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Supporting Information

Palladium-Catalyzed Asymmetric Hydrogenation of 3-Phthalimido Substituted Quinolines

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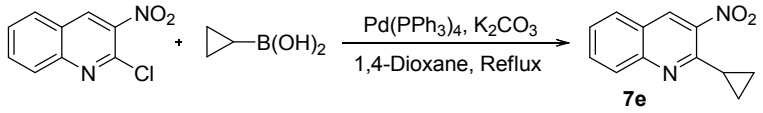
1. General:

Commercially available reagents were used without further purification. Solvents were treated prior to use according to the standard methods. ^{1}H NMR, ^{13}C NMR and ^{19}F NMR spectra were recorded at room temperature in $CDCl_3$ on 400 MHz instrument with tetramethylsilane (TMS) as internal standard. Enantiomeric excess was determined by HPLC analysis, using chiral column described below in detail. Optical rotations were measured by polarimeter. Flash column chromatography was performed on silica gel (200-300 mesh).

2. Synthesis of 3-Nitroquinolines

3-Nitroquinoline derivatives can be conveniently synthesized according to the known literature procedure.[1,2,3] 2-butyl-3-nitroquinoline (**7a**), 2-methyl-3-nitroquinoline (**7b**), 2-ethyl-3-nitroquinoline (**7c**), 2-propyl-3-nitroquinoline (**7d**), 2-isobutyl-3-nitroquinoline (**7f**), 2-isopentyl -3-nitroquinoline (**7g**), 2-hexyl-3-nitroquinoline (**7h**), 2-phenethyl-3-nitroquinoline (**7i**), 2-phenyl -3-nitroquinoline (**7k**), (*E*)-2-styryl-3-nitroquinoline (**7l**), and (*E*)-2-(4-fluorostyryl)-3-nitro-quinoline (**7l**) are known compounds.

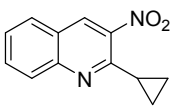
2.1. Synthesis of 3-Nitroquinoline 7e



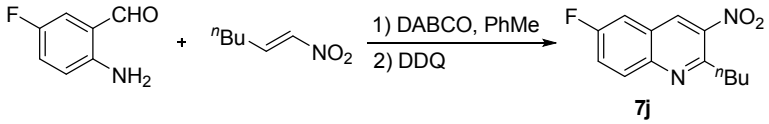
7e

Following a known literature report:[2,3] A mixture of 2-chloro-3-nitroquinoline (150 mg, 0.72 mmol), cyclopropylboronic acid (74 mg, 0.86 mmol), $Pd(PPh_3)_4$ (83 mg, 0.07 mmol) and K_2CO_3 (297 mg, 2.15 mmol) in 1,4-dioxane (6 mL) was stirred at reflux for 18 h, then cooled to rt, diluted with water (15 mL), then extracted with CH_2Cl_2 (15 mL×3). The combined organic layers were dried with Na_2SO_4. After filtration, the solvent was removed under reduced pressure and the residue was purified by flash chromatography on silica gel (hexane/EtOAc 30:1) to yield the product **7e**.

2-Cyclopropyl-3-nitroquinoline (7e): 83% yield, white solid, mp 104-106 ^{o}C, R_f = 0.90 (hexane/EtOAc 10:1). ^{1}H NMR (400 MHz, $CDCl_3$) δ = 8.61 (1 H, s), 7.97 (d, *J* = 8.5, 1 H), 7.85 (d, *J* = 8.2, 1 H), 7.82-7.76 (1 H, m), 7.55 (t, *J* = 7.5, 1 H), 2.81-2.70 (1 H, m), 1.43-1.35 (2 H, m), 1.20-1.11 (2 H, m); ^{13}C NMR (100 MHz, $CDCl_3$) δ = 155.6, 148.7, 144.5, 132.5, 132.3, 128.9, 128.6, 127.2, 124.7, 14.0, 11.4; HRMS Calculated for $C_{12}H_{11}N_2O_2$ $[M+H]^+$ 215.0821, found 215.0822.



2.2. Synthesis of 3-Nitroquinoline 7j



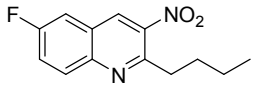
7j

Following a known literature report:[4] To a solution of 2-amino-5-fluorobenzaldehyde (790

1 G. A. Molander and C.-S. Yun, *Tetrahedron* **2002**, *58*, 1465.
2 X.-F. Cai, M.-W. Chen, Z.-S. Ye, R.-N. Guo, L. Shi, Y. Li and Y.-G. Zhou, *Chem. Asian J.* **2013**, *8*, 1381.
3 X.-F. Cai, R.-N. Guo, M.-W. Chen, L. Shi and Y.-G. Zhou, *Chem. Eur. J.* **2014**, DOI:10.1002/chem.201402592.
4 M.-C. Yan, Z. Tu, C. Lin, S. Ko, J. Hsu and C.-F. Yao, *J. Org. Chem.* **2004**, *69*, 1565.

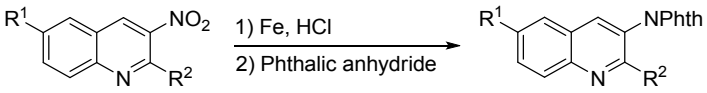
mg, 5.68 mmol) in toluene (25 mL) was added (*E*)-1-nitrohex-1-ene (880 mg, 6.81 mmol). The resulting mixture was placed in an oil bath and heated at 45 °C for 13.5 h, then 1,4-diaza-bicycle [2.2.2]octane (DABCO, 319 mg, 2.84 mmol) was added, the mixture was stirred for another 12 h. After cooled to room temperature, 2,3-dichloro-5,6-dicyano-1,4-benzoquinone (DDQ, 1.934 g, 8.52 mmol) was added and the solution was vigorously stirred for 0.5 h. After evaporation of the solvent, the residue was purified by flash chromatography on silica gel (hexane/EtOAc 20:1) to yield the product **7j**.

2-Butyl-6-fluoro-3-nitroquinoline (7j): 22% yield, light brown oil, R_f = 0.70 (hexane/EtOAc 10:1). ^{1}H NMR (400 MHz, $CDCl_3$) δ = 8.63 (s, 1H), 8.11 (dd, *J* = 9.3, 5.2, 1H), 7.66-7.58 (m, 1H), 7.52 (dd, *J* = 8.2, 2.8, 1H), 3.27-3.19 (m, 2H), 1.88-1.76 (m, 2H), 1.54-1.42 (m, 2H), 0.98 (t, *J* = 7.4, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ = 161.0 (d, $^1J_{FC}$ = 251.2), 154.8 (d, $^4J_{FC}$ = 2.9), 145.8, 144.5, 132.1 (d, $^4J_{FC}$ = 5.7), 131.7 (d, $^3J_{FC}$ = 9.2), 126.1 (d, $^3J_{FC}$ = 10.5), 122.9 (d, $^2J_{FC}$ = 25.9), 111.5 (d, $^2J_{FC}$ = 22.4), 35.8, 30.9, 22.7, 13.8; ^{19}F NMR (376 MHz, $CDCl_3$) δ = -111.0; HRMS Calculated for $C_{13}H_{14}N_2O_2$ $[M+H]^+$ 249.1039, found 249.1036.



3. Synthesis of 3-Phthalimido Substituted Quinolines

Quinolin-3-amines **2** can be conveniently synthesized according to the known literature procedure.[3] 2-(2-Butylquinolin-3-yl)isoindoline-1,3-dione (**2a**), 2-(2-methylquinolin-3-yl)isoindoline-1,3-dione (**2b**), 2-(2-ethylquinolin-3-yl)isoindoline-1,3-di-one (**2c**), 2-(2-propylquinolin-3-yl)isoindoline-1,3-dione (**2d**), 2-(2-isobutylquinolin-3-yl) isoindoline-1,3-dione (**2f**), 2-(2-isopentyl-quinolin-3-yl)isoindoline-1,3-dione (**2g**), 2-(2-hexyl-quinolin-3-yl)isoindoline-1,3-dione (**2h**), 2-(2-phenethylquinolin-3-yl)isoindoline-1,3-dione (**2i**), 2-(2-phenylquinolin-3-yl)isoindoline-1,3-dione (**2k**), and (*E*)-2-(2-styrylquinolin-3-yl)isoindoline-1,3-dione (**2l**) are known compounds.



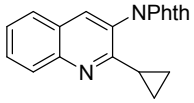
7 **2**

Following a known literature report:[3] To a solution of **7** (0.60 mmol) in a mixed solvent of ethanol and H_2O with a ratio of 4/1 (5.0 mL) was added iron powder (134 mg, 2.40 mmol) followed by HCl (0.1 M, 0.30 mL, 0.03 mmol), and the resulting mixture was vigorously stirred at 85 °C for 0.5-1.5 h. When the reduction reaction was complete (determined by TLC), saturated $NaHCO_3$ (5.0 mL) was added and the mixture was filtered through celite. The filtrate was extracted with CH_2Cl_2 (15 mL×3) and the combined organic layers were dried over Na_2SO_4. After filtration, the solvent was removed under reduced pressure and the crude product was pure enough for further reaction.

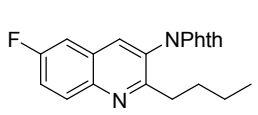
In a 25 mL round-bottom flask, the crude product and phthalic anhydride (89 mg, 0.60 mmol) were combined in acetic acid (5.0 mL). The resulting mixture was vigorously stirred at 120 °C for 18 h. The solvent was removed under reduced pressure, the residue was resolved in CH_2Cl_2 (10 mL) and washed with saturated $NaHCO_3$ (15 mL). The organic layer was dried (Na_2SO_4). After filtration, the solvent was removed under reduced pressure and the crude product was purified by flash chromatography on silica gel (hexane/EtOAc 5:1) to yield the product.

2-(2-Cyclopropylquinolin-3-yl)isoindoline-1,3-dione (2e): 73% yield, white solid, mp 199-201 °C, R_f = 0.35 (hexane/EtOAc 5:1). ^{1}H NMR (400 MHz, $CDCl_3$) δ = 8.05-7.96 (m, 4H), 7.82

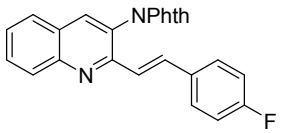
(dd, J = 5.3, 3.1, 2H), 7.77 (d, J = 8.0, 1H), 7.74-7.67 (m, 1H), 7.48 (t, J = 7.4, 1H), 2.06-1.97 (m, 1H), 1.36-1.28 (m, 2H), 1.02-0.93 (m, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ = 167.6, 160.4, 148.2, 136.0, 134.8, 132.1, 130.5, 129.0, 127.8, 126.6, 126.2, 125.2, 124.2, 13.9, 10.2; HRMS Calculated for $C_{20}H_{15}N_2O_2$ $[M+H]^+$ 315.1134, found 315.1141.



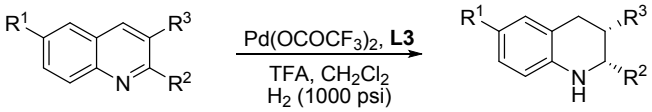
2-(2-Butyl-6-fluoroquinolin-3-yl)isoindoline-1,3-dione (2j): 70% yield, white solid, mp 204-206 °C, R_f = 0.55 (hexane/EtOAc 5:1). ^{1}H NMR (400 MHz, $CDCl_3$) δ = 8.11 (dd, J = 9.2, 5.2, 1H), 8.00 (dt, J = 6.9, 3.5, 2H), 7.96 (s, 1H), 7.84 (dd, J = 5.2, 3.1, 2H), 7.52 (td, J = 8.9, 2.8, 1H), 7.41 (dd, J = 8.6, 2.6, 1H), 2.89-2.78 (m, 2H), 1.76 (dt, J = 15.4, 7.6, 2H), 1.40-1.26 (m, 2H), 0.84 (t, J = 7.4, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ = 167.3, 160.4 (d, $^1J_{FC}$ = 248.3), 159.9 (d, $^4J_{FC}$ = 2.9), 145.1, 135.9 (d, $^4J_{FC}$ = 5.4), 134.7, 131.9, 131.5 (d, $^3J_{FC}$ = 9.2), 127.4 (d, $^3J_{FC}$ = 10.3), 125.7, 124.1, 120.6 (d, $^2J_{FC}$ = 25.8), 110.6 (d, $^2J_{FC}$ = 22.1), 34.3, 30.4, 22.6, 13.8; ^{19}F NMR (376 MHz, $CDCl_3$) δ = -113.5; HRMS Calculated for $C_{21}H_{18}FN_2O_2$ $[M+H]^+$ 349.1352, found 349.1371.



(*E*)-2-(2-(4-Fluorostyryl)quinolin-3-yl)isoindoline-1,3-dione (2m): 64% yield, light yellow solid, mp 269-271 °C, R_f = 0.50 (hexane/EtOAc 5:1). ^{1}H NMR (400 MHz, $CDCl_3$) δ = 8.17 (d, J = 8.5, 1H), 8.10-7.99 (m, 4H), 7.87 (dd, J = 5.3, 3.1, 2H), 7.79 (dd, J = 17.1, 8.1, 2H), 7.54 (t, J = 7.5, 1H), 7.48 (dd, J = 8.4, 5.6, 2H), 6.99 (dd, J = 11.9, 6.5, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ = 167.5, 163.2 (d, $^1J_{FC}$ = 248.8), 152.9, 148.3, 136.8, 135.7, 135.0, 133.0, 132.9, 132.0, 131.0, 129.5, 129.5 (d, $^3J_{FC}$ = 8.3), 127.9, 127.4, 127.0, 124.3, 121.9 (d, $^4J_{FC}$ = 2.1), 115.8 (d, $^2J_{FC}$ = 21.7); ^{19}F NMR (376 MHz, $CDCl_3$) δ = -112.3; HRMS Calculated for $C_{25}H_{16}FN_2O_2$ $[M+H]^+$ 395.1196, found 395.1187.

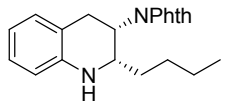


4. Asymmetric Hydrogenation of Substituted Quinolines



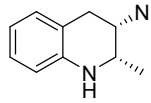
$Pd(OCOCF_3)_2$ (1.7 mg, 0.005 mmol) and **L3** (4.7 mg, 0.006 mmol) were placed in a dried Schlenk tube under nitrogen atmosphere, and degassed anhydrous acetone was added. The mixture was stirred at room temperature for 1 h, then, the solvent was removed under vacuum to give the catalyst. In a glovebox, quinolines (0.10 mmol) and TFA (6.8 mg, 4.4 μL, 0.06 mmol) were stirred in 1.0 mL CH_2Cl_2 at room temperature for 1 min. Subsequently, the above catalyst together with 3 mL CH_2Cl_2 was added to the reaction mixture. The hydrogenation was performed at 70 °C (or 80 °C) under H_2 (1000 psi) in a stainless steel autoclave for 18 h. After carefully releasing the hydrogen, saturated aqueous $NaHCO_3$ (5 mL) was added to the resulting mixture. After stirring for 10 min, the mixture was extracted with CH_2Cl_2 (3 x 5 mL) and dried over Na_2SO_4. Purification was performed by flash chromatography on silica gel (hexane/EtOAc 10:1) to give the product.

2-((2*S*,3*S*)-2-Butylquinolin-3-yl)isoindoline-1,3-dione (3a): known compound,[3] 91% yield, 90% ee, light yellow oil, $[\alpha]^{20}_D$ = -149.2 (*c* 0.60, CH_2Cl_2) [lit.[3]: $[\alpha]^{20}_D$ = +181.6 (*c* 0.64, CH_2Cl_2) for 93% ee (2*R*,3*R*)], R_f = 0.60 (hexane/EtOAc 5:1). ^{1}H NMR (400 MHz, $CDCl_3$) δ = 7.87-7.79 (m, 2H), 7.75-7.67 (m, 2H), 7.01 (dd, J = 15.1, 7.4, 2H), 6.68 (t, J = 7.4, 1H), 6.57 (d, J = 7.9, 1H), 4.87-4.78 (m, 1H), 4.04 (s,

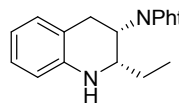


1H), 3.93 (dd, *J* = 16.6, 9.6, 1H), 3.50-3.41 (m, 1H), 3.04 (dd, *J* = 16.6, 6.2, 1H), 1.60 (dt, *J* = 13.0, 6.8, 1H), 1.50-1.39 (m, 2H), 1.32-1.23 (m, 3H), 0.86 (dd, *J* = 13.5, 6.6, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ = 168.8, 143.3, 134.0, 131.8, 129.0, 127.0, 123.2, 120.0, 117.6, 114.5, 54.4, 50.4, 30.3, 28.6, 27.2, 22.7, 14.1; HPLC: Chiracel OD-H column, 254 nm, 30 °C, *n*-hexane/*i*-propanol = 70/30, flow = 0.7 mL/min, retention time 12.2 min and 14.2 min (major).

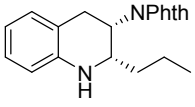
2-((2*S*,3*S*)-2-Methylquinolin-3-yl)isoindoline-1,3-dione (3b): known compound,[3] 86% yield, 81% ee, light yellow solid, mp 165-167 °C, $[\alpha]^{20}_D$ = -159.2 (*c* 0.60, CH_2Cl_2) [lit.[3]: $[\alpha]^{20}_D$ = +170.2 (*c* 0.56, CH_2Cl_2) for 81% ee (2*R*,3*R*)], R_f = 0.40 (hexane/EtOAc 5:1). ^{1}H NMR (400 MHz, $CDCl_3$) δ = 7.86-7.78 (m, 2H), 7.74-7.67 (m, 2H), 7.02 (t, *J* = 8.6, 2H), 6.69 (td, *J* = 7.5, 0.9, 1H), 6.55 (d, *J* = 7.9, 1H), 4.83-4.76 (m, 1H), 3.91 (dd, *J* = 16.6, 9.2, 1H), 3.84 (s, 1H), 3.73-3.65 (m, 1H), 3.06 (dd, *J* = 16.6, 6.4, 1H), 1.22 (d, *J* = 6.6, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ = 168.8, 143.4, 134.0, 131.8, 128.9, 127.0, 123.2, 119.9, 117.8, 114.5, 50.4, 49.8, 26.8, 17.9; HPLC: Chiracel OD-H column, 254 nm, 30 °C, *n*-hexane/*i*-propanol = 70/30, flow = 0.7 mL/min, retention time 21.7 min and 27.9 min (major).



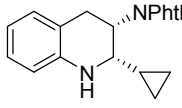
2-((2*S*,3*S*)-2-Ethylquinolin-3-yl)isoindoline-1,3-dione (3c): known compound,[3] 93% yield, 85% ee, light yellow solid, mp 162-164 °C, $[\alpha]^{20}_D$ = -182.8 (*c* 0.56, CH_2Cl_2) [lit.[3]: $[\alpha]^{20}_D$ = +197.7 (*c* 0.60, CH_2Cl_2) for 90% ee (2*R*,3*R*)], R_f = 0.45 (hexane/EtOAc 5:1). ^{1}H NMR (400 MHz, $CDCl_3$) δ = 7.86-7.79 (m, 2H), 7.74-7.68 (m, 2H), 7.01 (dd, *J* = 15.4, 7.5, 2H), 6.68 (t, *J*=7.4, 1H), 6.57 (d, *J* = 7.9, 1H), 4.88-4.81 (m, 1H), 4.09 (s, 1H), 3.95 (dd, *J* = 16.5, 9.8, 1H), 3.36 (dt, *J* = 9.7, 3.7, 1H), 3.02 (dd, *J* = 16.5, 6.2, 1H), 1.67-1.47 (m, 2H), 0.97 (t, *J* = 7.4, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ = 168.8, 143.2, 134.0, 131.8, 129.0, 127.0, 123.2, 120.0, 117.6, 114.5, 56.0, 50.3, 27.1, 23.5, 10.7; HPLC: Chiracel OD-H column, 254 nm, 30 °C, *n*-hexane/*i*-propanol = 70/30, flow = 0.7 mL/min, retention time 13.8 min and 20.5 min (major).



2-((2*S*,3*S*)-2-Propylquinolin-3-yl)isoindoline-1,3-dione (3d): known compound,[3] 97% yield, 87% ee, light yellow solid, mp 154-156 °C, $[\alpha]^{20}_D$ = -186.8 (*c* 0.62, CH_2Cl_2) [lit.[3]: $[\alpha]^{20}_D$ = +204.3 (*c* 0.60, CH_2Cl_2) for 92% ee (2*R*,3*R*)], R_f = 0.45 (hexane/EtOAc 5:1). ^{1}H NMR (400 MHz, $CDCl_3$) δ = 7.88-7.79 (m, 2H), 7.75-7.67 (m, 2H), 7.01 (dd, *J* = 14.3, 7.3, 2H), 6.69 (dd, *J* = 10.7, 4.0, 1H), 6.56 (d, *J* = 7.9, 1H), 4.86-4.79 (m, 1H), 4.03 (s, 1H), 3.94 (dd, *J* = 16.6, 9.7, 1H), 3.47 (dt, *J* = 10.0, 3.2, 1H), 3.04 (dd, *J* = 16.6, 6.2, 1H), 1.65-1.38 (m, 3H), 1.35-1.23 (m, 1H), 0.89 (t, *J* = 7.1, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ = 168.8, 143.2, 134.0, 131.8, 129.0, 127.0, 123.2, 120.0, 117.6, 114.5, 54.1, 50.4, 32.6, 27.2, 19.5, 14.0; HPLC: Chiracel OD-H column, 254 nm, 30 °C, *n*-hexane/*i*-propanol = 70/30, flow = 0.7 mL/min, retention time 12.6 min and 16.6 min (major).

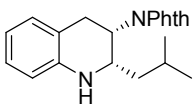


2-((2*S*,3*S*)-2-Cyclopropylquinolin-3-yl)isoindoline-1,3-dione (3e): 72% yield, 80% ee, yellow solid, mp 152-154 °C, $[\alpha]^{20}_D$ = -197.6 (*c* 0.38, CH_2Cl_2), R_f = 0.45 (hexane/EtOAc 5:1). ^{1}H NMR (400 MHz, $CDCl_3$) δ = 7.88-7.80 (m, 2H), 7.76-7.67 (m, 2H), 7.07-6.96 (m, 2H), 6.67 (t, *J* = 7.3, 1H), 6.56 (d, *J* = 7.9, 1H), 4.93-4.85 (m, 1H), 4.17 (dd, *J* = 16.3, 10.5, 1H), 4.05 (s, 1H), 3.04 (dd, *J* = 16.3, 5.9, 1H), 2.72 (dd, *J* = 9.3, 4.1, 1H), 1.20-1.05 (m, 1H), 0.54-0.40 (m, 2H), 0.21-0.11 (m, 1H), 0.06 (dq, *J* = 9.8, 4.7, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ = 166.5, 141.0, 131.7, 129.5, 126.6, 124.8, 120.9, 117.5, 115.2, 111.8, 56.8, 47.9, 24.8, 10.9, 1.0, -0.0; HRMS Calculated for $C_{20}H_{19}N_2O_2$ $[M+H]^+$ 319.1447, found 319.1453; HPLC: Chiracel OD-H column, 254 nm, 30 °C, *n*-hexane/*i*-propanol = 70/30,

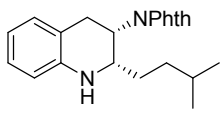


flow = 0.7 mL/min, retention time 18.9 min and 28.8 min (major).

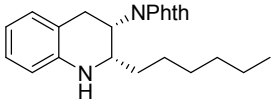
2-((2*S*,3*S*)-2-Isobutylquinolin-3-yl)isoindoline-1,3-dione (3f): known compound,[3] 94% yield, 90% ee, light yellow oil, $[\alpha]^{20}_D$ = -178.7 (*c* 0.62, CH_2Cl_2) [lit.[3]: $[\alpha]^{20}_D$ = +203.2 (*c* 0.66, CH_2Cl_2) for 94% ee (2*R*,3*R*)], R_f = 0.65 (hexane/EtOAc 5:1). ^{1}H NMR (400 MHz, $CDCl_3$) δ = 7.87-7.78 (m, 2H), 7.76-7.66 (m, 2H), 7.02 (dd, *J* = 14.1, 7.1, 2H), 6.69 (td, *J* = 7.4, 0.9, 1H), 6.57 (d, *J* = 7.8, 1H), 4.85-4.76 (m, 1H), 3.97 (s, 1H), 3.87 (dd, *J* = 16.7, 9.1, 1H), 3.58 (dt, *J* = 10.3, 3.3, 1H), 3.08 (dd, *J* = 16.7, 6.3, 1H), 1.79-1.67 (m, 1H), 1.63-1.54 (m, 1H), 1.25-1.18 (m, 1H), 0.91 (d, *J* = 6.6, 3H), 0.85 (d, *J* = 6.6, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ = 168.8, 143.4, 134.0, 131.8, 128.9, 127.0, 123.3, 120.1, 117.7, 114.5, 52.1, 50.5, 39.5, 27.4, 24.6, 23.9, 21.5; HPLC: Chiracel OD-H column, 254 nm, 30 °C, *n*-hexane/*i*-propanol = 70/30, flow = 0.7 mL/min, retention time 10.2 min and 17.4 min (major).



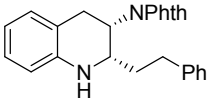
2-((2*S*,3*S*)-2-Isopentylquinolin-3-yl)isoindoline-1,3-dione (3g): known compound,[3] 91% yield, 90% ee, yellow oil, $[\alpha]^{20}_D$ = -184.2 (*c* 0.64, CH_2Cl_2) [lit.[3]: $[\alpha]^{20}_D$ = +176.8 (*c* 0.68, CH_2Cl_2) for 88% ee (2*R*,3*R*)], R_f = 0.65 (hexane/EtOAc 5:1). ^{1}H NMR (400 MHz, $CDCl_3$) δ = 7.86-7.79 (m, 2H), 7.74-7.68 (m, 2H), 7.01 (dd, *J* = 15.5, 7.5, 2H), 6.68 (t, *J* = 7.4, 1H), 6.57 (d, *J* = 7.9, 1H), 4.87-4.78 (m, 1H), 4.03 (s, 1H), 3.90 (dd, *J* = 16.6, 9.4, 1H), 3.42 (dt, *J* = 9.4, 3.6, 1H), 3.04 (dd, *J* = 16.6, 6.2, 1H), 1.63-1.43 (m, 3H), 1.39-1.28 (m, 1H), 1.23-1.12 (m, 1H), 0.82 (dd, *J* = 8.8, 6.7, 6H); ^{13}C NMR (100 MHz, $CDCl_3$) δ = 168.8, 143.3, 134.0, 131.8, 128.9, 127.0, 123.2, 120.1, 117.6, 114.5, 54.8, 50.4, 35.7, 28.6, 28.1, 27.4, 22.8, 22.4; HPLC: Chiracel OD-H column, 254 nm, 30 °C, *n*-hexane/*i*-propanol = 70/30, flow = 0.6 mL/min, retention time 13.2 min and 14.6 min (major).



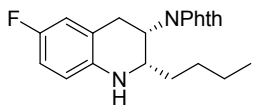
2-((2*S*,3*S*)-2-Hexylquinolin-3-yl)isoindoline-1,3-dione (3h): known compound,[3] 86% yield, 90% ee, yellow oil, $[\alpha]^{20}_D$ = -169.5 (*c* 0.62, CH_2Cl_2) [lit.[3]: $[\alpha]^{20}_D$ = +180.4 (*c* 0.70, CH_2Cl_2) for 92% ee (2*R*,3*R*)], R_f = 0.70 (hexane/EtOAc 5:1). ^{1}H NMR (400 MHz, $CDCl_3$) δ = 7.82 (dt, *J* = 7.0, 3.5, 2H), 7.75-7.67 (m, 2H), 7.01 (dd, *J* = 15.0, 7.4, 2H), 6.68 (td, *J* = 7.4, 0.8, 1H), 6.57 (d, *J* = 7.9, 1H), 4.86-4.79 (m, 1H), 4.03 (s, 1H), 3.92 (dd, *J* = 16.6, 9.6, 1H), 3.50-3.41 (m, 1H), 3.04 (dd, *J* = 16.6, 6.2, 1H), 1.59 (dd, *J* = 18.7, 9.4, 1H), 1.51-1.39 (m, 2H), 1.25 (dd, *J* = 14.3, 9.4, 7H), 0.83 (t, *J* = 6.8, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ = 168.8, 143.3, 134.0, 131.8, 129.0, 127.0, 123.2, 120.0, 117.6, 114.5, 54.4, 50.4, 31.8, 30.6, 29.2, 27.2, 26.4, 22.6, 14.0; HPLC: Chiracel OD-H column, 254 nm, 30 °C, *n*-hexane/*i*-propanol = 70/30, flow = 0.7 mL/min, retention time 11.3 min and 12.5 min (major).



