GROUP METHODS\ZM\D996-04-55.M
最后修改        : 2016/1/31 11:46:21
                  (调用后修改)
```



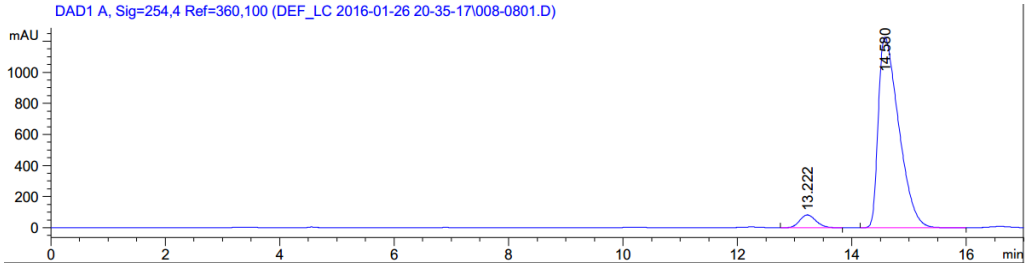
信号 1: DAD1 A, Sig=254,4 Ref=360,100

峰 #	保留时间 [min]	类型	峰宽 [min]	峰面积 [mAU*s]	峰高 [mAU]	峰面积 %
1	13.277	BB	0.2726	108.38966	6.12024	51.1261
2	14.847	BB	0.3015	103.61510	5.26655	48.8739
总量 :				212.00476	11.38679	

```
操作者          :                                   序列行 :  8
仪器            : 仪器 1                            位置 : 样品瓶 8
进样日期        : 2016/1/26 22:54:18                进样次数 :  1
                                                    进样量 : 5.0 µl
来自于序列的不同进样量！实际进样量：10.0 µl
采集方法        : C:\CHEM32\1\DATA\DEF_LC 2016-01-26 20-35-17\A995B5-55.M
最后修改        : 2016/1/26 22:53:16
                  (调用后修改)
分析方法        : F:\NIU GROUP METHODS\ZM\D996-04-55.M
最后修改        : 2016/1/31 11:46:21
```

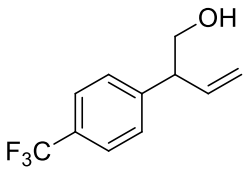


From 12h



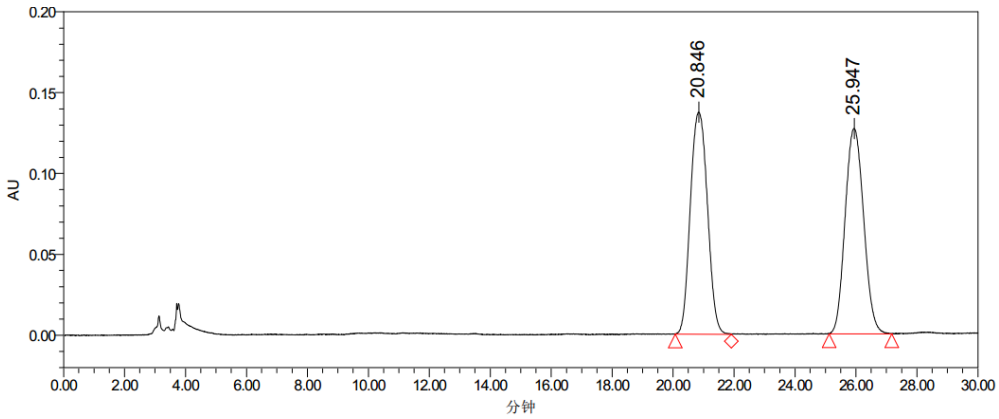
信号 1: DAD1 A, Sig=254,4 Ref=360,100

峰 #	保留时间 [min]	类型	峰宽 [min]	峰面积 [mAU*s]	峰高 [mAU]	峰面积 %
1	13.222	BB	0.3070	1628.41675	82.24026	5.0823
2	14.580	BB	0.3853	3.04126e4	1226.25525	94.9177
总量 :				3.20410e4	1308.49551	



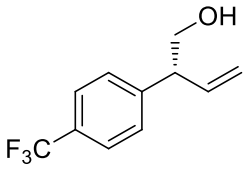
From (±)-12i

样品名称：	76C	采集者：	System
样品类型：	标准样	采集时间：	2016/1/30 10:45:08 CST
瓶号：	1	采集方法组：	c01d99
进样次数：	1	处理日期：	2016/1/30 21:26:14 CST
进样体积：	5.00 ul	处理方法：	1026
运行时间：	30.0 Minutes	通道名称：	210.6 纳米
样品组名称：	111	处理通道注释：	PDA 210.6 纳米



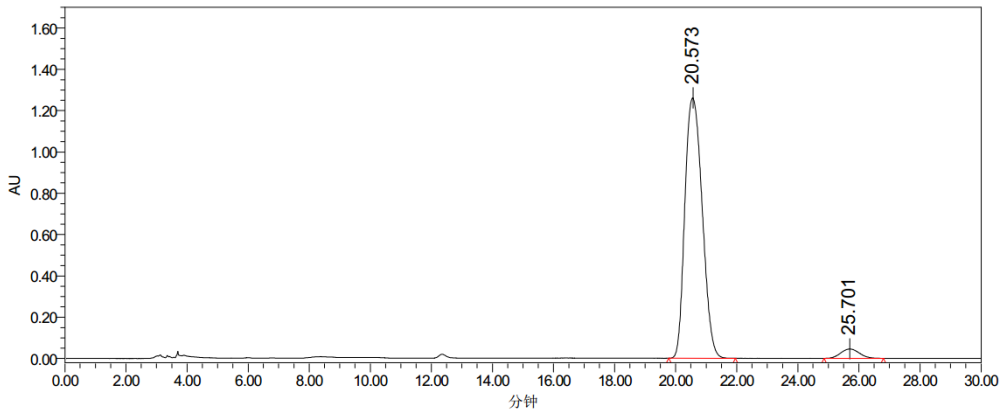
处理通道: PDA 210.6 纳米

	处理通道	保留时间 (分钟)	面积	% 面积	峰高
1	PDA 210.6 纳米	20.846	5348906	49.96	137342
2	PDA 210.6 纳米	25.947	5357962	50.04	126998



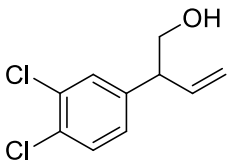
From 12i

样品名称：	295	采集者：	System
样品类型：	标准样	采集时间：	2016/1/30 11:15:48 CST
瓶号：	2	采集方法组：	c01d99
进样次数：	1	处理日期：	2016/1/30 21:31:40 CST
进样体积：	5.00 ul	处理方法：	1
运行时间：	30.0 Minutes	通道名称：	210.6 纳米
样品组名称：	111	处理通道注释：	PDA 210.6 纳米



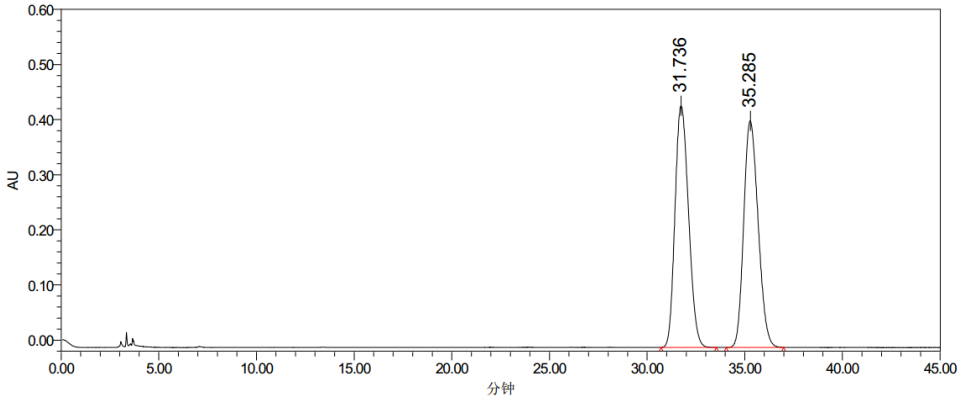
处理通道: PDA 210.6 纳米

	处理通道	保留时间 (分钟)	面积	% 面积	峰高
1	PDA 210.6 纳米	20.573	49715534	96.28	1260845
2	PDA 210.6 纳米	25.701	1921831	3.72	45333



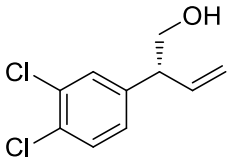
From (±) - 12j

样品名称：	LRZ-83C	采集者：	System
样品类型：	未知	采集时间：	2016/1/30 0:31:14 CST
瓶号：	3	采集方法组：	c01d99
进样次数：	1	处理日期：	2016/1/30 21:44:45 CST
进样体积：	5.00 ul	处理方法：	6
运行时间：	45.0 Minutes	通道名称：	224.1 纳米
样品组名称：	111	处理通道注释：	PDA 224.1 纳米



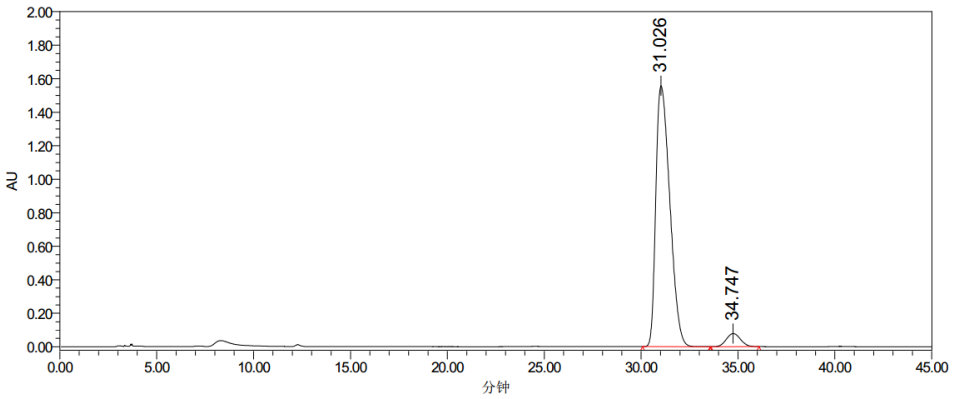
处理通道: PDA 224.1 纳米

	处理通道	保留时间 (分钟)	面积	% 面积	峰高
1	PDA 224.1 纳米	31.736	21104221	49.98	438736
2	PDA 224.1 纳米	35.285	21125235	50.02	411282



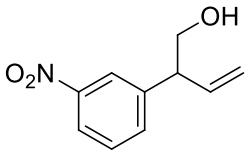
From 12j

样品名称：	ZM297	采集者：	System
样品类型：	未知	采集时间：	2016/1/30 1:16:55 CST
瓶号：	4	采集方法组：	c01d99
进样次数：	1	处理日期：	2016/1/30 21:46:20 CST
进样体积：	5.00 ul	处理方法：	7
运行时间：	45.0 Minutes	通道名称：	225.5 纳米
样品组名称：	111	处理通道注释：	PDA 225.5 纳米



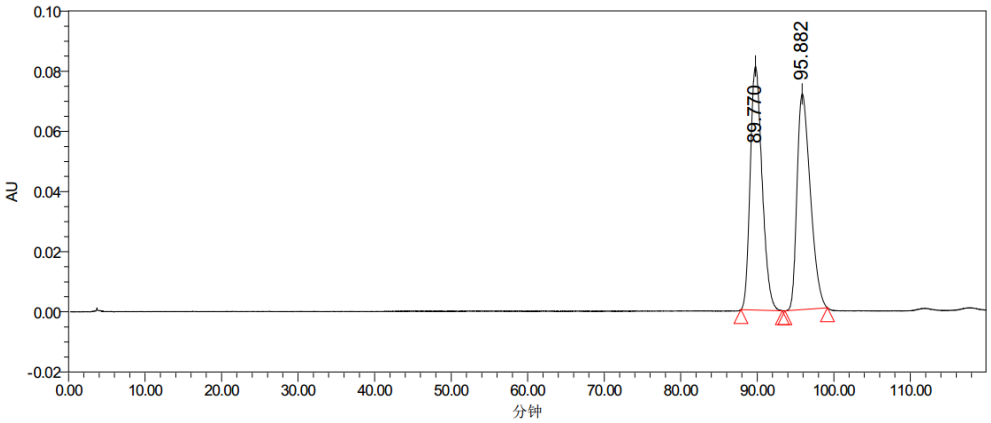
处理通道: PDA 225.5 纳米

	处理通道	保留时间 (分钟)	面积	% 面积	峰高
1	PDA 225.5 纳米	31.026	78164643	95.16	1557518
2	PDA 225.5 纳米	34.747	3978932	4.84	78156



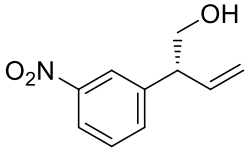
From (±)-12k

样品名称：	LRZ-83B
样品类型：	未知
瓶号：	7
进样次数：	1
进样体积：	5.00 ul
运行时间：	120.0 Minutes
样品组名称：	111
采集者：	System
采集时间：	2016/1/30 6:43:48 CST
采集方法组：	c01d99
处理日期：	2016/1/30 21:34:14 CST
处理方法：	2
通道名称：	271.4 纳米
处理通道注释：	PDA 271.4 纳米



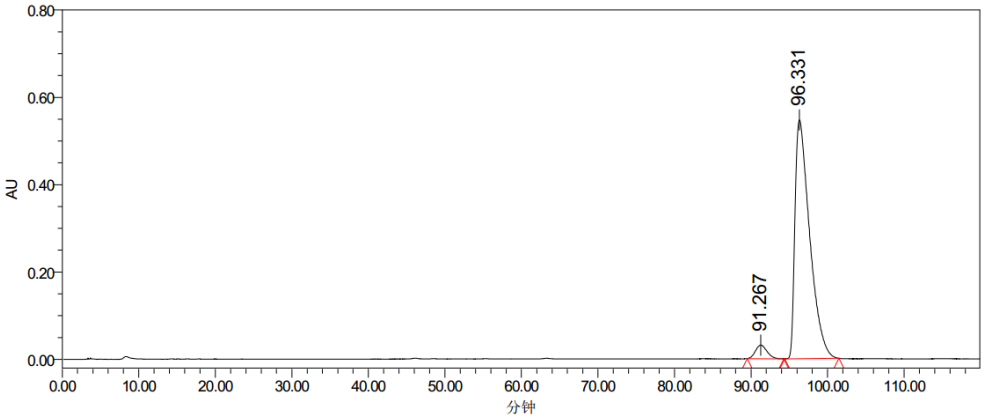