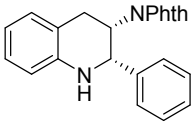
2-((2*S*,3*S*)-2-Phenethylquinolin-3-yl)isoindoline-1,3-dione (3i): known compound,[3] 95% yield, 90% ee, yellow oil, $[\alpha]^{20}_D$ = -147.2 (*c* 0.72, CH_2Cl_2) [lit.[3]: $[\alpha]^{20}_D$ = +156.0 (*c* 0.76, CH_2Cl_2) for 93% ee (2*R*,3*R*)], R_f = 0.50 (hexane/EtOAc 5:1). ^{1}H NMR (400 MHz, $CDCl_3$) δ = 7.85-7.76 (m, 2H), 7.74-7.65 (m, 2H), 7.20 (t, *J* = 7.2, 2H), 7.12 (dd, *J* = 8.9, 7.9, 3H), 7.00 (dd, *J* = 13.1, 7.1, 2H), 6.68 (t, *J* = 7.0, 1H), 6.48 (d, *J* = 7.9, 1H), 4.85-4.77 (m, 1H), 3.94 (dd, *J* = 16.4, 9.9, 2H), 3.49 (dt, *J* = 9.1, 3.4, 1H), 3.03 (dd, *J* = 16.6, 6.2, 1H), 2.84-2.74 (m, 1H), 2.72-2.58 (m, 1H), 2.00-1.79 (m, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ = 168.8, 143.0, 141.4, 134.0, 131.8, 129.0, 128.5, 128.4, 127.1, 126.0, 123.3, 120.0, 117.8, 114.7, 54.1, 50.5, 32.9, 32.0, 27.2; HPLC: Chiracel OD-H column, 254 nm, 30 °C, *n*-hexane/*i*-propanol = 70/30, flow = 0.7 mL/min, retention time 20.7 min and 56.5 min (major).



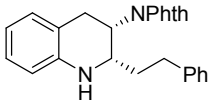
2-((2*S*,3*S*)-2-Butyl-6-fluoroquinolin-3-yl)isoindoline-1,3-dione (3j): 97% yield, 79% ee, yellow oil, $[\alpha]^{20}_D$ = -114.0 (*c* 0.52, CH_2Cl_2), R_f = 0.45 (hexane/EtOAc 5:1). ^{1}H NMR (400 MHz, $CDCl_3$) δ = 7.88-7.78 (m, 2H), 7.76-7.66 (m, 2H), 6.75 (dd, *J* = 15.0, 6.3, 2H), 6.51 (dd, *J* = 8.4, 4.8, 1H), 4.80 (td, *J* = 7.9, 3.5, 1H), 3.89 (s, 1H), 3.76 (dd, *J* = 17.1, 8.1, 1H), 3.45-3.36 (m, 1H), 3.09 (dd, *J* = 17.1, 6.7, 1H), 1.58-1.39 (m, 3H), 1.35-1.21 (m, 3H), 0.86 (t, *J* = 7.0, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ = 168.8, 156.0 (d, $^1J_{FC}$ = 235.5), 139.8, 134.0, 131.8, 123.3, 121.8 (d, $^3J_{FC}$ = 7.1), 115.4 (d, $^3J_{FC}$ = 7.7), 115.0 (d, $^2J_{FC}$ = 22.2), 113.5 (d, $^2J_{FC}$ = 22.5), 54.8, 49.8, 30.3, 28.6, 28.0, 22.6, 14.0; ^{19}F NMR (376 MHz, $CDCl_3$) δ = -127.3; HRMS Calculated for $C_{21}H_{22}FN_2O_2$ $[M+H]^+$ 353.1665, found 353.1656; HPLC: Chiracel OD-H column, 254 nm, 30 °C, *n*-hexane/*i*-propanol = 70/30, flow = 0.7 mL/min, retention time 9.9 min and 14.1 min (major).



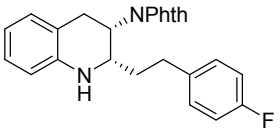
2-((2*S*,3*S*)-2-Phenylquinolin-3-yl)isoindoline-1,3-dione (3k): known compound,[3] 83% yield, 14% ee, light yellow solid, mp 254-256 °C, $[\alpha]^{20}_D$ = -39.3 (*c* 0.60, CH_2Cl_2) [lit.[3]: $[\alpha]^{20}_D$ = +135.4 (*c* 0.70, CH_2Cl_2) for 40% ee (2*R*,3*R*)], R_f = 0.40 (hexane/EtOAc 5:1). ^{1}H NMR (400 MHz, $CDCl_3$) δ = 7.75-7.69 (m, 2H), 7.69-7.63 (m, 2H), 7.26-7.01 (m, 7H), 6.72 (t, *J* = 7.1, 1H), 6.62 (d, *J* = 7.9, 1H), 4.97 (dt, *J* = 10.4, 5.1, 1H), 4.75 (d, *J* = 4.6, 1H), 4.32 (s, 1H), 3.95 (dd, *J* = 16.3, 10.7, 1H), 3.03 (dd, *J* = 16.3, 5.4, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ = 168.1, 143.5, 141.1, 133.9, 131.6, 129.0, 128.3, 127.9, 127.4, 127.3, 123.1, 119.4, 117.5, 113.4, 57.7, 51.1, 26.6; HPLC: Chiracel OD-H column, 254 nm, 30 °C, *n*-hexane/*i*-propanol = 70/30, flow = 0.7 mL/min, retention time 18.7 min and 32.8 min (major).



2-((2*S*,3*S*)-2-Phenethylquinolin-3-yl)isoindoline-1,3-dione (**3i,** the hydrogenation product is the same as hydrogenation of (*E*)-2-(2-phenethylquinolin-3-yl)isoindoline-1,3-dione **(2i)** due to hydrogenation of C=C double bond of side chain of substrate **2l):** known compound,[3] 99% yield, 90% ee, yellow oil, R_f = 0.50 (hexane/EtOAc 5:1). HPLC: Chiracel OD-H column, 254 nm, 30 °C, *n*-hexane/*i*-propanol = 70/30, flow = 0.7 mL/min, retention time 20.7 min and 55.9 min (major).



2-((2*S*,3*S*)-2-(4-fluorophenethyl)-1,2,3,4-tetrahydroquinolin-3-yl)isoindoline-1,3-dione (3m): 86% yield, 88% ee, light yellow oil, $[\alpha]^{20}_D$ = -132.2 (*c* 0.64, CH_2Cl_2), R_f = 0.60 (hexane/EtOAc 5:1). ^{1}H NMR (400 MHz, $CDCl_3$) δ = 7.81 (dt, *J* = 7.0, 3.5, 2H), 7.76-7.65 (m, 2H), 7.12-6.96 (m, 4H), 6.87 (t, *J* = 8.7, 2H), 6.69 (t, *J* = 7.2, 1H), 6.51 (d, *J* = 7.9, 1H), 4.85-4.76 (m, 1H), 3.95 (dd, *J* = 16.5, 10.0, 2H), 3.48 (dt, *J* = 7.2, 3.3, 1H), 3.02 (dd, *J* = 16.6, 6.1, 1H), 2.84-2.71 (m, 1H), 2.69-2.55 (m, 1H), 2.00-1.72 (m, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ = 168.8, 161.3 (d, $^1J_{FC}$ = 243.8), 142.9, 137.0 (d, $^4J_{FC}$ = 3.2), 134.1, 131.8, 129.7 (d, $^3J_{FC}$ = 7.8), 129.0, 127.1, 123.3, 112.0, 117.9, 115.2 (d, $^2J_{FC}$ = 21.1), 114.7, 54.0, 50.4, 32.2, 32.0, 27.1; ^{19}F NMR (376 MHz, $CDCl_3$) δ = -117.4; HRMS Calculated for $C_{25}H_{22}FN_2O_2$ $[M+H]^+$ 401.1665, found 401.1664; HPLC: Chiracel OD-H column, 254 nm, 30 °C, *n*-hexane/*i*-propanol = 70/30, flow = 0.7 mL/min, retention time 21.0 min (major) and 41.2 min



(*cis*)-Propyl 2-methyl-1,2,3,4-tetrahydroquinoline-3-carboxylate (8a): 52% yield, 35% ee, known compound,[5] colorless oil, $[\alpha]^{20}_D$ = -13.3 (*c* 0.24, CH_2Cl_2), [lit.[5]: $[\alpha]^{20}_D$ = +23.4 (*c* 1.0,

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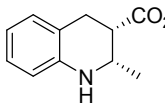
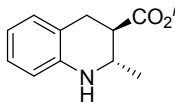
$CHCl_3$) for 85% ee (2*R*,3*R*)], R_f = 0.50 (hexane/EtOAc 10:1). ^1H NMR (400 MHz, $CDCl_3$) δ =



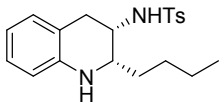
6.99 (dd, *J* = 14.6, 7.5, 2H), 6.64 (dd, *J* = 10.7, 4.1, 1H), 6.50 (d, *J* = 7.9, 1H), 4.14-4.02 (m, 2H), 3.98-3.82 (m, 2H), 3.12-3.00 (m, 1H), 3.00-2.87 (m, 2H), 1.72-1.60 (m, 2H), 1.14 (d, *J* = 6.5, 3H), 0.94 (t, *J* = 7.4, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ = 173.0, 142.9, 129.5, 127.0, 119.1, 117.4, 114.6, 66.2, 47.4, 42.3, 25.5, 22.0, 17.9, 10.4; HPLC: Chiracel OD-H column, 254 nm, 30 °C, *n*-hexane/*i*-propanol = 70/30, flow = 0.7 mL/min, retention time 7.6 min (major) and 8.2 min.

(*trans*)-Propyl 2-methyl-1,2,3,4-tetrahydroquinoline-3-carboxylate (8b): 39% yield, 0% ee, colorless oil, R_f = 0.60 (hexane/EtOAc 10:1). ^1H NMR (400 MHz, $CDCl_3$) δ = 6.98 (t, *J* = 7.4,



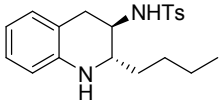
2H), 6.62 (dd, *J* = 10.7, 4.1, 1H), 6.49 (d, *J* = 7.7, 1H), 4.15-4.05 (m, 2H), 3.68 (s, 1H), 3.54 (dq, *J* = 9.3, 6.2, 1H), 3.05 (dd, *J* = 16.0, 11.4, 1H), 2.91 (dd, *J* = 16.0, 4.9, 1H), 2.53-2.43 (m, 1H), 1.75-1.62 (m, 2H), 1.24 (t, *J* = 5.8, 3H), 0.96 (t, *J* = 7.4, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ = 174.4, 143.6, 129.1, 127.1, 119.5, 117.3, 113.8, 66.2, 49.1, 45.8, 30.6, 22.0, 20.6, 10.4; HRMS Calculated for $C_{14}H_{20}NO_2$ $[M+H]^+$ 234.1494, found 234.1497.

***N*-((*cis*)-2-butyl-1,2,3,4-tetrahydroquinolin-3-yl)-4-methylbenzenesulfonamide (9a):** 11% yield, 51% ee, known compound,[3] white solid, mp 164-165 °C, $[\alpha]^{20}_D$ = +11.3 (*c* 0.08, CH_2Cl_2),



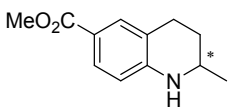
[lit.[3]: $[\alpha]^{20}_D$ = -46.5 (*c* 0.20, CH_2Cl_2) for >99% ee (2*S*,3*S*)], R_f = 0.55 (hexane/EtOAc 5:1). ^1H NMR (400 MHz, $CDCl_3$) δ = 7.72 (d, *J* = 8.2, 2H), 7.27 (d, *J* = 8.1, 2H), 6.98 (t, *J* = 7.5, 1H), 6.77 (d, *J* = 7.4, 1H), 6.63 (t, *J* = 7.3, 1H), 6.48 (d, *J* = 7.9, 1H), 4.87 (d, *J* = 9.2, 1H), 3.80-3.69 (m, 1H), 3.60 (s, 1H), 3.19 (t, *J* = 6.5, 1H), 2.87 (dd, *J* = 16.6, 3.9, 1H), 2.57 (dd, *J* = 16.6, 2.1, 1H), 2.42 (s, 3H), 1.46-1.26 (m, 2H), 1.23-1.05 (m, 4H), 0.84 (t, *J*=6.9, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ = 143.5, 143.2, 138.8, 130.5, 129.6, 127.3, 127.0, 118.5, 117.8, 114.2, 54.8, 48.4, 34.3, 31.7, 27.7, 22.6, 21.5, 13.9; HPLC: Chirapak AD-H column, 254 nm, 30 °C, *n*-hexane/*i*-propanol = 80/20, flow = 0.9 mL/min, retention time 11.6 min and 13.2 min (major).

***N*-((*trans*)-2-butyl-1,2,3,4-tetrahydroquinolin-3-yl)-4-methylbenzenesulfonamide (9b):** 22% yield, 9% ee, known compound,[3] colorless oil, R_f = 0.50 (hexane/EtOAc 5:1). ^1H NMR



(400 MHz, $CDCl_3$) δ = 7.72 (d, *J* = 8.3, 2H), 7.28 (d, *J* = 8.1, 2H), 6.98 (t, *J* = 7.3, 1H), 6.78 (d, *J* = 7.4, 1H), 6.61 (td, *J* = 7.4, 0.8, 1H), 6.47 (d, *J* = 8.0, 1H), 4.92 (d, *J* = 9.3, 1H), 3.98 (s, 1H), 3.62 (td, *J* = 8.0, 3.6, 1H), 3.06-2.95 (m, 1H), 2.82 (dd, *J* = 16.7, 4.5, 1H), 2.53-2.39 (m, 4H), 1.36-1.17 (m, 6H), 0.84 (t, *J* = 7.0, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ = 143.3, 142.0, 138.6, 130.3, 129.7, 127.5, 126.9, 117.7, 116.5, 114.3, 55.0, 49.0, 33.8, 29.7, 27.7, 22.4, 21.5, 13.9; HPLC: Chirapak AD-H column, 254 nm, 30 °C, *n*-hexane/*i*-propanol = 75/25, flow = 0.8 mL/min, retention time 10.5 min (major) and 12.3 min.

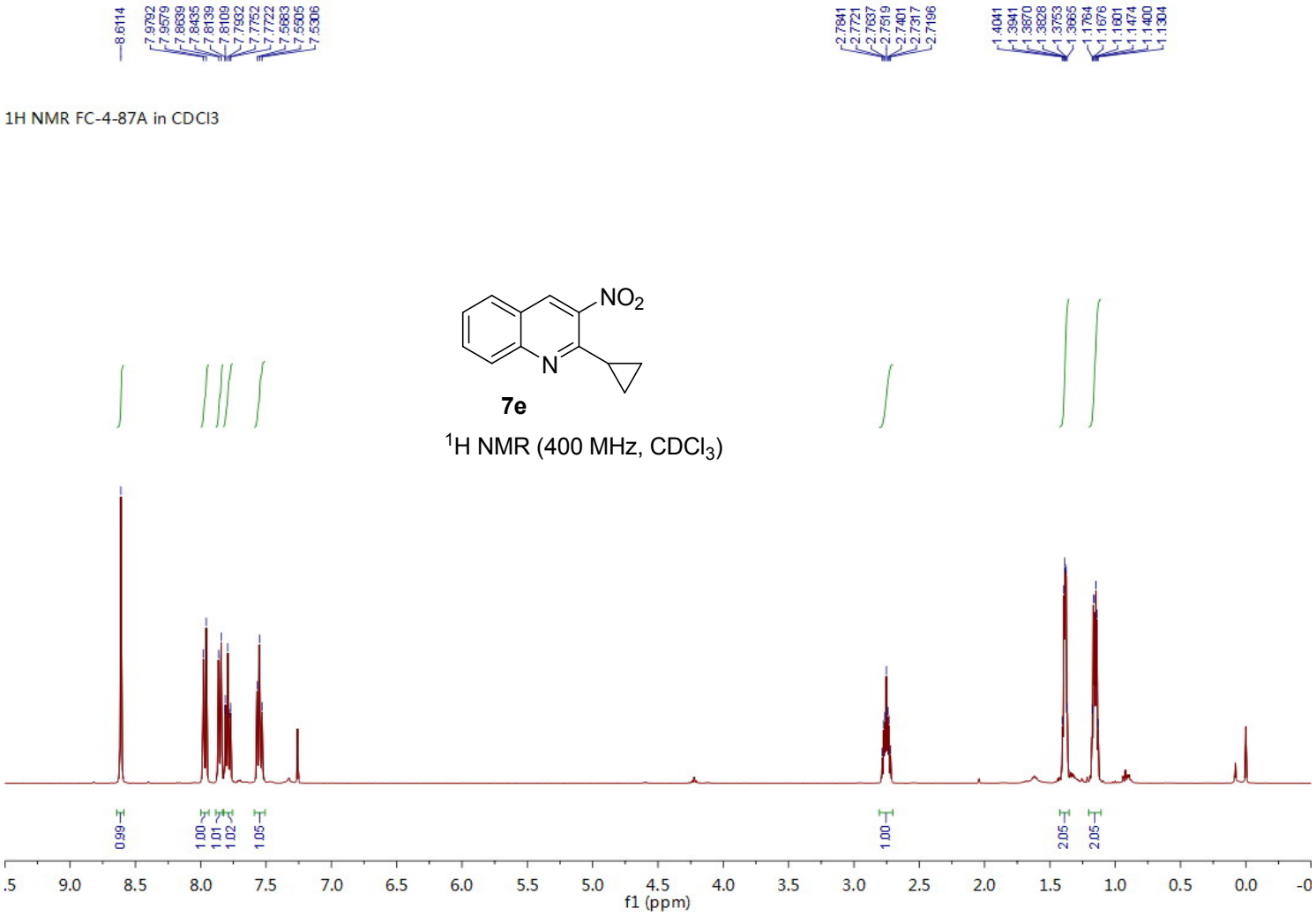
Methyl 2-methyl-1,2,3,4-tetrahydroquinoline-6-carboxylate (10): known compound (CAS: 1389882-44-3), 48% yield, 27% ee, white solid, mp 68-70 °C, $[\alpha]^{20}_D$ = -34.2 (*c* 0.12, CH_2Cl_2), R_f

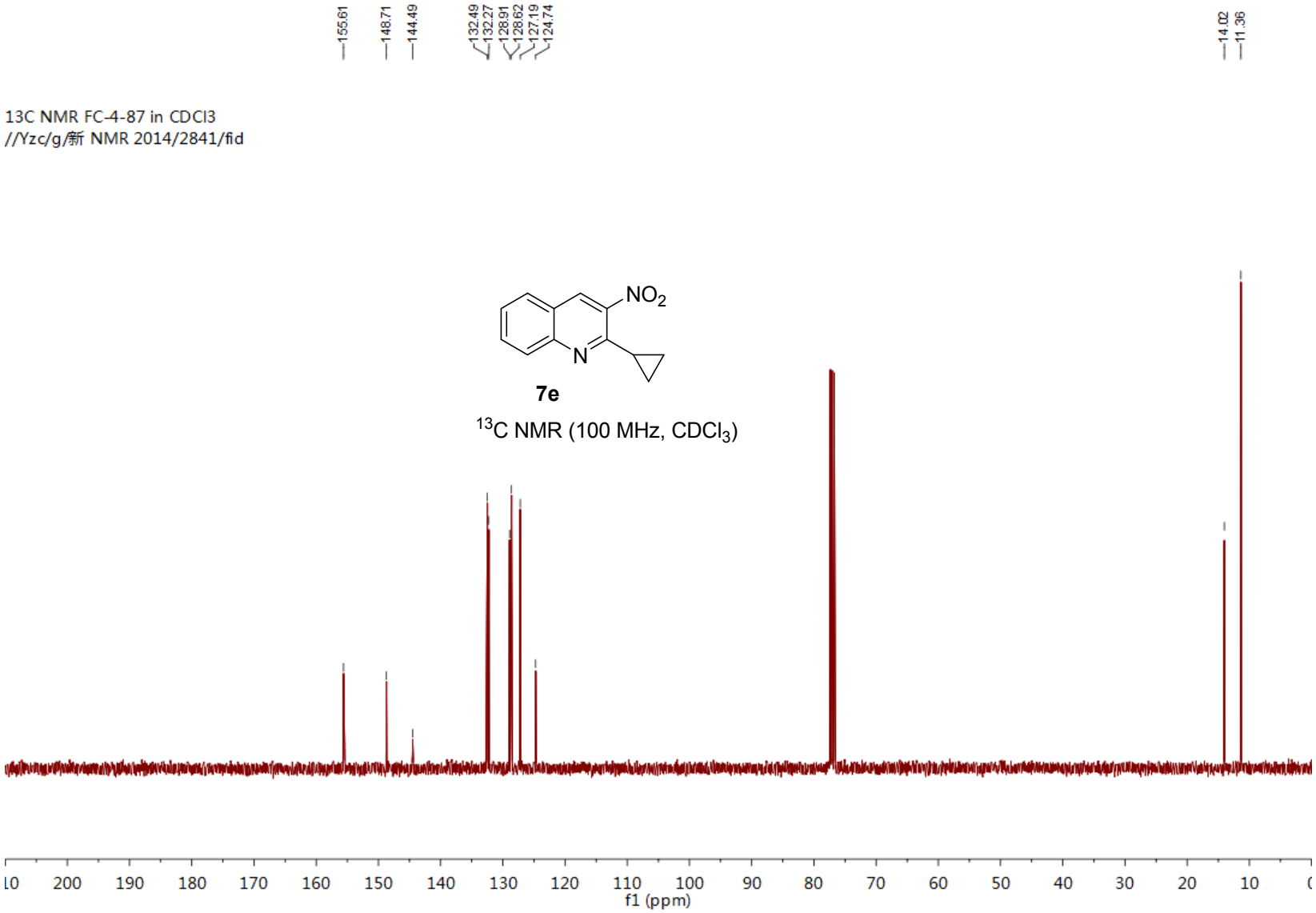


= 0.55 (hexane/EtOAc 5:1). ^1H NMR (400 MHz, $CDCl_3$) δ = 7.68-7.61 (m, 2H), 6.39 (d, *J* = 8.8, 1H), 4.14 (s, 1H), 3.83 (s, 3H), 3.53-3.43 (m, 1H), 2.87-2.70 (m, 2H), 1.99-1.90 (m, 1H), 1.63-1.51 (m, 1H), 1.23 (d, *J* = 6.3, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ = 167.5, 148.7, 131.1, 129.1, 119.7, 117.7, 112.6, 51.4, 47.2,

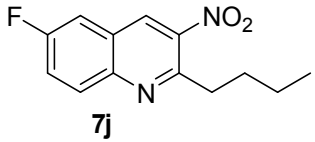
29.5, 26.3, 22.4; HPLC: Chiracel OD-H column, 254 nm, 30 °C, *n*-hexane/*i*-propanol = 85/15, flow = 0.7 mL/min, retention time 12.3 min and 15.0 min (major).

5. Copy of NMR and HPLC for racemic and chiral compounds



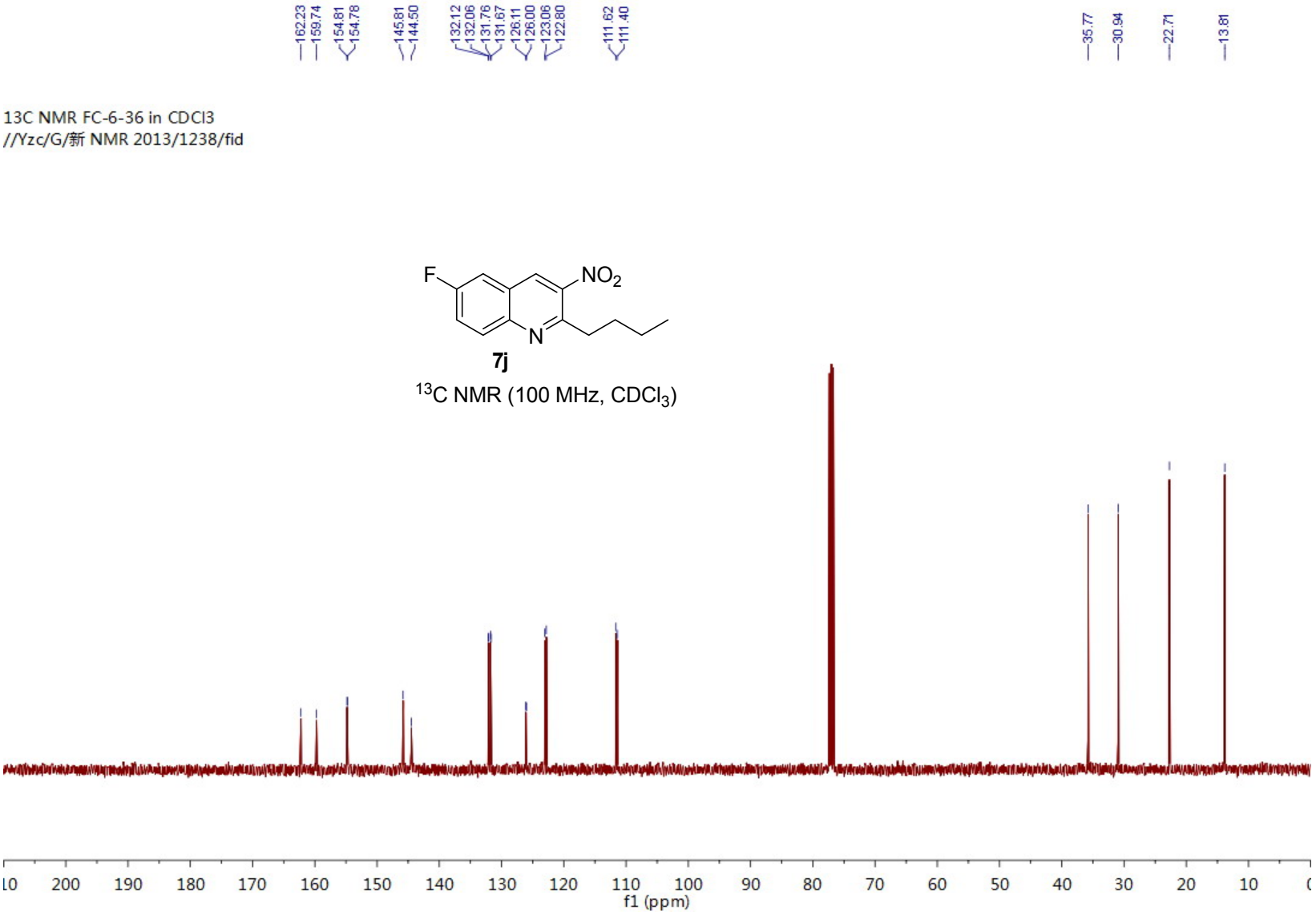

155.61
148.71
144.49
132.49
132.27
128.91
128.62
127.19
124.74
14.02
11.36
13C NMR FC-4-87 in CDCl3
//Yzc/g/新 NMR 2014/2841/fid
NO2
N
7e
13C NMR (100 MHz, CDCl3)
f1 (ppm)

1H NMR FC-6-36 in CDCl3
//Yzc/G/新 NMR 2013/1236/fid

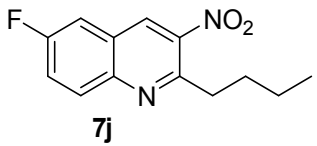


7j

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


162.23
159.74
154.81
154.78
145.81
144.50
132.12
132.06
131.76
131.67
126.11
126.00
123.06
122.80
111.62
111.40
35.77
30.94
22.71
13.81
13C NMR FC-6-36 in CDCl3
//Yzc/G/新 NMR 2013/1238/fid
F
NO2
N
7j
13C NMR (100 MHz, CDCl3)
f1 (ppm)