处理通道: PDA 271.4 纳米

	处理通道	保留时间 (分钟)	面积	% 面积	峰高
1	PDA 271.4 纳米	89.770	8768916	50.29	81115
2	PDA 271.4 纳米	95.882	8667826	49.71	71778



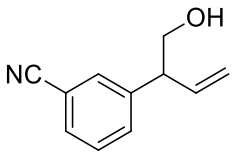
From 12k

样品名称：	ZM296
样品类型：	未知
瓶号：	8
进样次数：	1
进样体积：	5.00 ul
运行时间：	120.0 Minutes
样品组名称：	111
采集者：	System
采集时间：	2016/1/30 8:44:27 CST
采集方法组：	c01d99
处理日期：	2016/1/30 21:37:23 CST
处理方法：	3
通道名称：	264.6 纳米
处理通道注释：	PDA 264.6 纳米



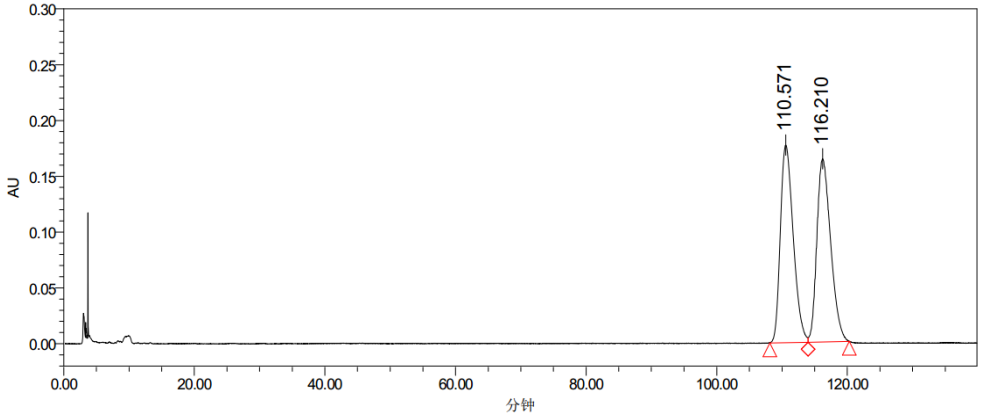
处理通道: PDA 264.6 纳米

	处理通道	保留时间 (分钟)	面积	% 面积	峰高
1	PDA 264.6 纳米	91.267	3267617	4.29	31185
2	PDA 264.6 纳米	96.331	72966491	95.71	547116



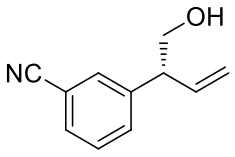
From (±)-12l

样品名称：	LRZ-83AS	采集者：	System
样品类型：	未知	采集时间：	2016/1/30 2:02:32 CST
瓶号：	5	采集方法组：	c01d99
进样次数：	1	处理日期：	2016/1/30 21:39:51 CST
进样体积：	5.00 ul	处理方法：	4
运行时间：	140.0 Minutes	通道名称：	215.8 纳米
样品组名称：	111	处理通道注释：	PDA 215.8 纳米



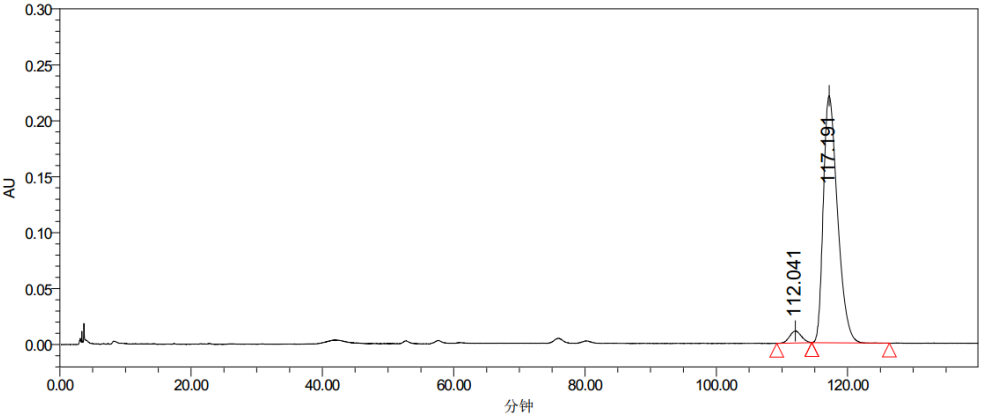
处理通道: PDA 215.8 纳米

	处理通道	保留时间 (分钟)	面积	% 面积	峰高
1	PDA 215.8 纳米	110.571	24355857	50.22	177166
2	PDA 215.8 纳米	116.210	24139715	49.78	164143



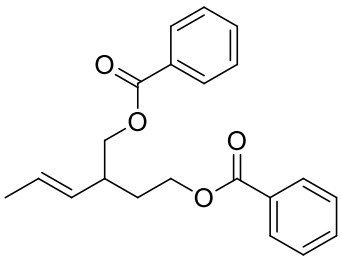
From 12l

样品名称：	ZM298	采集者：	System
样品类型：	未知	采集时间：	2016/1/30 4:23:10 CST
瓶号：	6	采集方法组：	c01d99
进样次数：	1	处理日期：	2016/1/30 21:42:30 CST
进样体积：	5.00 ul	处理方法：	5
运行时间：	140.0 Minutes	通道名称：	219.9 纳米
样品组名称：	111	处理通道注释：	PDA 219.9 纳米



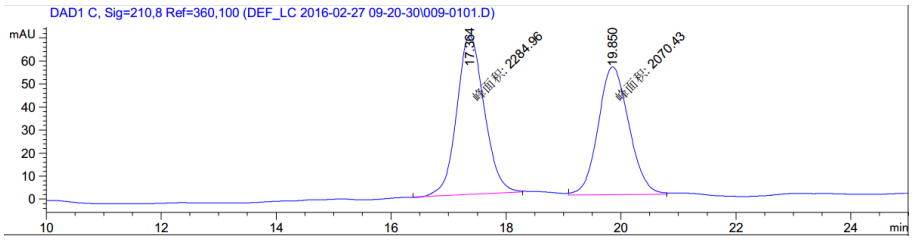
处理通道: PDA 219.9 纳米

	处理通道	保留时间 (分钟)	面积	% 面积	峰高
1	PDA 219.9 纳米	112.041	1339364	3.89	10787
2	PDA 219.9 纳米	117.191	33054895	96.11	220735



From (±)-12m

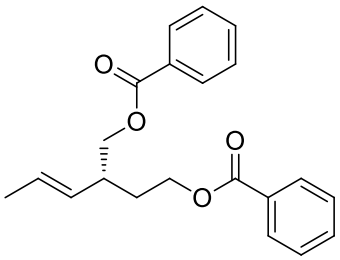
操作者 :　　序列行 : 1
仪器 : 仪器 1　　位置 : 样品瓶 9
进样日期 : 2016/2/27 9:24:24　　进样次数 : 1
进样量 : 5.0 µl
采集方法 : C:\CHEM32\1\DATA\DEF_LC 2016-02-27 09-20-30\A99B1-55.M
最后修改 : 2016/2/27 10:02:58
(调用后修改)
分析方法 : F:\NIU GROUP METHODS\LRZ\A92B8-40.M
最后修改 : 2016/2/27 10:55:41



信号 3: DAD1 C, Sig=210,8 Ref=360,100

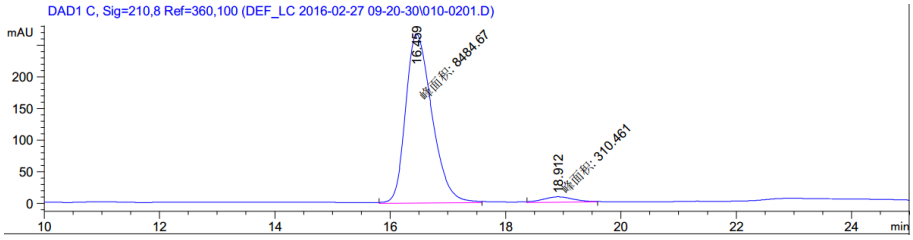
峰 #	保留时间 [min]	类型	峰宽 [min]	峰面积 [mAU*s]	峰高 [mAU]	峰面积 %
1	17.364	MM	0.5519	2284.96216	69.00832	52.4628
2	19.850	MM	0.6206	2070.43018	55.60455	47.5372

总量 : 4355.39233 124.61286



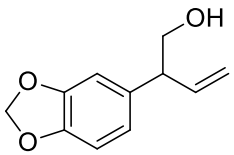
From 12m

操作者 :　　序列行 : 2
仪器 : 仪器 1　　位置 : 样品瓶 10
进样日期 : 2016/2/27 10:04:13　　进样次数 : 1
进样量 : 5.0 µl
采集方法 : C:\CHEM32\1\DATA\DEF_LC 2016-02-27 09-20-30\A99B1-55.M
最后修改 : 2016/2/27 10:07:48
(调用后修改)
分析方法 : F:\NIU GROUP METHODS\LRZ\A92B8-40.M
最后修改 : 2016/2/27 11:00:03



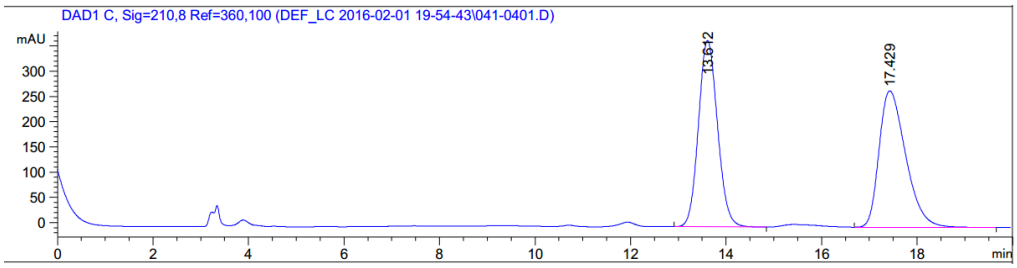
信号 3: DAD1 C, Sig=210,8 Ref=360,100

峰 #	保留时间 [min]	类型	峰宽 [min]	峰面积 [mAU*s]	峰高 [mAU]	峰面积 %
1	16.459	MM	0.5284	8484.67480	267.62097	96.4701
2	18.912	MM	0.6106	310.46069	8.47369	3.5299



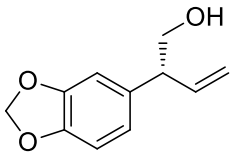
From (±)-12n

操作者 :
仪器 : 仪器 1
进样日期 : 2016/2/1 21:43:48
序列行 : 4
位置 : 样品瓶 41
进样次数 : 1
进样量 : 5.0 µl
来自于序列的不同进样量! 实际进样量: 50.0 µl
采集方法 : C:\CHEM32\1\DATA\DEF_LC 2016-02-01 19-54-43\A50D50-100.M
最后修改 : 2016/2/1 21:39:50
(调用后修改)
分析方法 : F:\NIU GROUP METHODS\ZM\D996-04-55.M
最后修改 : 2016/2/1 22:40:20
(调用后修改)



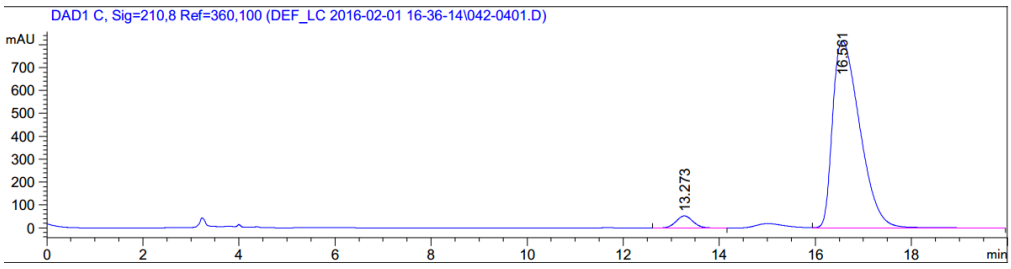
信号 3: DAD1 C, Sig=210,8 Ref=360,100

峰 #	保留时间 [min]	类型	峰宽 [min]	峰面积 [mAU*s]	峰高 [mAU]	峰面积 %
1	13.612	BB	0.4311	1.02134e4	368.74274	49.4322
2	17.429	BB	0.5972	1.04480e4	270.13333	50.5678
总量 :				2.06613e4	638.87607	



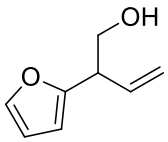