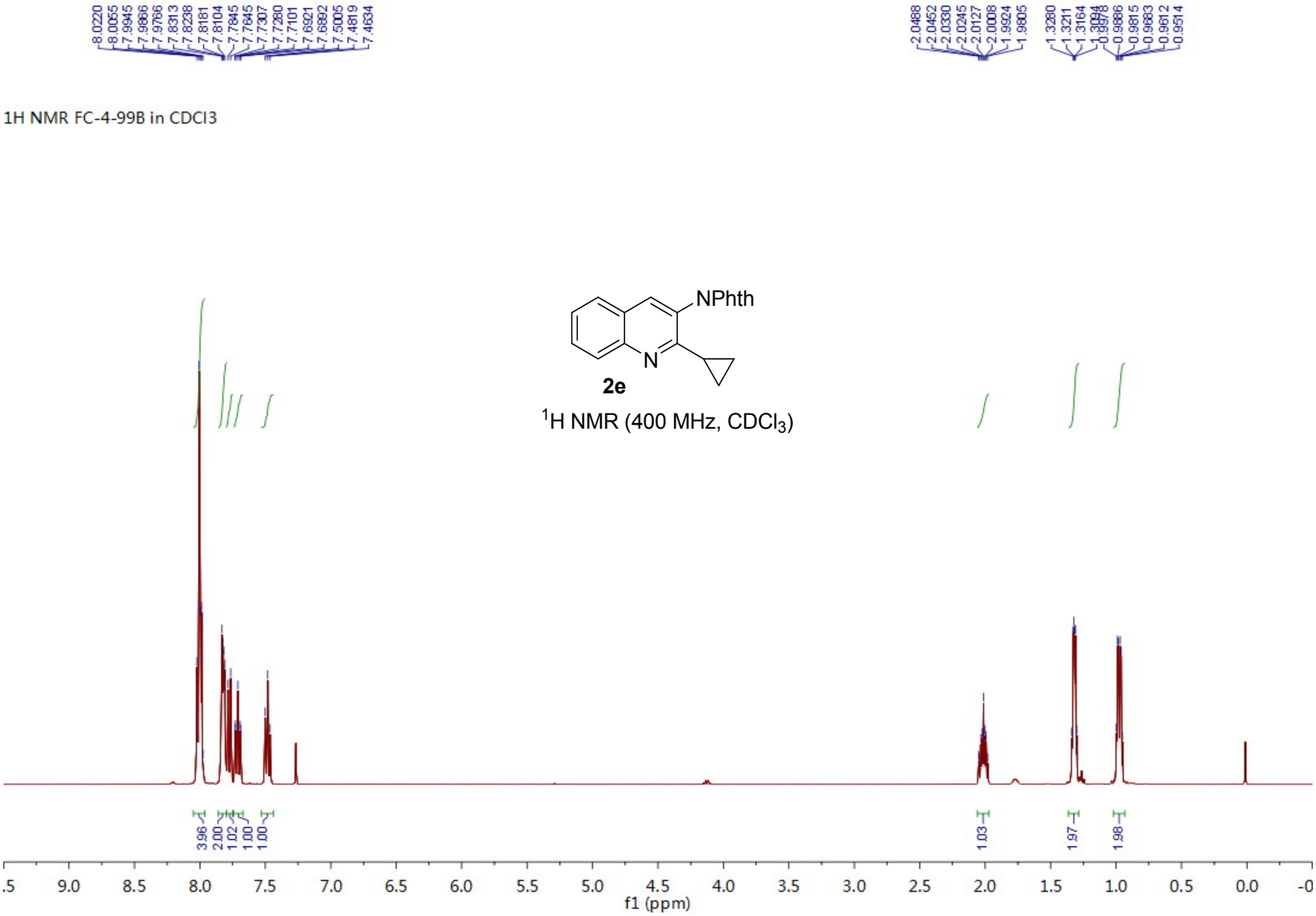
19F NMR FC-6-36 in CDCl3
//Yzc/G/新 NMR 2013/1237/fid

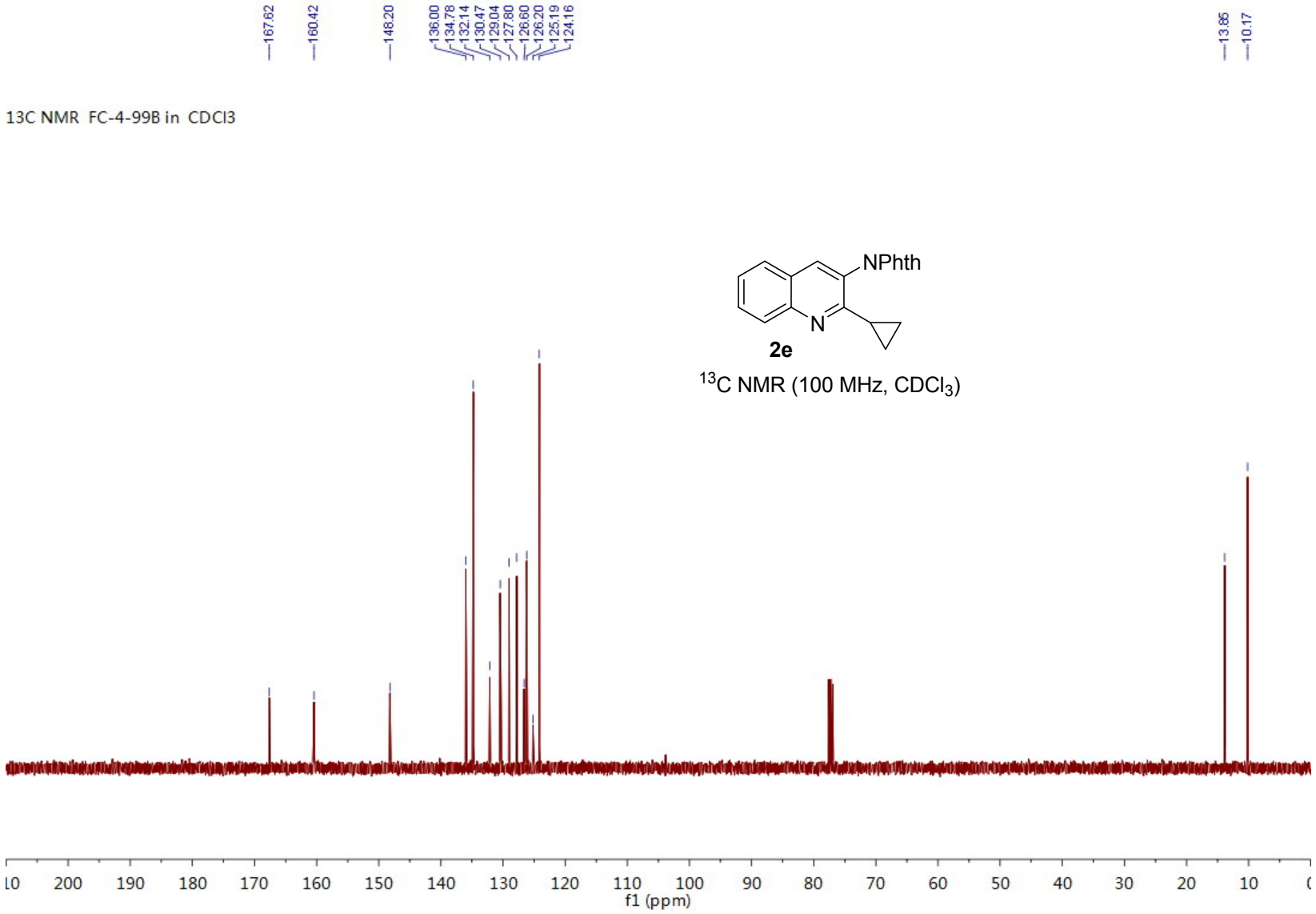


7j

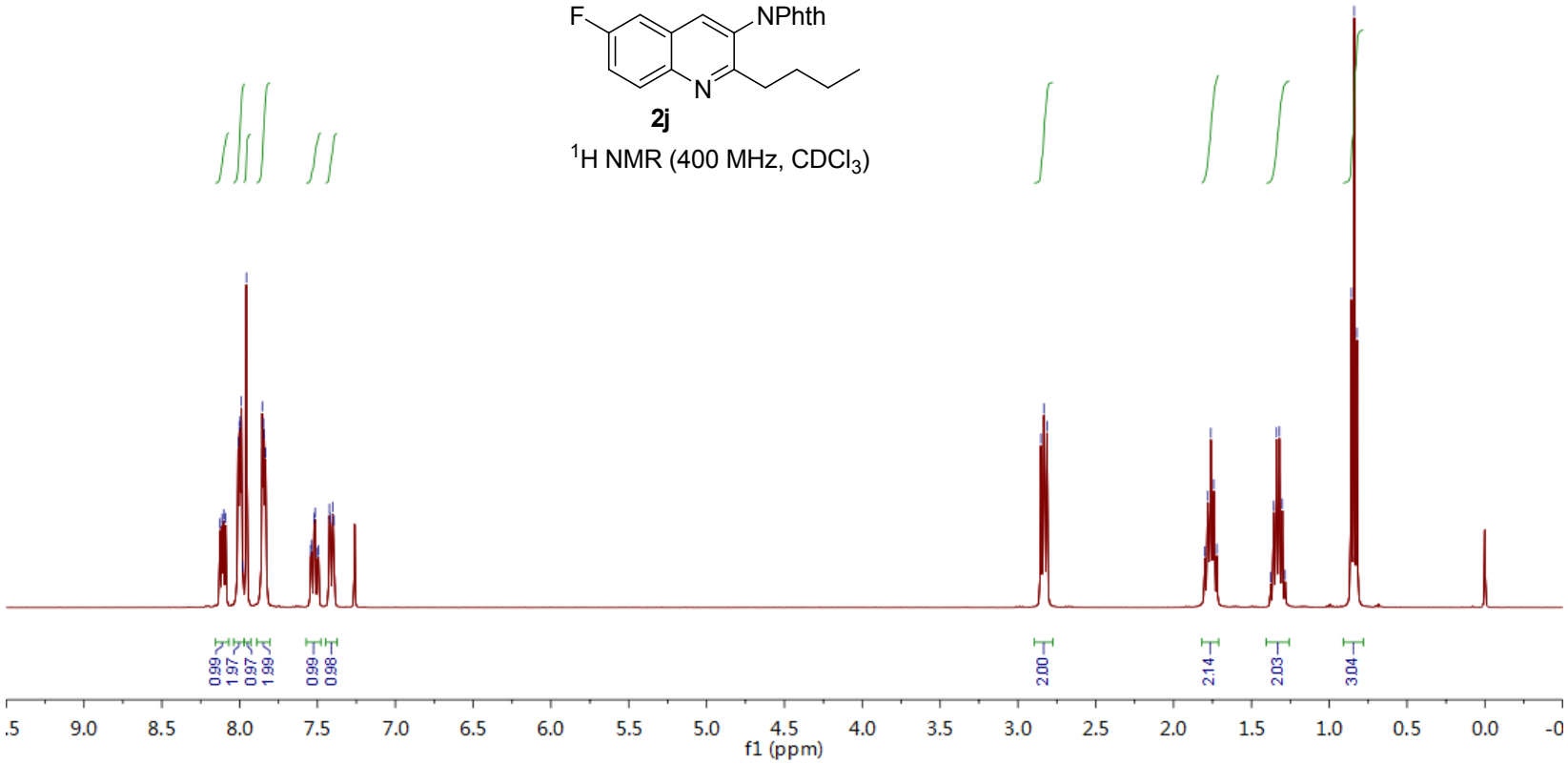
^{19}F NMR (376 MHz, $CDCl_3$)

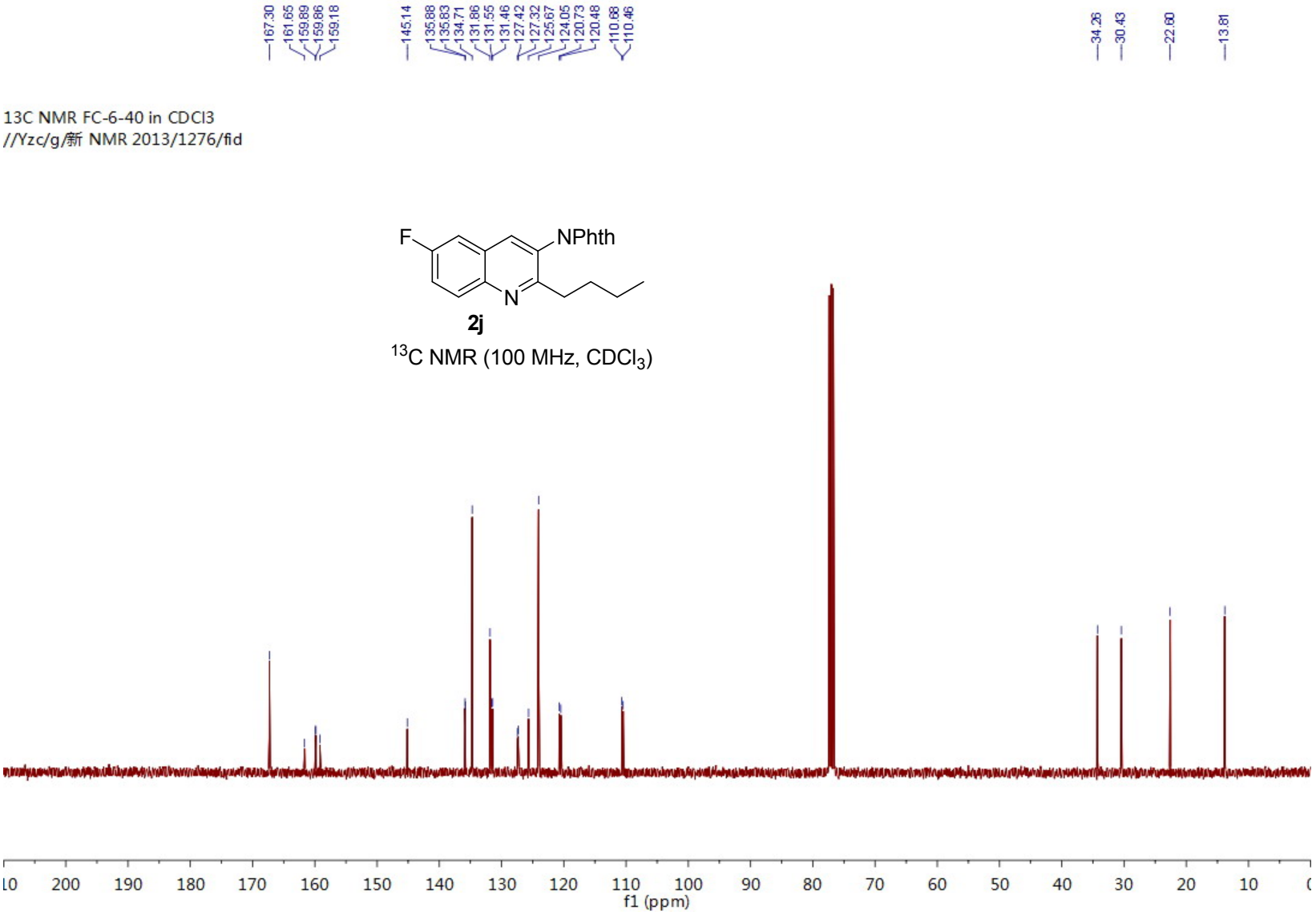
1H NMR FC-4-99B in CDCl3



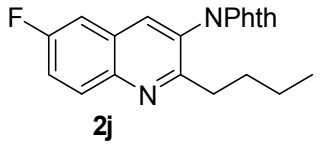

167.62
160.42
148.20
136.00
134.78
132.14
130.47
129.04
127.80
126.60
126.20
125.19
124.16
13.85
10.17
13C NMR FC-4-99B in CDCl3
NPhth
N
2e
^{13}C NMR (100 MHz, $CDCl_3$)
f1 (ppm)

1H NMR FC-6-40 in CDCl3
//Yzc/g/新 NMR 2013/1274/fid




167.30
161.65
159.89
159.86
159.18
145.14
135.88
135.83
134.71
131.86
131.55
131.46
127.42
127.32
125.67
124.05
120.73
120.48
110.68
110.46
34.26
30.43
22.80
13.81
13C NMR FC-6-40 in CDCl3
//Yzc/g/新 NMR 2013/1276/fid
F
NPhth
N
2j
13C NMR (100 MHz, CDCl3)
f1 (ppm)

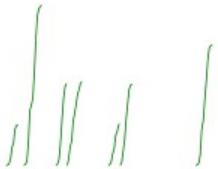
19F NMR FC-6-40 in CDCl3
//Yzc/g/新 NMR 2013/1275/fid

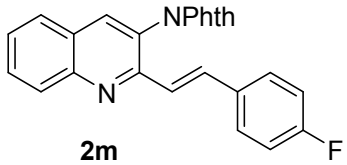


2j

^{19}F NMR (376 MHz, $CDCl_3$)

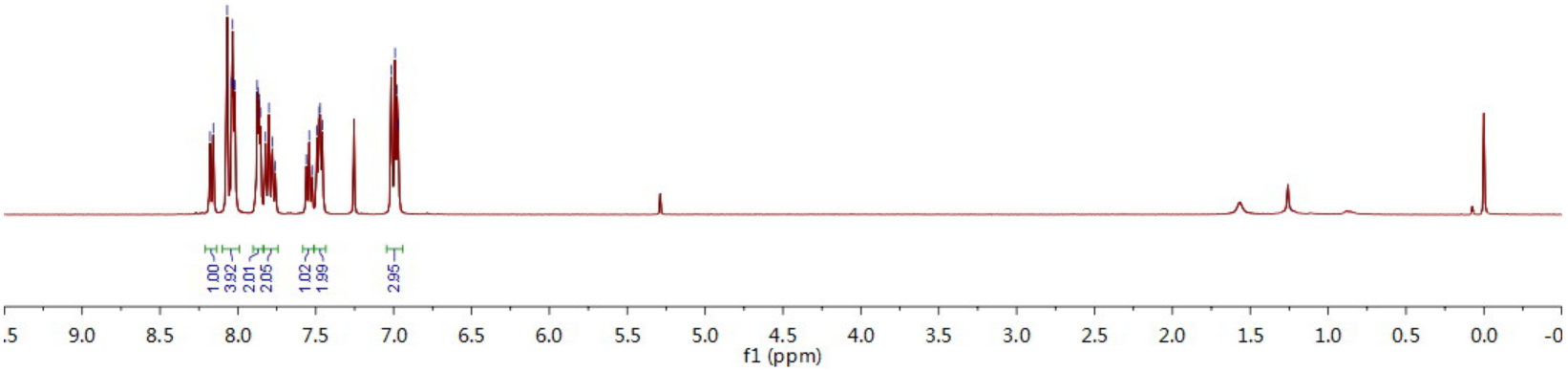
1H NMR FC-5-46 in CDCl3
//Yzc/g/新 NMR 2013/1263/fid



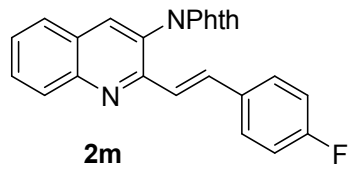


2m

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



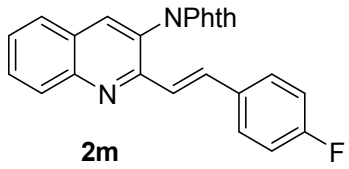
13C NMR FC-5-46 in CDCl3



2m

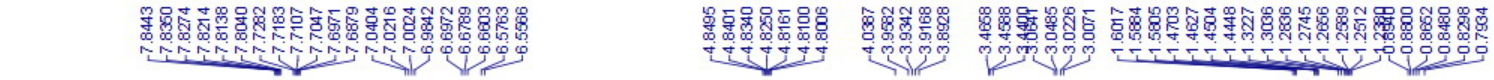
^{13}C NMR (100 MHz, $CDCl_3$)

FNMR-2013-FC-5-46 in CDCl3

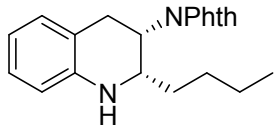


2m

^{19}F NMR (376 MHz, $CDCl_3$)

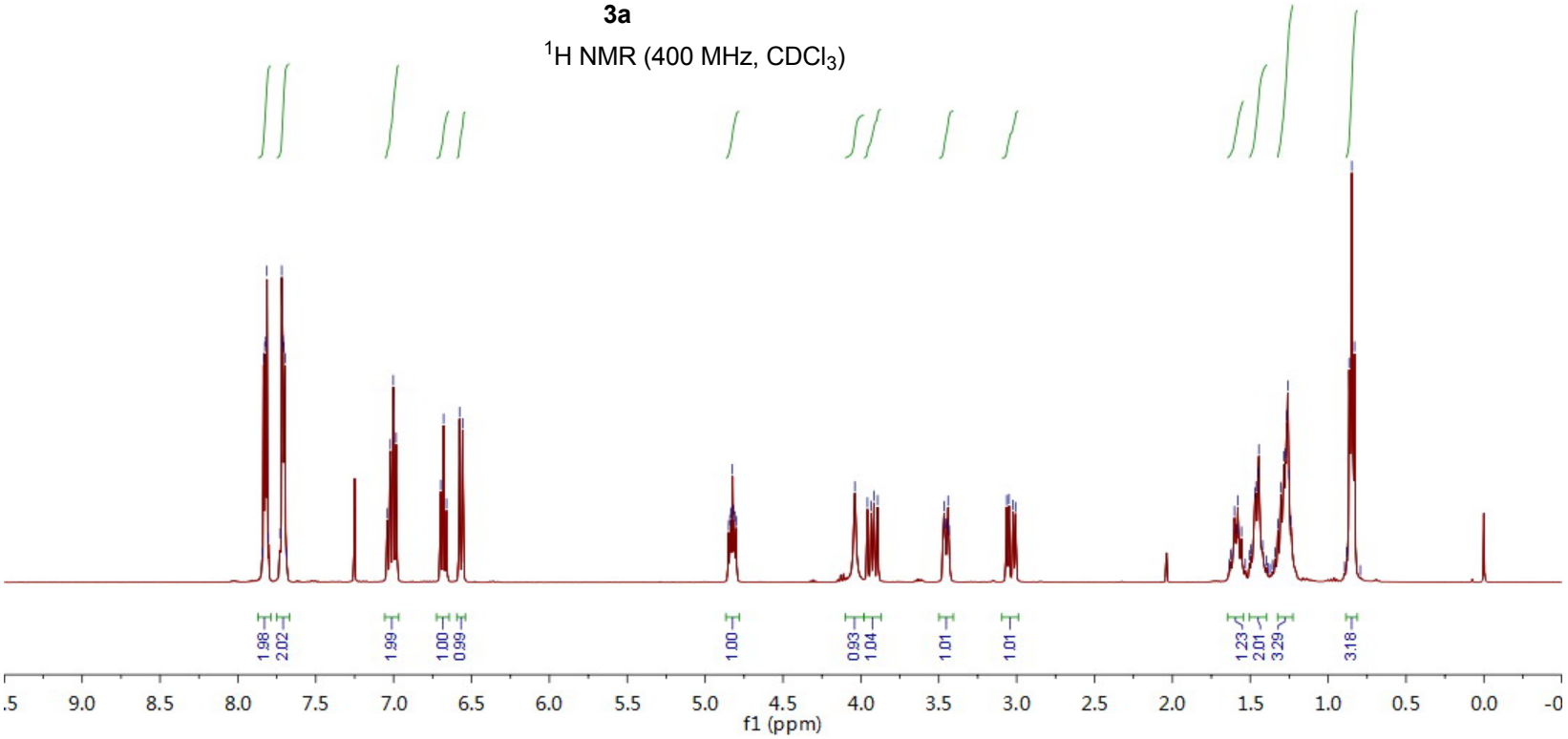


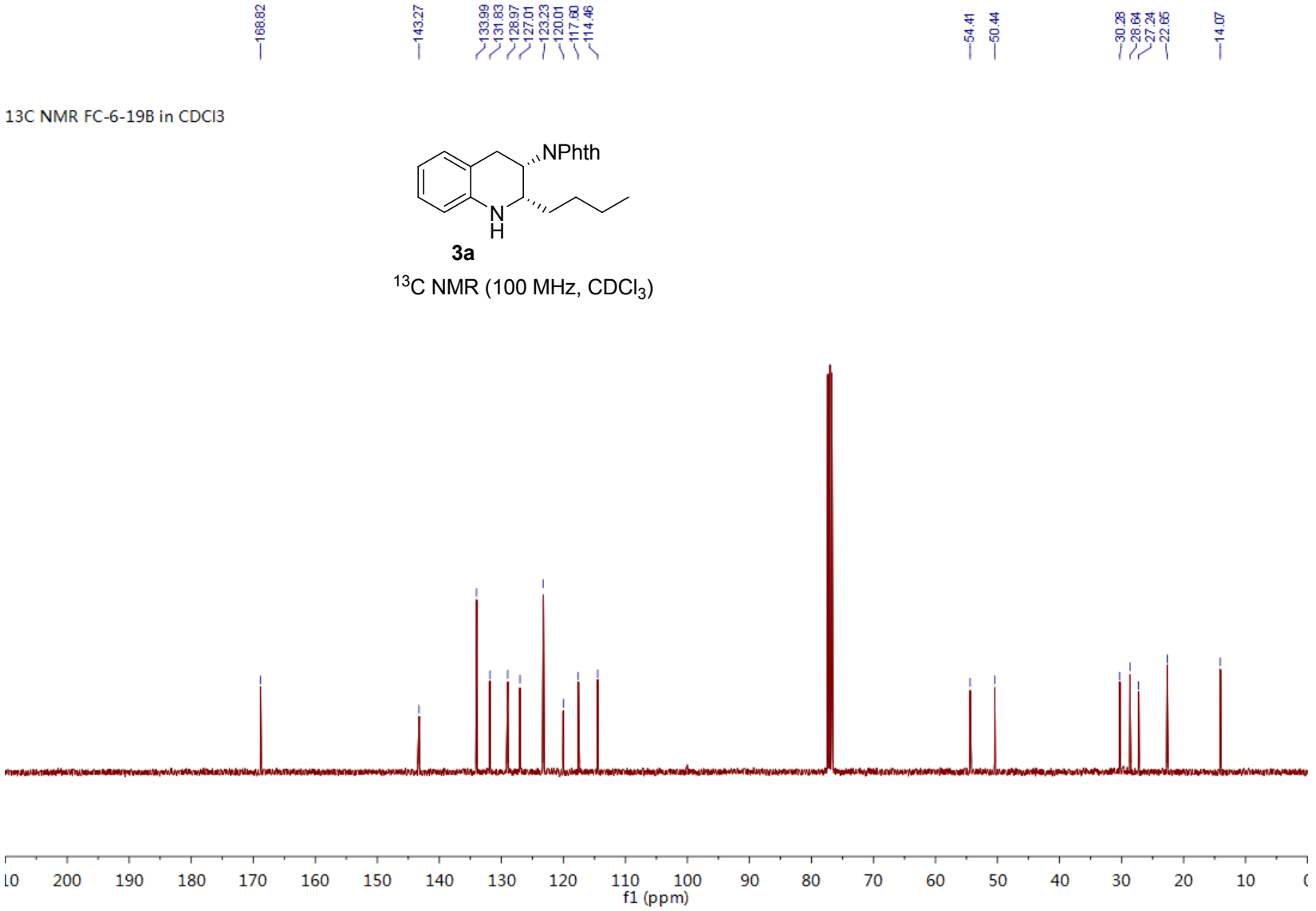
1H NMR FC-6-19B in CDCl3
G:/新 NMR 2013/956/fid

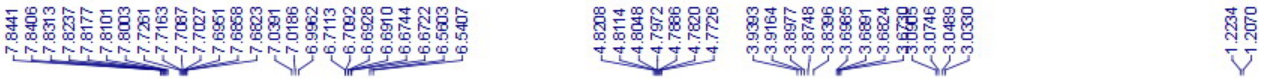


3a

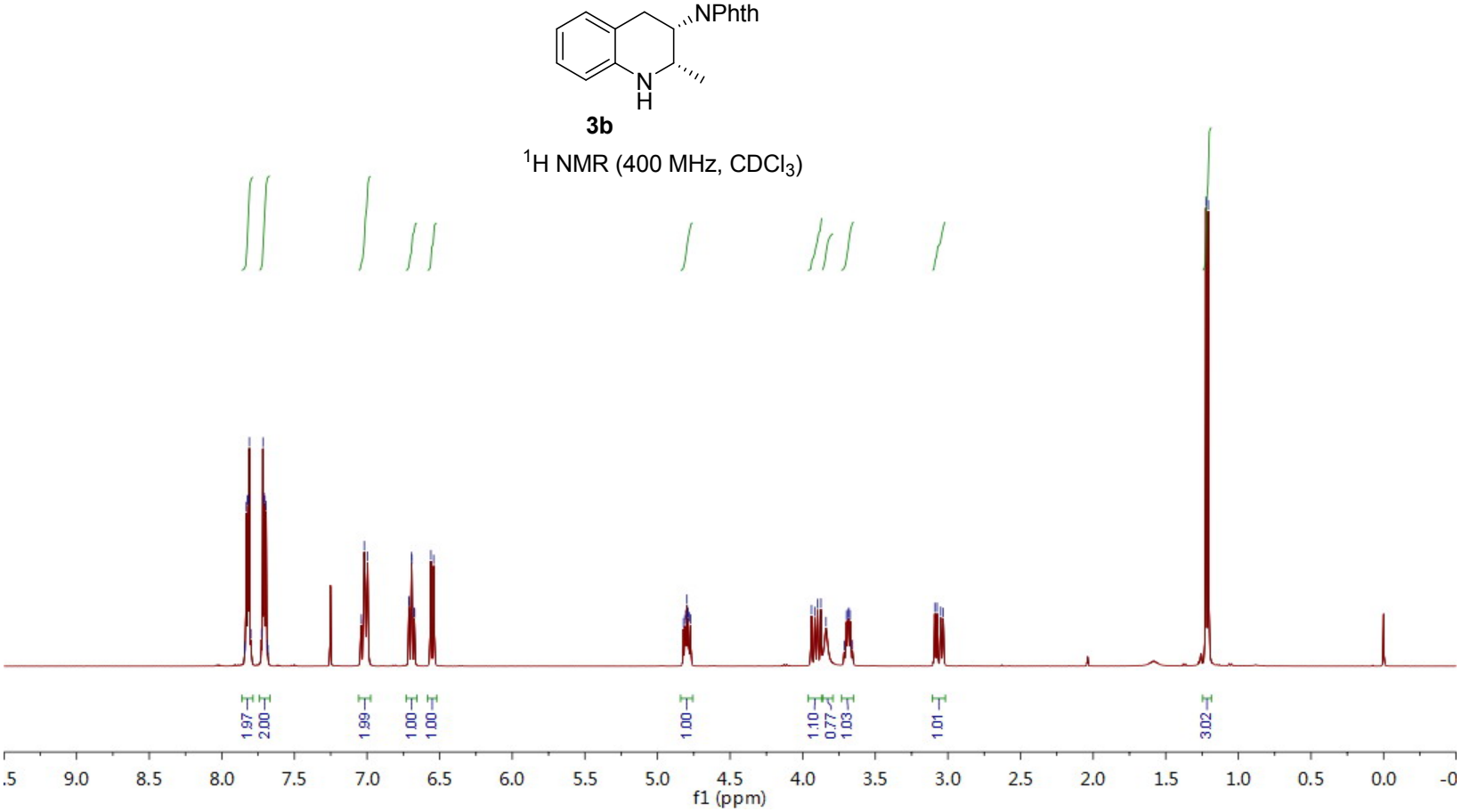
^{1}H NMR (400 MHz, $CDCl_3$)