From 12n

操作者 :
仪器 : 仪器 1
进样日期 : 2016/2/1 18:26:06
序列行 : 4
位置 : 样品瓶 42
进样次数 : 1
进样量 : 5.0 µl
来自于序列的不同进样量! 实际进样量: 3.0 µl
采集方法 : C:\CHEM32\1\DATA\DEF_LC 2016-02-01 16-36-14\A50D50-100.M
最后修改 : 2016/2/1 18:02:47
(调用后修改)
分析方法 : F:\NIU GROUP METHODS\ZM\D996-04-55.M
最后修改 : 2016/2/1 22:40:20
(调用后修改)



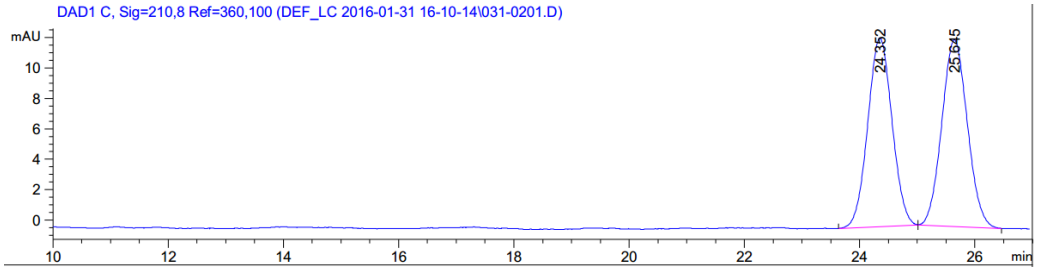
信号 3: DAD1 C, Sig=210,8 Ref=360,100

峰 #	保留时间 [min]	类型	峰宽 [min]	峰面积 [mAU*s]	峰高 [mAU]	峰面积 %
1	13.273	BB	0.3794	1307.04846	53.06569	3.9116
2	16.561	VBA	0.6158	3.21080e4	818.17914	96.0884
总量 :				3.34150e4	871.24483	



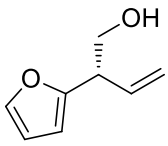
From (±)-12o

操作者 :
仪器 : 仪器 1
进样日期 : 2016/1/31 16:40:16
序列行 : 2
位置 : 样品瓶 31
进样次数 : 1
进样量 : 5.0 µl
来自于序列的不同进样量！实际进样量：30.0 µl
采集方法 : C:\CHEM32\1\DATA\DEF_LC 2016-01-31 16-10-14\A50D50-100.M
最后修改 : 2016/1/31 16:51:12
(调用后修改)
分析方法 : F:\NIU GROUP METHODS\ZM\D996-04-55.M
最后修改 : 2016/1/31 17:15:32



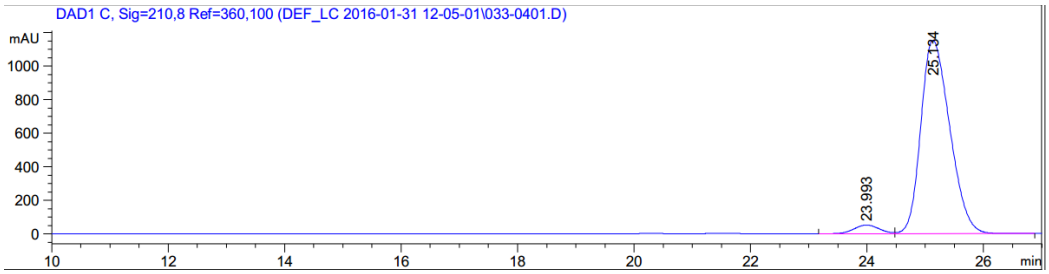
信号 3: DAD1 C, Sig=210,8 Ref=360,100

峰 #	保留时间 [min]	类型	峰宽 [min]	峰面积 [mAU*s]	峰高 [mAU]	峰面积 %
1	24.352	BB	0.4528	362.62354	12.41349	48.9685
2	25.645	BB	0.4733	377.90128	12.26902	51.0315
总量 :				740.52481	24.68251	



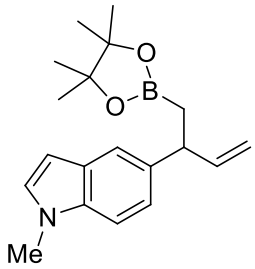
From 12o

操作者 :
仪器 : 仪器 1
进样日期 : 2016/1/31 14:00:04
序列行 : 4
位置 : 样品瓶 33
进样次数 : 1
进样量 : 5.0 µl
来自于序列的不同进样量！实际进样量：3.0 µl
采集方法 : C:\CHEM32\1\DATA\DEF_LC 2016-01-31 12-05-01\A50D50-100.M
最后修改 : 2016/1/31 13:58:37
(调用后修改)
分析方法 : F:\NIU GROUP METHODS\ZM\D996-04-55.M
最后修改 : 2016/1/31 17:15:32



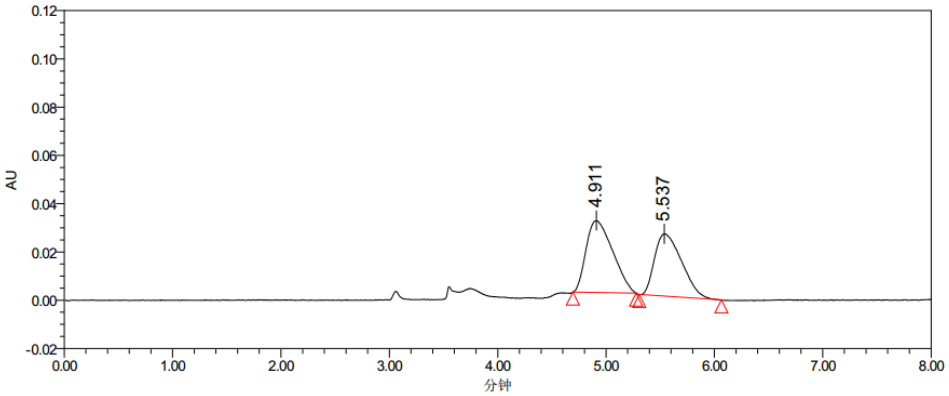
信号 3: DAD1 C, Sig=210,8 Ref=360,100

峰 #	保留时间 [min]	类型	峰宽 [min]	峰面积 [mAU*s]	峰高 [mAU]	峰面积 %
1	23.993	BV	0.4697	1548.56201	51.66929	3.7506
2	25.134	VB	0.5398	3.97403e4	1153.98218	96.2494
总量 :				4.12888e4	1205.65147	



(±)-12p

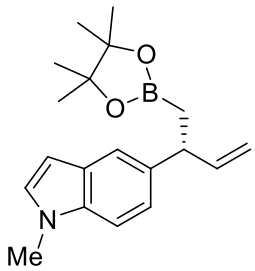
样品名称：	281-R	采集者：	System
样品类型：	标准样	采集时间：	2016/1/27 18:59:17 CST
瓶号：	14	采集方法组：	c01d99
进样次数：	1	处理日期：	2016/1/31 13:38:19 CST
进样体积：	10.00 ul	处理方法：	16
运行时间：	10.0 Minutes	通道名称：	224.0 纳米
样品组名称：	LRZ	处理通道注释：	PDA 224.0 纳米



样品名称 281-R; 样品瓶 14; 进样 1; 通道 2998; 采集日期 2016/1/27 18:59:17 CST

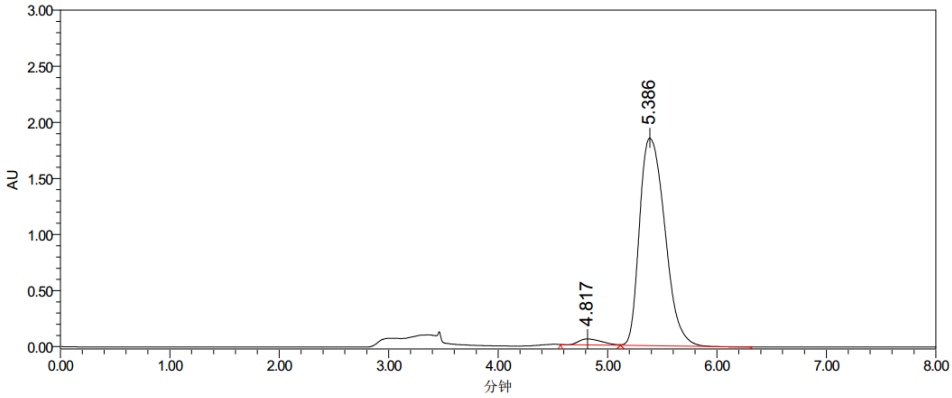
处理通道: PDA 224.0 纳米

	处理通道	保留时间 (分钟)	面积	% 面积	峰高
1	PDA 224.0 纳米	4.911	508451	53.03	29798
2	PDA 224.0 纳米	5.537	450351	46.97	25775



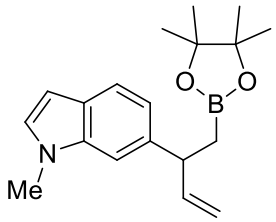
12p

样品名称：	ZM-285	采集者：	System
样品类型：	标准样	采集时间：	2016/1/27 12:50:31 CST
瓶号：	15	采集方法组：	c01d99
进样次数：	1	处理日期：	2016/2/1 18:11:37 CST
进样体积：	5.00 ul	处理方法：	22
运行时间：	10.0 Minutes	通道名称：	223.2 纳米
样品组名称：	LRZ	处理通道注释：	PDA 223.2 纳米



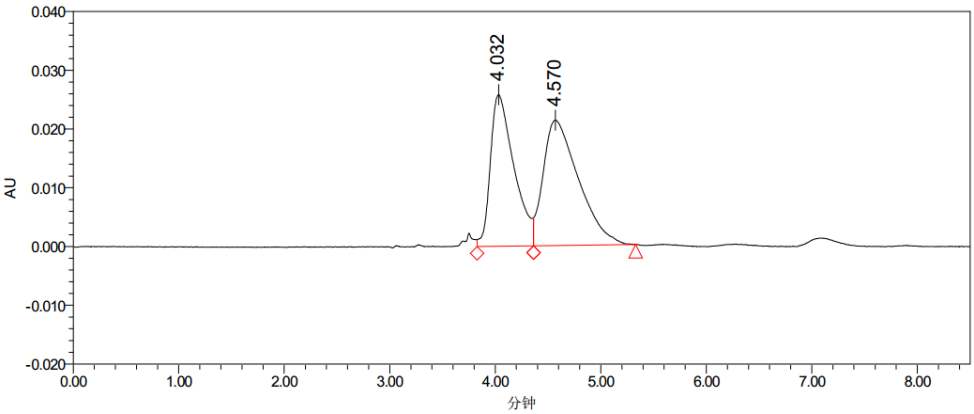
处理通道: PDA 223.2 纳米

	处理通道	保留时间 (分钟)	面积	% 面积	峰高
1	PDA 223.2 纳米	4.817	771732	2.52	52476
2	PDA 223.2 纳米	5.386	29835802	97.48	1853008



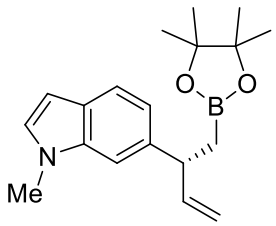
(±)-12q

样品名称：	ZM283	采集者：	System
样品类型：	标准样	采集时间：	2016/1/28 1:08:54 CST
瓶号：	7	采集方法组：	c01d99
进样次数：	1	处理日期：	2016/1/31 11:11:28 CST
进样体积：	10.00 ul	处理方法：	11
运行时间：	10.0 Minutes	通道名称：	276.3 纳米
样品组名称：	LRZ	处理通道注释：	PDA 276.3 纳米



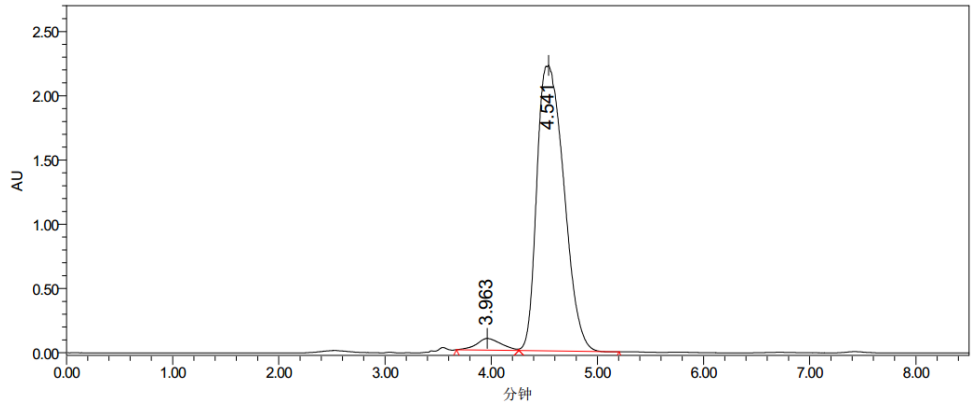
处理通道: PDA 276.3 纳米

	处理通道	保留时间 (分钟)	面积	% 面积	峰高
1	PDA 276.3 纳米	4.032	400284	44.67	25771
2	PDA 276.3 纳米	4.570	495839	55.33	21331



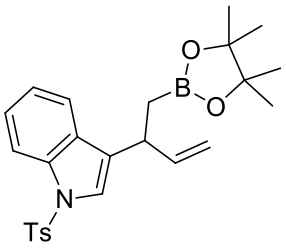
12q

样品名称：	ZM-287	采集者：	System
样品类型：	未知	采集时间：	2016/1/27 4:24:21 CST