168.82
143.27
133.99
131.83
128.97
127.01
123.23
120.01
117.60
114.46
54.41
50.44
30.28
28.64
27.24
22.65
14.07
13C NMR FC-6-19B in CDCl3
NPhth
N
H
3a
^{13}C NMR (100 MHz, $CDCl_3$)
f1 (ppm)

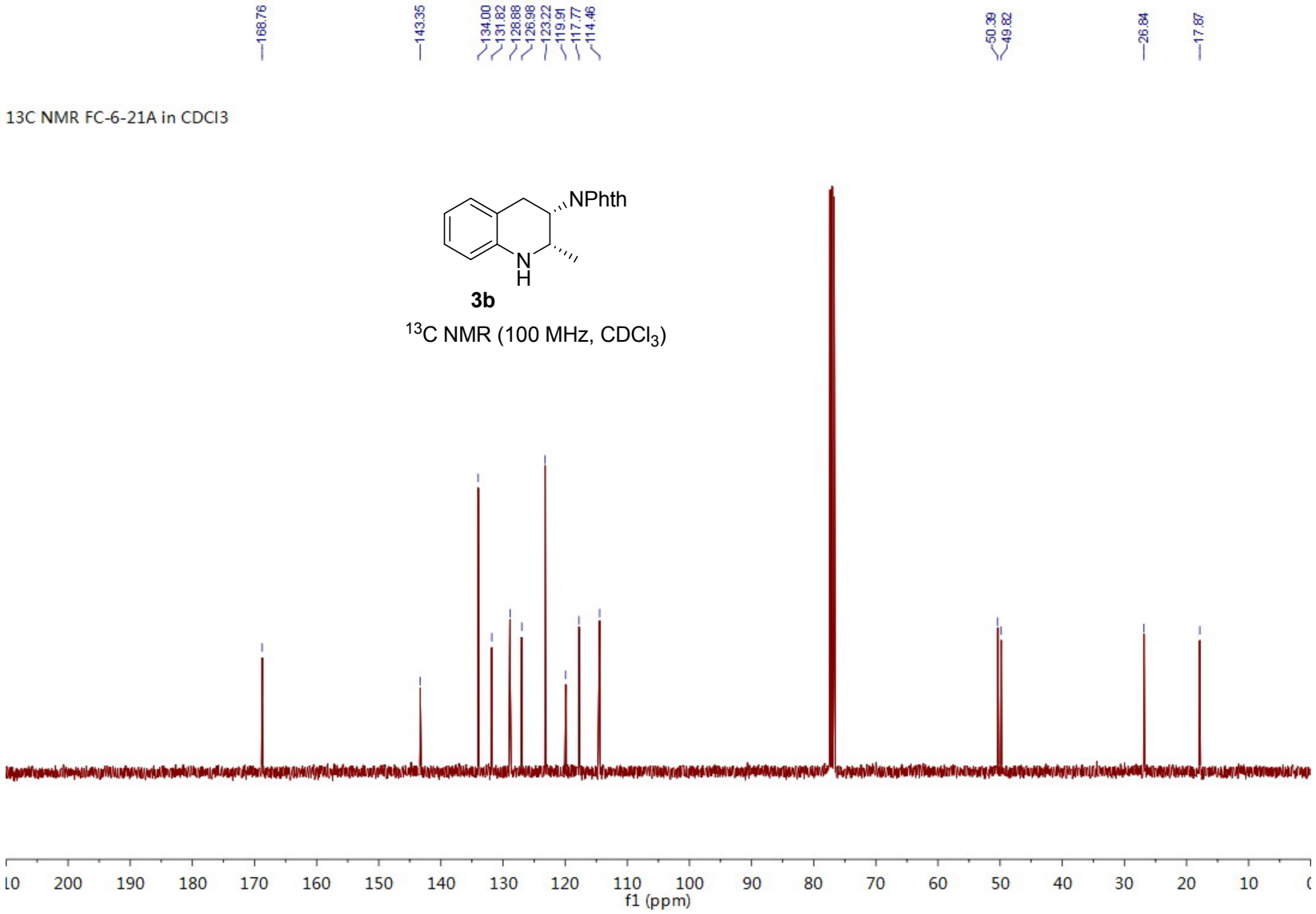


1H NMR FC-6-21A in CDCl3

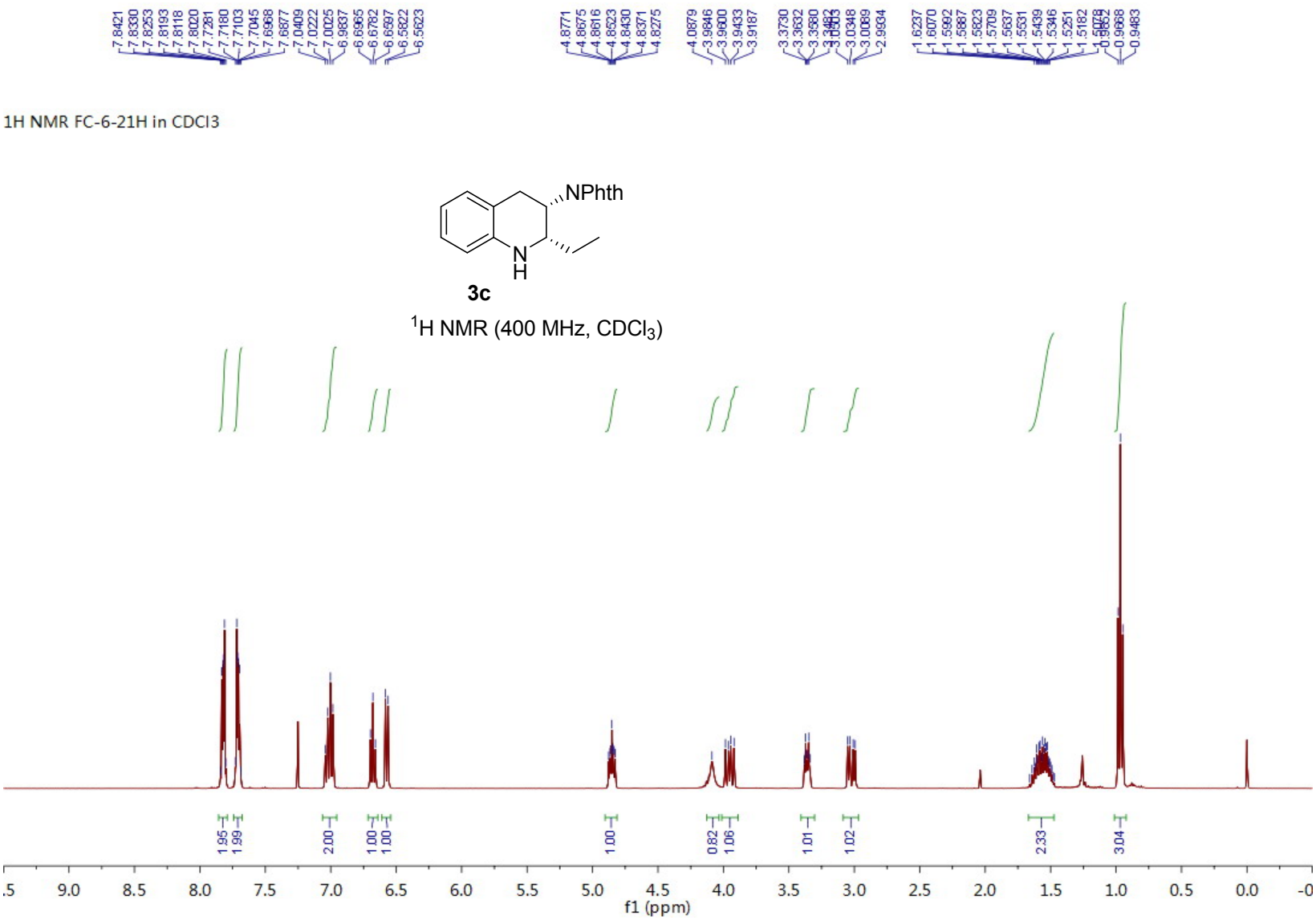


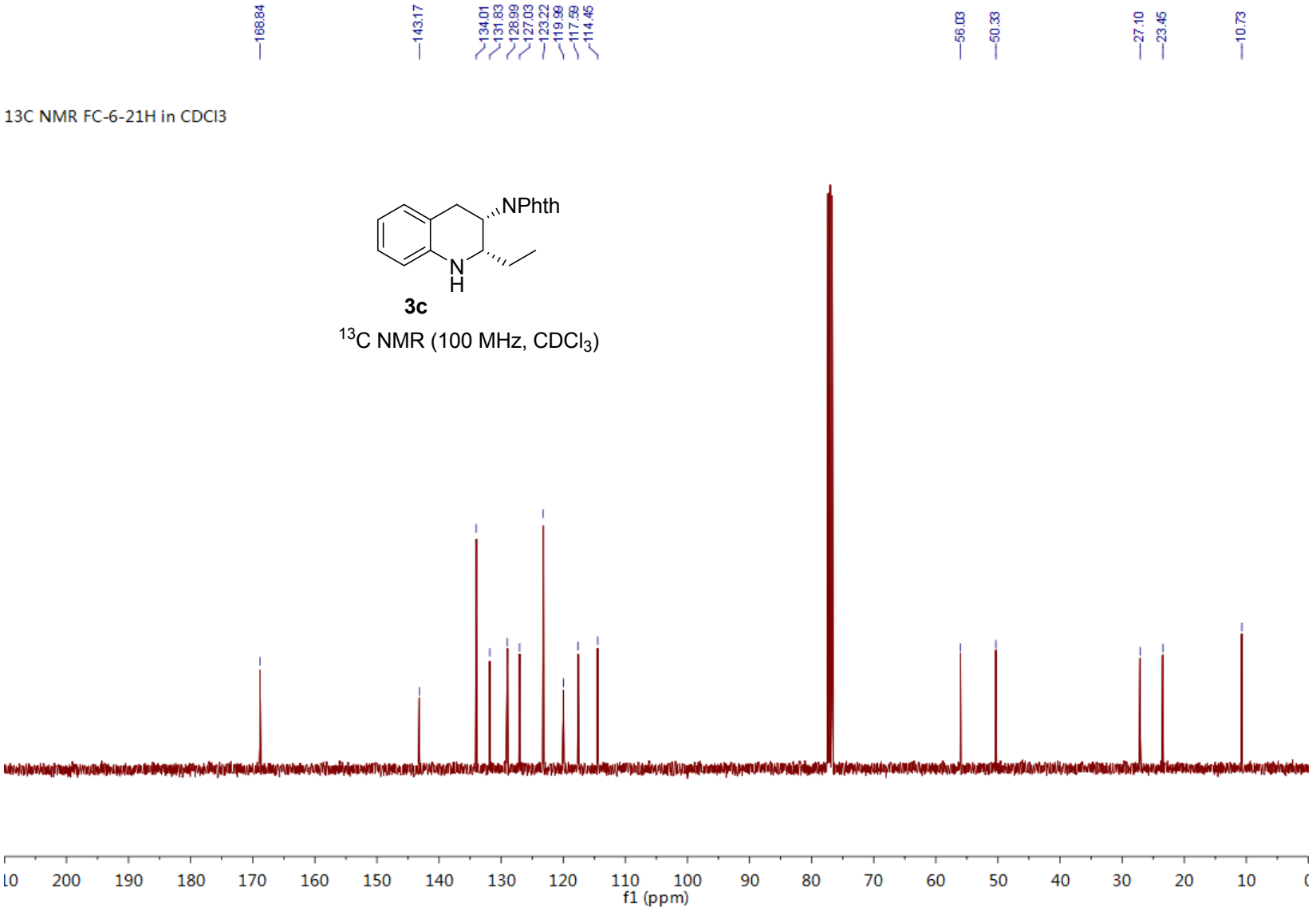
3b

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

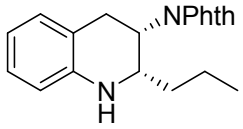

168.76
143.35
134.00
131.82
128.88
126.98
123.22
119.91
117.77
114.46
50.39
49.82
26.84
17.87
13C NMR FC-6-21A in CDCl3
NPhth
N
H
3b
^{13}C NMR (100 MHz, $CDCl_3$)
f1 (ppm)

1H NMR FC-6-21H in CDCl3



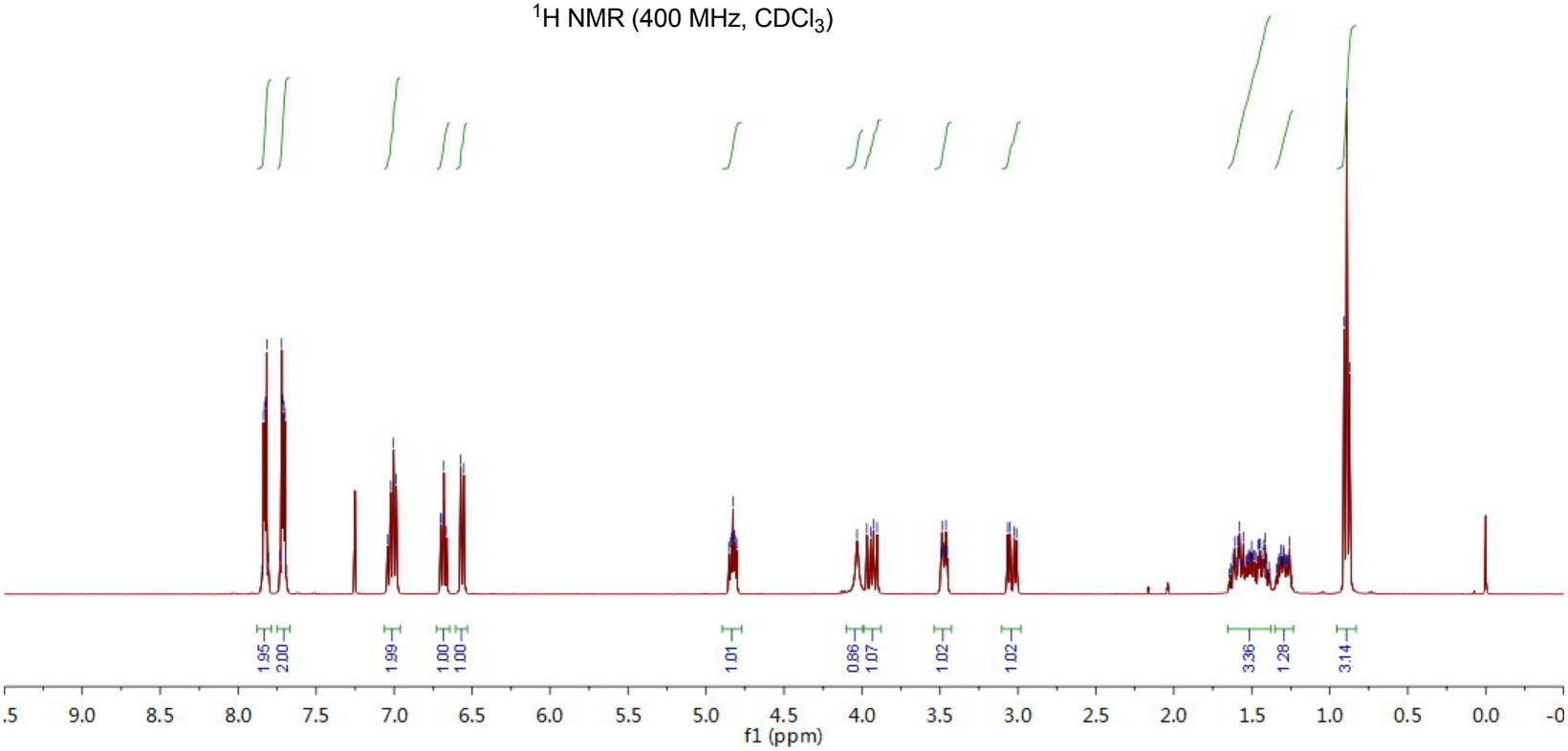

168.84
143.17
134.01
131.83
128.99
127.03
123.22
119.99
117.59
114.45
56.03
50.33
27.10
23.45
10.73
13C NMR FC-6-21H in CDCl3
NPhth
N
H
3c
^{13}C NMR (100 MHz, $CDCl_3$)
f1 (ppm)

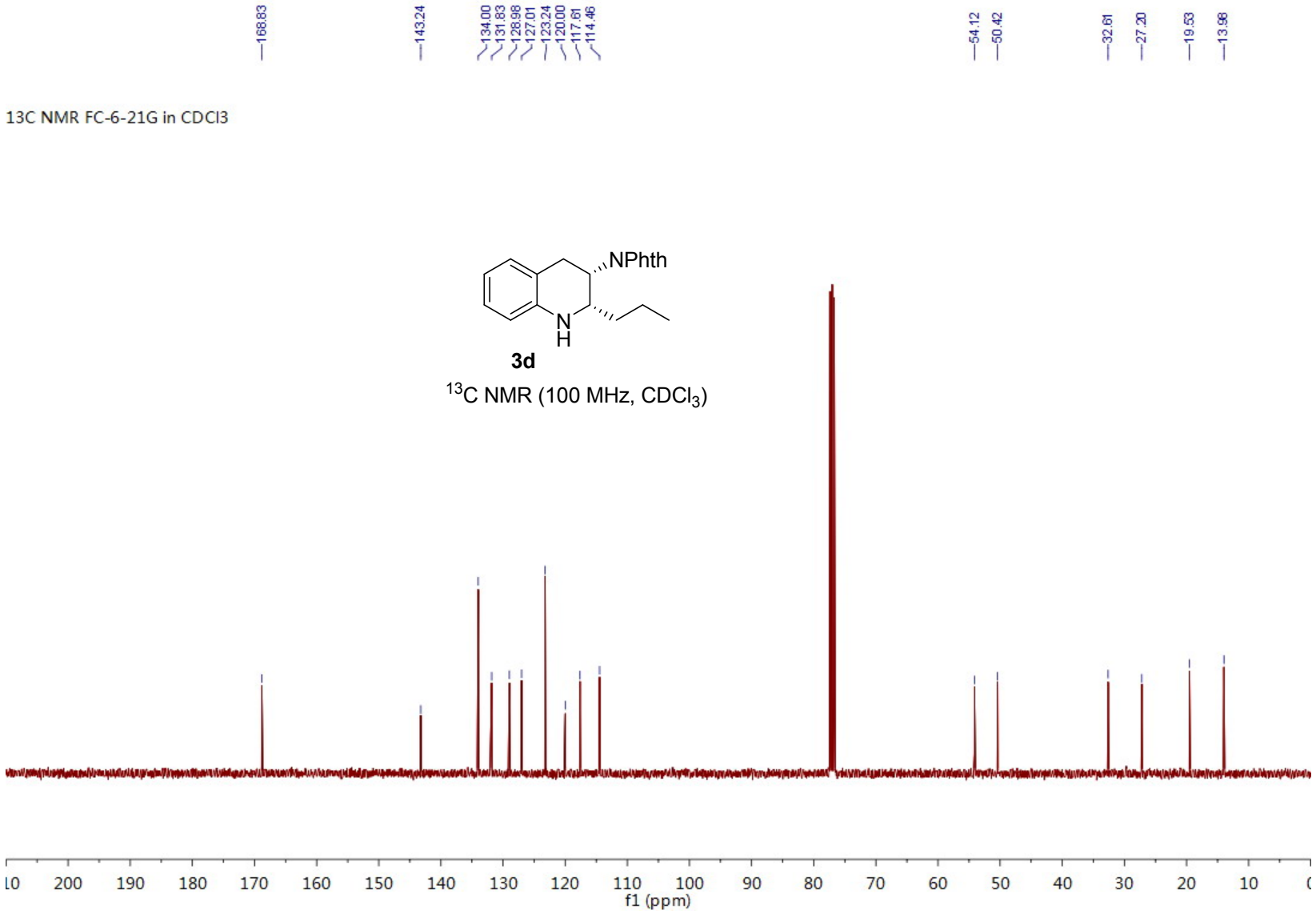
1H NMR FC-6-21G in CDCl3



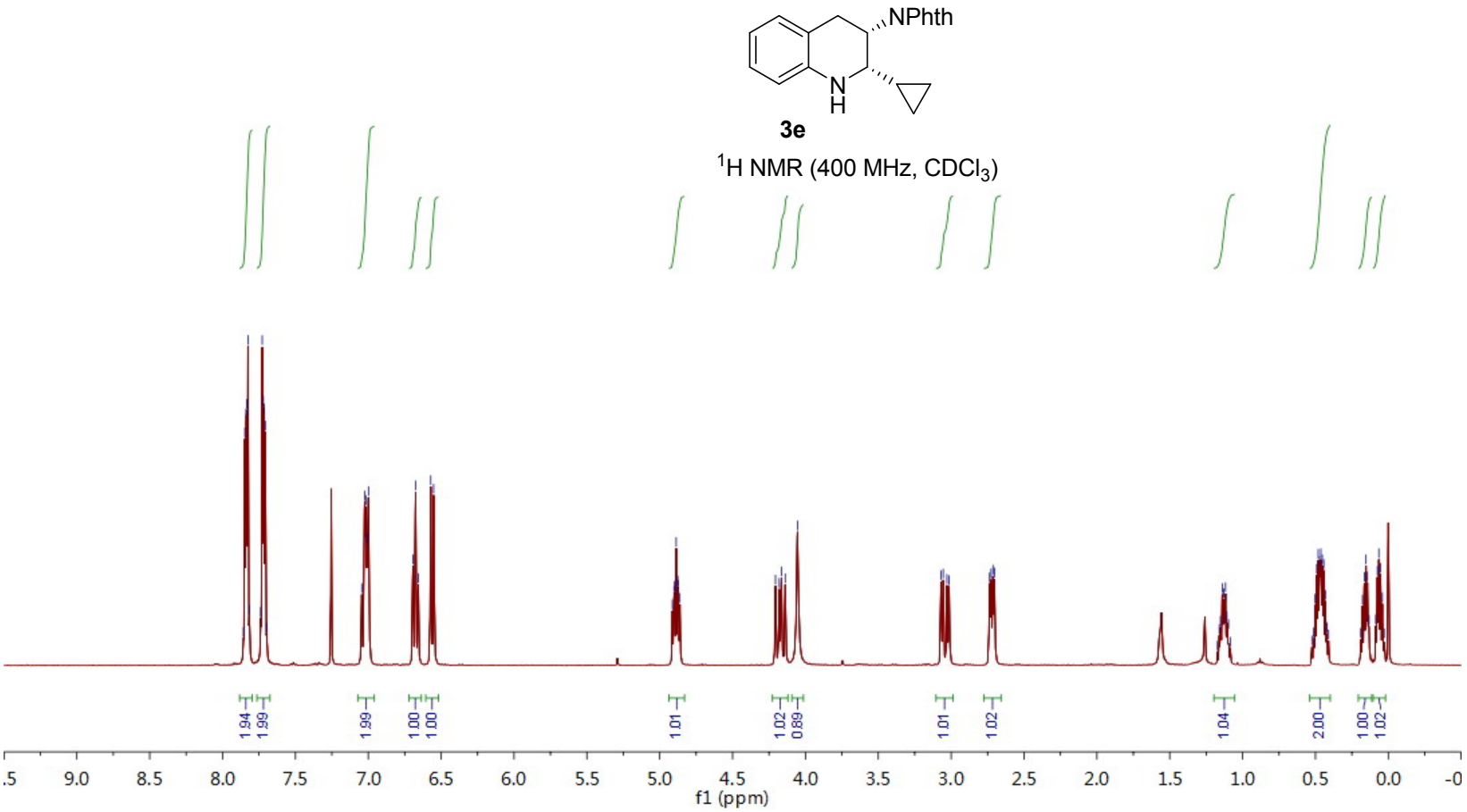
3d

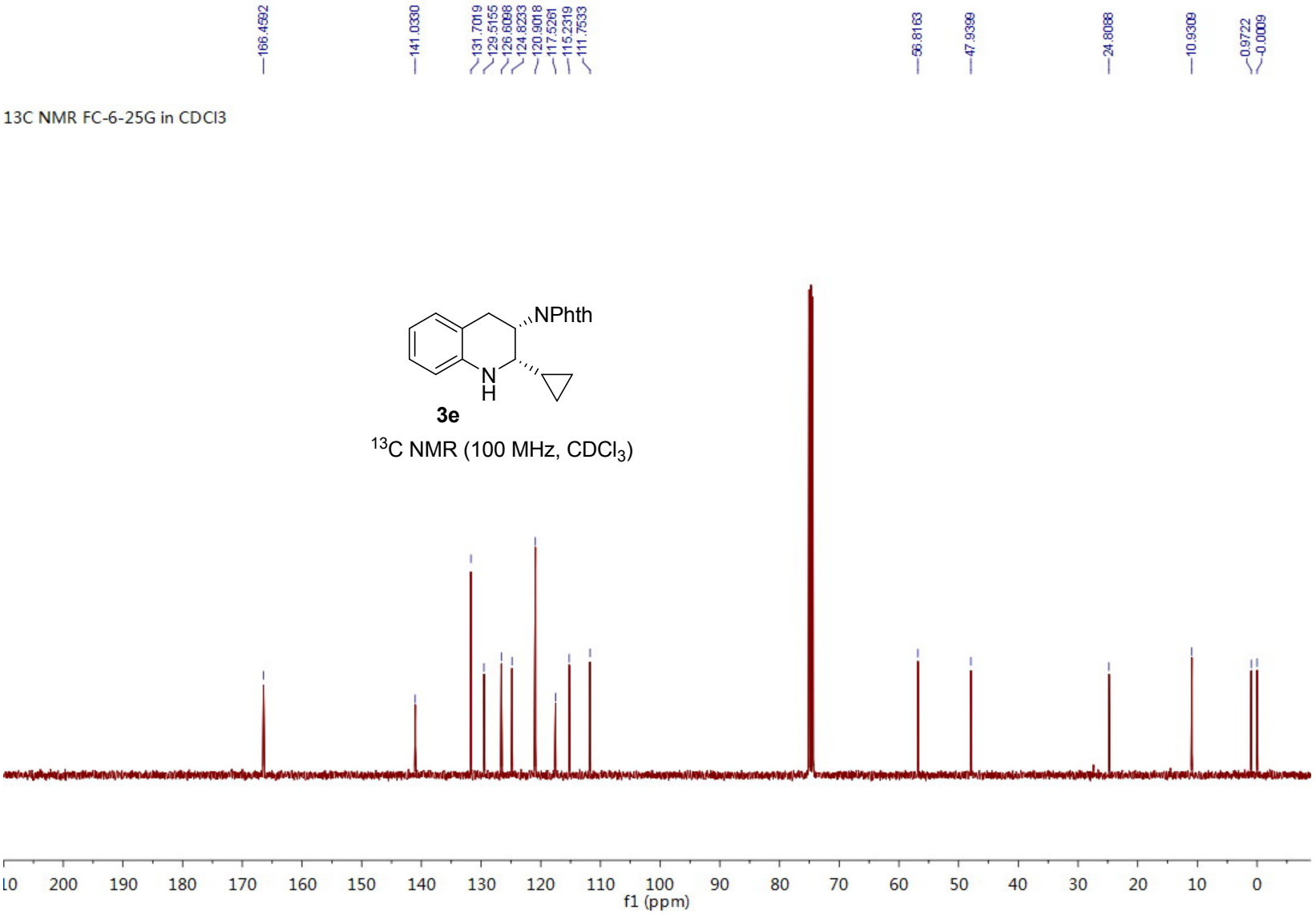
^{1}H NMR (400 MHz, $CDCl_3$)



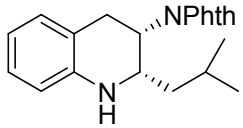

168.83
143.24
134.00
131.83
128.98
127.01
123.24
120.00
117.61
114.46
54.12
50.42
32.61
27.20
19.53
13.98
13C NMR FC-6-21G in CDCl3
NPhth
N
H
3d
^{13}C NMR (100 MHz, $CDCl_3$)
f1 (ppm)

1H NMR FC-6-25G in CDCl3



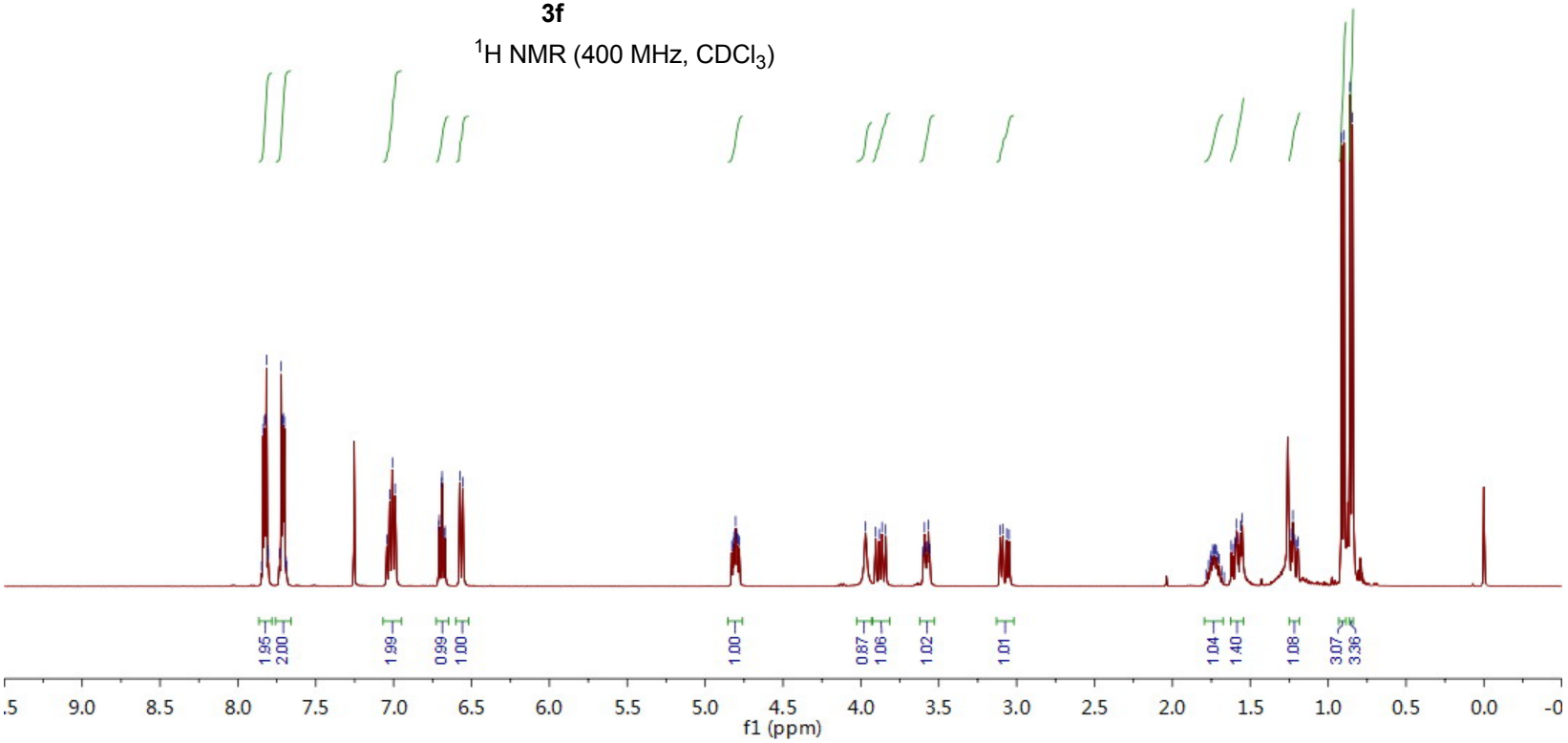

166.4392
141.0330
131.7019
129.5155
126.6098
124.8233
120.9018
117.5261
115.2319
111.7533
56.8163
47.9399
24.8088
10.9309
0.9722
-0.0009
13C NMR FC-6-25G in CDCl3
NPhth
N
H
3e
^{13}C NMR (100 MHz, $CDCl_3$)
f1 (ppm)

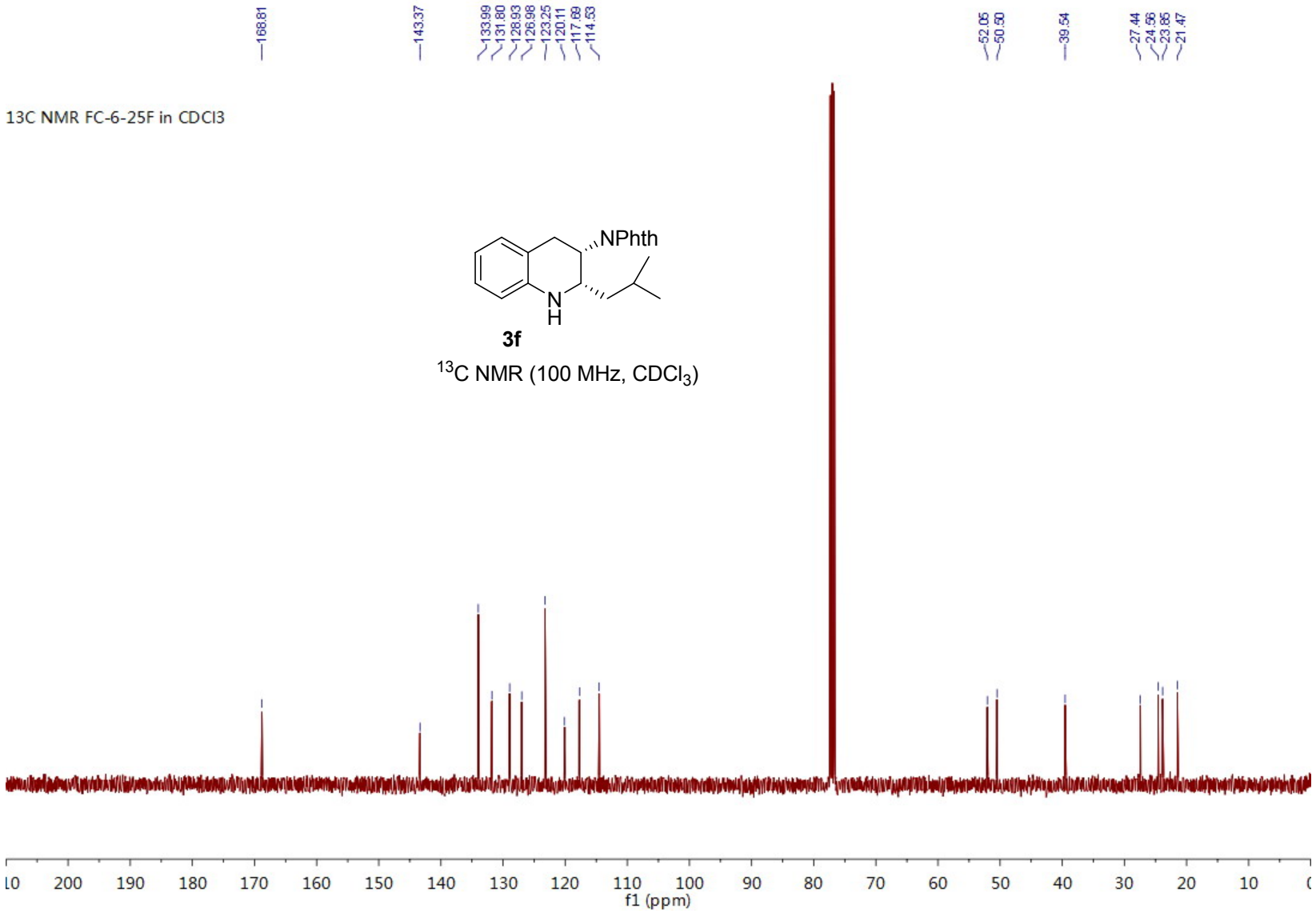
1H NMR FC-6-25F in CDCl3



3f

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

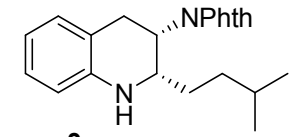




3f

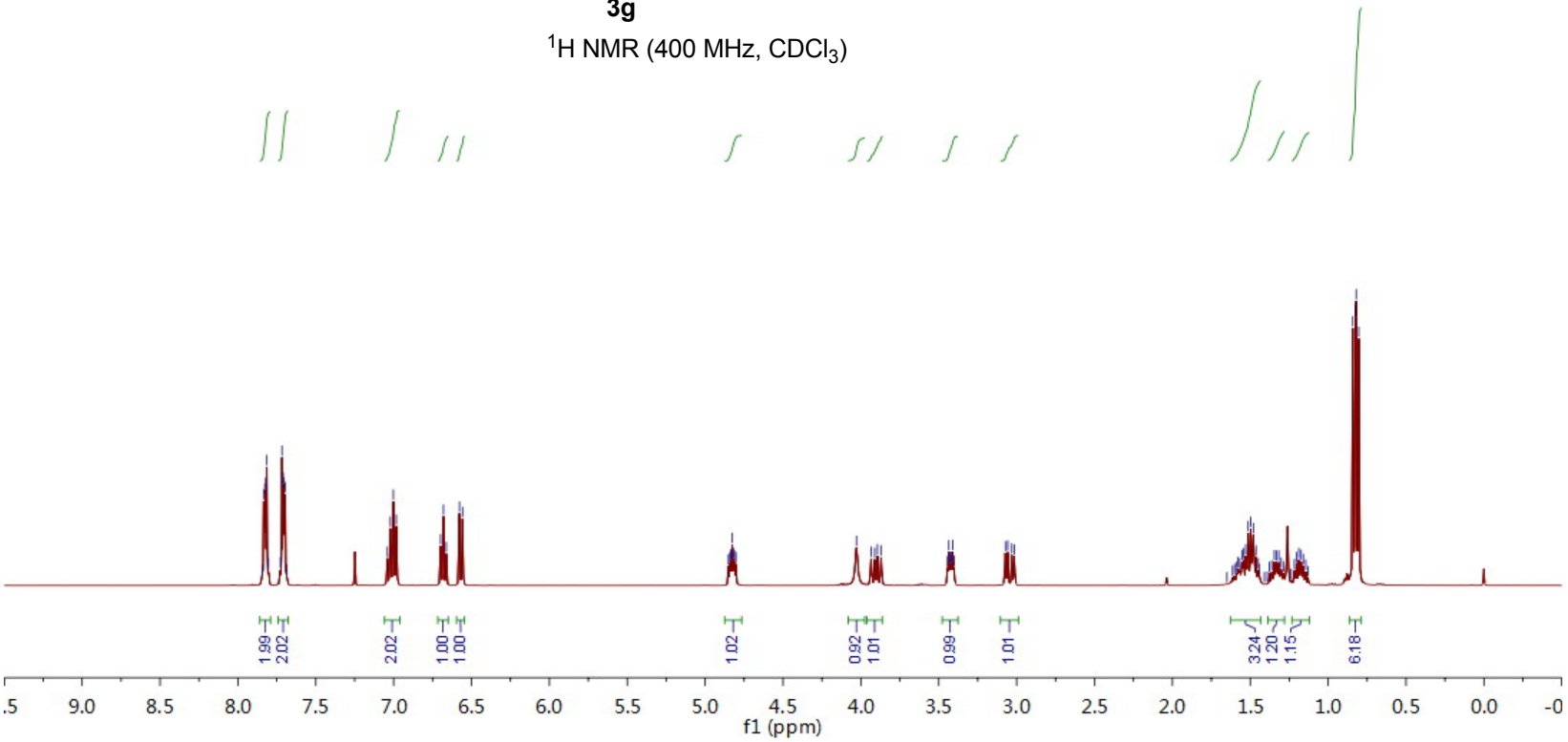
^{13}C NMR (100 MHz, $CDCl_3$)

1H NMR FC-6-25E in CDCl3



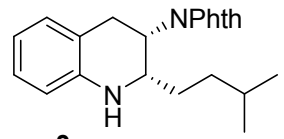
3g

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



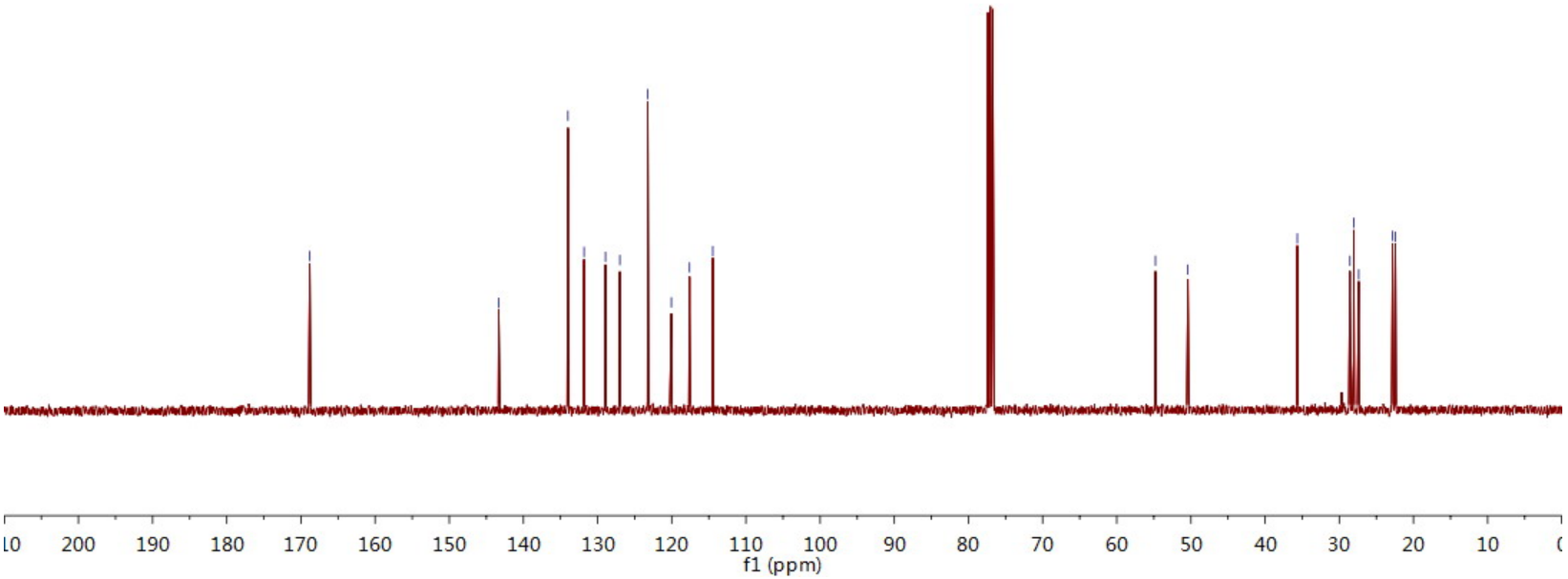
168.81
143.33
134.00
131.82
128.93
127.00
123.23
120.05
117.61
114.47
54.79
50.41
35.66
28.57
28.05
27.38
22.81
22.42

13C NMR FC-6-25E in CDCl3

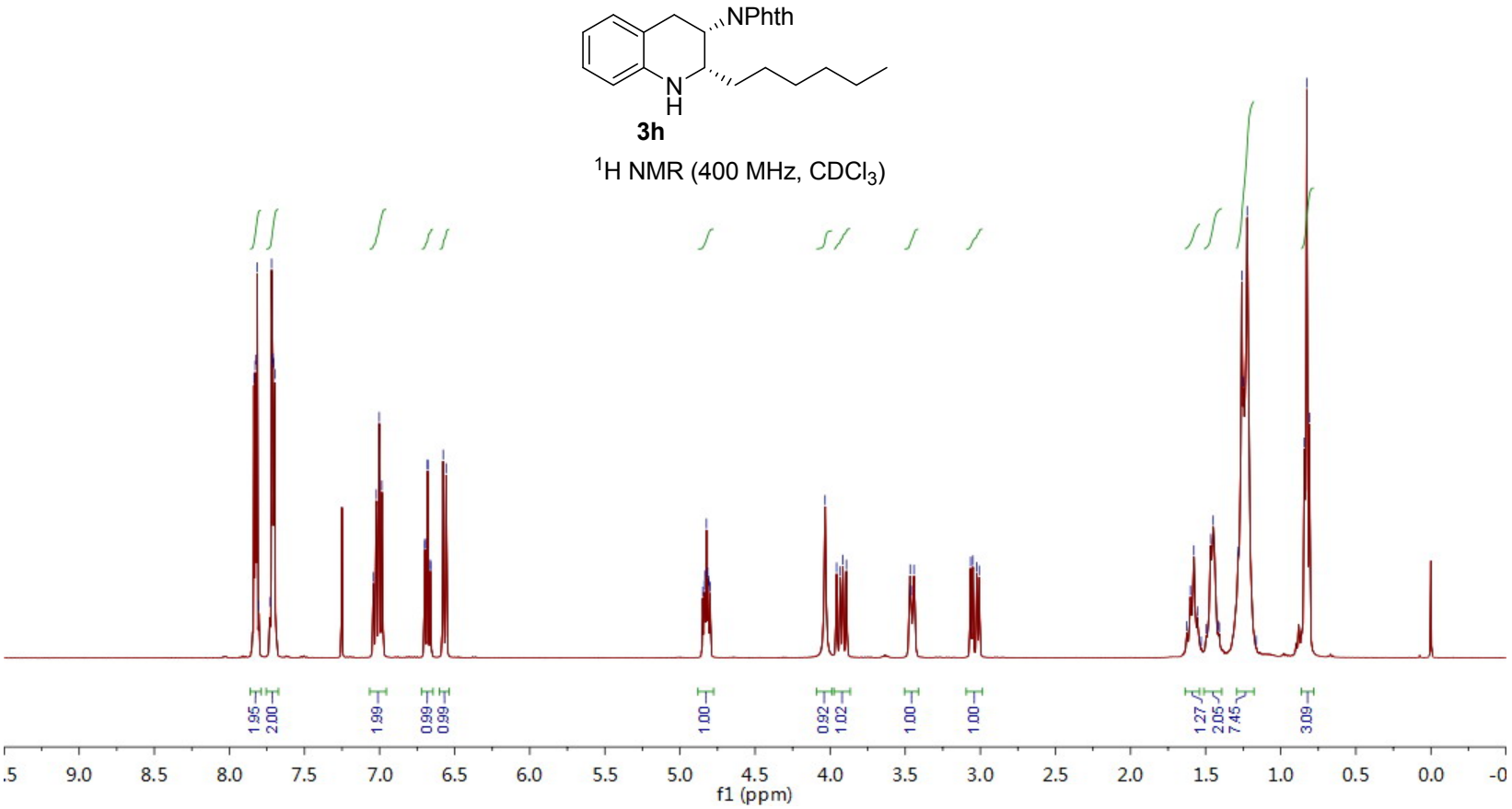


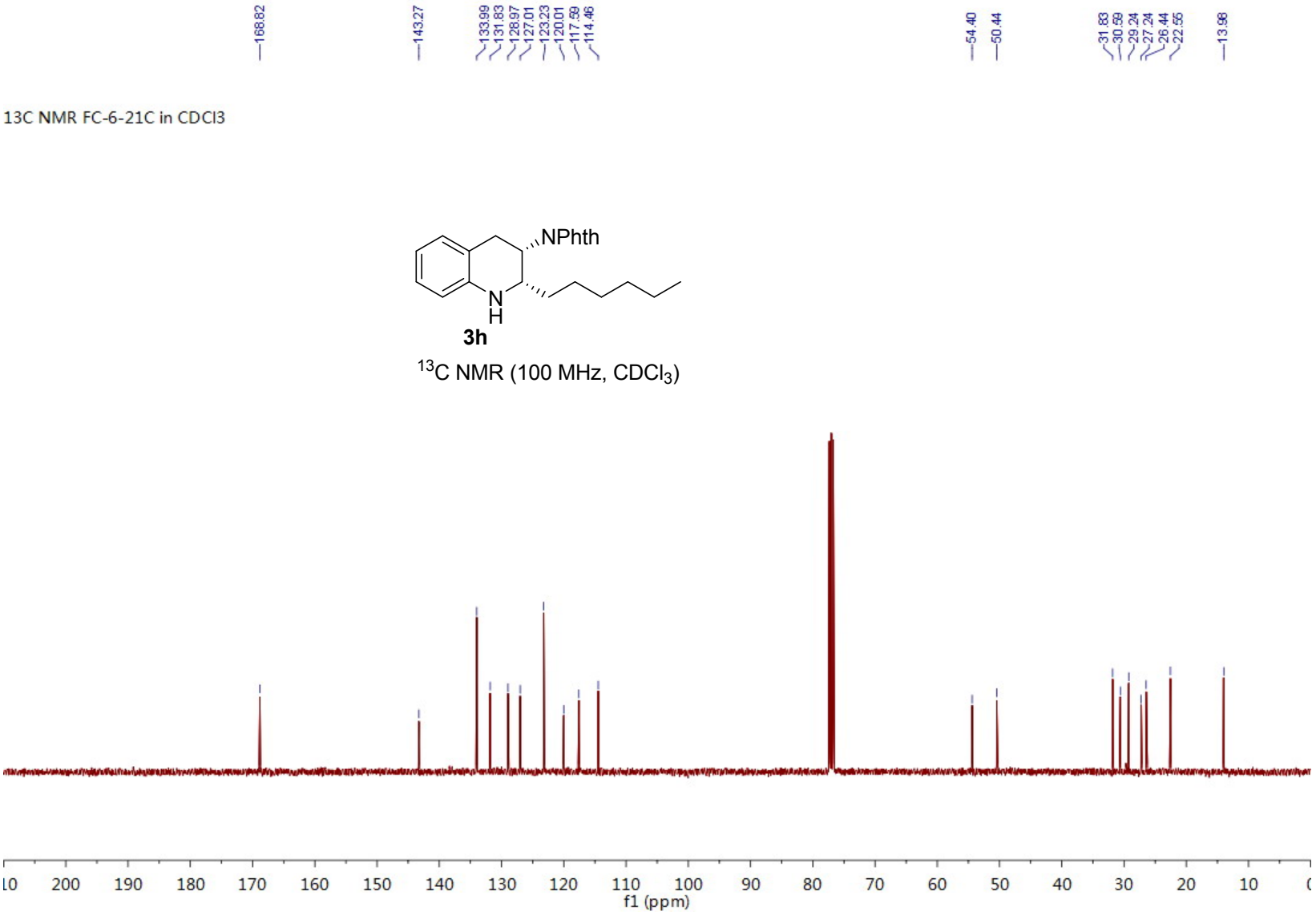
3g

^{13}C NMR (100 MHz, $CDCl_3$)

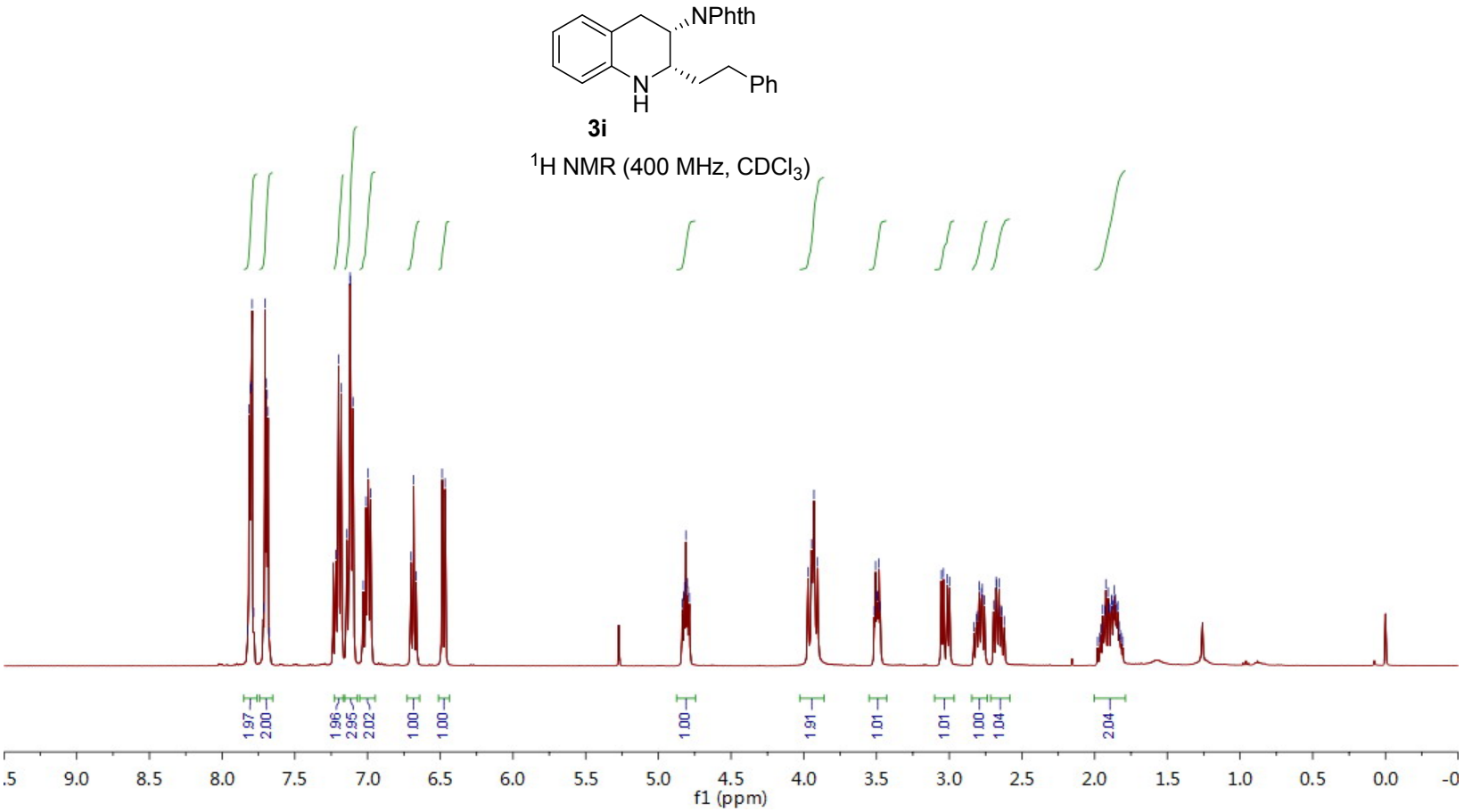


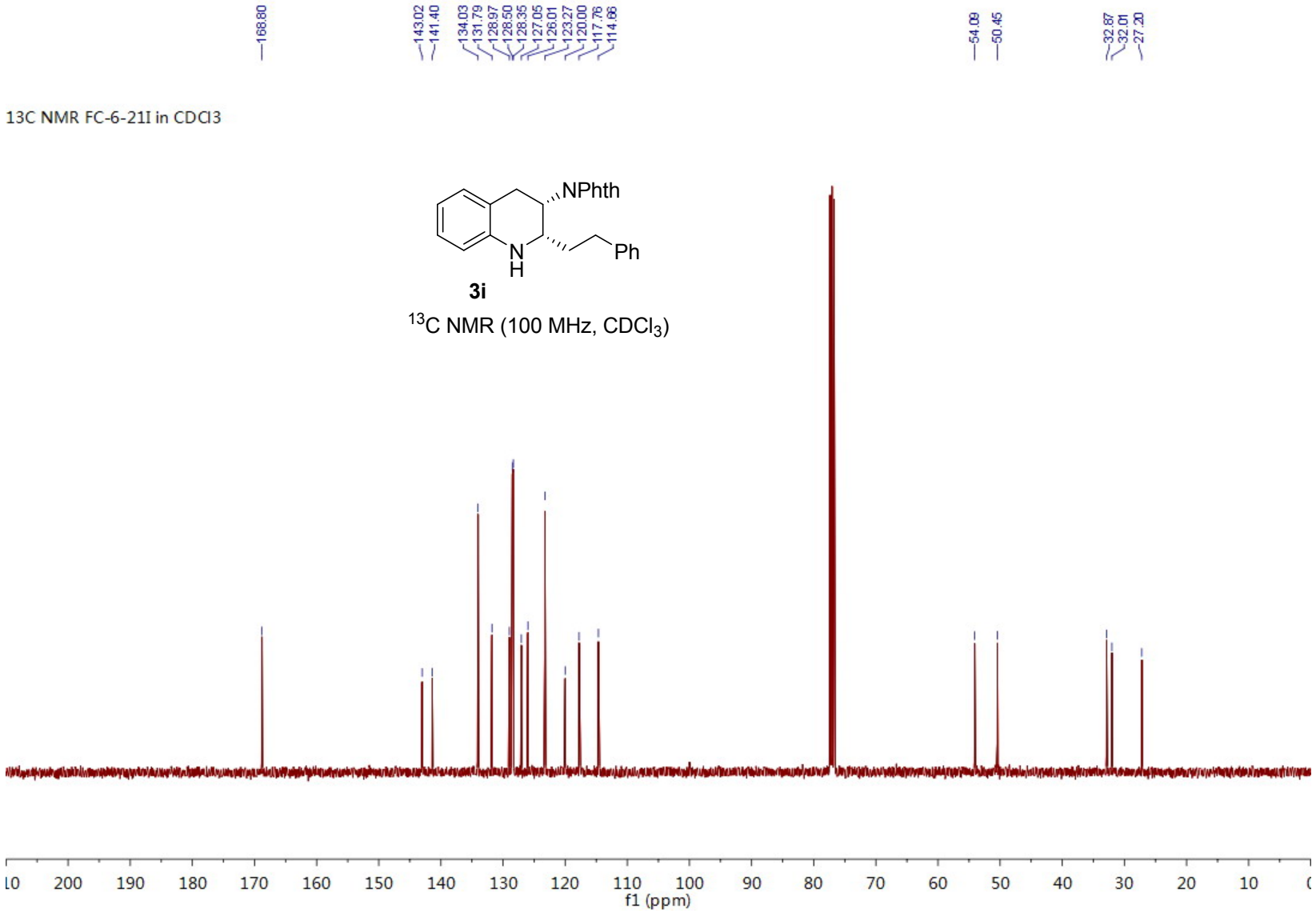
1H NMR FC-6-21C in CDCl3



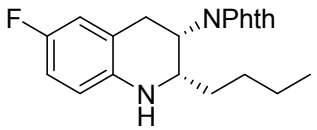

168.82
143.27
133.99
131.83
128.97
127.01
123.23
120.01
117.59
114.46
54.40
50.44
31.83
30.59
29.24
27.24
26.44
22.55
13.98
13C NMR FC-6-21C in CDCl3
NPhth
N
H
3h
^{13}C NMR (100 MHz, $CDCl_3$)
f1 (ppm)