瓶号：	8	采集方法组：	c01d99
进样次数：	1	处理日期：	2016/1/31 11:25:01 CST
进样体积：	5.00 ul	处理方法：	12
运行时间：	10.0 Minutes	通道名称：	214.4 纳米
样品组名称：	lrz	处理通道注释：	PDA 214.4 纳米



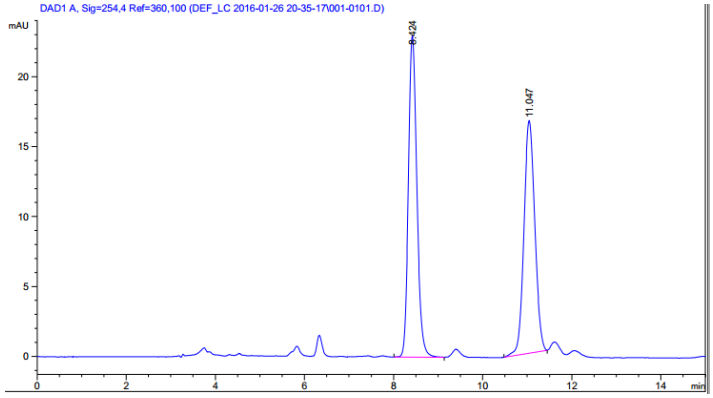
处理通道: PDA 214.4 纳米

	处理通道	保留时间 (分钟)	面积	% 面积	峰高
1	PDA 214.4 纳米	3.963	1469190	3.59	91025
2	PDA 214.4 纳米	4.541	39403130	96.41	2222315



(±)-12r

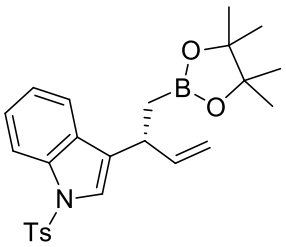
操作者 :
仪器 : 仪器 1
进样日期 : 2016/1/26 20:36:16
序列行 : 1
位置 : 样品瓶 1
进样次数 : 1
进样量 : 5.0 µl
来自于序列的不同进样量！实际进样量：10.0 µl
采集方法 : C:\CHEM32\1\DATA\DEF_LC 2016-01-26 20-35-17\A995B5-55.M
最后修改 : 2016/1/26 20:59:21
(调用后修改)
分析方法 : F:\NIU GROUP METHODS\ZM\D996-04-55.M



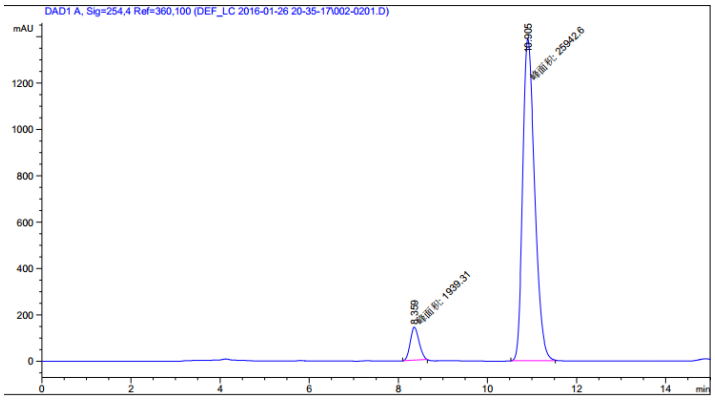
信号 1: DAD1 A, Sig=254,4 Ref=360,100

峰 #	保留时间 [min]	类型	峰宽 [min]	峰面积 [mAU*s]	峰高 [mAU]	峰面积 %
1	8.424	BB	0.2009	300.95462	22.96175	51.6540
2	11.047	BB	0.2617	281.68054	16.61944	48.3460
总量 :				582.63516	39.58119	

操作者 :
仪器 : 仪器 1
进样日期 : 2016/1/26 21:00:35
序列行 : 2
位置 : 样品瓶 2
进样次数 : 1
进样量 : 5.0 µl
来自于序列的不同进样量！实际进样量：10.0 µl
采集方法 : C:\CHEM32\1\DATA\DEF_LC 2016-01-26 20-35-17\A995B5-55.M
最后修改 : 2016/1/26 21:20:33
(调用后修改)
分析方法 : F:\NIU GROUP METHODS\ZM\D996-04-55.M

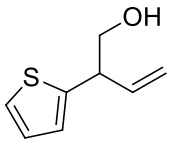


12r



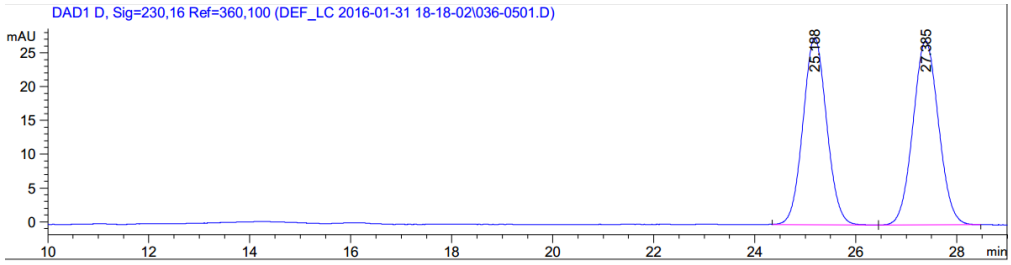
信号 1: DAD1 A, Sig=254,4 Ref=360,100

峰 #	保留时间 [min]	类型	峰宽 [min]	峰面积 [mAU*s]	峰高 [mAU]	峰面积 %
1	8.359	MM	0.2279	1939.31421	141.79733	6.9555
2	10.905	MM	0.3115	2.59426e4	1388.00305	93.0445
总量 :				2.78819e4	1529.80038	



From (±)-12s

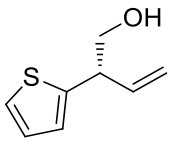
操作者 :　　序列行 : 5
仪器 : 仪器 1　　位置 : 样品瓶 36
进样日期 : 2016/1/31 20:22:50　　进样次数 : 1
进样量 : 5.0 µl
来自于序列的不同进样量！实际进样量：100.0 µl
采集方法 : C:\CHEM32\1\DATA\DEF_LC 2016-01-31 18-18-02\A50D50-100.M
最后修改 : 2016/1/31 20:20:41
(调用后修改)
分析方法 : F:\NIU GROUP METHODS\ZM\D996-04-55.M
最后修改 : 2016/1/31 20:53:56
(调用后修改)



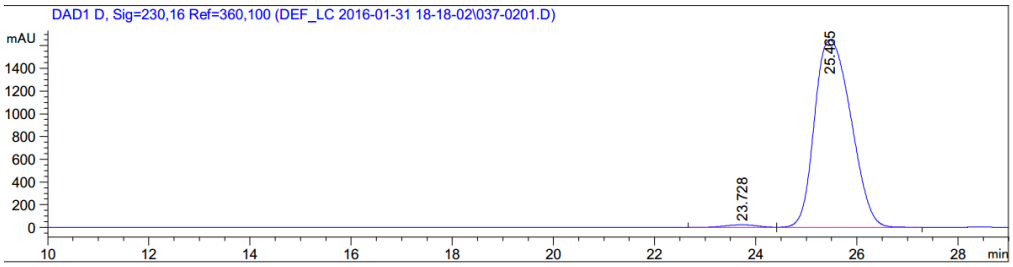
信号 4: DAD1 D, Sig=230,16 Ref=360,100

峰 #	保留时间 [min]	类型	峰宽 [min]	峰面积 [mAU*s]	峰高 [mAU]	峰面积 %
1	25.188	BB	0.5083	901.11456	27.64498	48.4615
2	27.385	BB	0.5468	958.32776	27.21355	51.5385
总量 :				1859.44232	54.85853	

操作者 :　　序列行 : 2
仪器 : 仪器 1　　位置 : 样品瓶 37
进样日期 : 2016/1/31 18:56:08　　进样次数 : 1
进样量 : 5.0 µl
来自于序列的不同进样量！实际进样量：10.0 µl
采集方法 : C:\CHEM32\1\DATA\DEF_LC 2016-01-31 18-18-02\A50D50-100.M
最后修改 : 2016/1/31 18:18:48
(调用后修改)
分析方法 : F:\NIU GROUP METHODS\ZM\D996-04-55.M
最后修改 : 2016/1/31 20:53:56

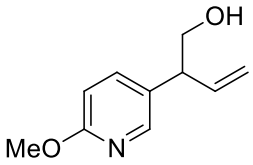


From 12s



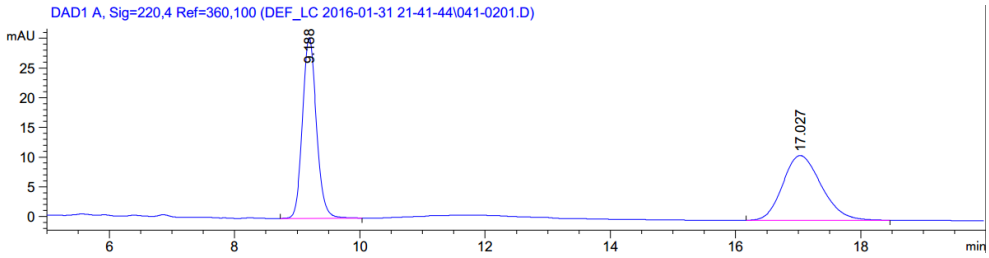
信号 4: DAD1 D, Sig=230,16 Ref=360,100

峰 #	保留时间 [min]	类型	峰宽 [min]	峰面积 [mAU*s]	峰高 [mAU]	峰面积 %
1	23.728	BV	0.7083	1009.75879	22.72808	1.2139
2	25.465	VB	0.8146	8.21720e4	1651.21130	98.7861
总量 :				8.31817e4	1673.93938	



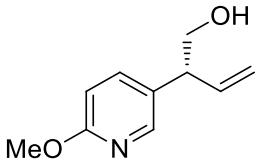
From (±)-12t

操作者 :
仪器 : 仪器 1
进样日期 : 2016/1/31 22:04:20
序列行 : 2
位置 : 样品瓶 41
进样次数 : 1
进样量 : 5.0 µl
来自于序列的不同进样量！实际进样量: 50.0 µl
采集方法 : C:\CHEM32\1\DATA\DEF_LC 2016-01-31 21-41-44\A90B10-35.M
最后修改 : 2016/1/31 22:02:36
(调用后修改)
分析方法 : F:\NIU GROUP METHODS\ZM\D996-04-55.M
最后修改 : 2016/1/31 22:34:07



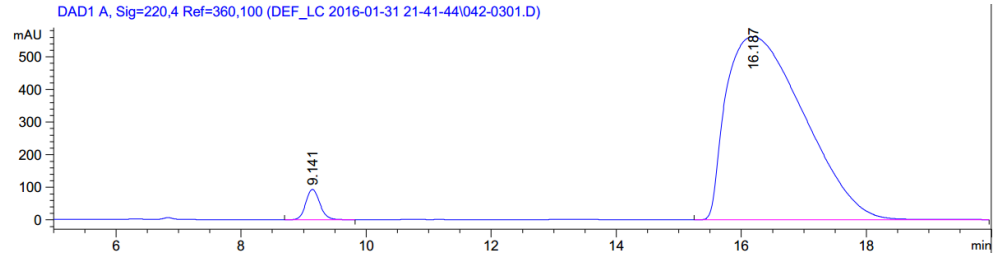
信号 1: DAD1 A, Sig=220,4 Ref=360,100

峰 #	保留时间 [min]	类型	峰宽 [min]	峰面积 [mAU*s]	峰高 [mAU]	峰面积 %
1	9.188	BB	0.2385	470.96280	30.44506	50.2775
2	17.027	BB	0.6441	465.76367	10.90874	49.7225
总量 :				936.72647	41.35379	



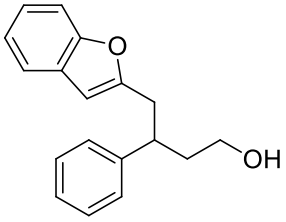
From 12t

操作者 :
仪器 : 仪器 1
进样日期 : 2016/1/31 22:25:59
序列行 : 3
位置 : 样品瓶 42
进样次数 : 1
进样量 : 5.0 µl
采集方法 : C:\CHEM32\1\DATA\DEF_LC 2016-01-31 21-41-44\A90B10-35.M
最后修改 : 2016/1/31 22:02:36
(调用后修改)
分析方法 : F:\NIU GROUP METHODS\ZM\D996-04-55.M
最后修改 : 2016/1/31 22:34:07



信号 1: DAD1 A, Sig=220,4 Ref=360,100

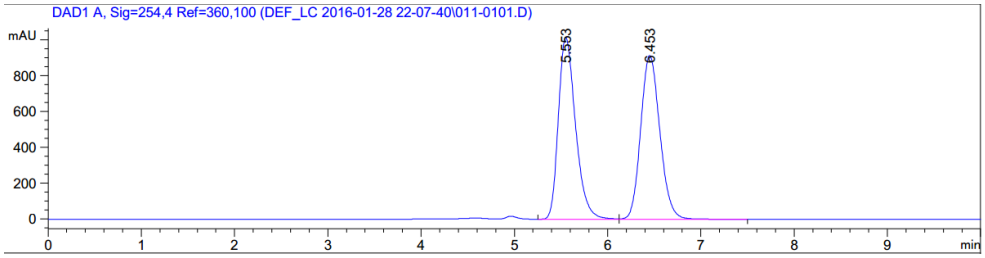
峰 #	保留时间 [min]	类型	峰宽 [min]	峰面积 [mAU*s]	峰高 [mAU]	峰面积 %
1	9.141	BB	0.2402	1450.02759	92.83096	2.9026
2	16.187	BBA	1.3853	4.85053e4	561.79187	97.0974
总量 :				4.99553e4	654.62283	



(±)-23

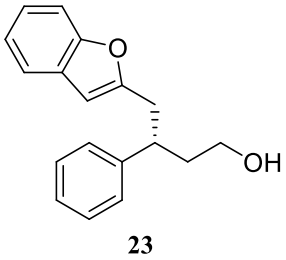
操作者 :
仪器 : 仪器 1
进样日期 : 2016/1/28 22:08:34
采集方法 : C:\CHEM32\1\DATA\DEF_LC 2016-01-28 22-07-40\A99B1-60.M
最后修改 : 2016/1/28 22:19:38
(调用后修改)
分析方法 : F:\NIU GROUP METHODS\ZM\D996-04-55.M
最后修改 : 2016/1/31 11:59:11

序列行 : 1
位置 : 样品瓶 11
进样次数 : 1
进样量 : 5.0 µl



信号 1: DAD1 A, Sig=254,4 Ref=360,100

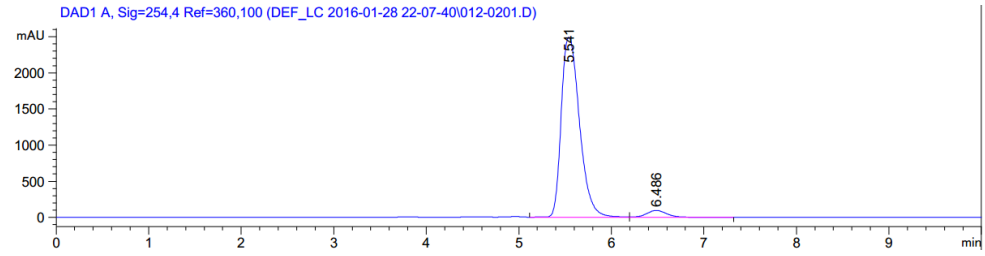
峰 #	保留时间 [min]	类型	峰宽 [min]	峰面积 [mAU*s]	峰高 [mAU]	峰面积 %
1	5.553	BV	0.1969	1.29806e4	1016.79865	49.8492
2	6.453	VB	0.2225	1.30591e4	915.03088	50.1508



23

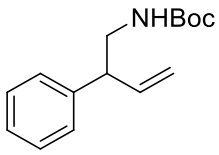
操作者 :
仪器 : 仪器 1
进样日期 : 2016/1/28 22:20:46
采集方法 : C:\CHEM32\1\DATA\DEF_LC 2016-01-28 22-07-40\A99B1-60.M
最后修改 : 2016/1/28 22:31:00
(调用后修改)
分析方法 : F:\NIU GROUP METHODS\ZM\D996-04-55.M
最后修改 : 2016/1/31 11:59:11

序列行 : 2
位置 : 样品瓶 12
进样次数 : 1
进样量 : 5.0 µl



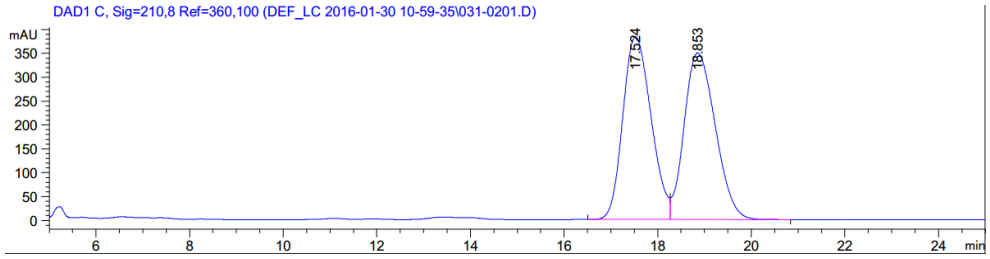
信号 1: DAD1 A, Sig=254,4 Ref=360,100

峰 #	保留时间 [min]	类型	峰宽 [min]	峰面积 [mAU*s]	峰高 [mAU]	峰面积 %
1	5.541	VV	0.2134	3.40718e4	2494.08374	96.0105
2	6.486	VB	0.2313	1415.79150	94.23799	3.9895
总量 :				3.54876e4	2588.32173	



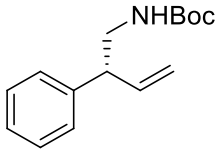
(±)-24

操作者 :　　序列行 : 2
仪器 : 仪器 1　　位置 : 样品瓶 31
进样日期 : 2016/1/30 12:41:57　　进样次数 : 1
进样量 : 5.0 µl
来自于序列的不同进样量！实际进样量：10.0 µl
采集方法 : C:\CHEM32\1\DATA\DEF_LC 2016-01-30 10-59-35\A50D50-100.M
最后修改 : 2016/1/30 13:26:29
(调用后修改)
分析方法 : F:\NIU GROUP METHODS\ZM\D996-04-55.M
最后修改 : 2016/1/31 12:07:22



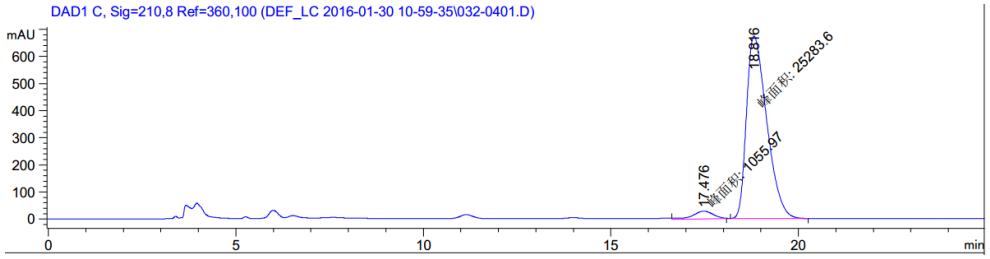
信号 3: DAD1 C, Sig=210,8 Ref=360,100

峰 #	保留时间 [min]	类型	峰宽 [min]	峰面积 [mAU*s]	峰高 [mAU]	峰面积 %
1	17.524	BV	0.6581	1.60505e4	383.60754	49.8282
2	18.853	VB	0.7362	1.61612e4	349.04108	50.1718
总量 :				3.22117e4	732.64862	



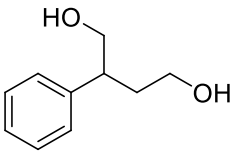
24

操作者 :　　序列行 : 4
仪器 : 仪器 1　　位置 : 样品瓶 32
进样日期 : 2016/1/30 13:35:28　　进样次数 : 1
进样量 : 5.0 µl
采集方法 : C:\CHEM32\1\DATA\DEF_LC 2016-01-30 10-59-35\A50D50-100.M
最后修改 : 2016/1/30 13:39:33
(调用后修改)
分析方法 : F:\NIU GROUP METHODS\LRZ\A90B10-60.M
最后修改 : 2016/2/19 15:51:10



信号 3: DAD1 C, Sig=210,8 Ref=360,100

峰 #	保留时间 [min]	类型	峰宽 [min]	峰面积 [mAU*s]	峰高 [mAU]	峰面积 %
1	17.476	MM	0.6178	1055.96899	28.48757	4.0091
2	18.816	MM	0.6263	2.52836e4	672.81012	95.9909
总量 :				2.63396e4	701.29769	



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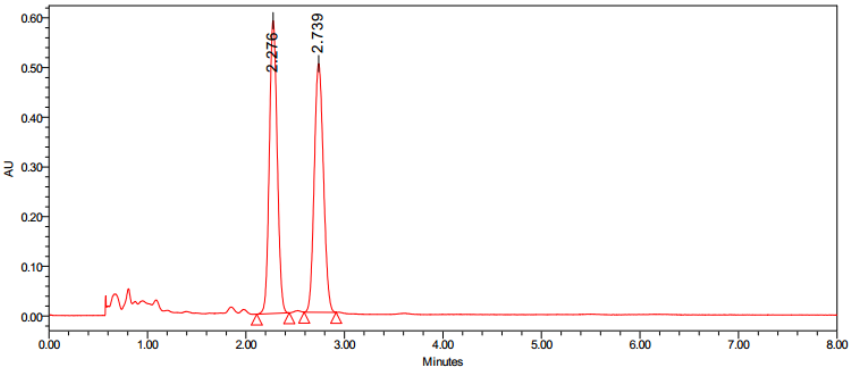
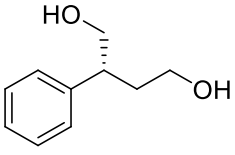
SAMPLE INFORMATION

Date Acquired:	4/14/2016 12:31:41 PM CST
Sample Name:	DIOL-XXT
Vial:	1:E,2
Injection Volume:	5.00 ul
Acq. Method Set:	2mL_20 B4_C4
Acquired By:	System
Column:	CHIRALPAK IC-3(4.6*100mm,3um)
Co_Solvent:	IPA
Column_Temperature:	35
Co_Solvent%:	20
Back_Pressure:	2000psi
Flow_rate:	2mL/min