1H NMR FC-6-21I in CDCl3



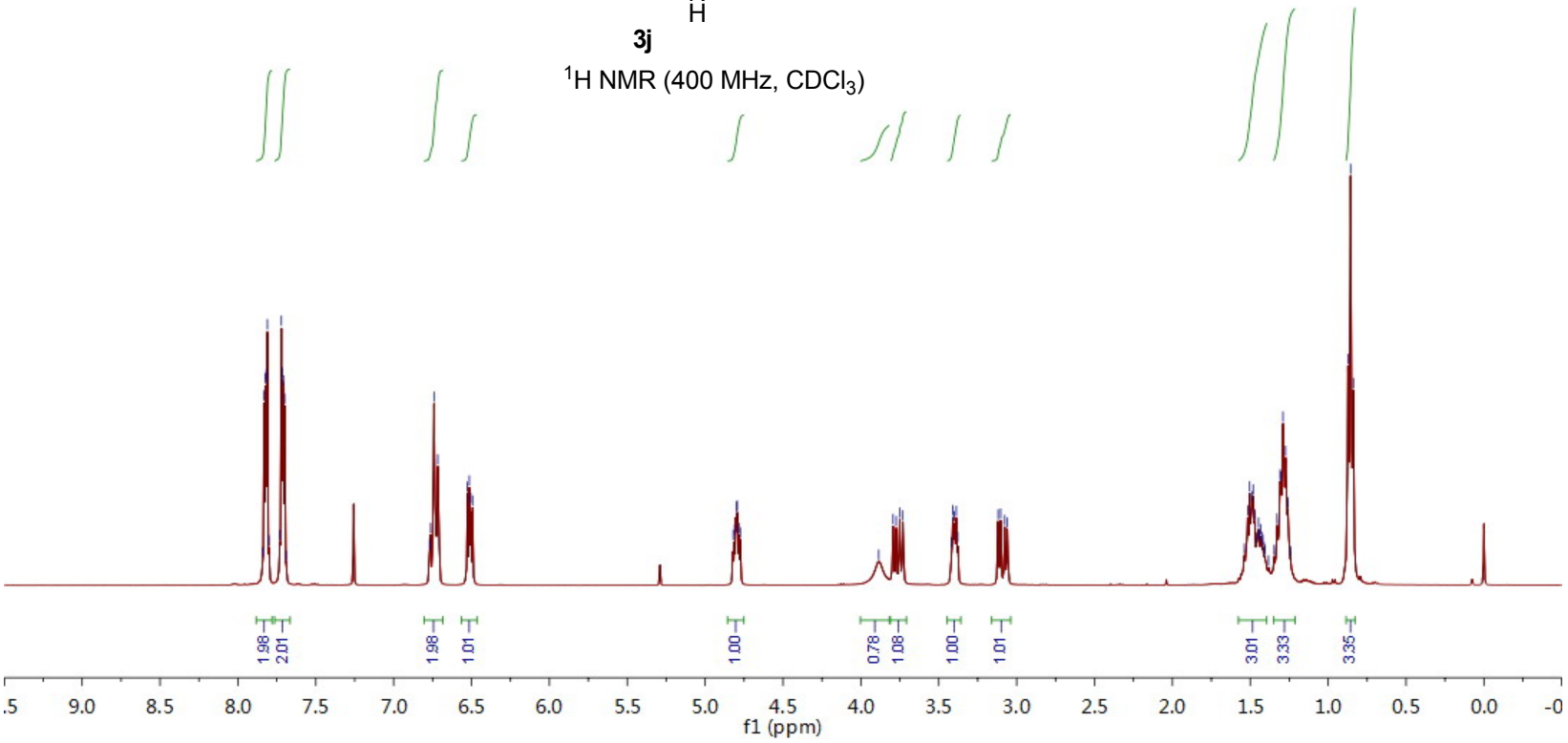

168.80
143.02
141.40
134.03
131.79
128.97
128.50
128.35
127.05
126.01
123.27
120.00
117.76
114.66
54.09
50.45
32.87
32.01
27.20
13C NMR FC-6-21I in CDCl3
NPhth
N
H
Ph
3i
^{13}C NMR (100 MHz, $CDCl_3$)
f1 (ppm)

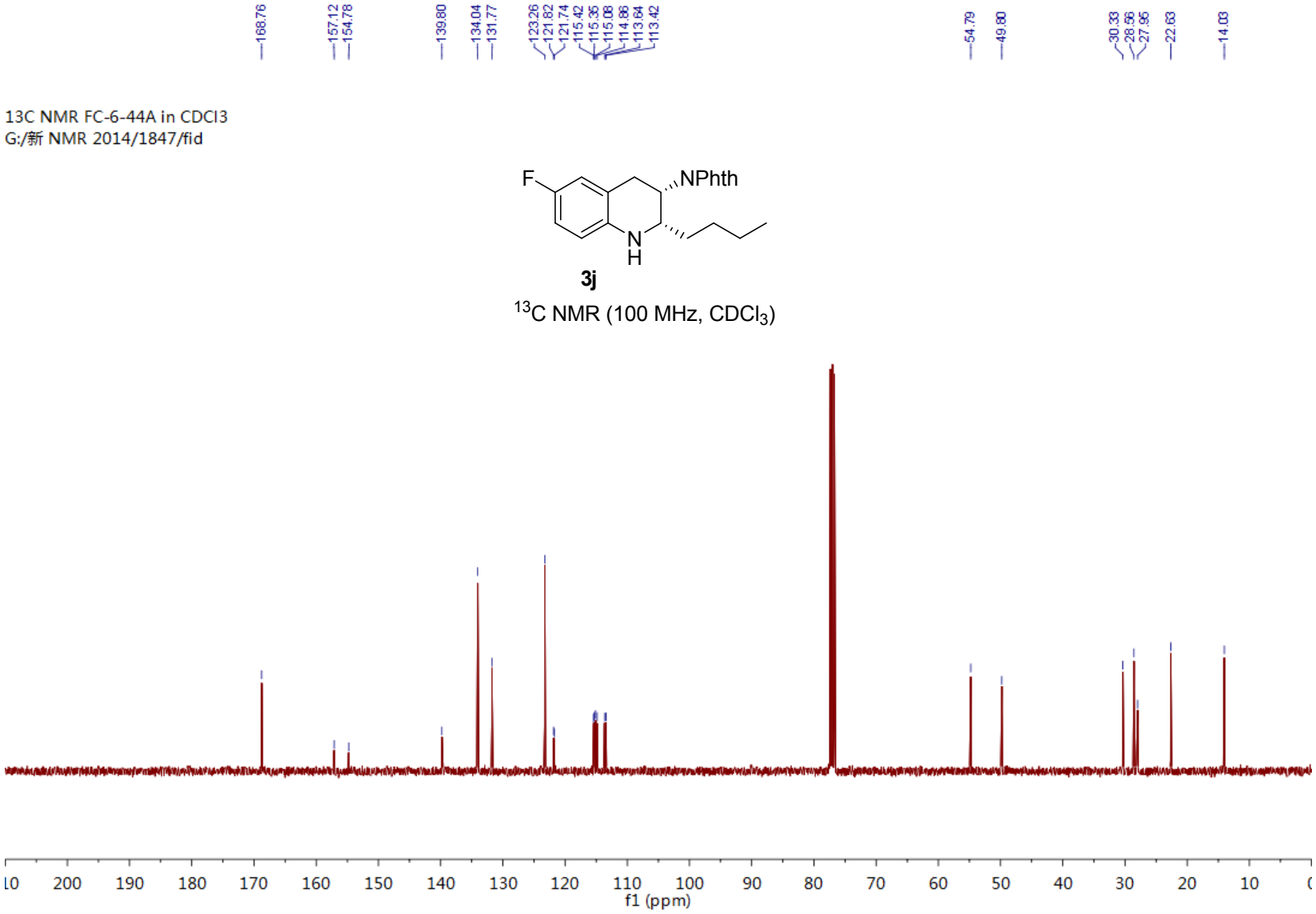
1H NMR FC-6-44A in CDCl3
G:/新 NMR 2014/1845/fid



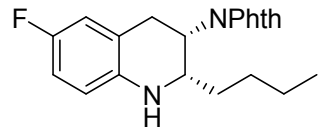
3j

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




168.76
157.12
154.78
139.80
134.04
131.77
123.26
121.82
121.74
115.42
115.35
115.08
114.86
113.64
113.42
54.79
49.80
30.33
28.56
27.95
22.63
14.03
13C NMR FC-6-44A in CDCl3
G:/新 NMR 2014/1847/fid
F
NPhth
N
H
3j
13C NMR (100 MHz, CDCl3)
f1 (ppm)

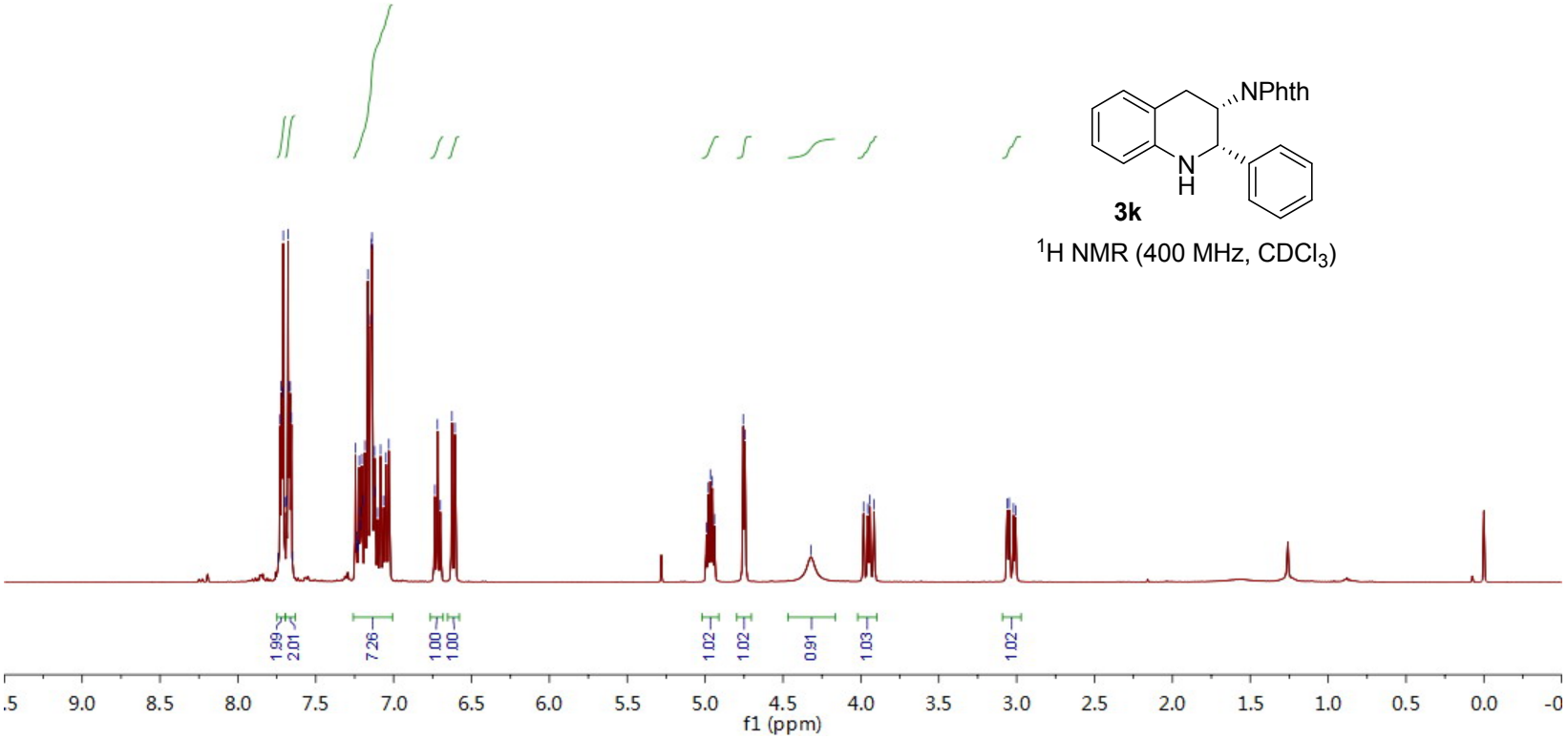
19F NMR FC-6-44A in CDCl3
G:/新 NMR 2014/1846/fid



3j

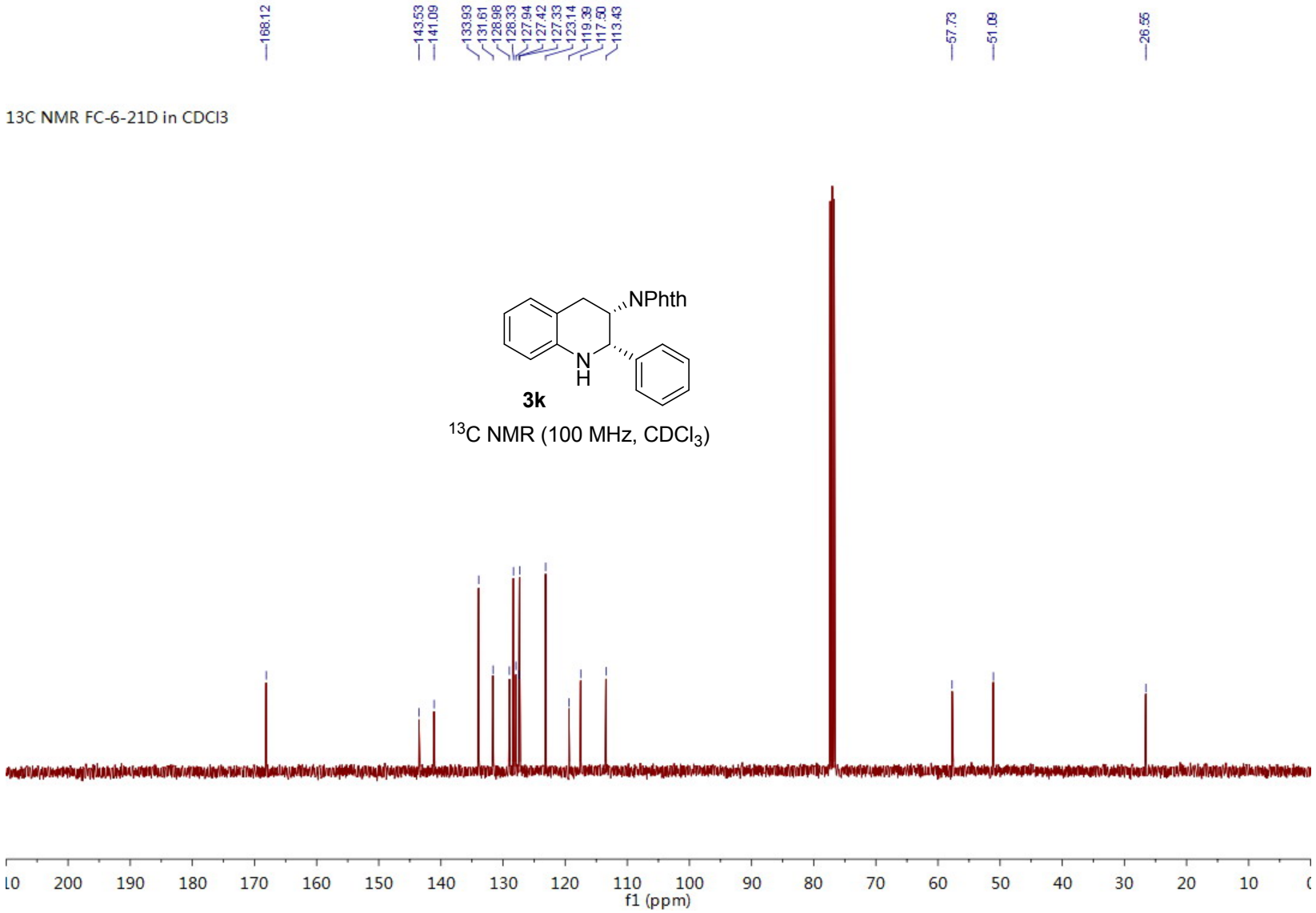
^{19}F NMR (376 MHz, $CDCl_3$)

1H NMR FC-6-21D in CDCl3

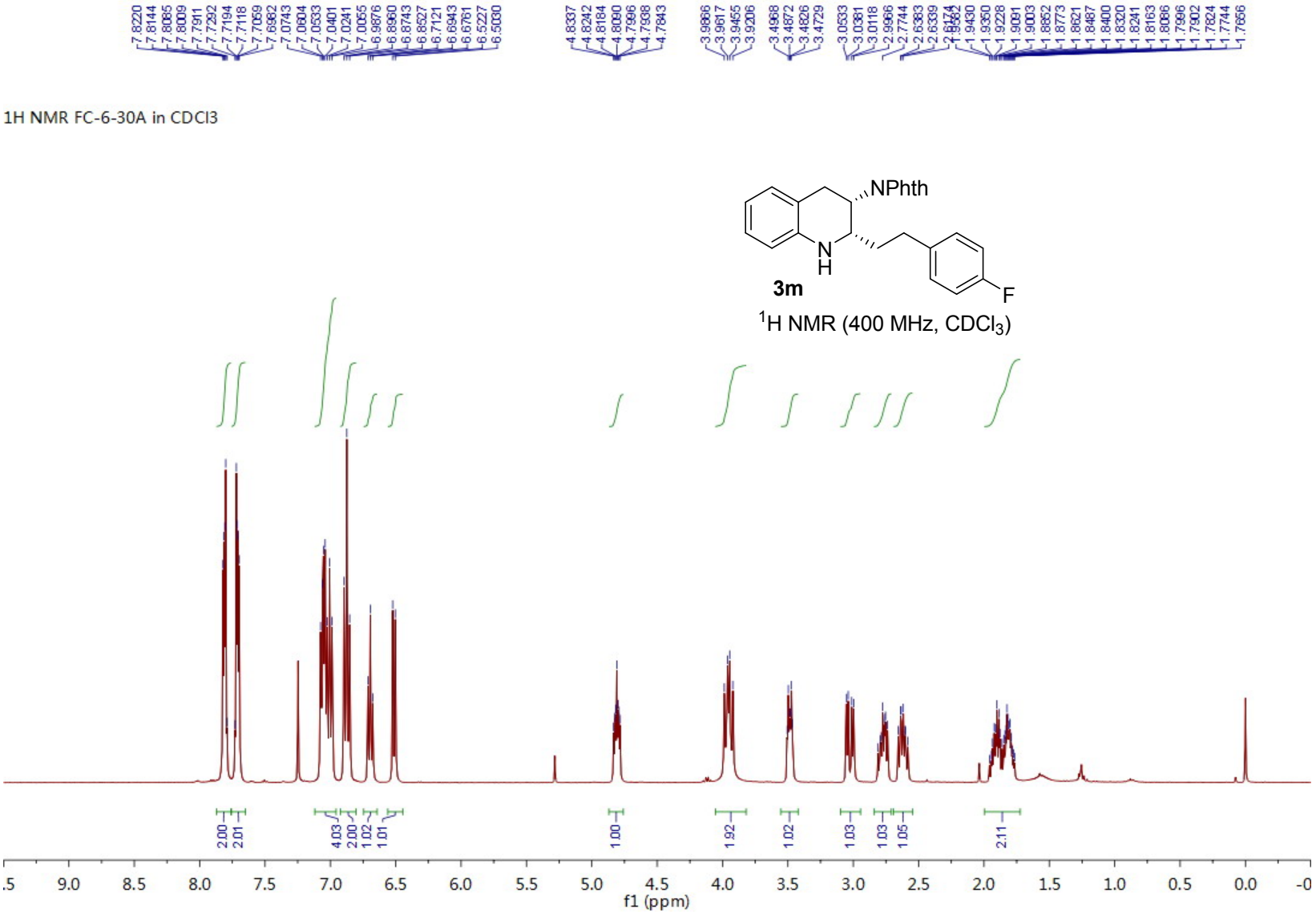


3k

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

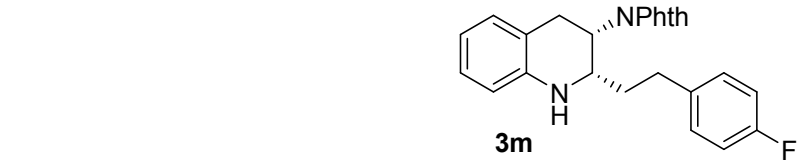

168.12
143.53
141.09
133.93
131.61
128.98
128.33
127.94
127.42
127.33
123.14
119.39
117.50
113.43
57.73
51.09
26.55
13C NMR FC-6-21D in CDCl3
NPhth
N
H
3k
^{13}C NMR (100 MHz, $CDCl_3$)
f1 (ppm)

1H NMR FC-6-30A in CDCl3



168.80
162.53
160.11
142.86
137.03
136.99
134.07
131.75
129.69
129.62
129.03
127.10
123.27
119.98
117.85
115.31
115.10
114.67
53.95
50.43
32.24
32.01
27.09

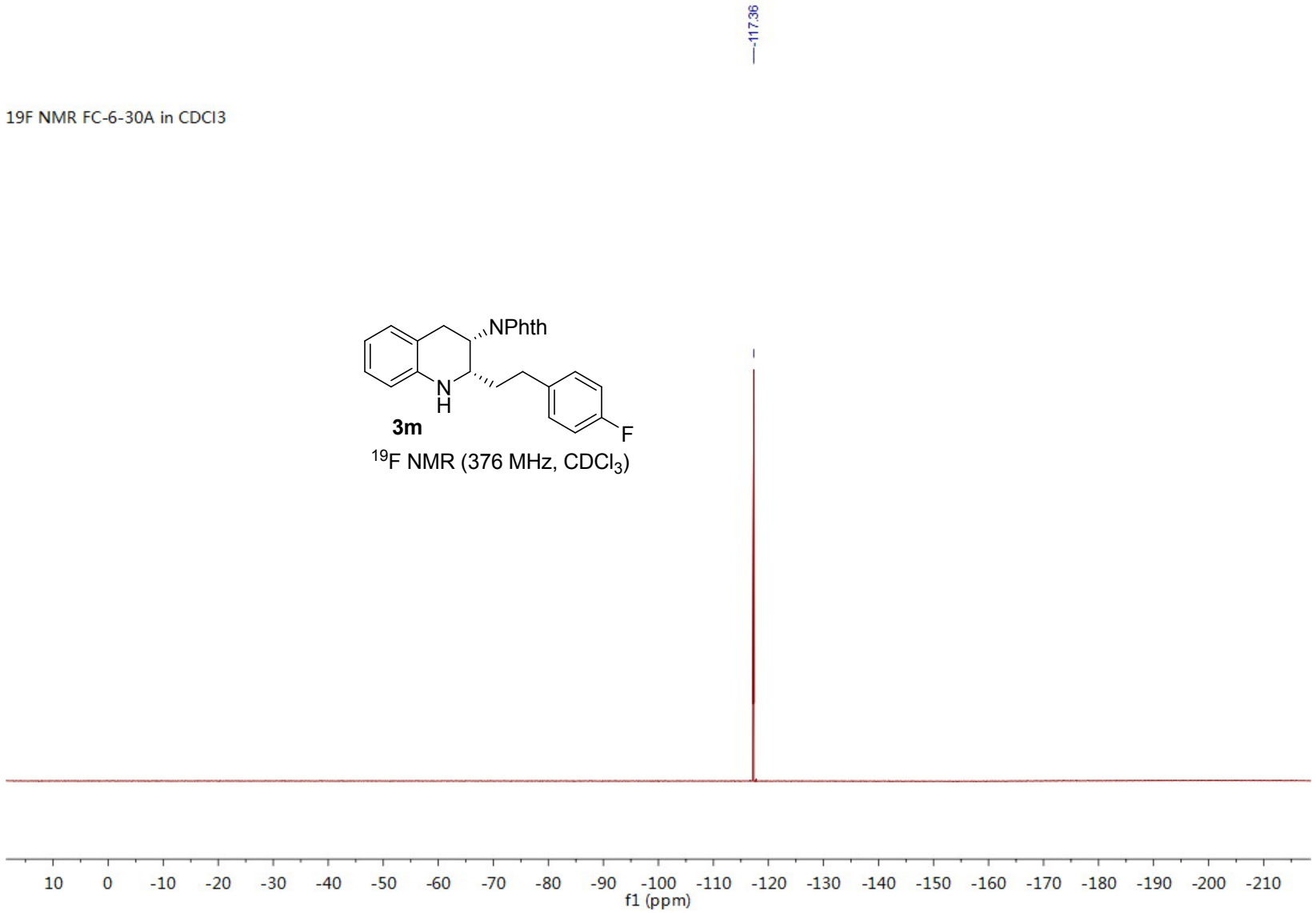
13C NMR FC-6-30A in CDCl3



3m

^{13}C NMR (100 MHz, $CDCl_3$)