Proc. Chnl. Descr.:	PDA 210.0 nm (210-400)nm
PDA_Start_Wavelength:	200 nm
PDA_Stop_Wavelength:	400 nm



Peak Results

	RT	Height	Area	% Area
1	2.28	589674	3272523	50.31
2	2.74	500495	3232632	49.69



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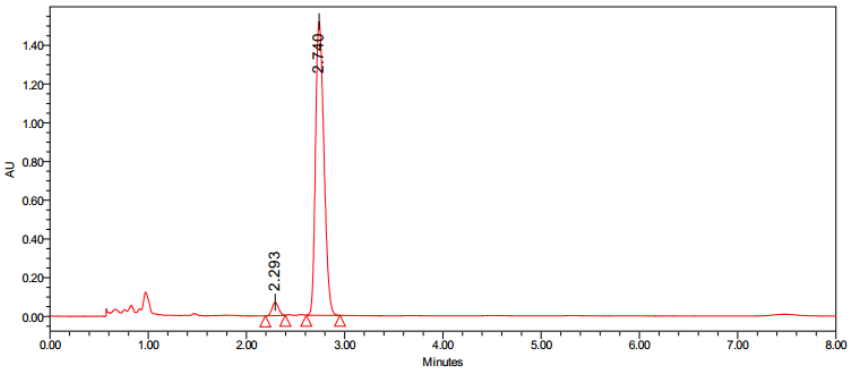
SAMPLE INFORMATION

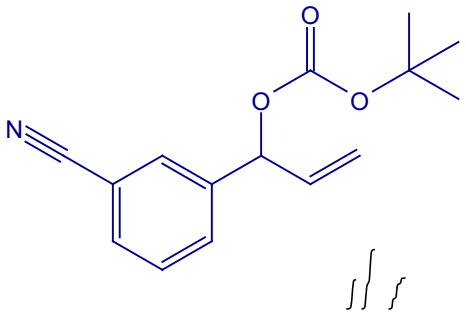
Date Acquired:	4/14/2016 1:06:27 PM CST
Sample Name:	DIOL
Vial:	1:E,3
Injection Volume:	5.00 ul
Acq. Method Set:	2mL_20 B4_C4
Acquired By:	System
Column:	CHIRALPAK IC-3(4.6*100mm,3um)
Co_Solvent:	IPA
Column_Temperature:	35
Co_Solvent%:	20
Back_Pressure:	2000psi
Flow_rate:	2mL/min
Proc. Chnl. Descr.:	PDA 210.0 nm (210-400)nm
PDA_Start_Wavelength:	200 nm
PDA_Stop_Wavelength:	400 nm

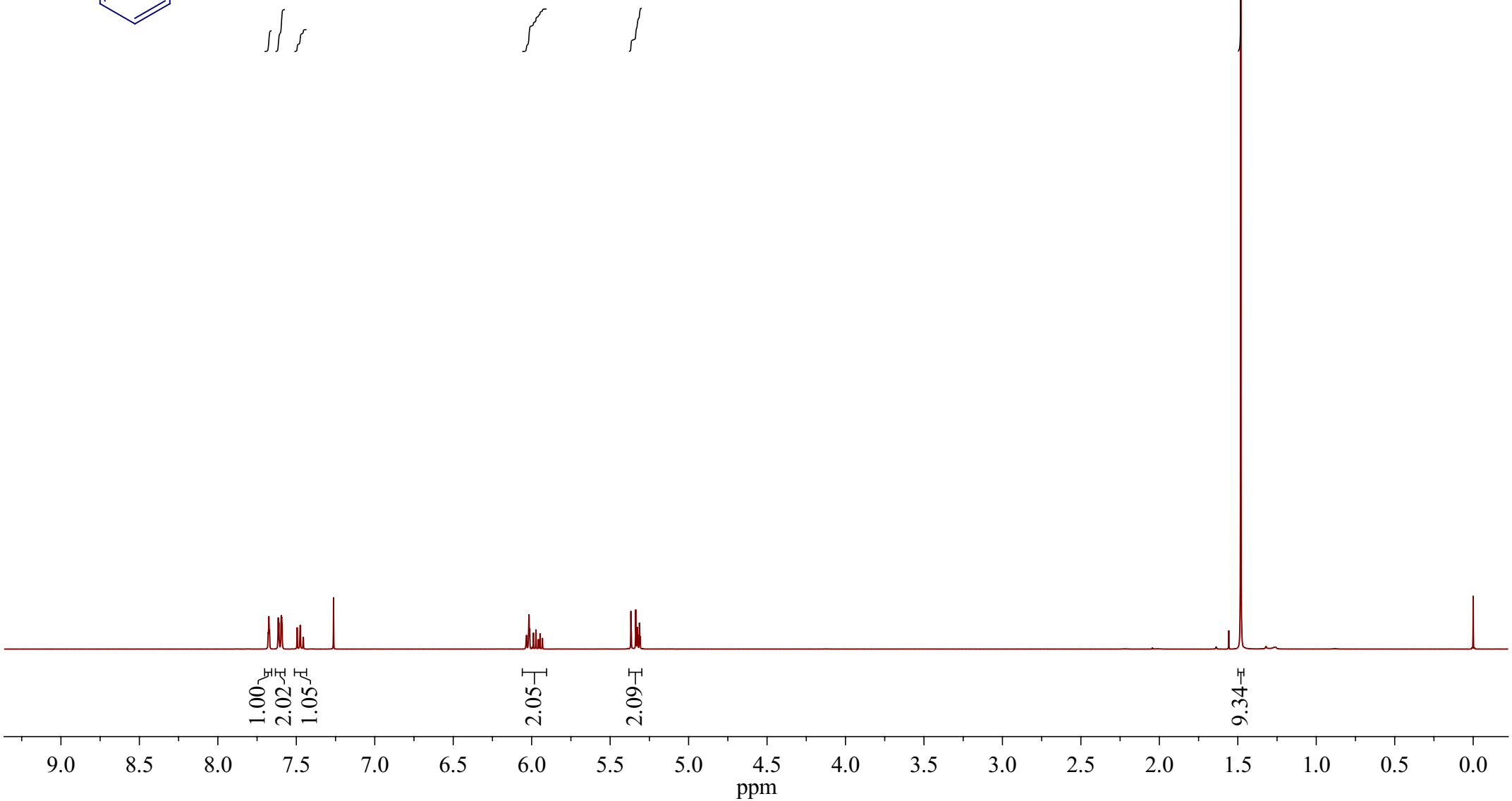


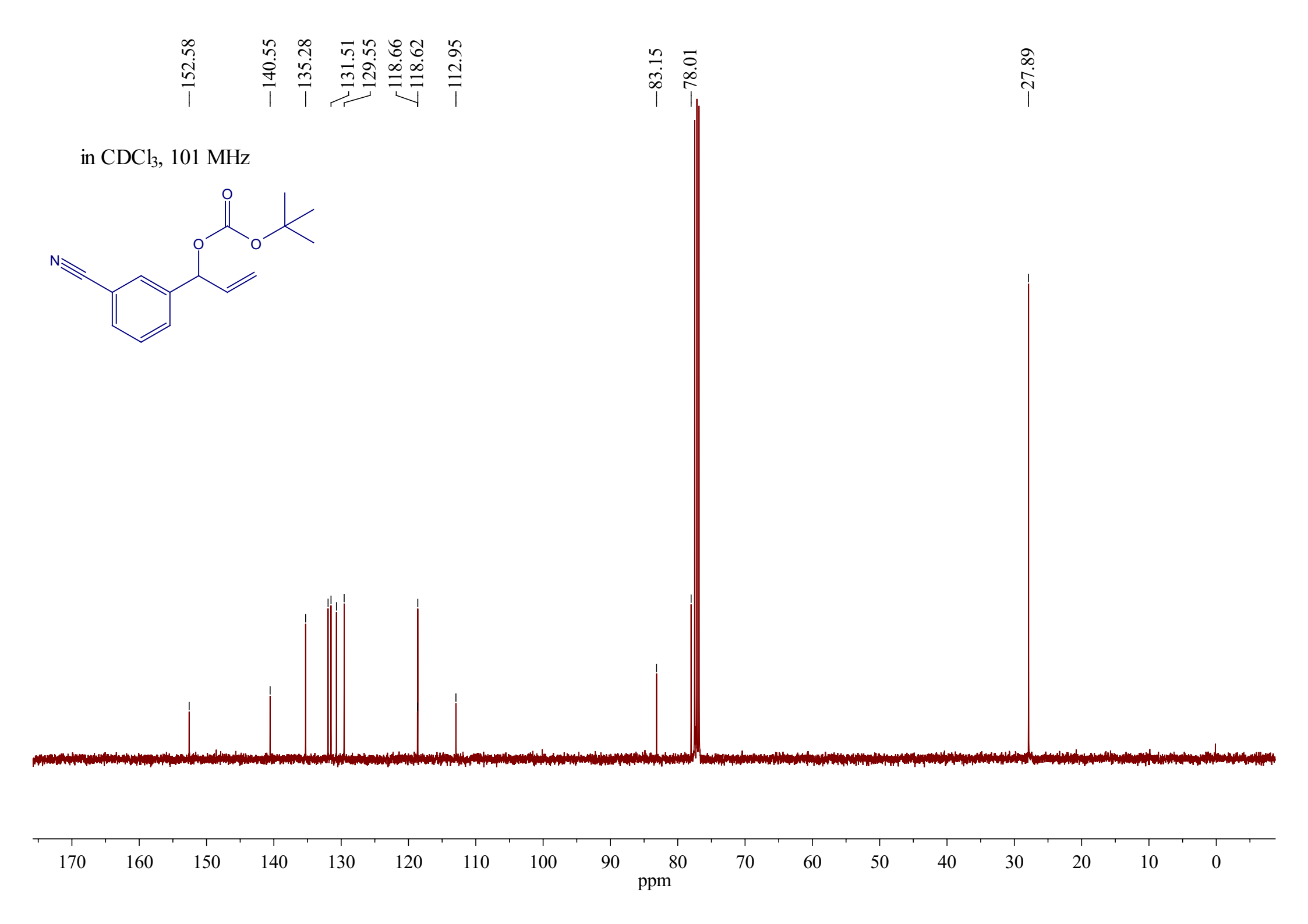
Peak Results

	RT	Height	Area	% Area
1	2.29	67981	310358	3.33
2	2.74	1517147	9016100	96.67

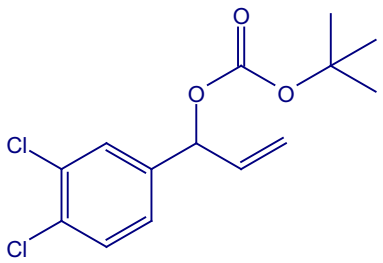
in $CDCl_3$, 400 MHz

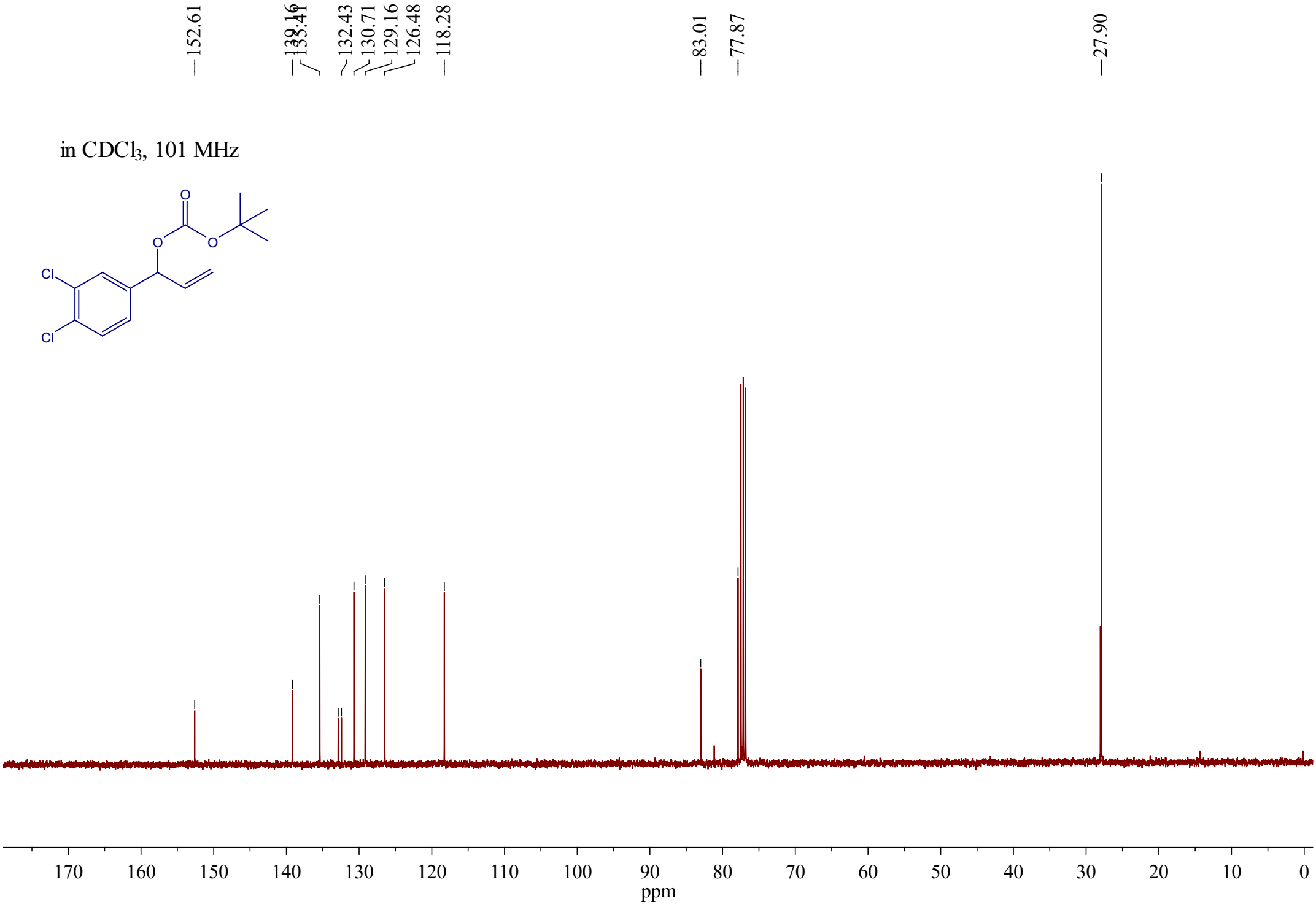




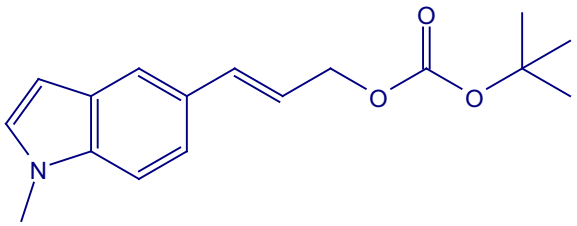

152.58
140.55
135.28
131.51
129.55
118.66
118.62
112.95
83.15
78.01
27.89
in CDCl3, 101 MHz
O
O
O
N
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
ppm

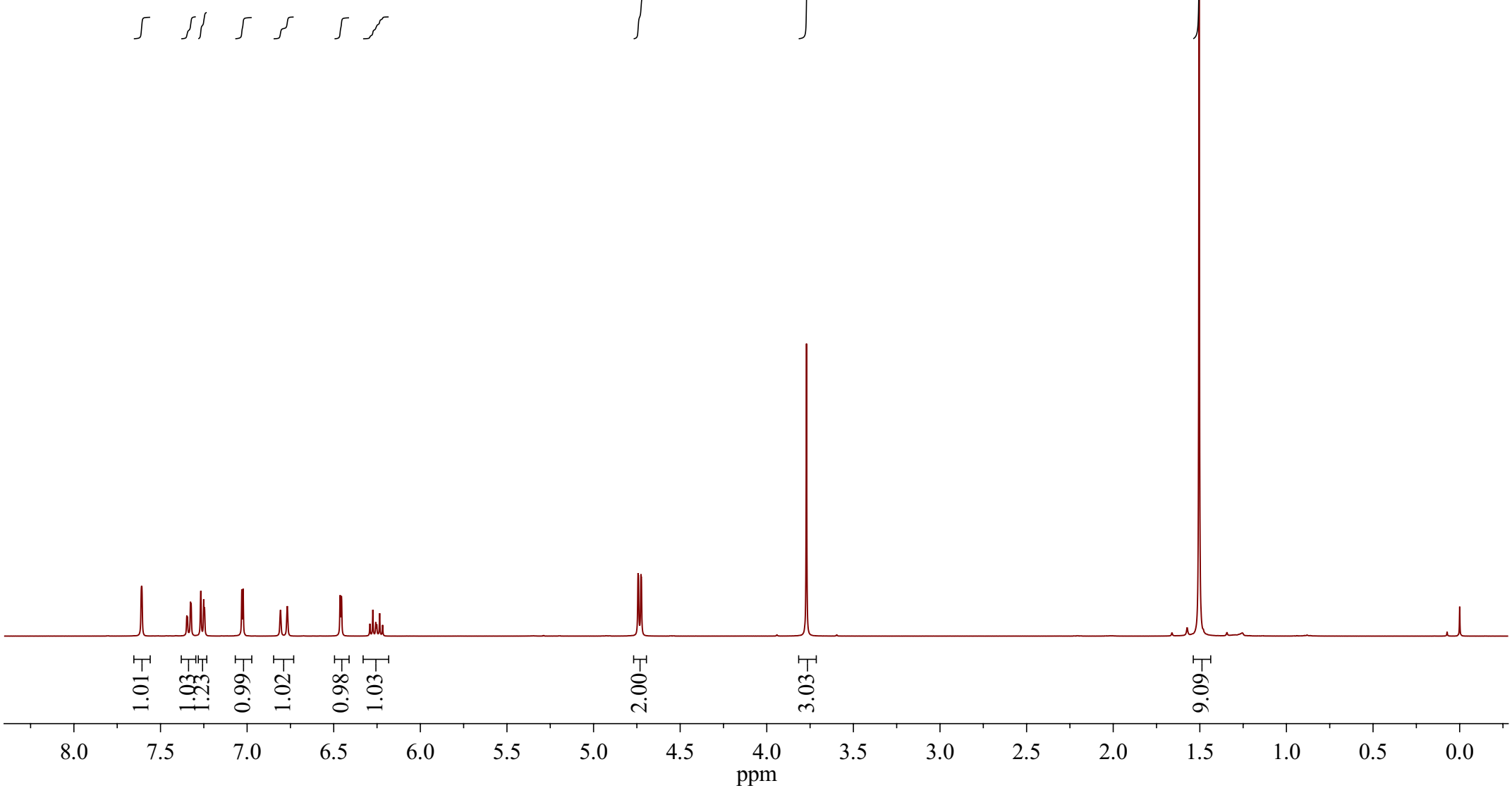
in $CDCl_3$, 400 MHz

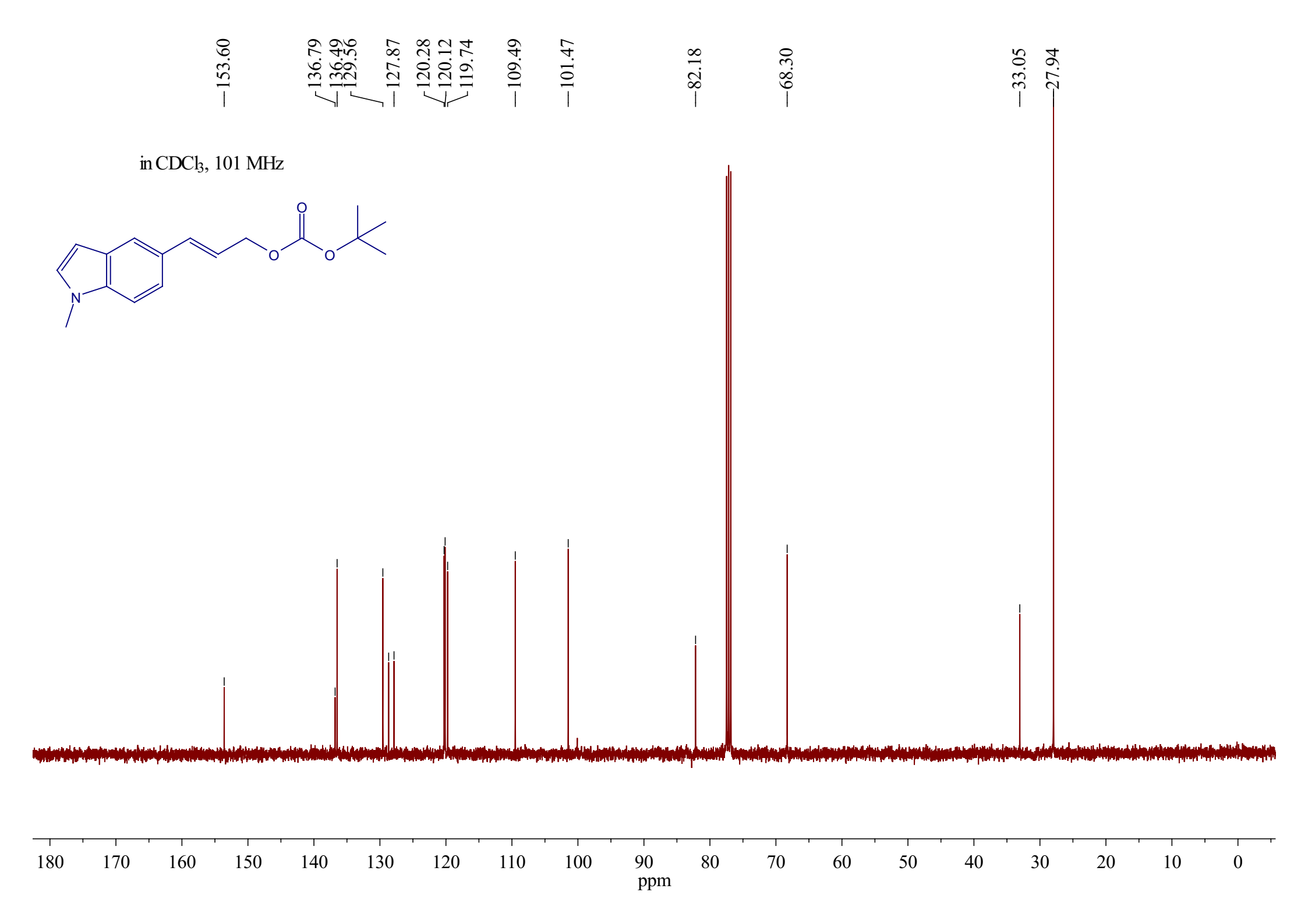



152.61
139.16
133.41
132.43
130.71
129.16
126.48
118.28
83.01
77.87
27.90
in CDCl3, 101 MHz
O
O
O
Cl
Cl
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
ppm

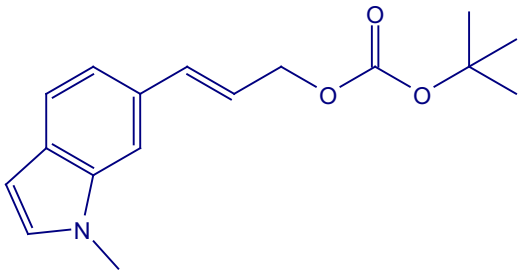
in $CDCl_3$, 400 MHz

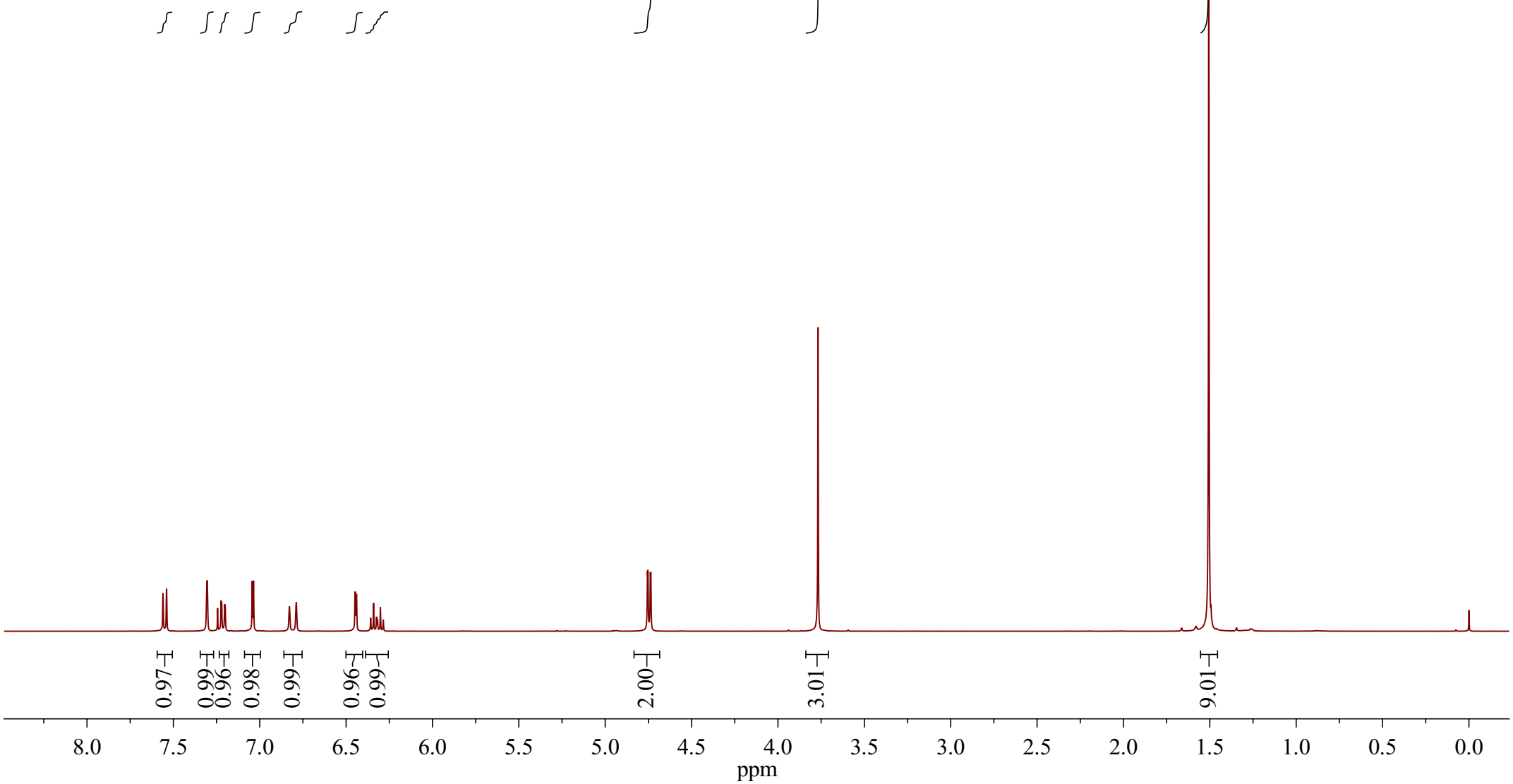


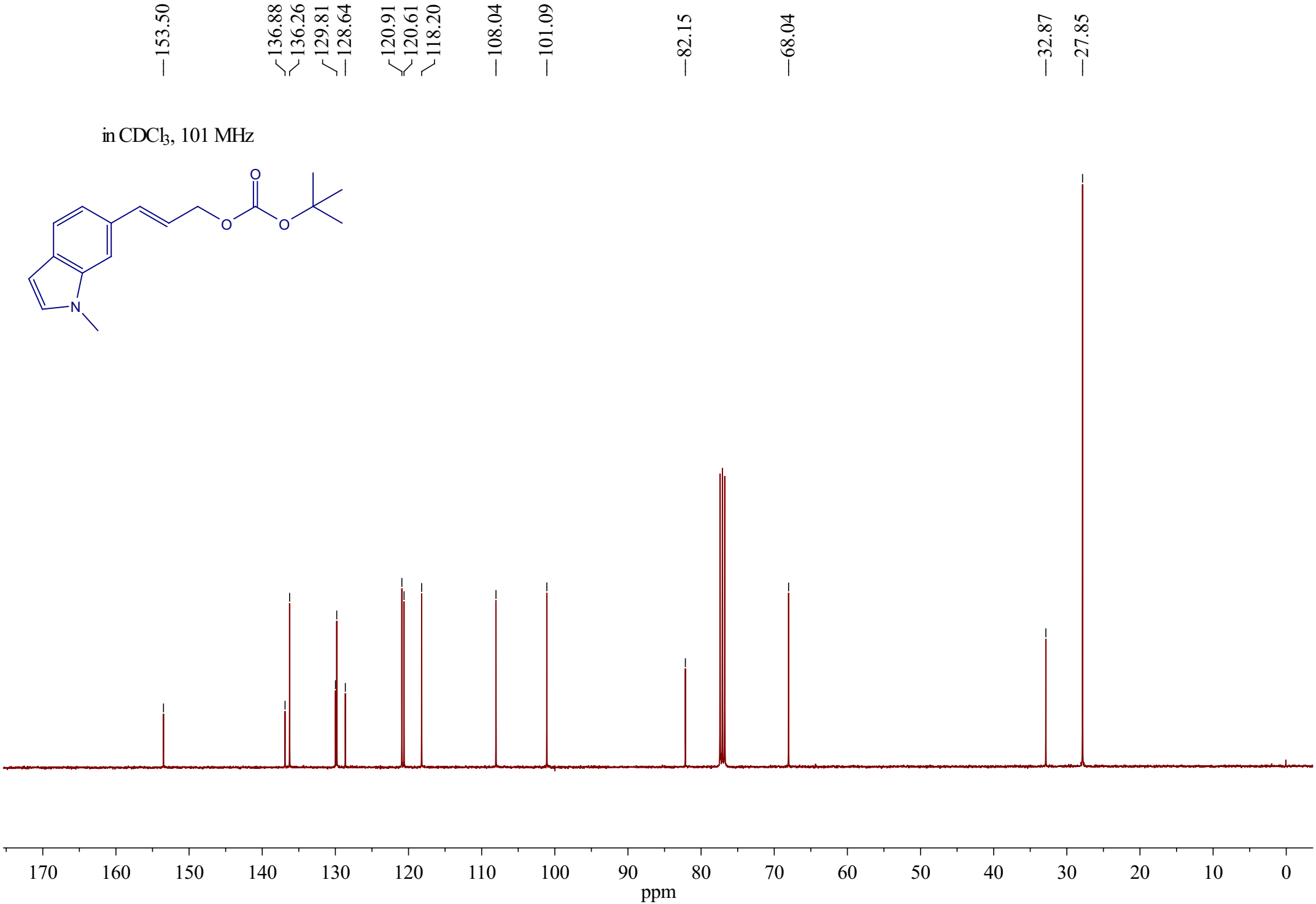



153.60
136.79
136.49
129.56
127.87
120.28
120.12
119.74
109.49
101.47
82.18
68.30
33.05
27.94
in CDCl3, 101 MHz
O
O
O
N
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
ppm

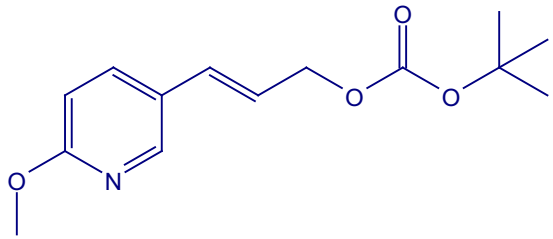
in $CDCl_3$, 400 MHz

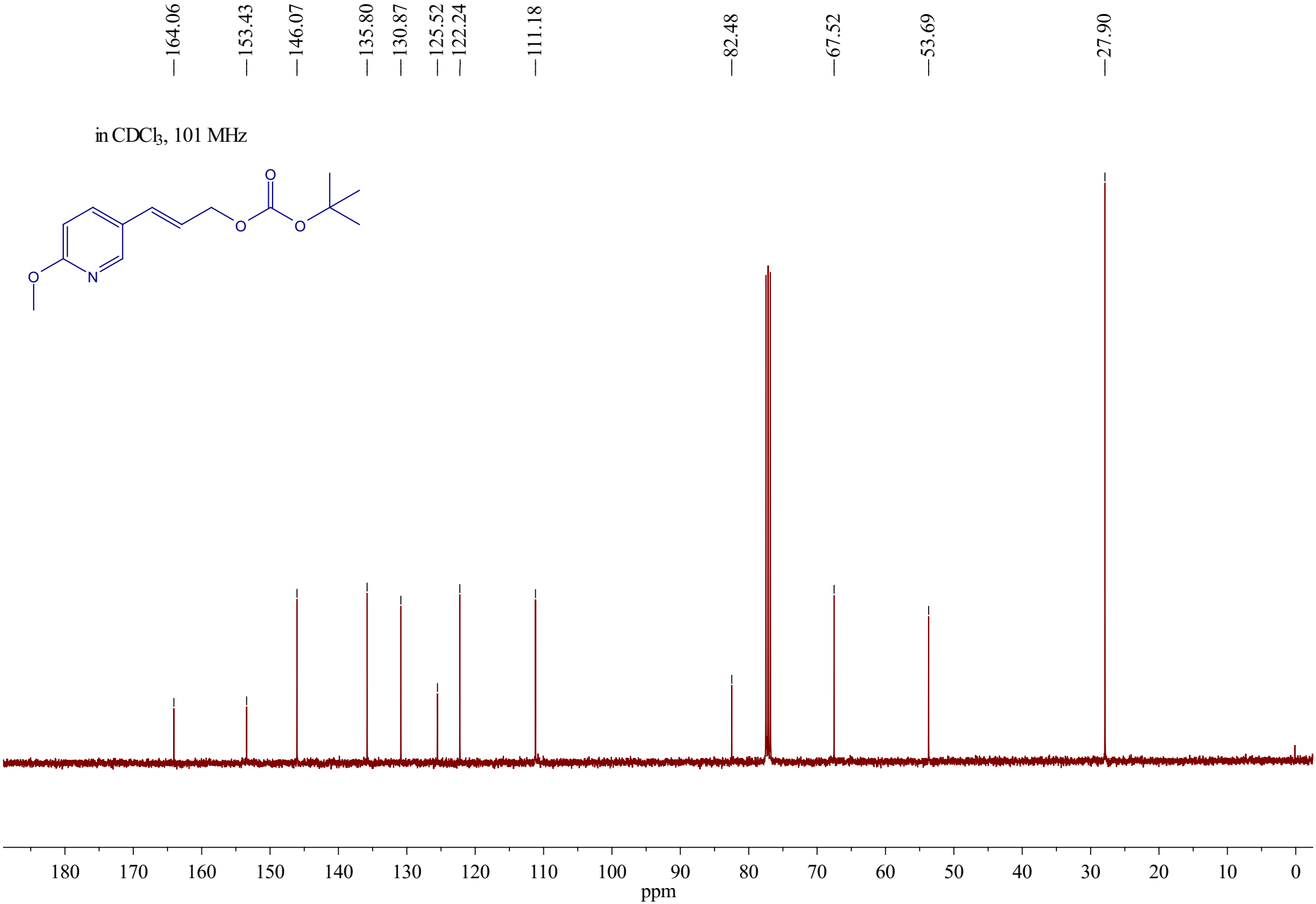




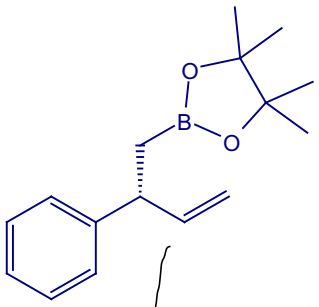

153.50
136.88
136.26
129.81
128.64
120.91
120.61
118.20
108.04
101.09
82.15
68.04
32.87
27.85
in CDCl3, 101 MHz
O
O
O
N
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
ppm

in $CDCl_3$, 400 MHz

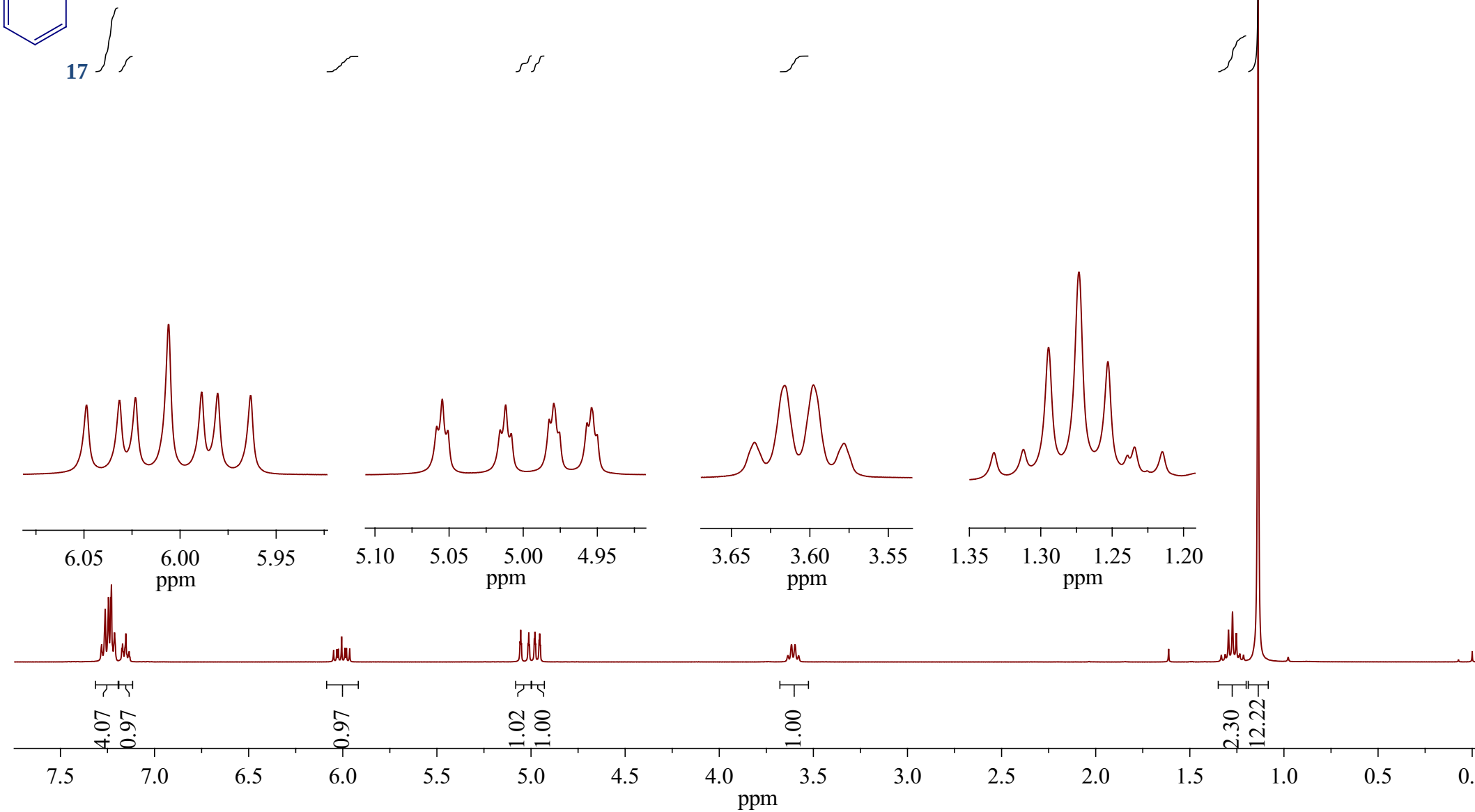



164.06
153.43
146.07
135.80
130.87
125.52
122.24
111.18
82.48
67.52
53.69
27.90
in CDCl3, 101 MHz
O
O
O
O
N
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
ppm

in CDCl3, 400 MHz

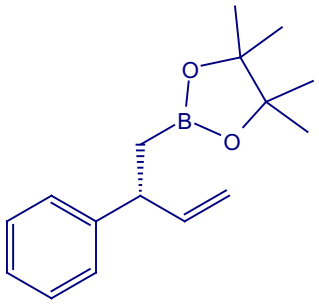


17

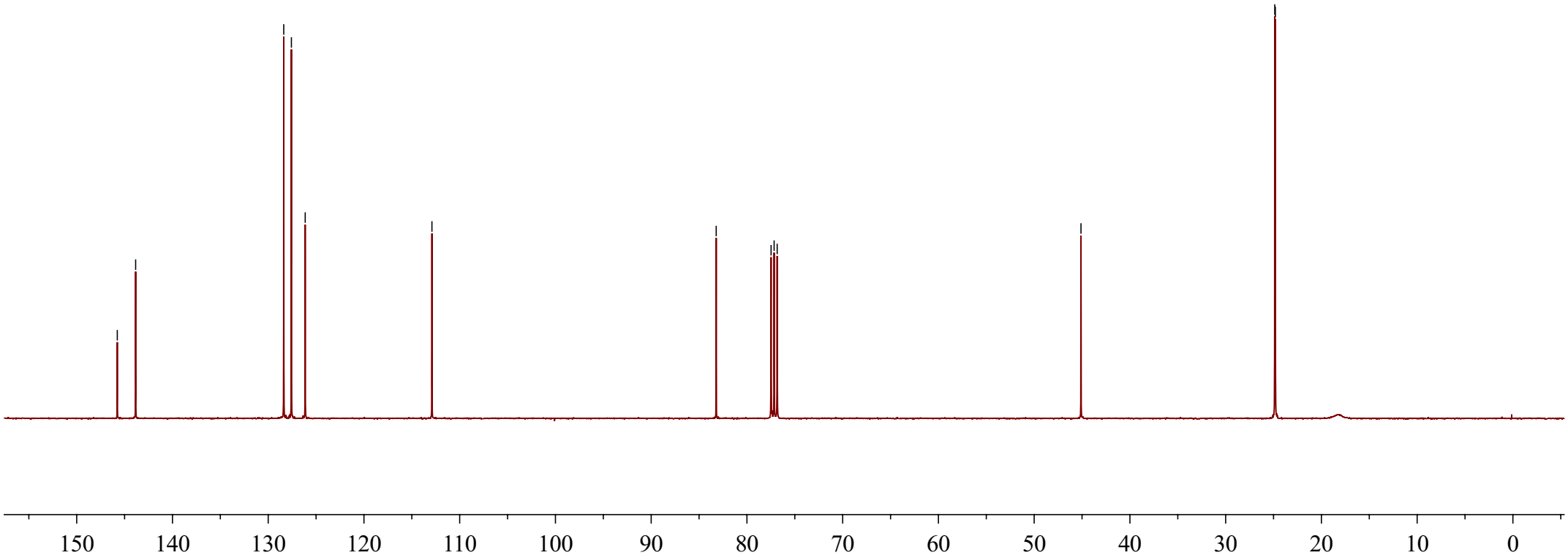


145.76
143.84
128.38
127.58
126.14
112.90
83.21
77.48
77.16
76.84
45.11
24.87
24.81

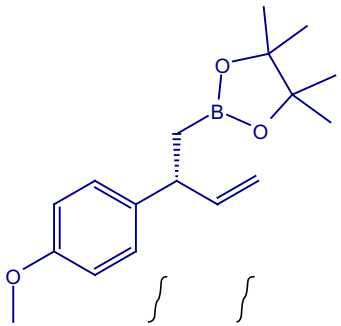
in $CDCl_3$, 101 MHz



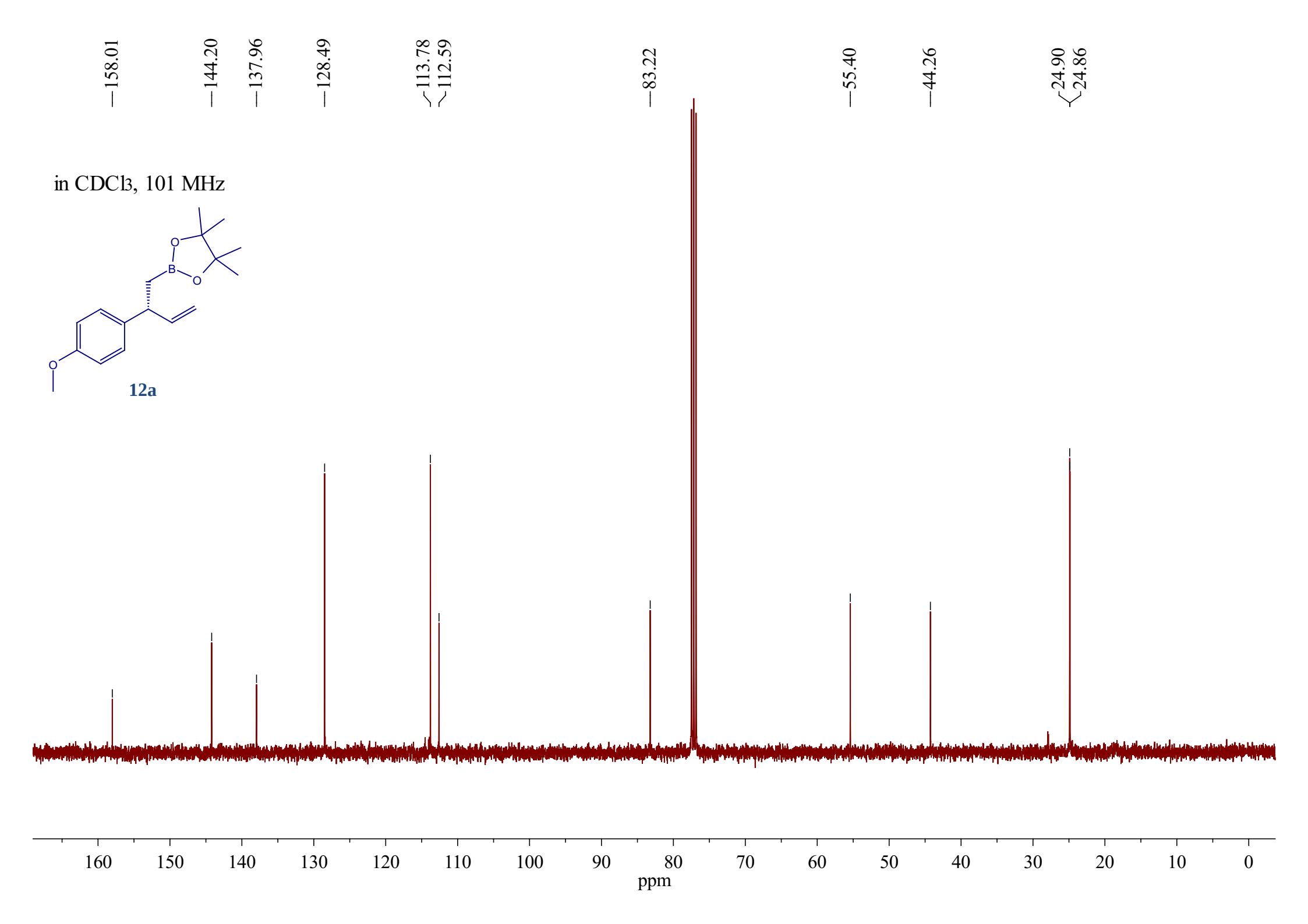
17



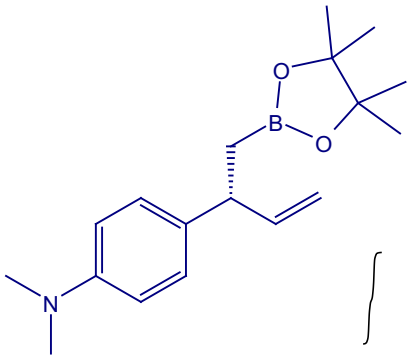
in CDCl3, 400 MHz



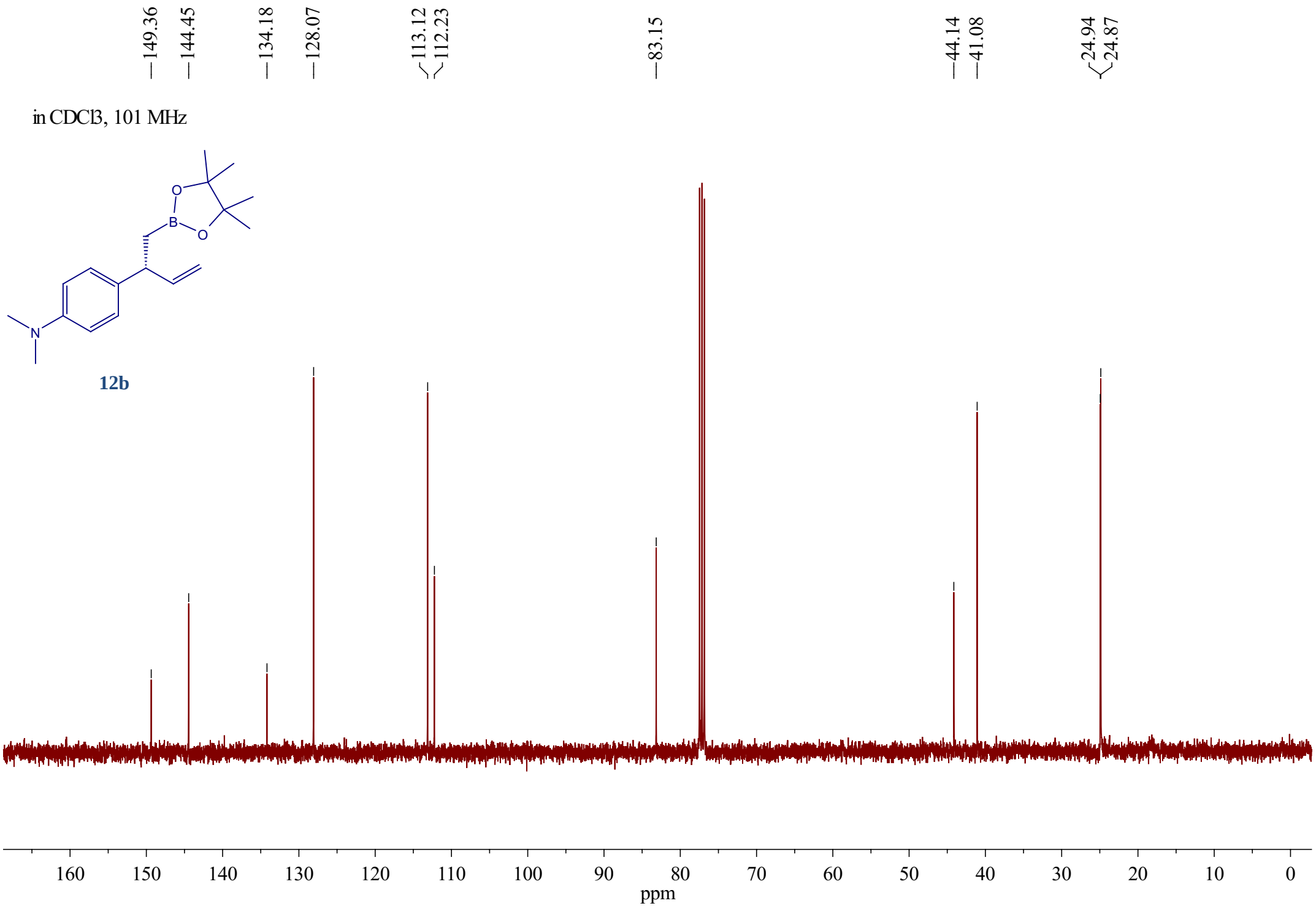
12a


158.01
144.20
137.96
128.49
113.78
112.59
83.22
55.40
44.26
24.90
24.86
in CDCl3, 101 MHz
O
B
O
O
12a
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
ppm

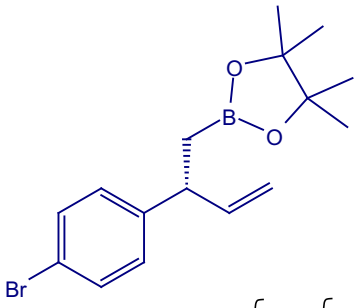
in CDCl3, 400 MHz



12b


149.36
144.45
134.18
128.07
113.12
112.23
83.15
44.14
41.08
24.94
24.87
in CDCl3, 101 MHz
O
B
O
N
12b
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
ppm

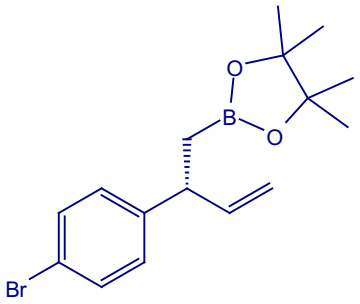
in CDCl3, 400 MHz



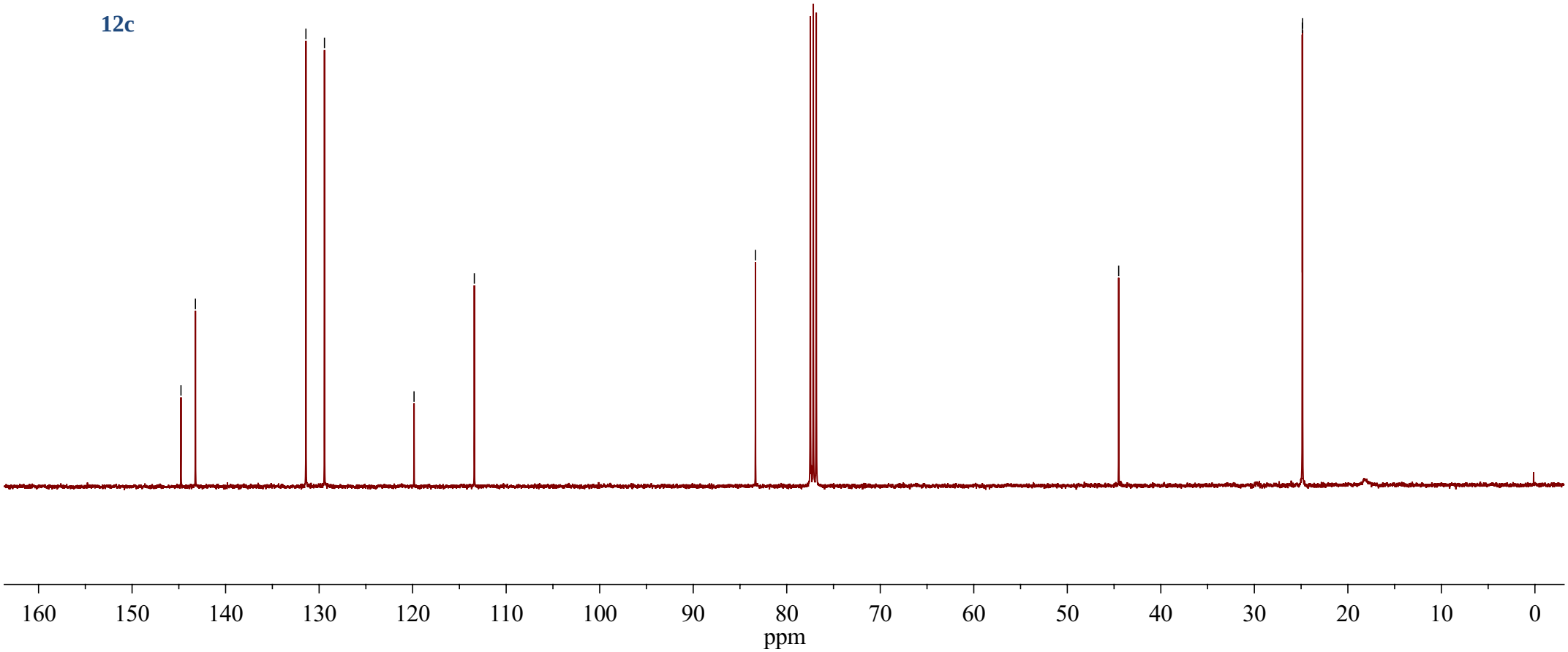
12c

144.77
143.23
131.41
129.43
119.85
113.40
83.34
44.51
24.87
24.85

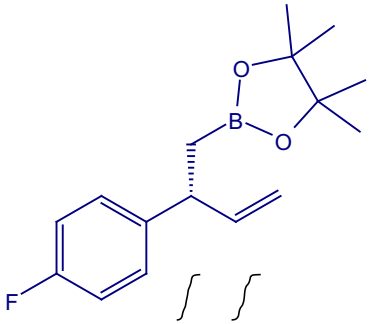
in CDCl3, 101 MHz



12c



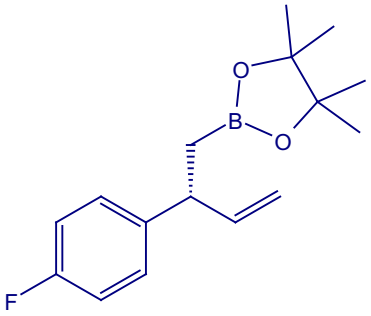
in CDCl3, 400 MHz



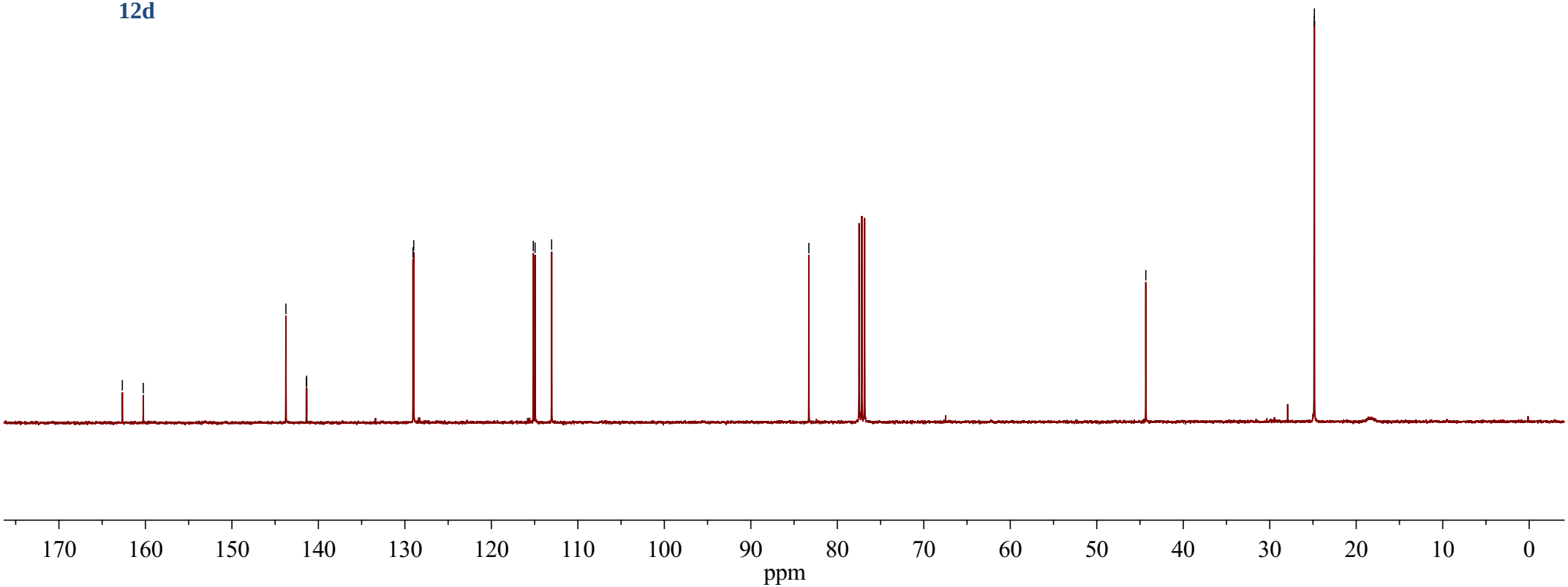
12d

162.67
160.25
143.75
141.39
141.36
129.05
128.98
115.15
114.94
113.03
83.29
44.33
24.86
24.84

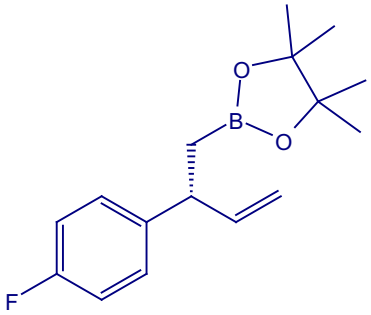
in CDCl3, 101 MHz



12d



in CDCl3, 376 MHz

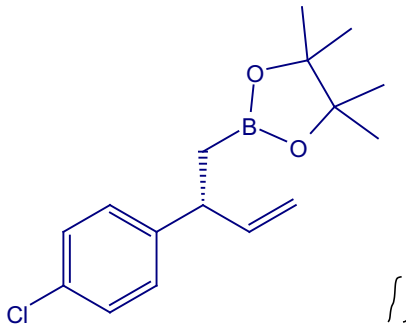


-117.60

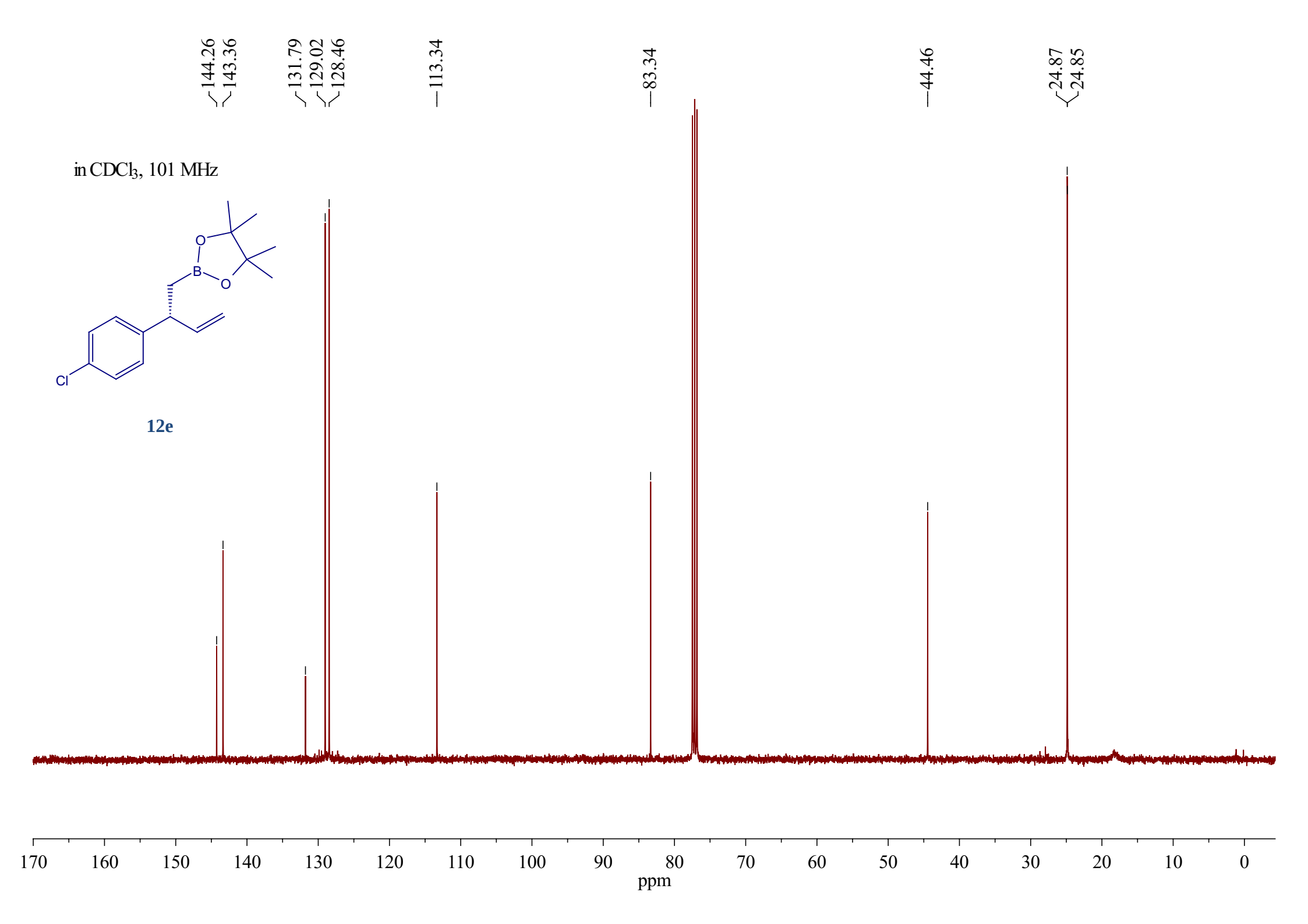
10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -110 -120 -140 -160 -180 -200

ppm

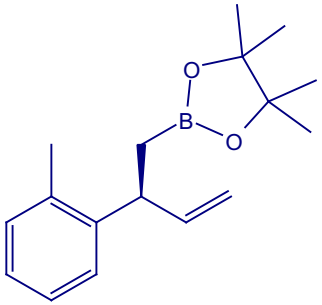
in $CDCl_3$, 400 MHz



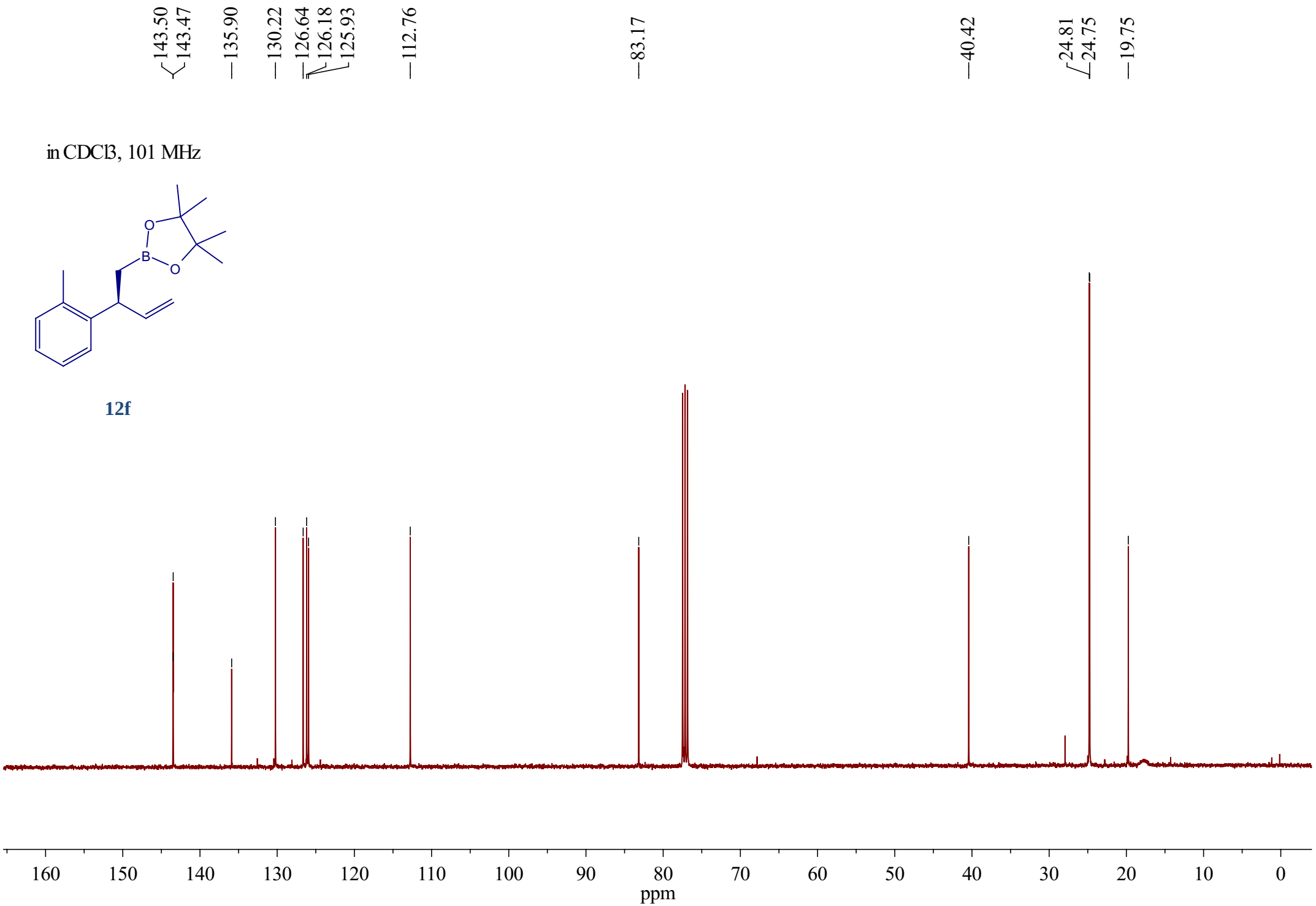
12e


144.26
143.36
131.79
129.02
128.46
113.34
83.34
44.46
24.87
24.85
in CDCl3, 101 MHz
O
B
O
Cl
12e
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
ppm

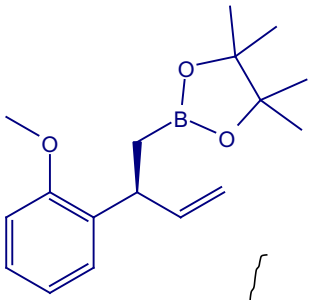
in CDCl3, 400 MHz



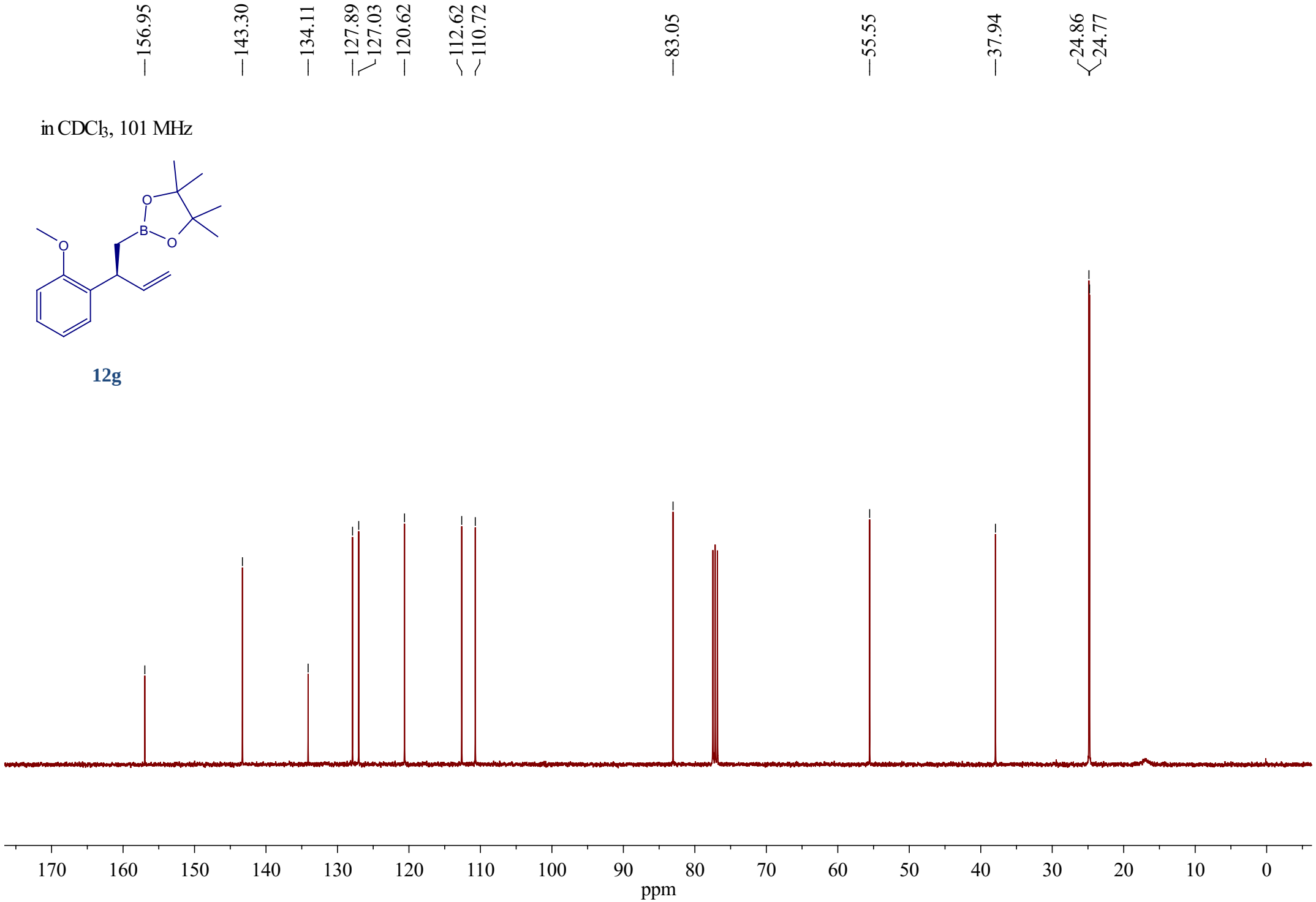
12f


143.50
143.47
135.90
130.22
126.64
126.18
125.93
112.76
83.17
40.42
24.81
24.75
19.75
in CDCl3, 101 MHz
O
B
O
12f
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
ppm

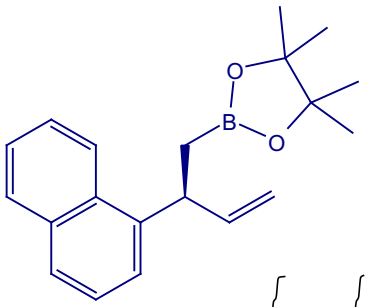
in $CDCl_3$, 400 MHz



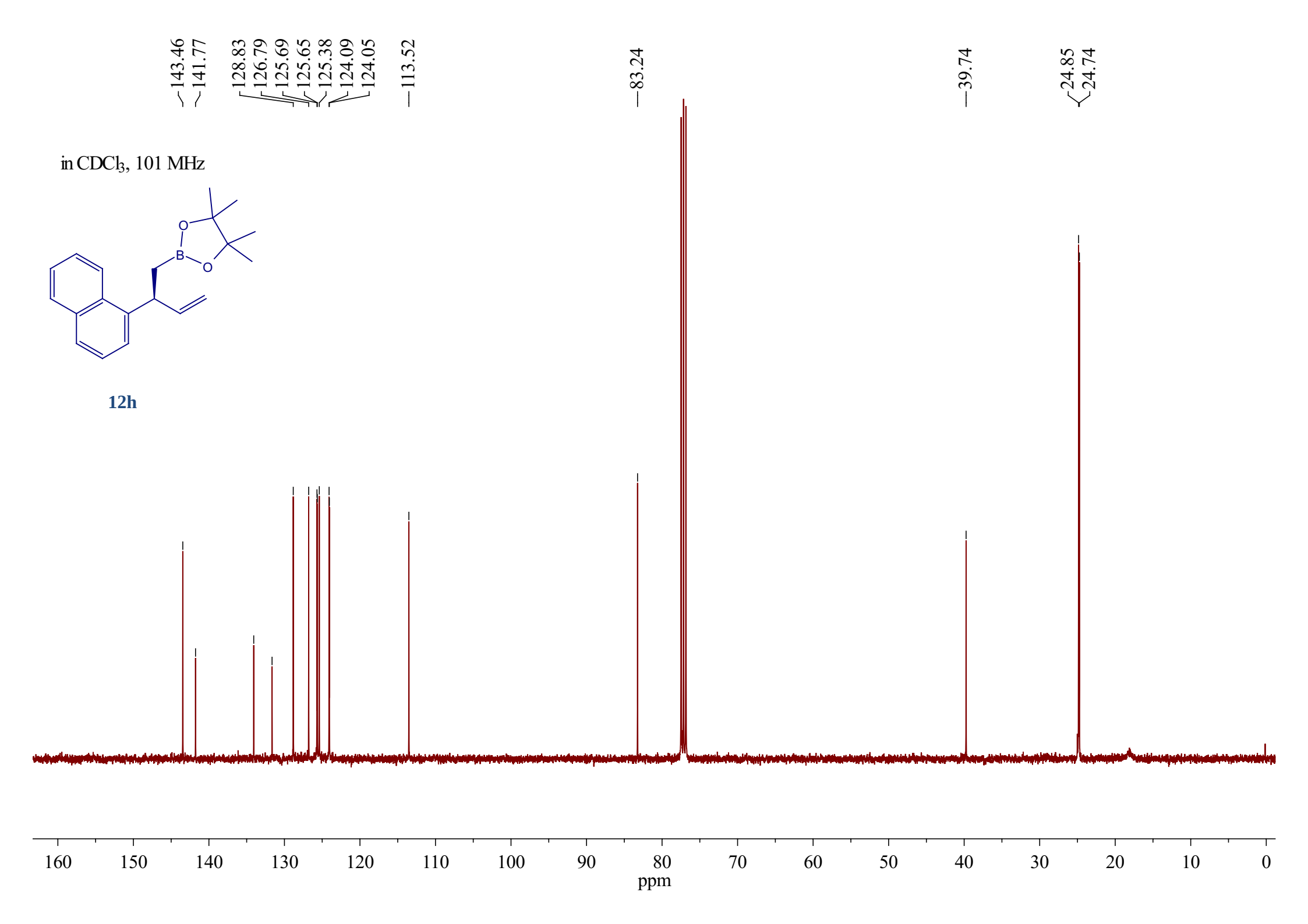
12g


156.95
143.30
134.11
127.89
127.03
120.62
112.62
110.72
83.05
55.55
37.94
24.86
24.77
in CDCl3, 101 MHz
O
B
O
O
12g
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
ppm

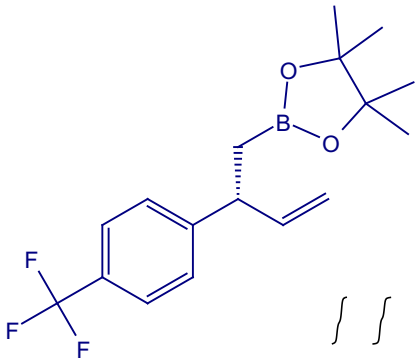
in $CDCl_3$, 400 MHz



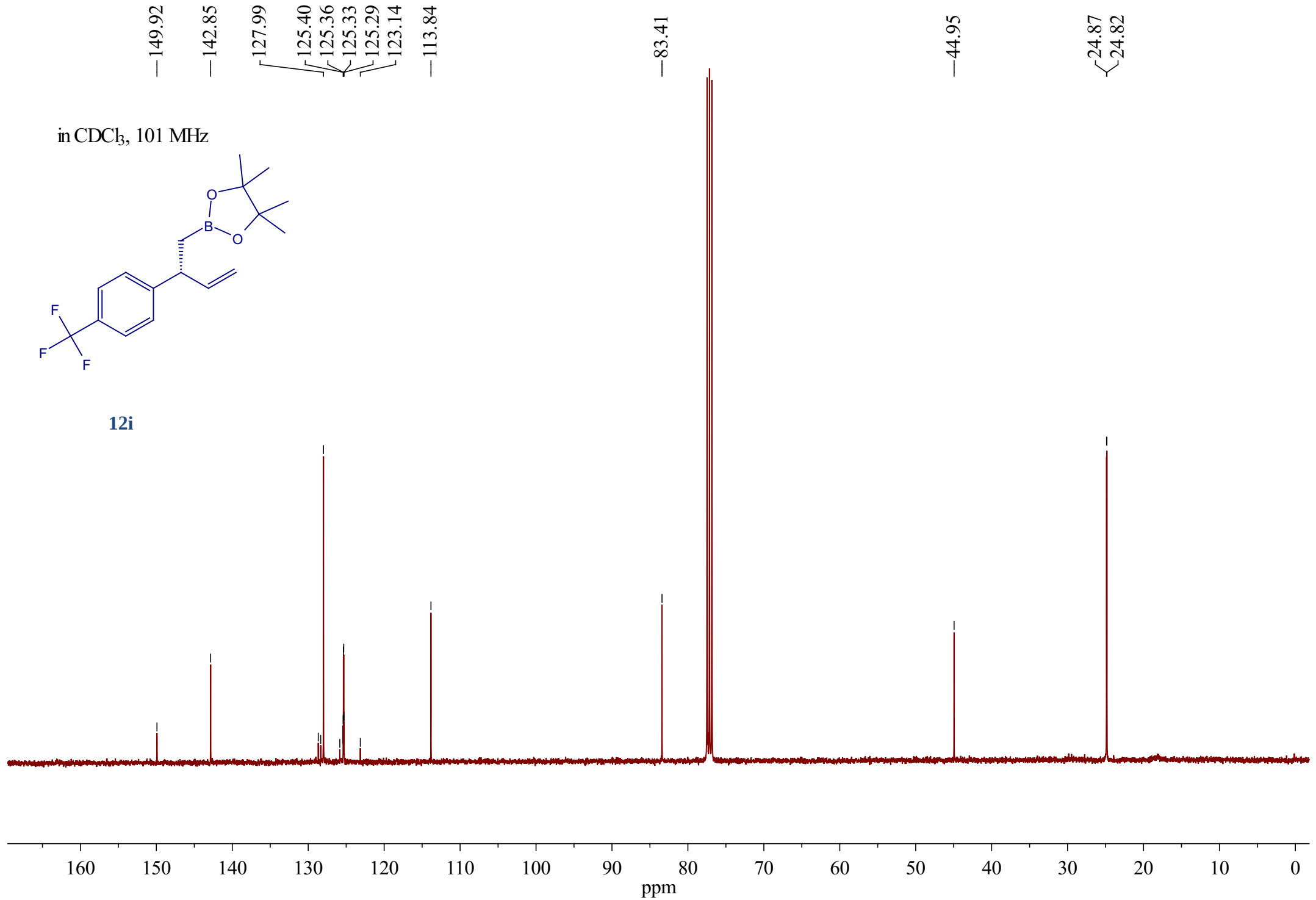
12h


143.46
141.77
128.83
126.79
125.69
125.65
125.38
124.09
124.05
113.52
83.24
39.74
24.85
24.74
in CDCl3, 101 MHz
O
B
O
12h
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
ppm

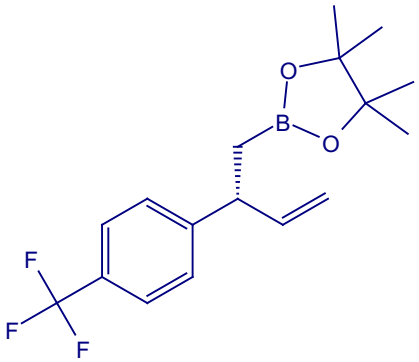
in $CDCl_3$, 400 MHz



12i


149.92
142.85
127.99
125.40
125.36
125.33
125.29
123.14
113.84
83.41
44.95
24.87
24.82
in CDCl3, 101 MHz
O
B
O
F
F
F
12i
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
ppm

in $CDCl_3$, 376 MHz

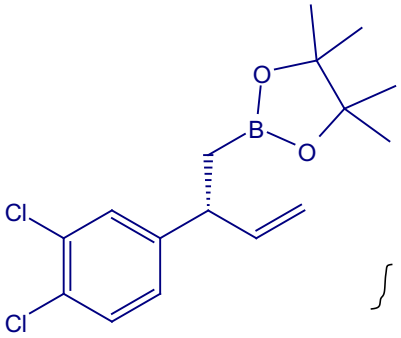


-62.33

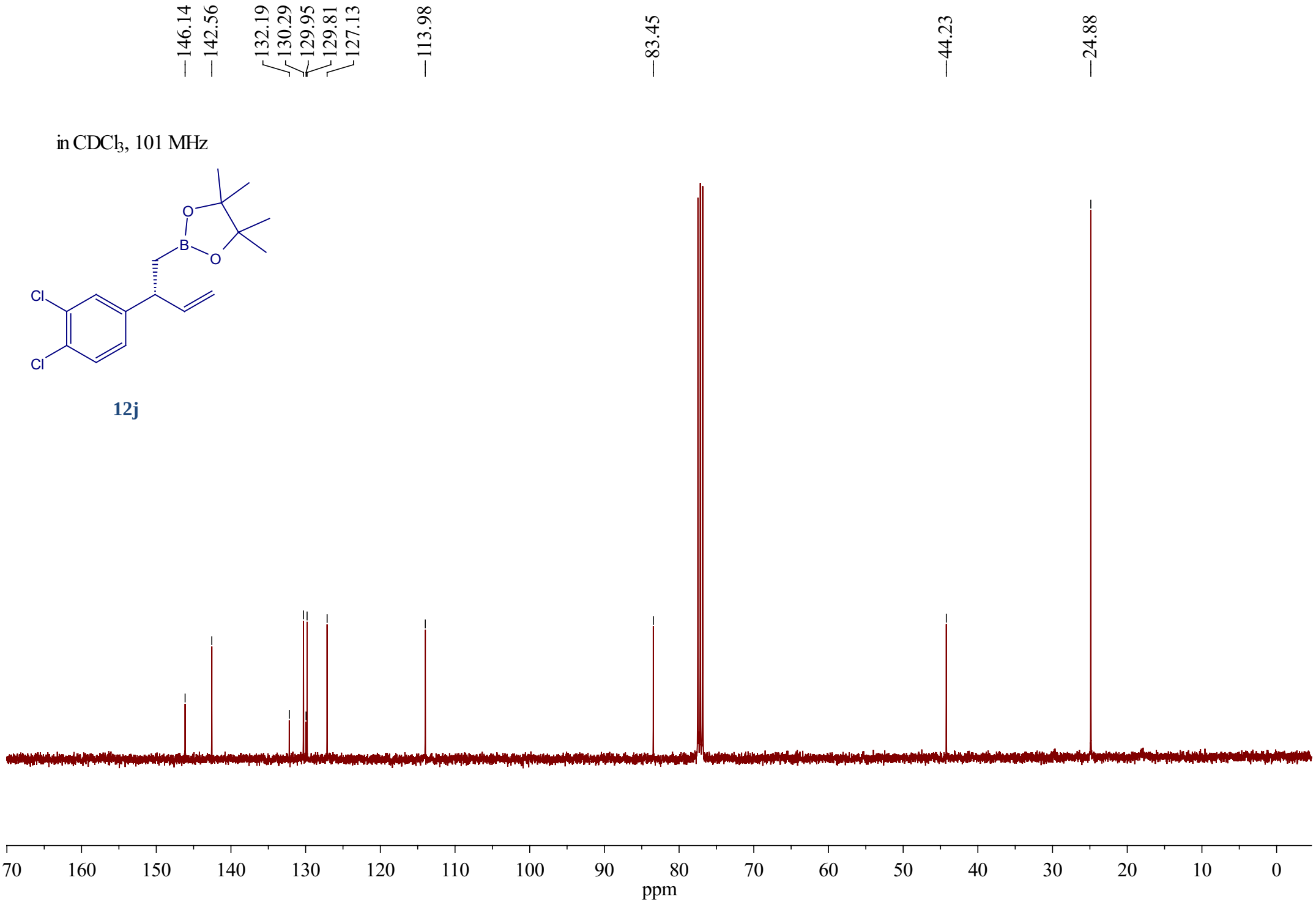
10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -110 -120 -140 -160 -180 -200

ppm

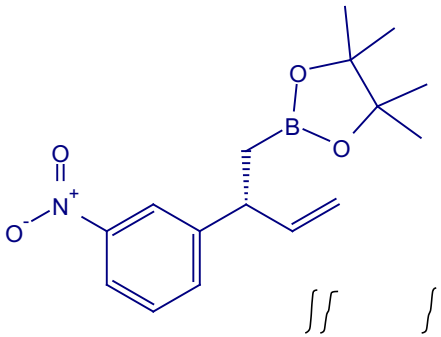
in $CDCl_3$, 400 MHz



12j


146.14
142.56
132.19
130.29
129.95
129.81
127.13
113.98
83.45
44.23
24.88
in CDCl3, 101 MHz
Cl
Cl
O
B
O
12j
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
ppm

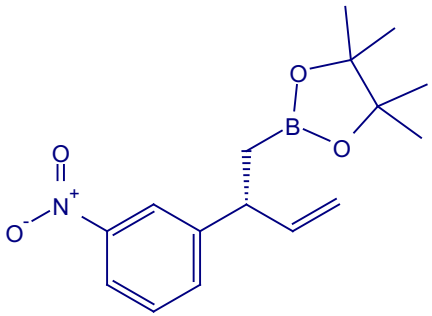
in $CDCl_3$, 400 MHz



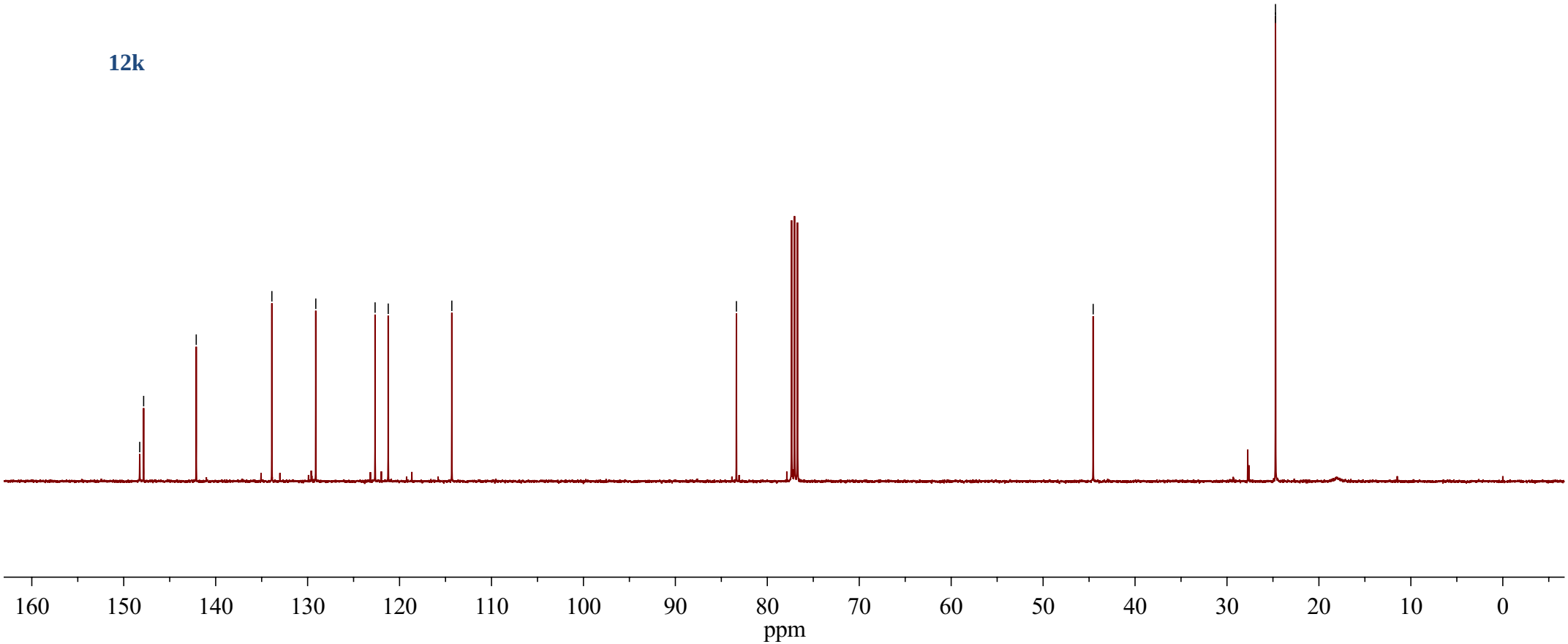
12k

148.262
147.836
142.115
133.888
129.111
122.661
121.232
114.314
83.360
44.555
24.723
24.719

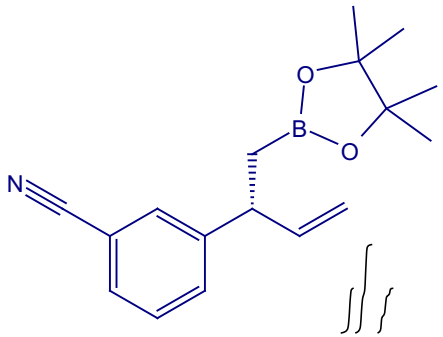
in $CDCl_3$, 101 MHz



12k



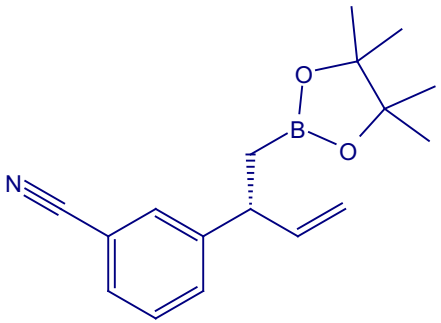
in $CDCl_3$, 400 MHz



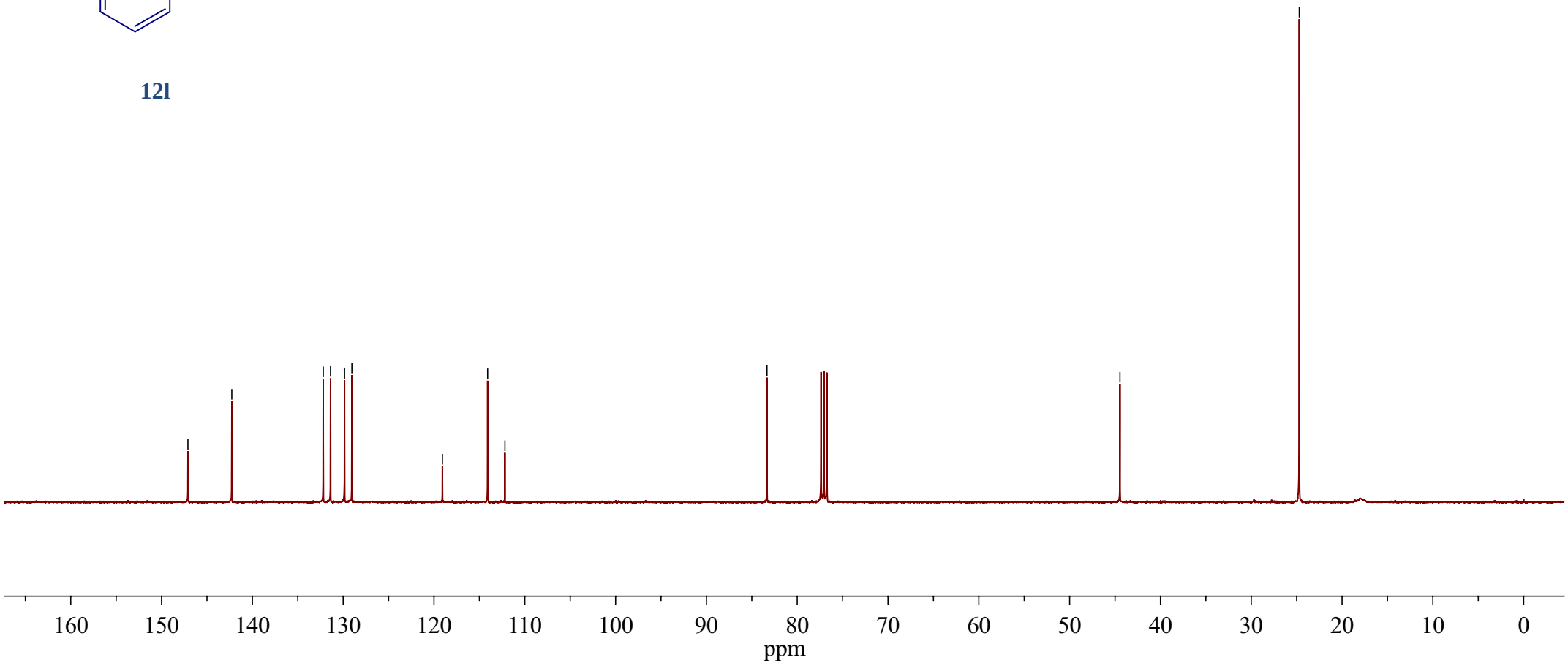
12l

147.10
142.27
132.20
131.39
129.85
129.04
119.07
114.09
112.19
83.33
44.46
24.71

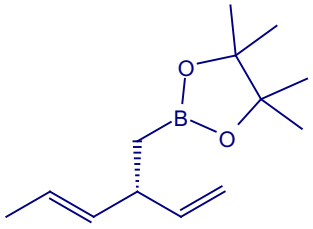
in $CDCl_3$, 101 MHz



12l



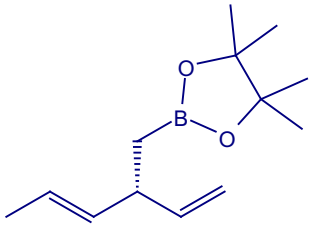
in $CDCl_3$, 400 MHz



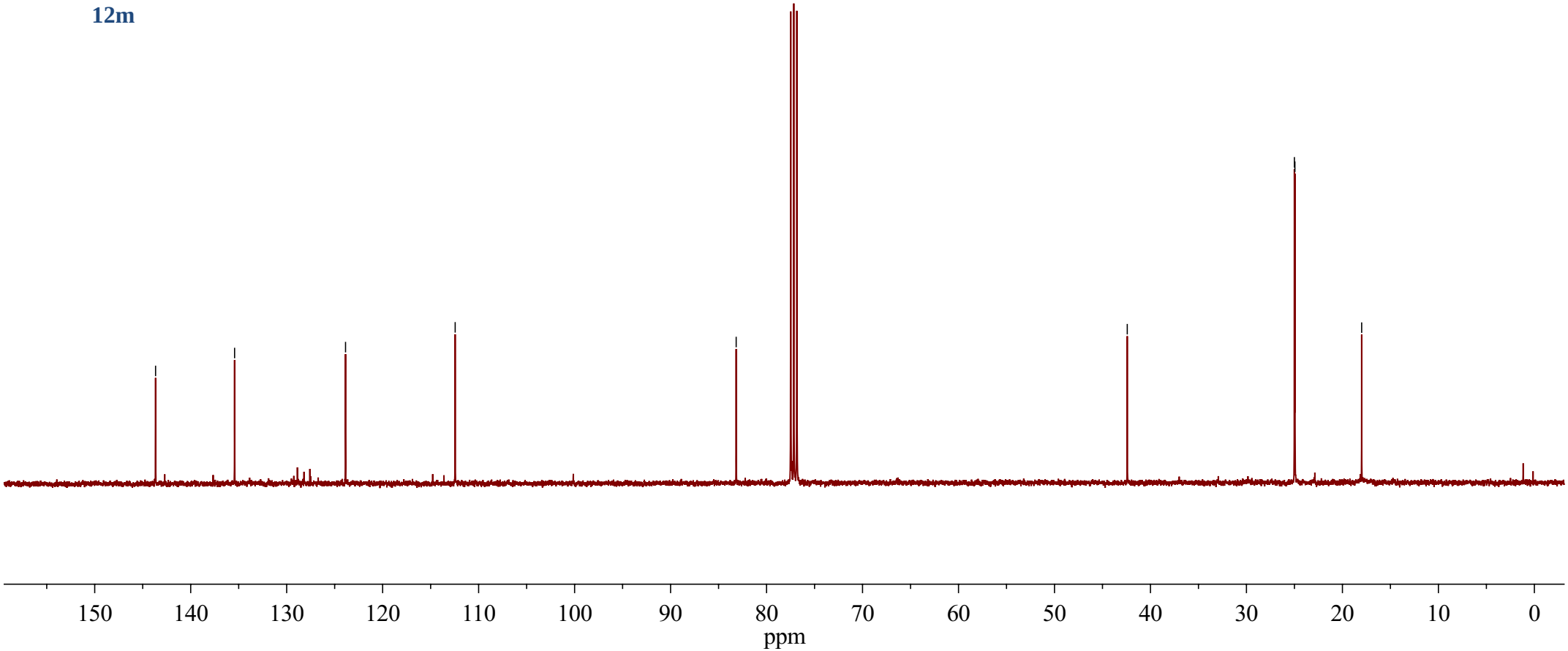
12m

143.66
135.43
123.87
112.44
83.17
42.42