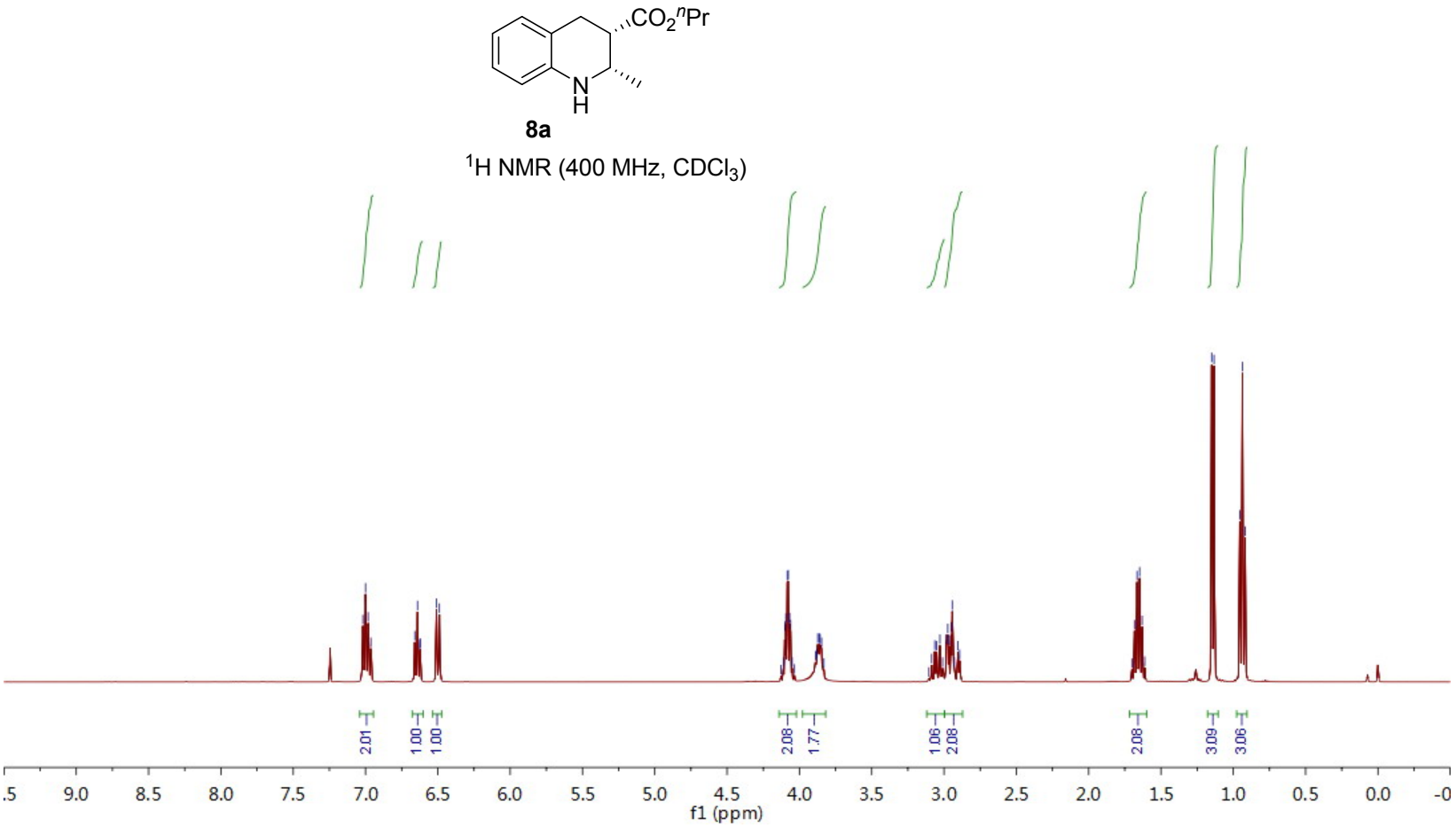
19F NMR FC-6-30A in CDCl3

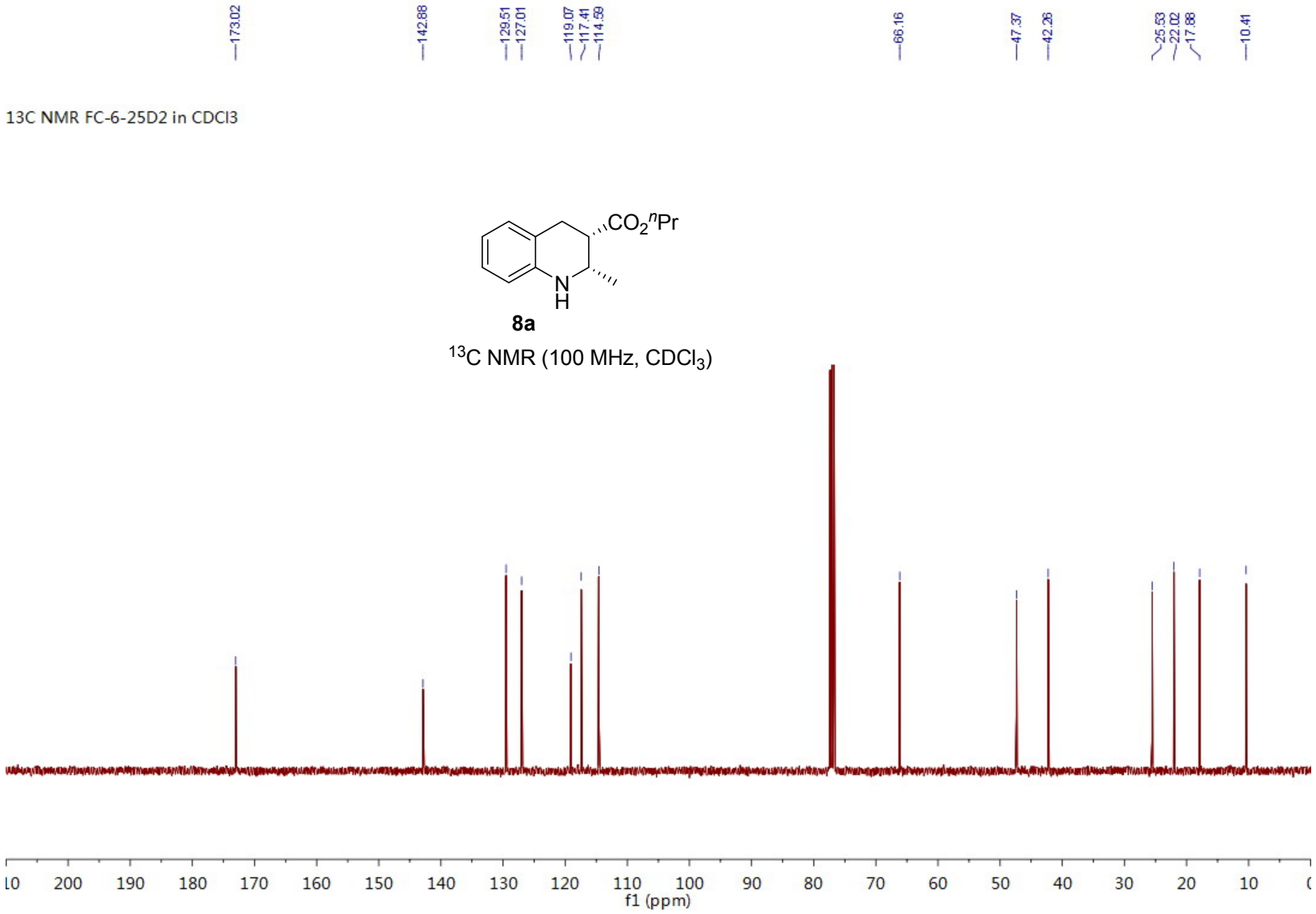


3m

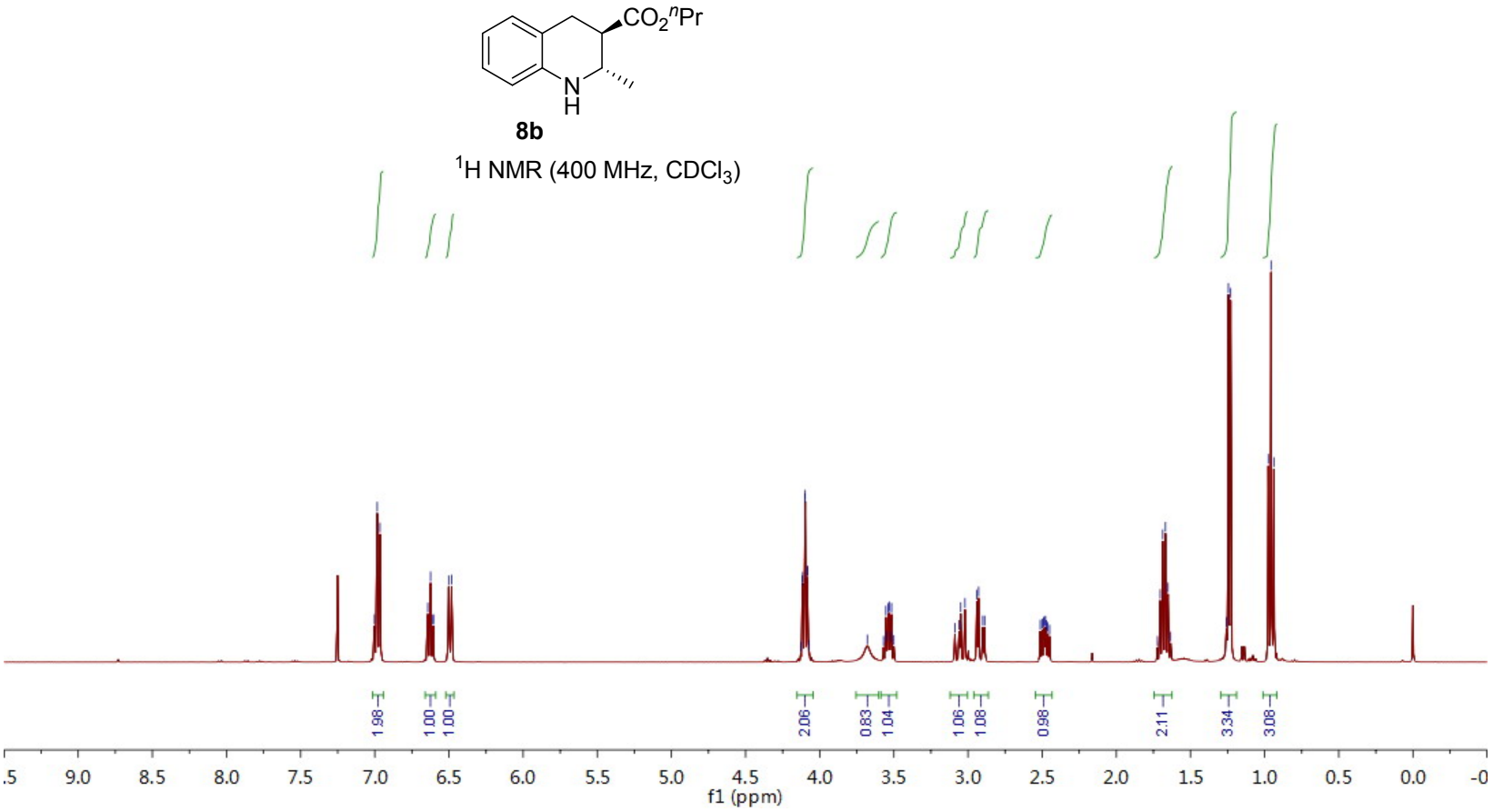
^{19}F NMR (376 MHz, $CDCl_3$)

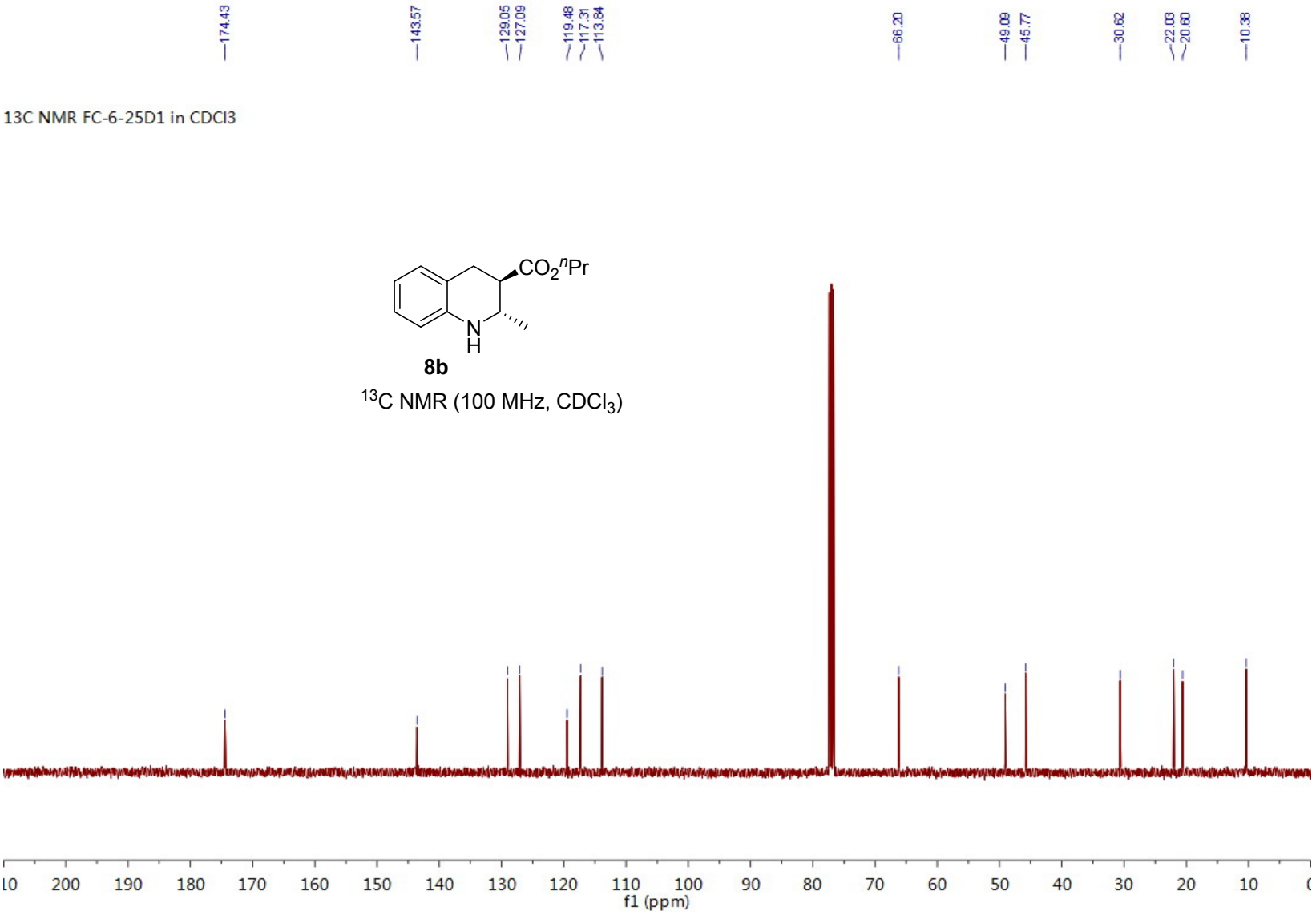
1H NMR FC-6-25D2 in CDCl3



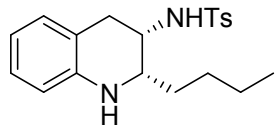

173.02
142.88
129.51
127.01
119.07
117.41
114.59
66.16
47.37
42.26
25.53
22.02
17.88
10.41
13C NMR FC-6-25D2 in CDCl3
CO2nPr
N
H
8a
13C NMR (100 MHz, CDCl3)
f1 (ppm)

1H NMR FC-6-25D1 in CDCl3



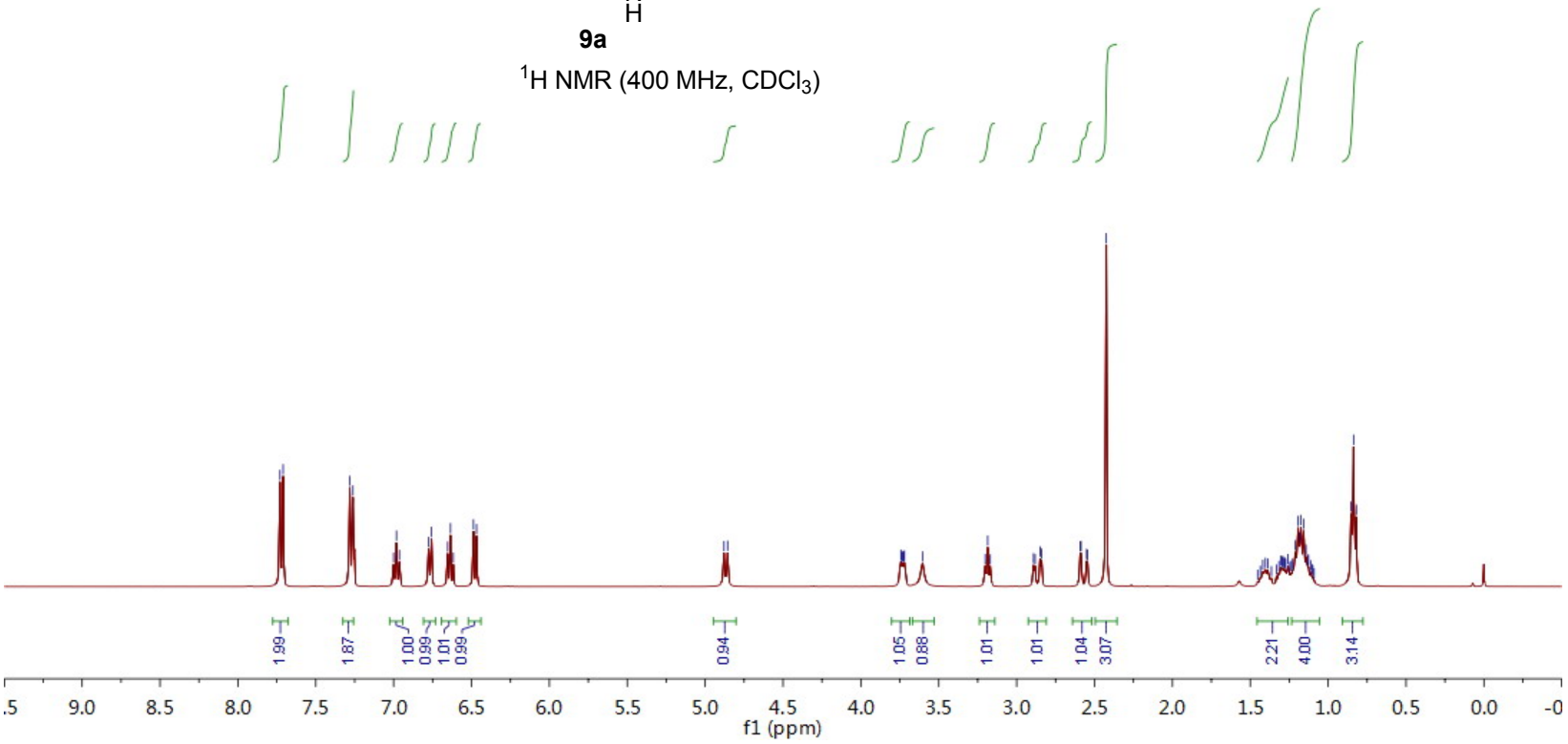

174.43
143.57
129.05
127.09
119.48
117.31
113.84
66.20
49.09
45.77
30.62
22.03
20.60
10.38
13C NMR FC-6-25D1 in CDCl3
CO2nPr
N
H
8b
13C NMR (100 MHz, CDCl3)
f1 (ppm)

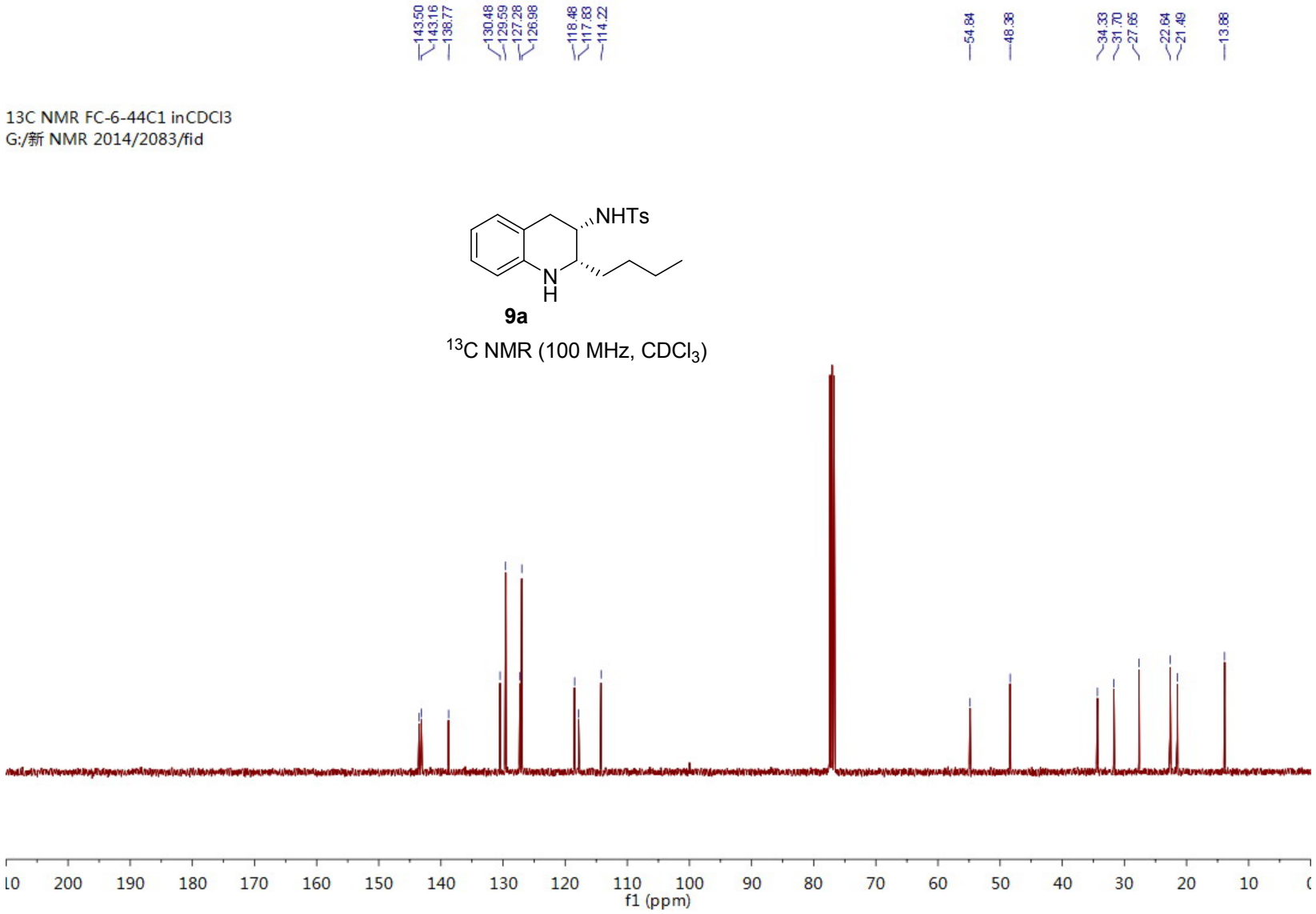
1H NMR FC-6-44C1 inCDCl3
G:/新 NMR 2014/2082/fid

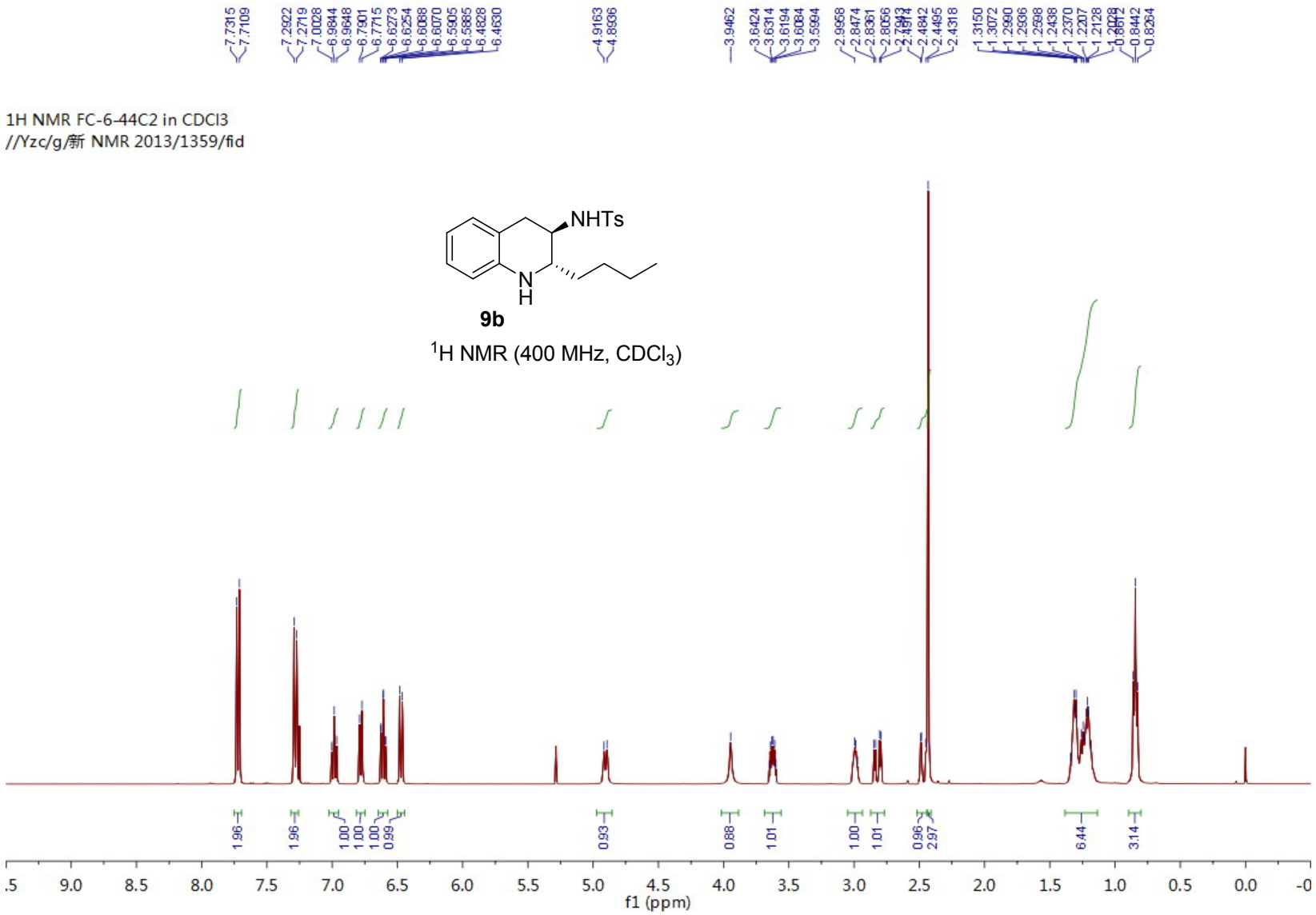


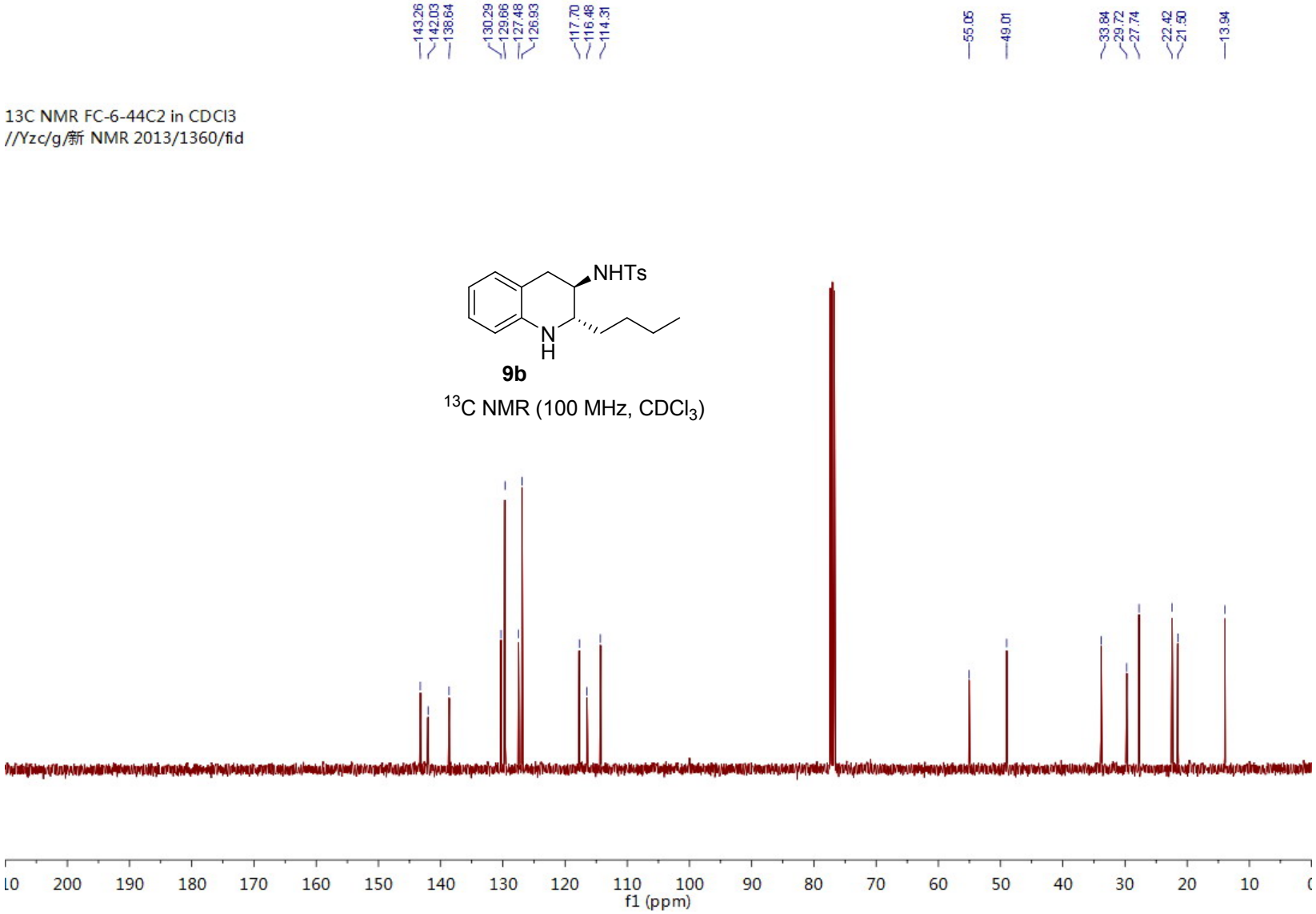
9a

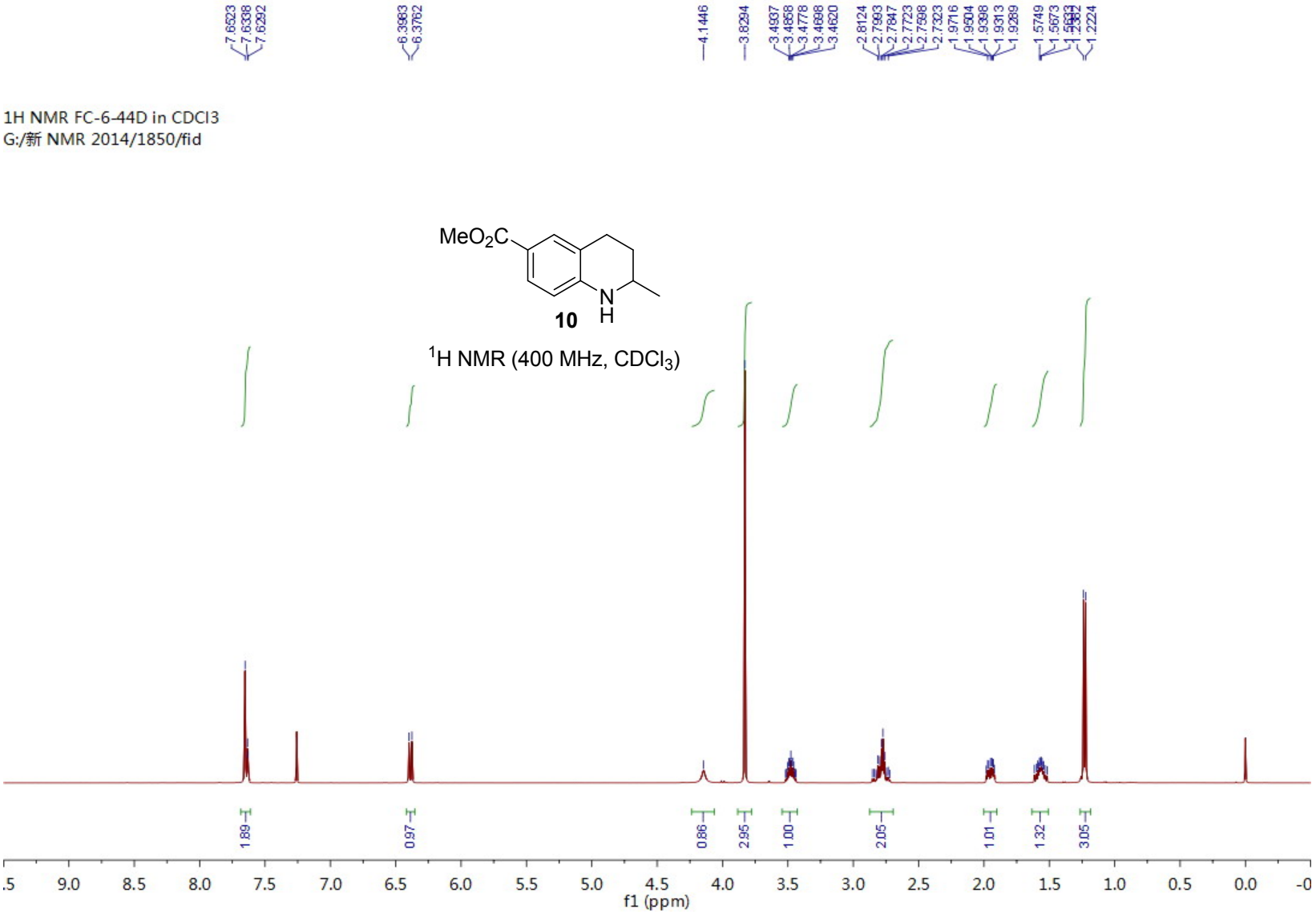
^{1}H NMR (400 MHz, $CDCl_3$)