25.00
24.95
17.99

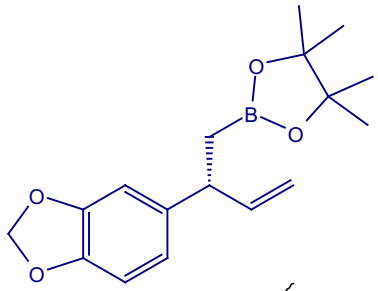
in $CDCl_3$, 101 MHz



12m



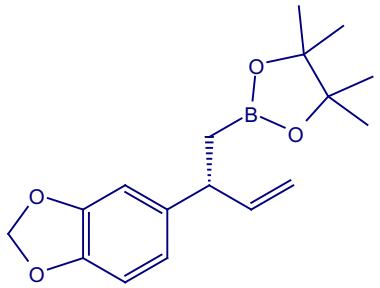
in CDCl3, 400 MHz



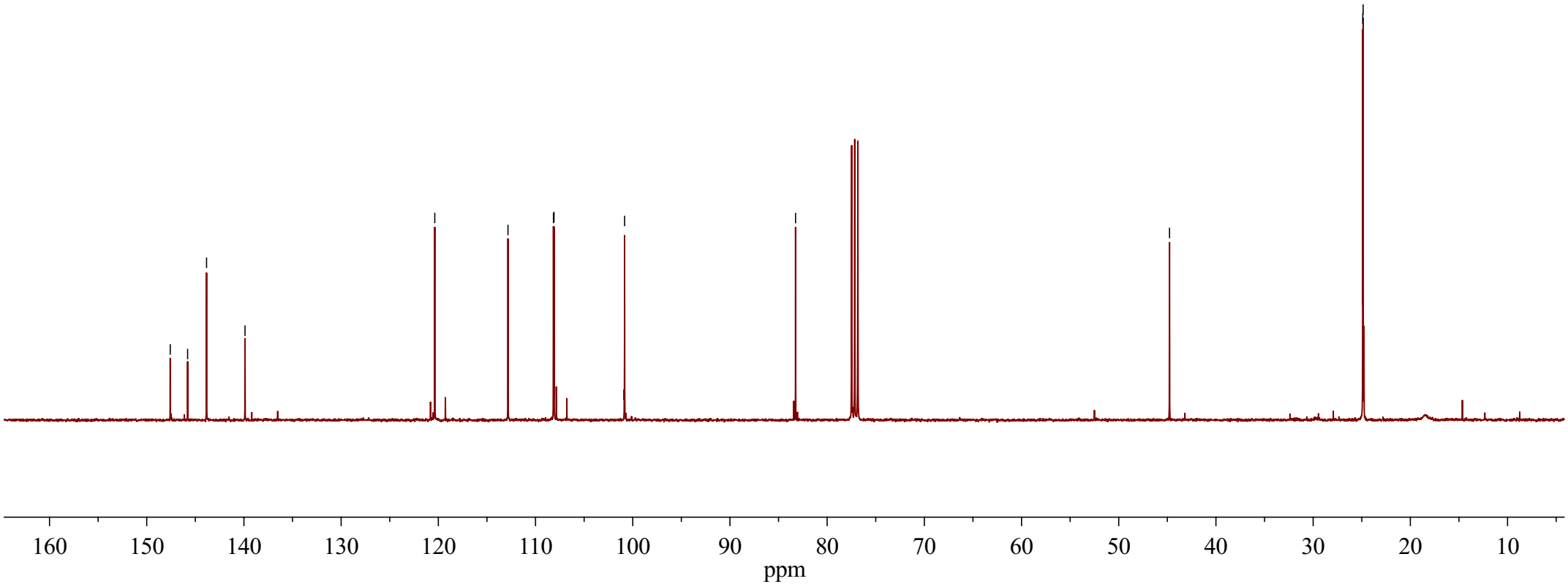
12n

147.58
145.79
143.84
139.89
120.37
112.84
108.16
108.10
100.84
83.25
44.78
24.90
24.86

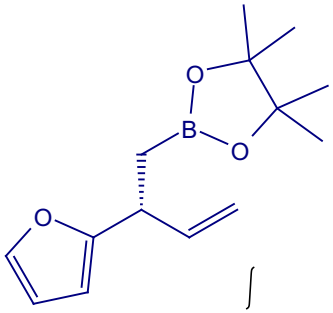
in CDCl3, 101 MHz



12n



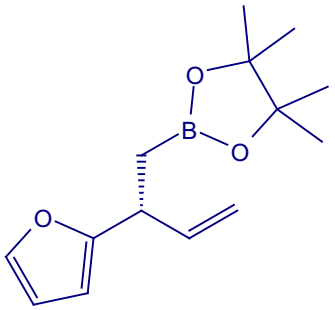
in $CDCl_3$, 400 MHz



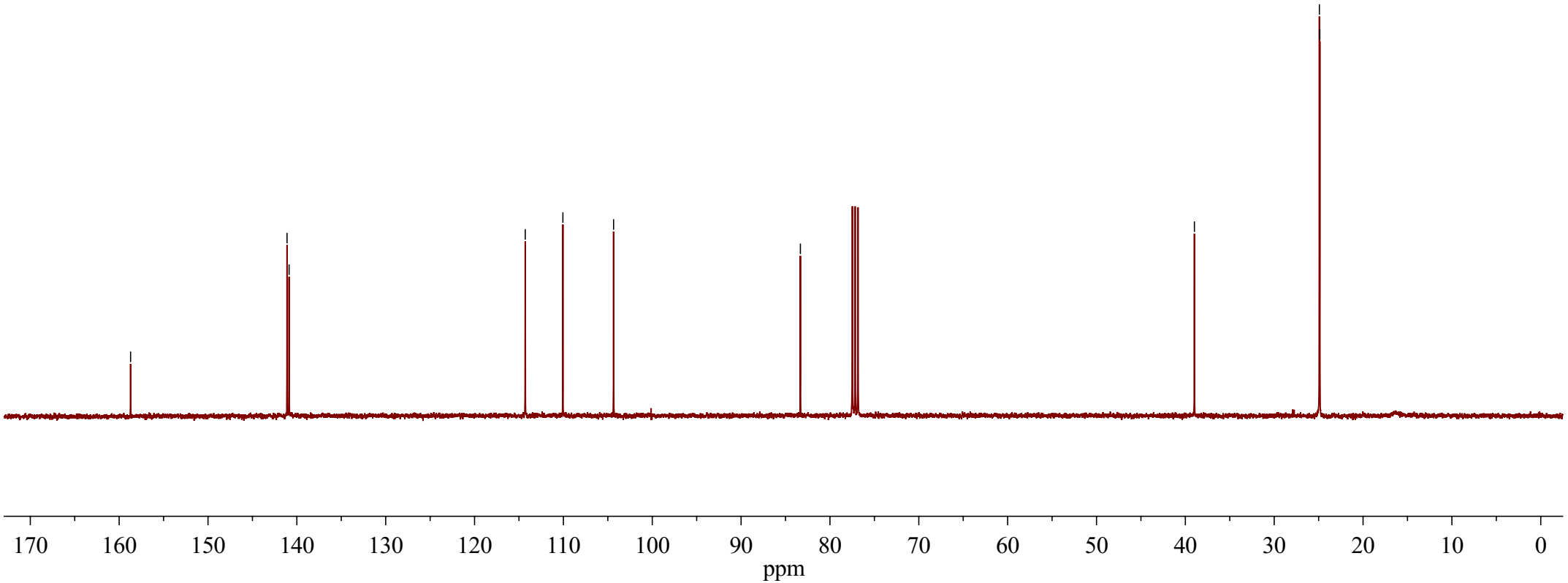
12o

158.71
141.10
140.87
114.29
110.06
104.35
83.33
38.98
24.92
24.87

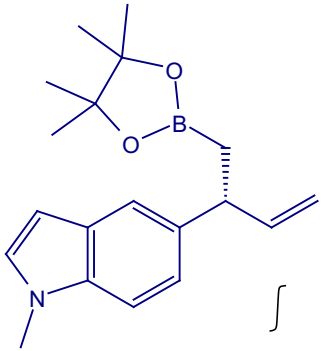
in $CDCl_3$, 101 MHz



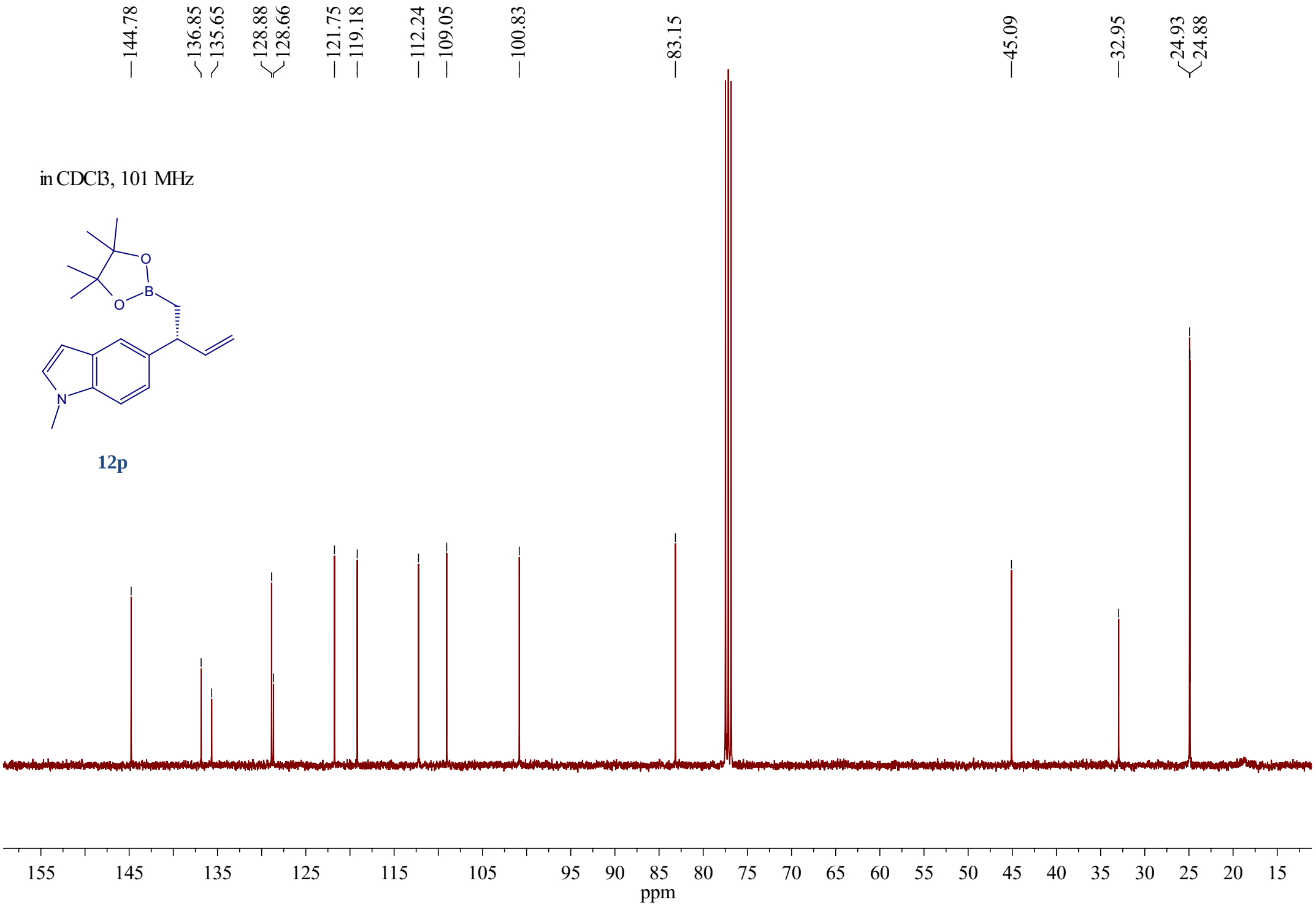
12o



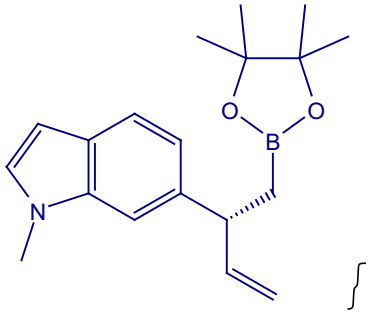
in CDCl3, 400 MHz



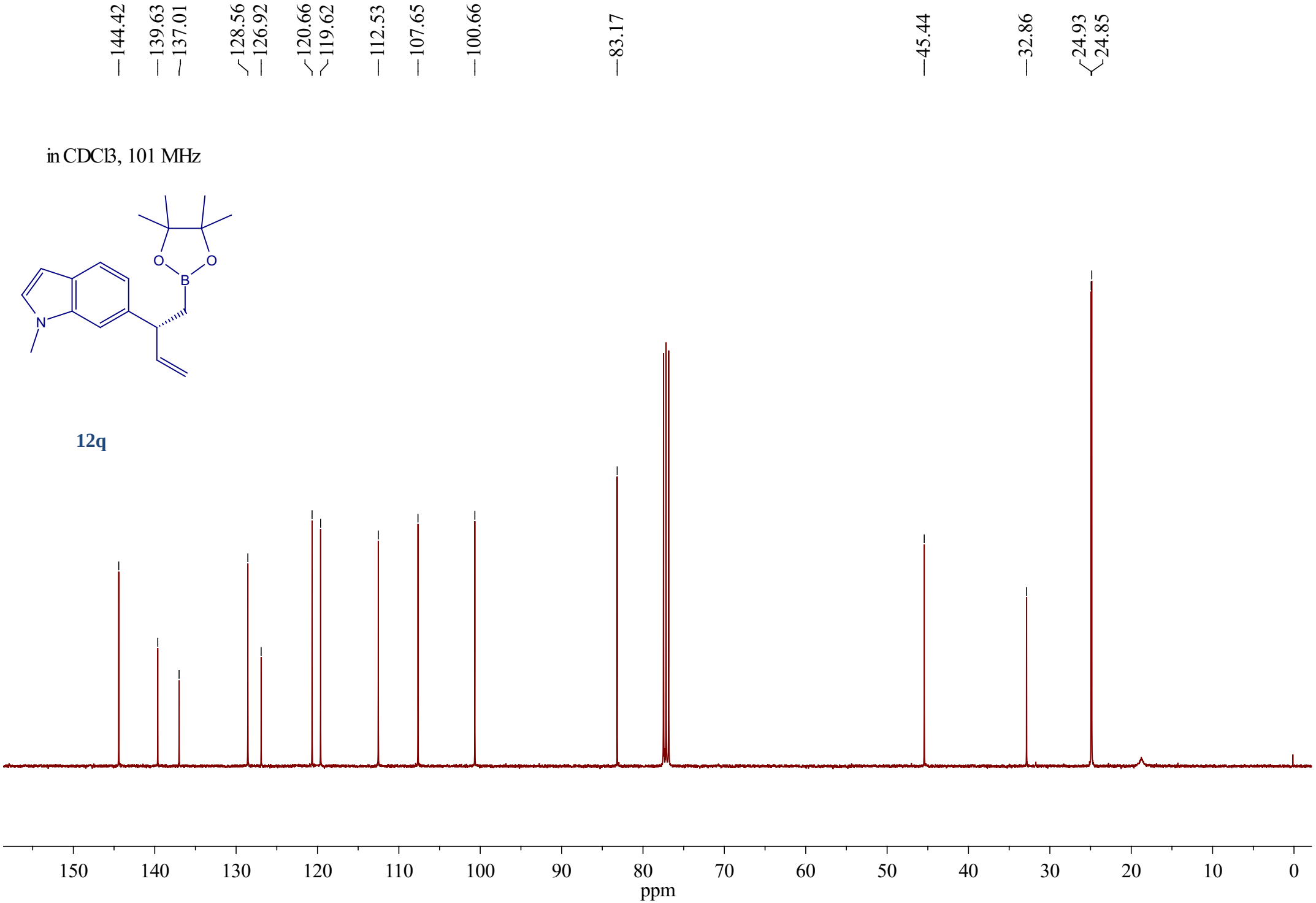
12p


144.78
136.85
135.65
128.88
128.66
121.75
119.18
112.24
109.05
100.83
83.15
45.09
32.95
24.93
24.88
in CDCl3, 101 MHz
O
B
O
N
12p
155
145
135
125
115
105
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
ppm

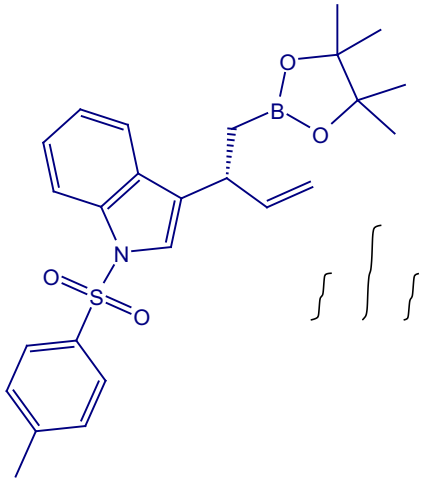
in CDCl3, 400 MHz



12q


144.42
139.63
137.01
128.56
126.92
120.66
119.62
112.53
107.65
100.66
83.17
45.44
32.86
24.93
24.85
in CDCl3, 101 MHz
O
O
B
N
12q
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
ppm

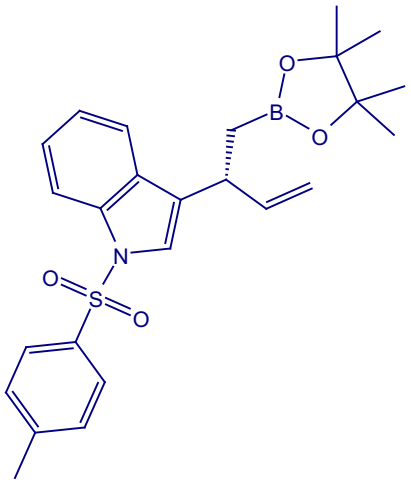
in CDCl3, 400 MHz



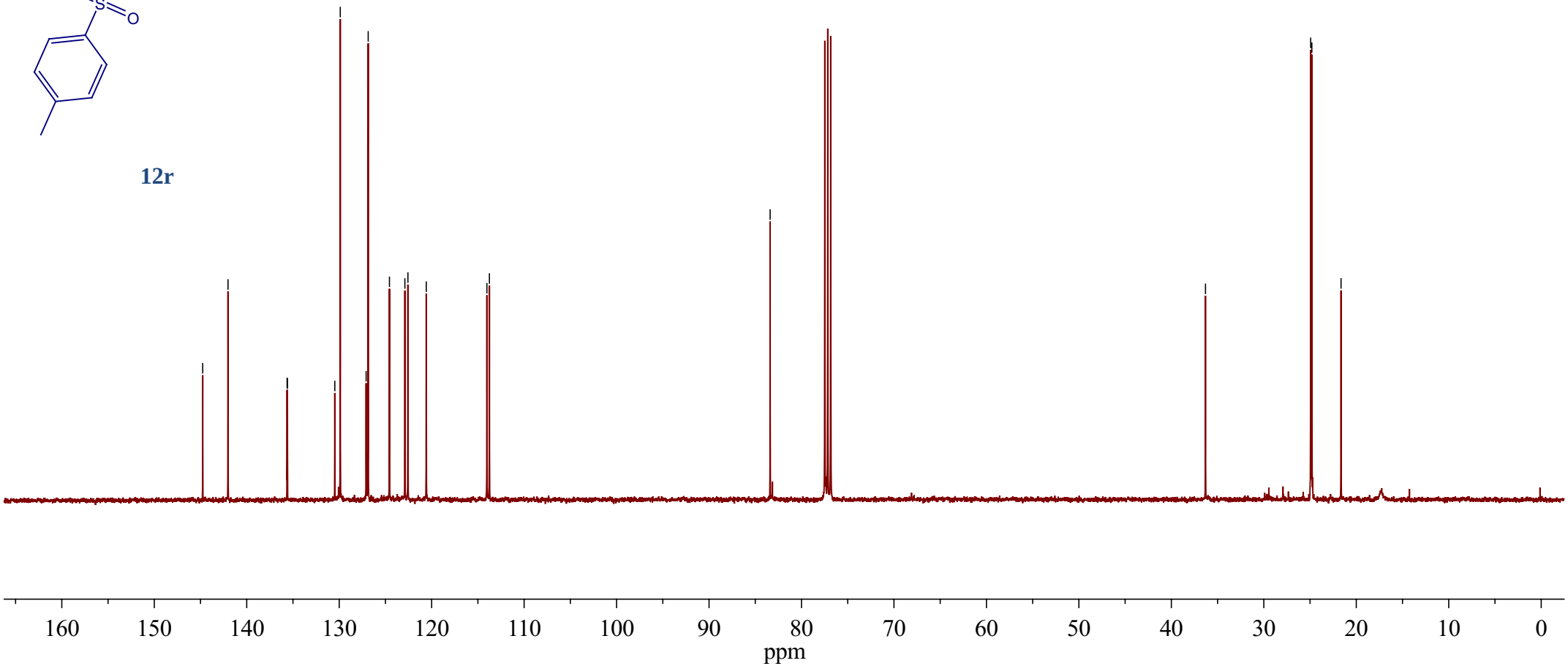
12r

144.76
142.02
135.64
135.60
129.88
126.86
122.90
120.58
114.02
113.76
83.39
36.31
24.93
24.81
21.65

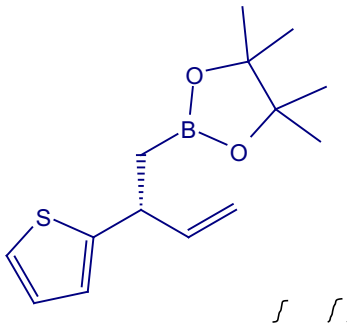
in CDCl3, 101 MHz



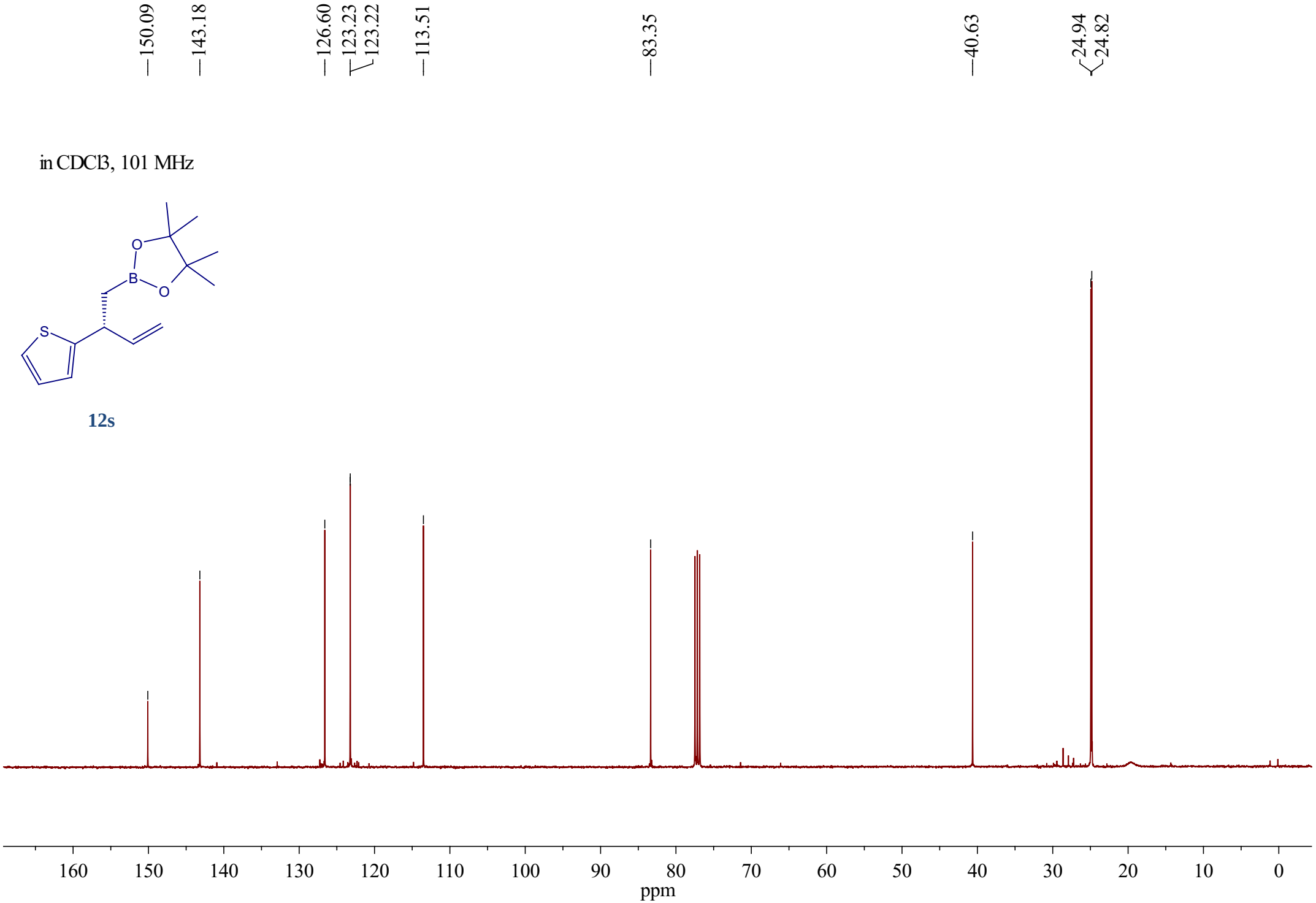
12r



in CDCl3, 400 MHz

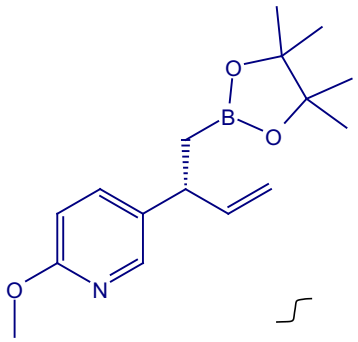


12s

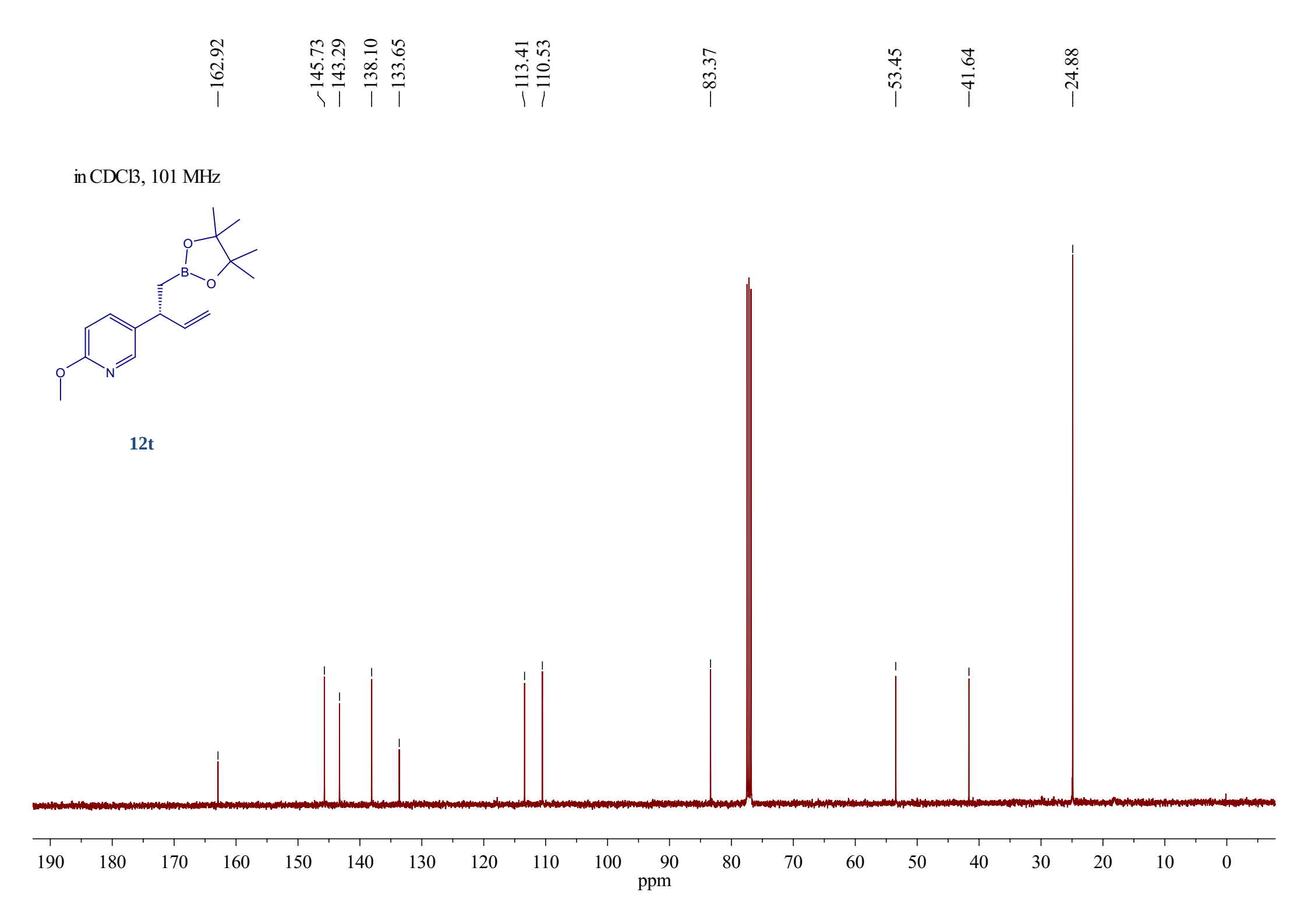

150.09
143.18
126.60
123.23
123.22
113.51
83.35
40.63
24.94
24.82
in CDCl3, 101 MHz
O
B
O
S
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
ppm

12s

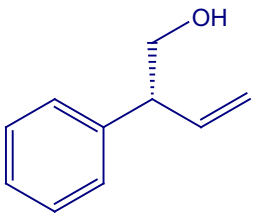
in CDCl3, 400 MHz



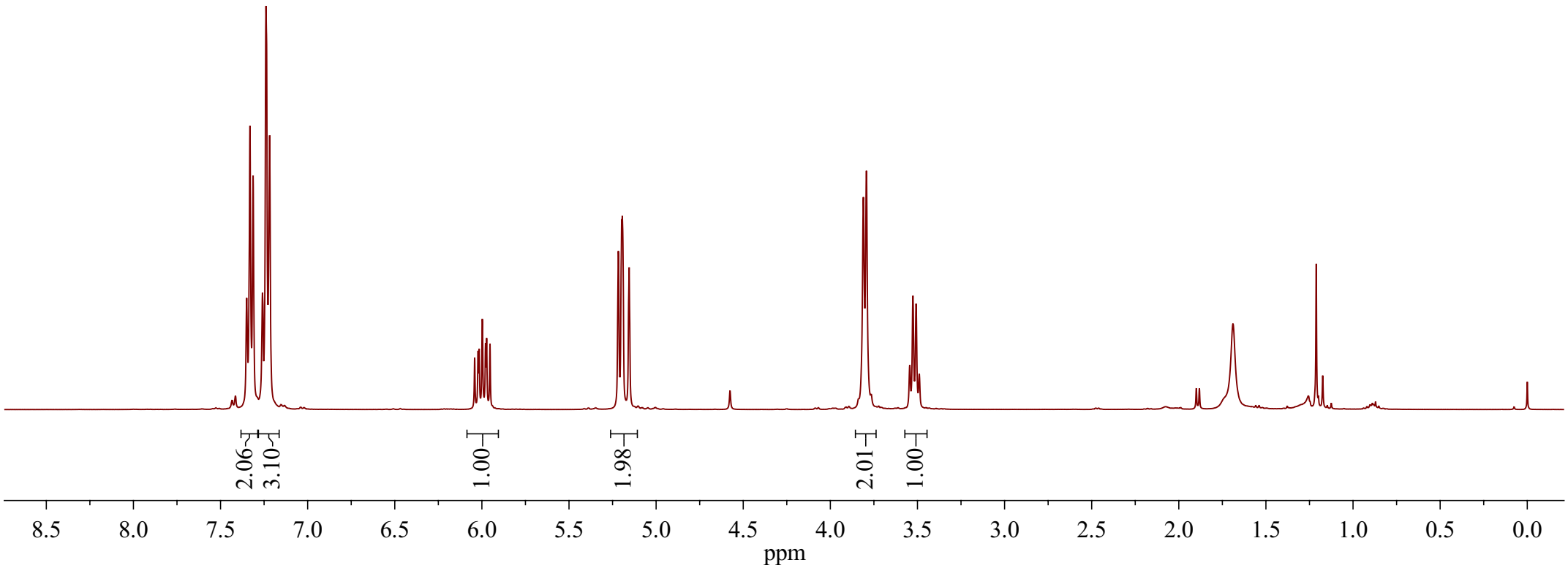
12t

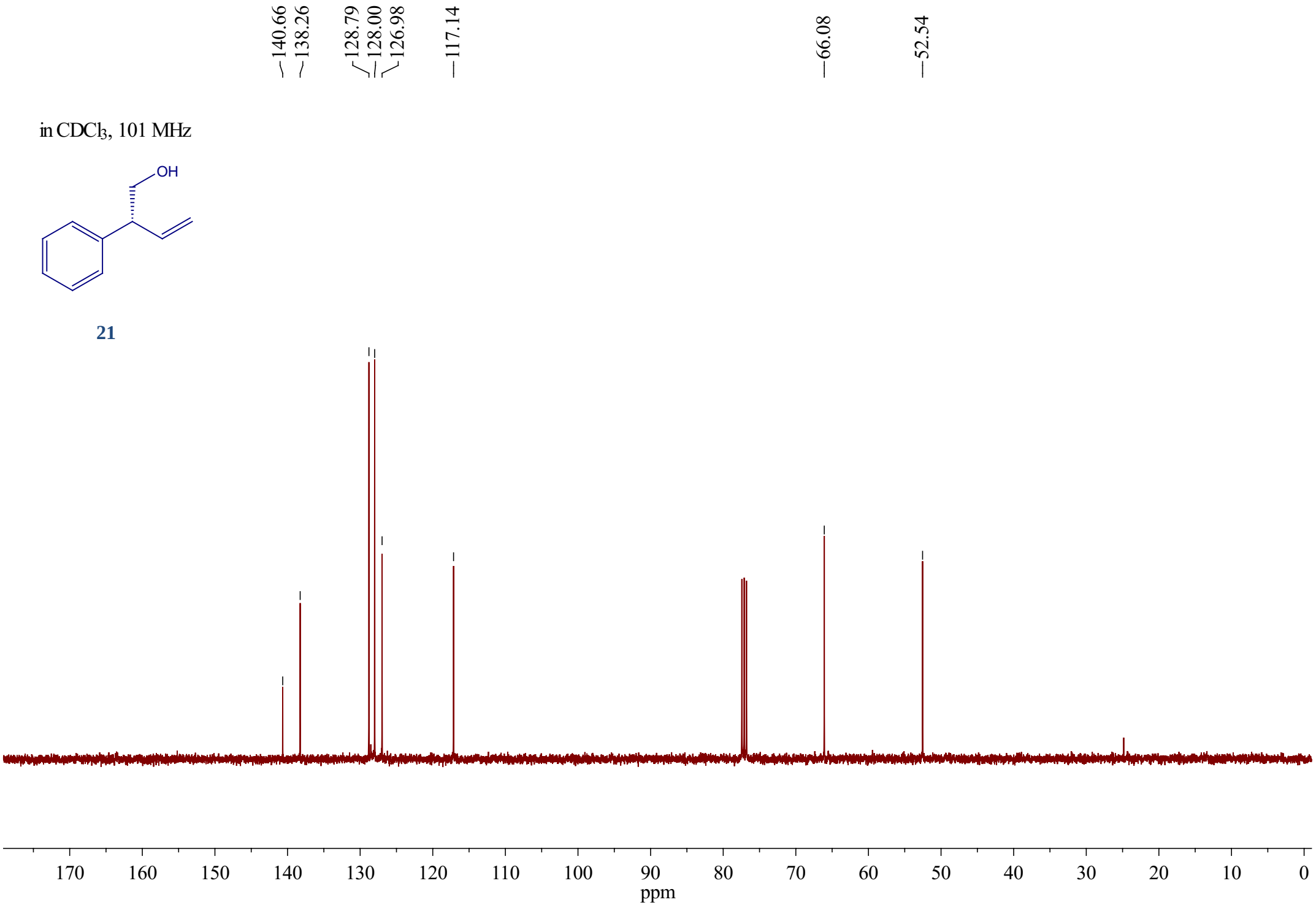

162.92
145.73
143.29
138.10
133.65
113.41
110.53
83.37
53.45
41.64
24.88
in CDCl3, 101 MHz
O
B
O
O
N
12t
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
ppm

in $CDCl_3$, 400 MHz

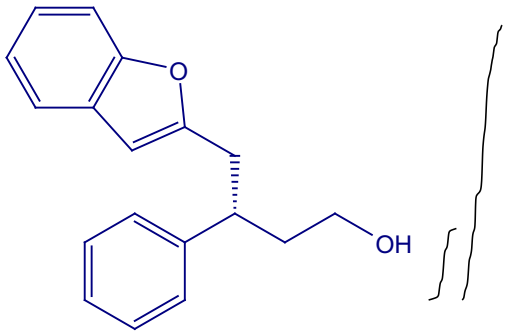


21

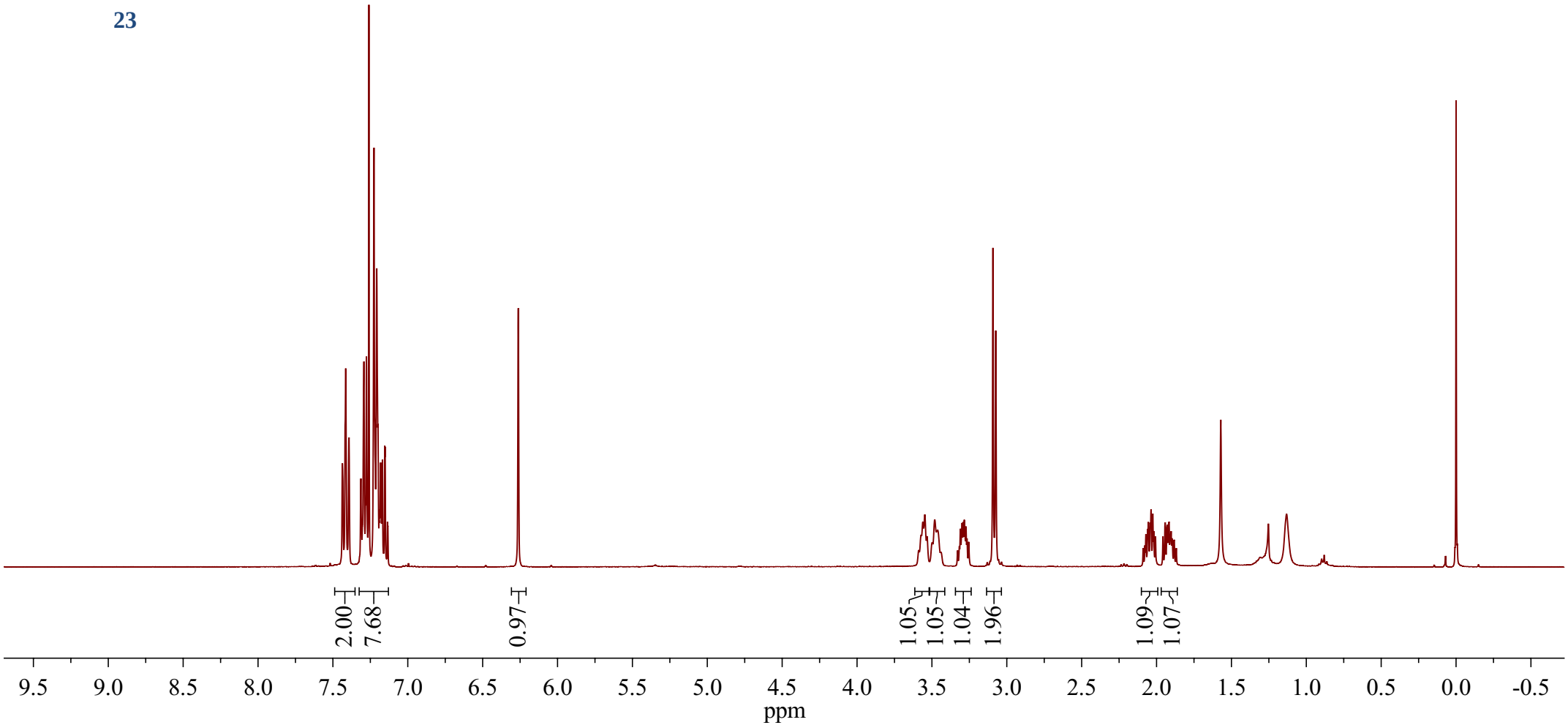


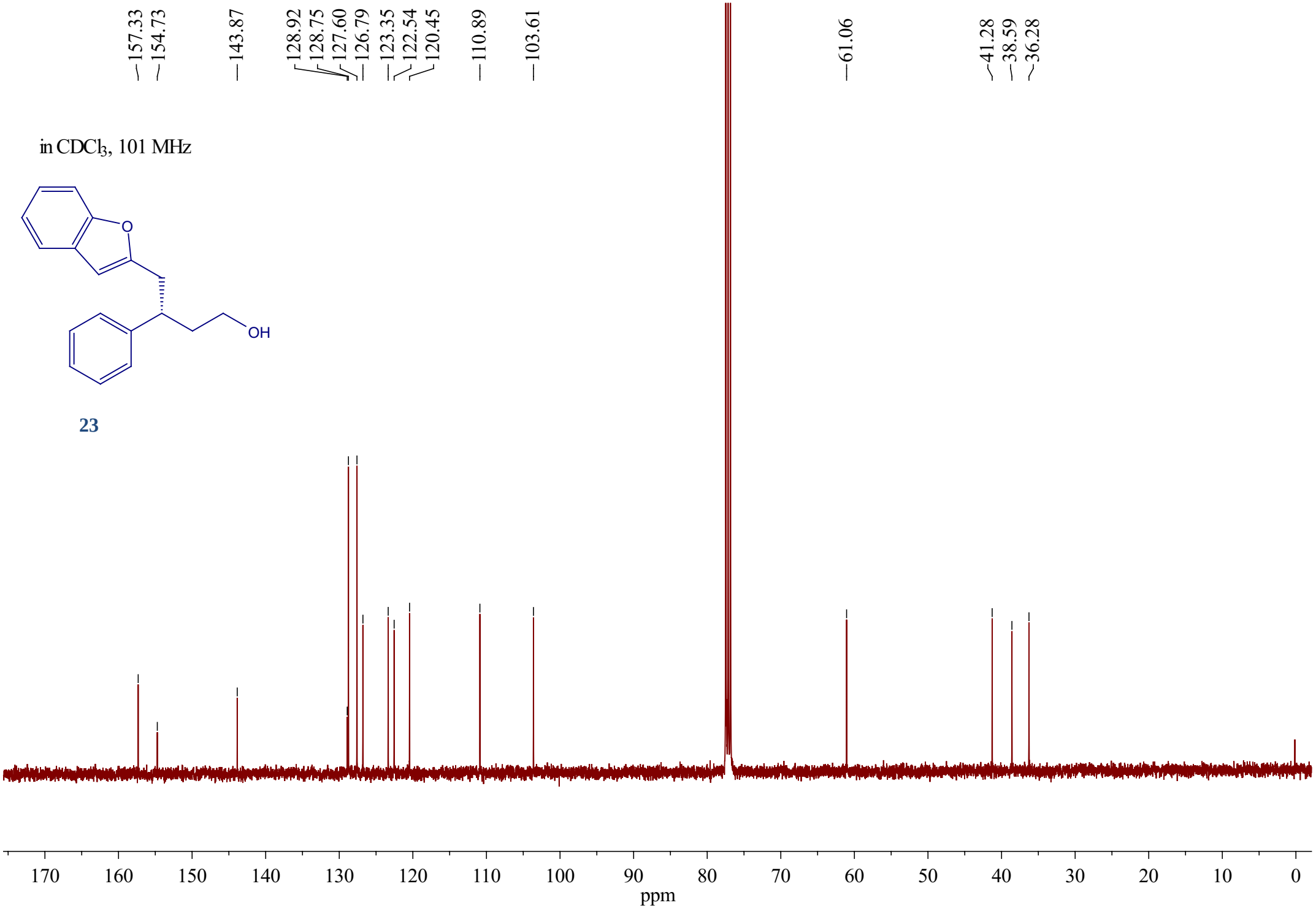

140.66
138.26
128.79
128.00
126.98
117.14
66.08
52.54
in CDCl3, 101 MHz
OH
21
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
ppm

in $CDCl_3$, 400 MHz

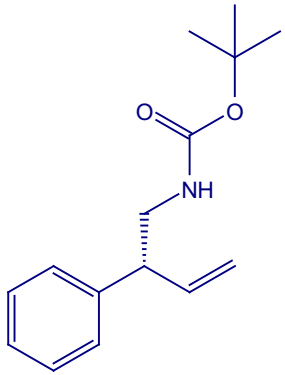


23

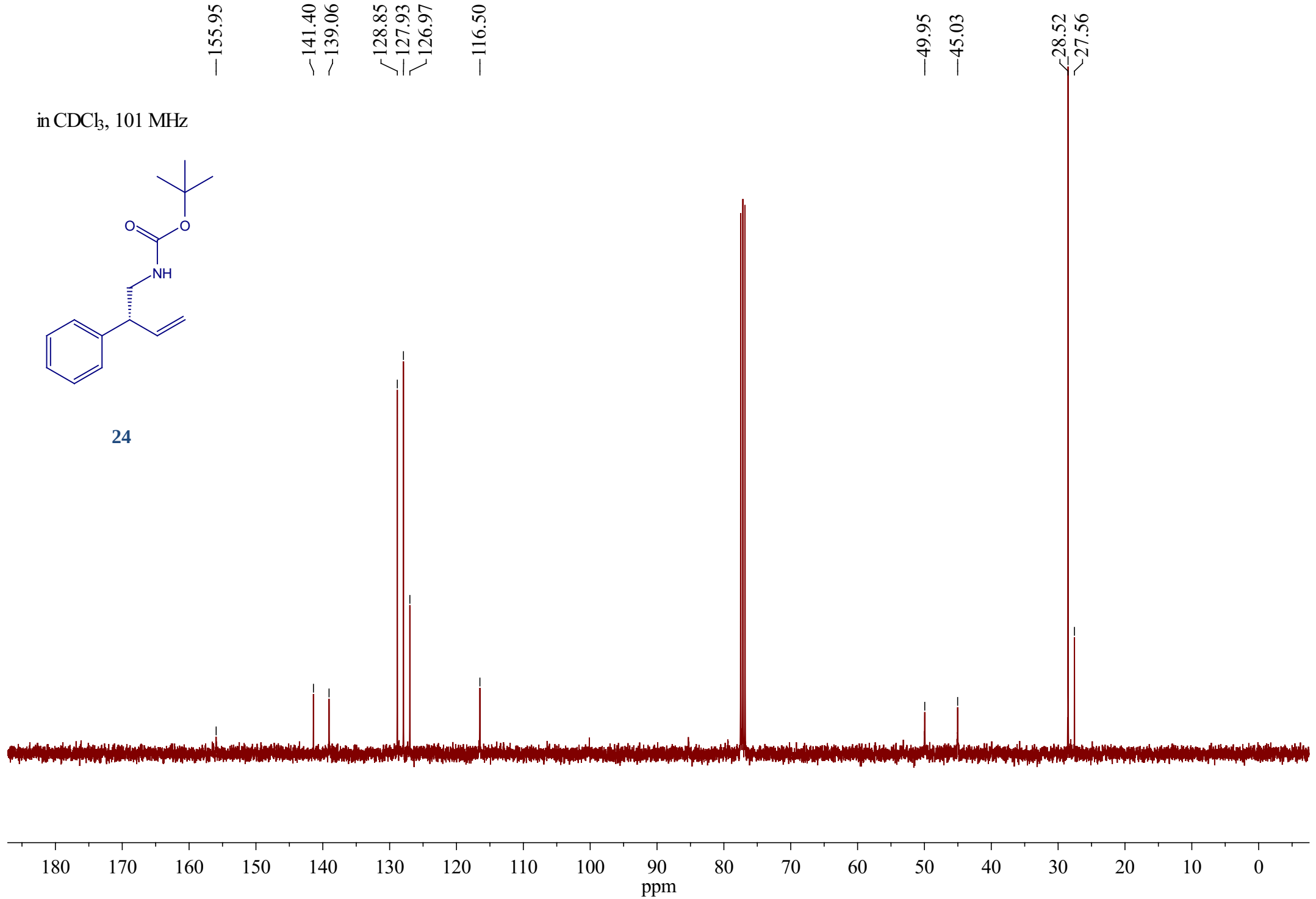



157.33
154.73
143.87
128.92
128.75
127.60
126.79
123.35
122.54
120.45
110.89
103.61
61.06
41.28
38.59
36.28
in CDCl3, 101 MHz
O
OH
23
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
ppm

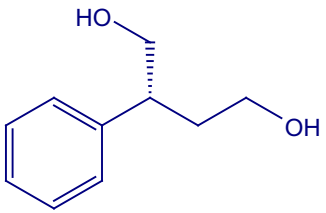
in $CDCl_3$, 400 MHz



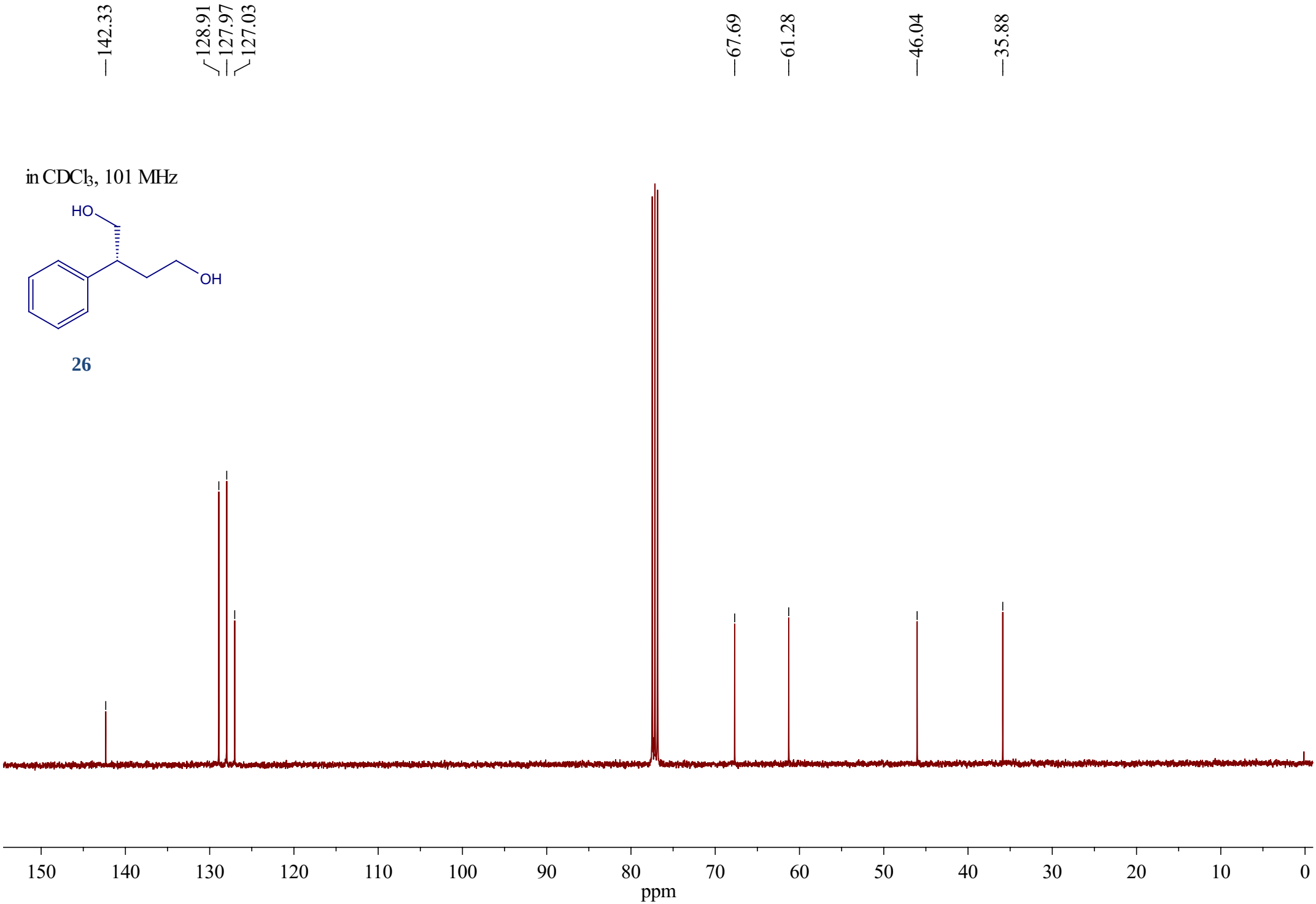
24


155.95
141.40
139.06
128.85
127.93
126.97
116.50
49.95
45.03
28.52
27.56
in CDCl3, 101 MHz
O
O
NH
24
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
ppm

in $CDCl_3$, 400 MHz



26


142.33
128.91
127.97
127.03
67.69
61.28
46.04
35.88
in CDCl3, 101 MHz
HO
OH
26
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
ppm

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