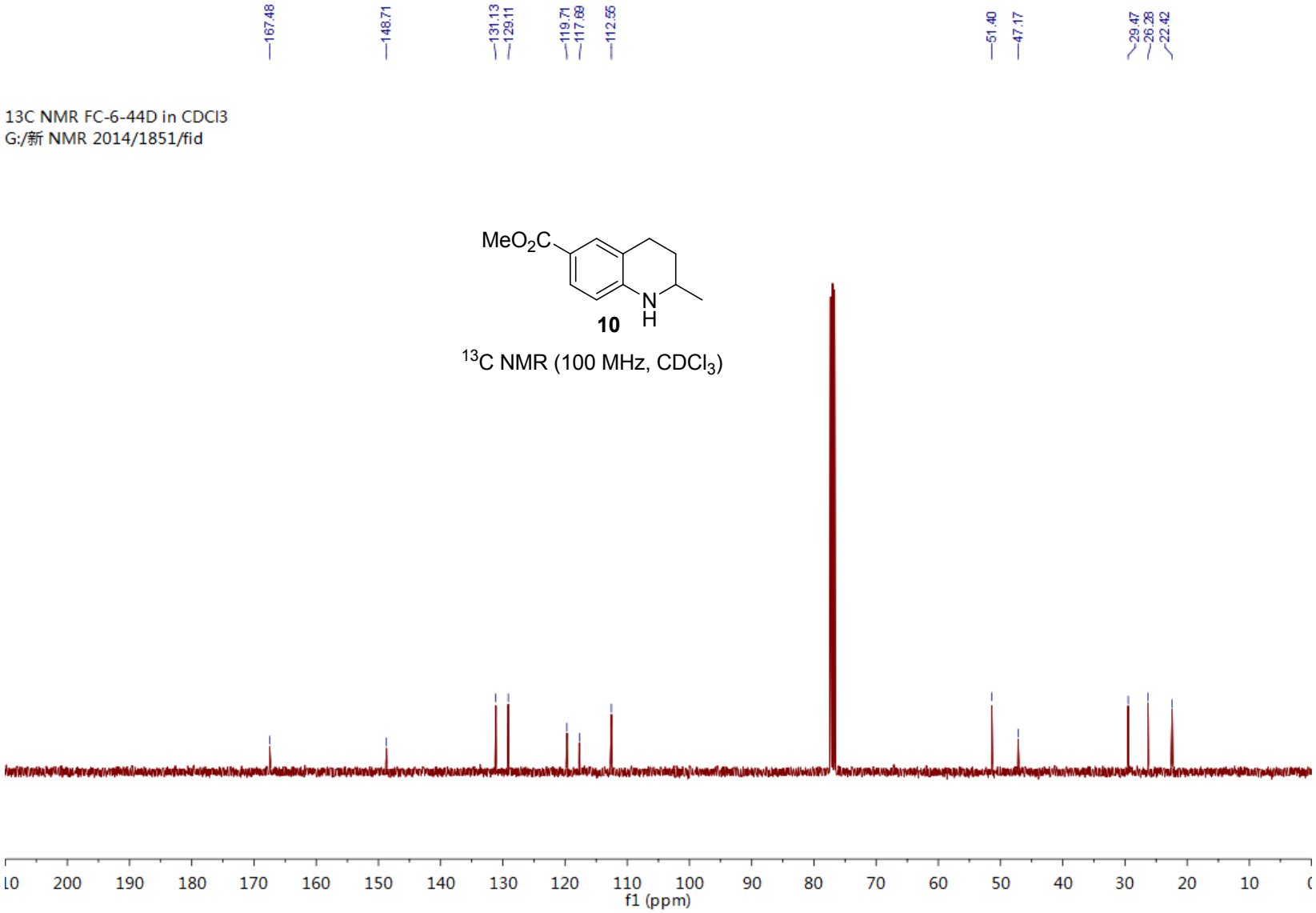



143.50
143.16
138.77
130.48
129.59
127.28
126.98
118.48
117.83
114.22
54.84
48.38
34.33
31.70
27.65
22.64
21.49
13.88
13C NMR FC-6-44C1 inCDCl3
G:/新 NMR 2014/2083/fid
NHTs
N
H
9a
^{13}C NMR (100 MHz, $CDCl_3$)
f1 (ppm)


7.7315
7.7109
7.2922
7.2719
7.0028
6.9844
6.9648
6.7901
6.7715
6.6273
6.6254
6.6088
6.6070
6.5905
6.5885
6.4828
6.4630
4.9163
4.8936
3.9462
3.6424
3.6314
3.6194
3.6084
3.5994
2.9958
2.8474
2.8361
2.8056
2.4842
2.4495
2.4318
1.3150
1.3072
1.2990
1.2936
1.2598
1.2438
1.2370
1.2207
1.2128
0.8842
0.8264
1H NMR FC-6-44C2 in CDCl3
//Yzc/g/新 NMR 2013/1359/fid
NHTs
N
H
9b
1H NMR (400 MHz, CDCl3)
1.96
1.96
1.00
1.00
1.00
0.99
0.93
0.88
1.01
1.00
1.01
0.96
2.97
6.44
3.14
f1 (ppm)


143.26
142.03
138.64
130.29
129.66
127.48
126.93
117.70
116.48
114.31
55.05
49.01
33.84
29.72
27.74
22.42
21.50
13.94
13C NMR FC-6-44C2 in CDCl3
//Yzc/g/新 NMR 2013/1360/fid
NHTs
N
H
9b
13C NMR (100 MHz, CDCl3)
f1 (ppm)


7.6623
7.6338
7.6292
6.3983
6.3762
4.1446
3.8294
3.4937
3.4858
3.4778
3.4698
3.4620
2.8124
2.7993
2.7847
2.7723
2.7598
2.7323
1.9716
1.9504
1.9398
1.9313
1.9289
1.5749
1.5673
1.2224
1H NMR FC-6-44D in CDCl3
G:/新 NMR 2014/1850/fid
MeO2C
N
H
10
1H NMR (400 MHz, CDCl3)
1.89
0.97
0.86
2.95
1.00
2.05
1.01
1.32
3.05
f1 (ppm)


167.48
148.71
131.13
129.11
119.71
117.69
112.55
51.40
47.17
29.47
26.28
22.42
13C NMR FC-6-44D in CDCl3
G:/新 NMR 2014/1851/fid
MeO2C
N
H
10
13C NMR (100 MHz, CDCl3)
f1 (ppm)

Data File C:\FC-2\YZN002874.D
Sample Name: FC-4-91D

```
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Acq. Operator   : WH
Acq. Instrument : Instrument 1                    Location : Vial 1
Injection Date  : 5/25/2013 3:34:54 PM
Acq. Method     : C:\CHEM32\1\METHODS\DEF LC.M
Last changed    : 5/25/2013 3:18:43 PM by WH
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed    : 10/24/2013 8:18:08 PM by B
                  (modified after loading)
Sample Info     : OD-H, H/i-PrOH = 70/30, 0.7 mL/min, 30 oC, 254nm
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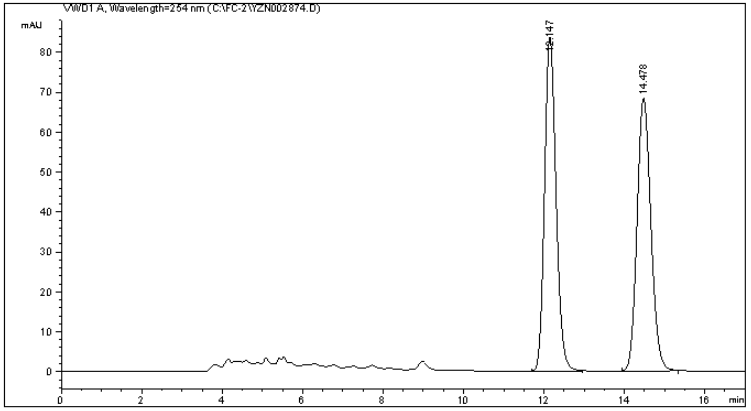


```
==========================================================================
                        Area Percent Report
==========================================================================

Sorted By             :      Signal
Multiplier:                   :      1.0000
Dilution:                     :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: VWD1 A, Wavelength=254 nm

Peak RetTime Type  Width     Area      Height     Area
  #   [min]       [min]  mAU   *s   [mAU   ]      %
----|-------|----|-------|---------|---------|--------|
   1  12.147 BB    0.3050 1655.66174   83.72147  50.3159
   2  14.478 BB    0.3708 1634.87048   68.35770  49.6841

Totals :                  3290.53223  152.07918

==========================================================================
                        *** End of Report ***
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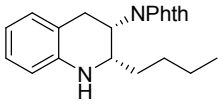
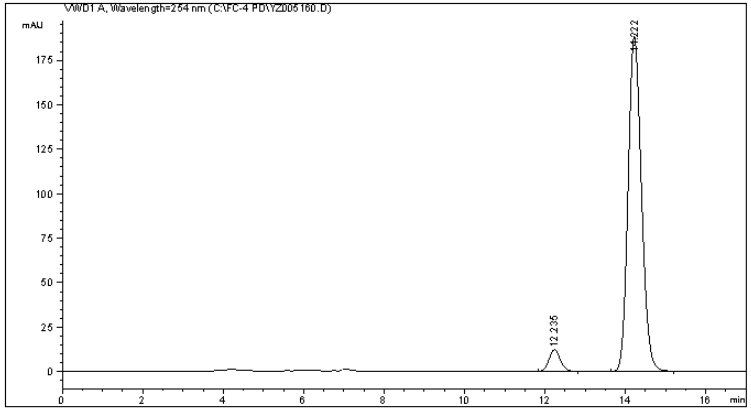


cis-(±)-**3a**

Data File C:\FC-4 PD\YZ005160.D
Sample Name: FC-6-19B

```
==========================================================================
Acq. Operator   : ZHOU
Acq. Instrument : Instrument 1                    Location : Vial 1
Injection Date  : 11/3/2013 7:47:45 AM
Acq. Method     : C:\HPCHEM\1\METHODS\DEMOCAL2.M
Last changed    : 11/3/2013 5:56:48 AM by ZHOU
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed    : 3/19/2014 1:42:02 PM by Z
                  (modified after loading)
Sample Info     : OD-H, H/i-PrOH = 70/30 0.7 mL/min, 30 oC, 254 nm
```




```
==========================================================================
                        Area Percent Report
==========================================================================

Sorted By             :      Signal
Multiplier:                   :      1.0000
Dilution:                     :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: VWD1 A, Wavelength=254 nm

Peak RetTime Type  Width     Area      Height     Area
  #   [min]       [min]  mAU   *s   [mAU   ]      %
----|-------|----|-------|---------|---------|--------|
   1  12.235 BB    0.3061  240.73900   12.19050   5.2448
   2  14.222 BB    0.3585 4349.30615  188.11835  94.7552

Totals :                  4590.04515  200.30884

==========================================================================
                        *** End of Report ***
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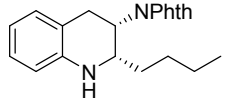
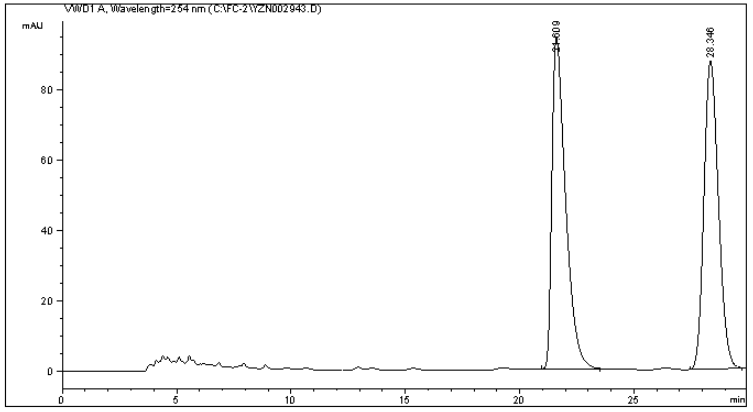


cis-(−)-**3a**

Data File C:\FC-2\YZN002943.D
Sample Name: FC-5-12B

```
==========================================================================
Acq. Operator   : WH
Acq. Instrument : Instrument 1                    Location : Vial 1
Injection Date  : 6/8/2013 4:41:20 PM
Acq. Method     : C:\CHEM32\1\METHODS\DEF LC.M
Last changed    : 6/8/2013 4:18:00 PM by WH
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed    : 10/9/2013 10:14:04 PM by B
                  (modified after loading)
Sample Info     : OD-H, H/i-PrOH = 70/30, 0.7 mL/min, 30 oC, 254nm
```

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==========================================================================
                        Area Percent Report
==========================================================================

Sorted By             :      Signal
Multiplier:                   :      1.0000
Dilution:                     :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: VWD1 A, Wavelength=254 nm

Peak RetTime Type  Width     Area      Height     Area
  #   [min]       [min]  mAU   *s   [mAU   ]      %
----|-------|----|-------|---------|---------|-------|
   1  21.609 BB    0.6230 3910.40552   94.11921  50.3693
   2  28.346 BB    0.6843 3853.05908   87.46463  49.6307

Totals :                  7763.46460  181.58384

==========================================================================
                        *** End of Report ***
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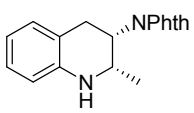
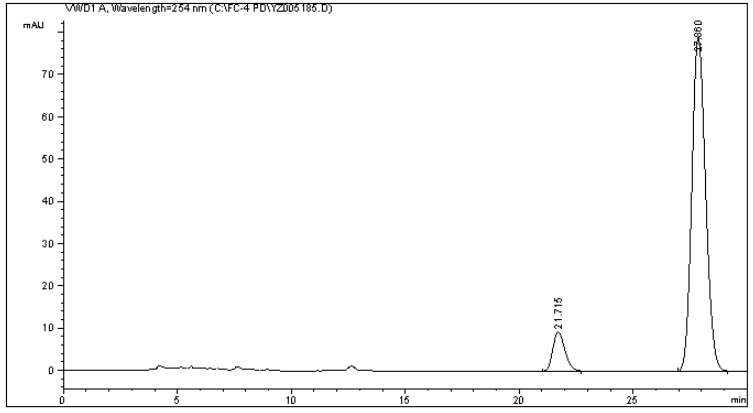


cis-(±)-**3b**

Data File C:\FC-4 PD\YZ005185.D
Sample Name: FC-6-21A

```
==========================================================================
Acq. Operator   : ZHOU
Acq. Instrument : Instrument 1                    Location : Vial 1
Injection Date  : 11/6/2013 9:02:50 AM
Acq. Method     : C:\HPCHEM\1\METHODS\DEMOCAL2.M
Last changed    : 11/6/2013 7:52:30 AM by ZHOU
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed    : 3/19/2014 1:45:03 PM by Z
                  (modified after loading)
Sample Info     : OD-H, H/i-PrOH = 70/30, 0.7 mL/min, 30 oC, 254 nm
```




```
==========================================================================
                        Area Percent Report
==========================================================================

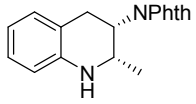
Sorted By             :      Signal
Multiplier:                   :      1.0000
Dilution:                     :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: VWD1 A, Wavelength=254 nm

Peak RetTime Type  Width     Area      Height     Area
  #   [min]       [min]  mAU   *s   [mAU   ]      %
----|-------|----|-------|---------|---------|-------|
   1  21.715 BB    0.5722  346.06189    9.30622   9.4320
   2  27.860 BB    0.6514 3322.97461   79.15966  90.5680

Totals :                  3669.03650   88.46588

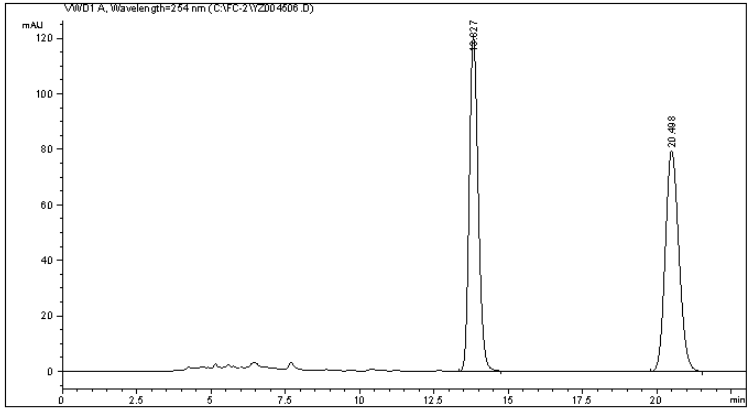
==========================================================================
                        *** End of Report ***
```



cis-(−)-**3b**

Data File C:\FC-2\YZ004506.D
Sample Name: FC-5-4B

```
==========================================================================
Acq. Operator   : WH
Acq. Instrument : Instrument 1                    Location : Vial 1
Injection Date  : 6/5/2013 1:31:59 AM
Acq. Method     : C:\HPCHEM\1\METHODS\DEF LC.M
Last changed    : 6/5/2013 1:14:42 AM by WH
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed    : 10/9/2013 10:16:54 PM by B
                  (modified after loading)
Sample Info     : OD-H, H/i-PrOH = 70/30, 0.7 mL/min, 30 oC, 254 nm
```




```
==========================================================================
                        Area Percent Report
==========================================================================

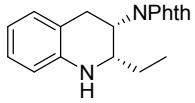
Sorted By             :      Signal
Multiplier:                   :      1.0000
Dilution:                     :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: VWD1 A, Wavelength=254 nm

Peak RetTime Type  Width     Area      Height     Area
  #   [min]      [min]  mAU   *s   [mAU   ]      %
----|-------|----|-------|---------|---------|-------|
   1  13.827 BB    0.3250 2529.78125  120.51426  50.0247
   2  20.498 BB    0.4955 2527.28491   79.63683  49.9753

Totals :                  5057.06616  200.15109

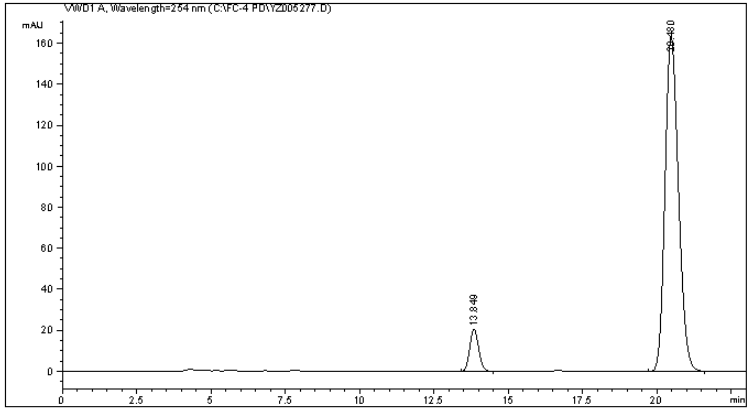

==========================================================================
                        *** End of Report ***
```



cis-(±)-**3c**

Data File C:\FC-4 PD\YZ005277.D
Sample Name: FC-6-21H

```
==========================================================================
Acq. Operator   : ZHOU
Acq. Instrument : Instrument 1                    Location : Vial 1
Injection Date  : 11/16/2013 12:43:13 PM
Acq. Method     : C:\HPCHEM\1\METHODS\DEMOCAL2.M
Last changed    : 11/16/2013 11:40:55 AM by ZHOU
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed    : 3/19/2014 2:03:59 PM by Z
                  (modified after loading)
Sample Info     : OD-H, H/i-PrOH =70/30, 0.70 mL/min, 30 oC, 254nm
```




```
==========================================================================
                        Area Percent Report
==========================================================================

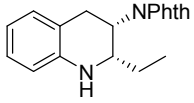
Sorted By             :      Signal
Multiplier:                   :      1.0000
Dilution:                     :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: VWD1 A, Wavelength=254 nm

Peak RetTime Type  Width     Area      Height     Area
  #   [min]      [min]  mAU   *s   [mAU   ]      %
----|-------|----|-------|---------|---------|-------|
   1  13.849 BB    0.3228  431.96985   20.75943   7.7395
   2  20.480 BB    0.4888 5149.38428  163.28098  92.2605

Totals :                  5581.35413  184.04040

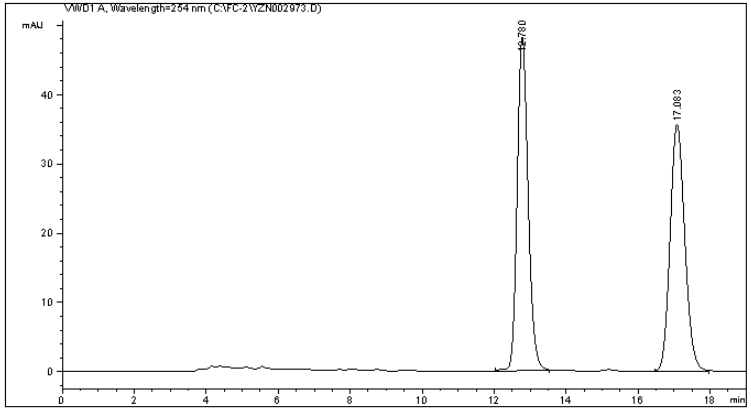

==========================================================================
                        *** End of Report ***
```



cis-(−)-**3c**

Data File C:\FC-2\YZN002973.D
Sample Name: FC-5-15E

```
==========================================================================
Acq. Operator   : WH
Acq. Instrument : Instrument 1                    Location : Vial 1
Injection Date  : 6/11/2013 9:32:17 PM
Acq. Method     : C:\CHEM32\1\METHODS\DEF LC.M
Last changed    : 6/11/2013 9:31:54 PM by WH
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed    : 10/9/2013 10:19:15 PM by B
                  (modified after loading)
Sample Info     : OD-H, H/i-PrOH = 70/30, 0.7 mL/min, 30 oC, 254nm
```




```
==========================================================================
                        Area Percent Report
==========================================================================

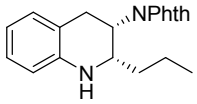
Sorted By             :      Signal
Multiplier:                   :      1.0000
Dilution:                     :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: VWD1 A, Wavelength=254 nm

Peak RetTime Type  Width     Area      Height     Area
  #   [min]      [min]  mAU   *s   [mAU   ]      %
----|-------|----|-------|----------|----------|--------|
   1  12.780 BB    0.3250 1017.71002   48.18303  50.2071
   2  17.083 BB    0.4396 1009.31415   35.64315  49.7929

Totals :                  2027.02417   83.82618

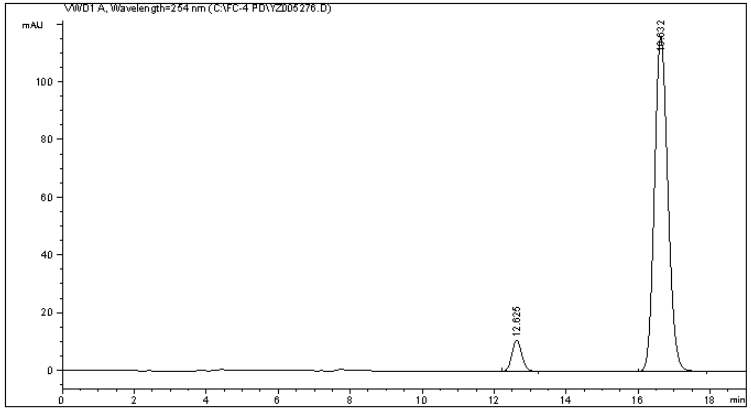

==========================================================================
                        *** End of Report ***
```



cis-(±)-**3d**

Data File C:\FC-4 PD\YZ005276.D
Sample Name: FC-6-21G

```
==========================================================================
Acq. Operator   : ZHOU
Acq. Instrument : Instrument 1                    Location : Vial 1
Injection Date  : 11/16/2013 12:21:34 PM
Acq. Method     : C:\HPCHEM\1\METHODS\DEMOCAL2.M
Last changed    : 11/16/2013 11:40:55 AM by ZHOU
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed    : 3/19/2014 1:56:09 PM by Z
                  (modified after loading)
Sample Info     : OD-H, H/i-PrOH =70/30, 0.70 mL/min, 30 oC, 254nm
```




```
==========================================================================
                        Area Percent Report
==========================================================================

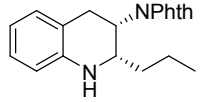
Sorted By             :      Signal
Multiplier:                   :      1.0000
Dilution:                     :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: VWD1 A, Wavelength=254 nm

Peak RetTime Type  Width     Area      Height     Area
  #   [min]      [min]  mAU   *s   [mAU   ]      %
----|-------|----|-------|----------|----------|--------|
   1  12.625 BB    0.2964  206.74997   10.78981   6.4153
   2  16.632 BB    0.4054 3015.99756  115.94248  93.5847

Totals :                  3222.74753  126.73229

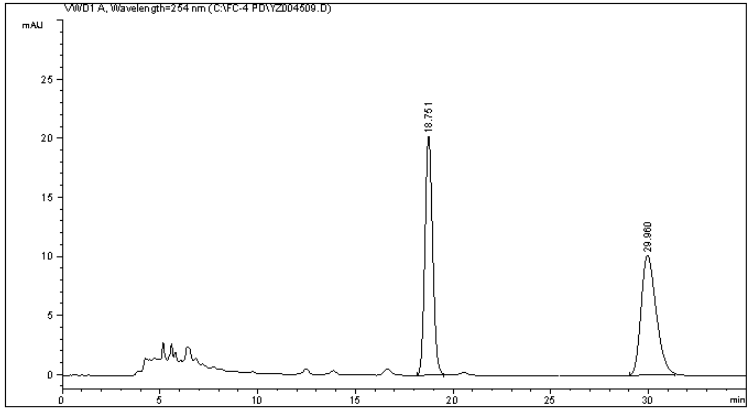

==========================================================================
                        *** End of Report ***
```



cis-(–)-**3d**

Data File C:\FC-4 PD\YZ004509.D
Sample Name: FC-5-4D

```
==========================================================================
Acq. Operator   : WH
Acq. Instrument : Instrument 1                    Location : Vial 1
Injection Date  : 6/5/2013 2:18:54 AM
Acq. Method     : C:\HPCHEM\1\METHODS\DEF LC.M
Last changed    : 6/5/2013 1:14:42 AM by WH
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed    : 3/19/2014 2:24:22 PM by Z
                  (modified after loading)
Sample Info     : OD-H, H/i-PrOH = 70/30, 0.7 mL/min, 30 oC, 254 nm
```




```
==========================================================================
                        Area Percent Report
==========================================================================

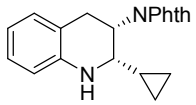
Sorted By             :      Signal
Multiplier:                   :      1.0000
Dilution:                     :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: VWD1 A, Wavelength=254 nm

Peak RetTime Type  Width     Area      Height     Area
  #   [min]       [min]  mAU   *s   [mAU   ]      %
----|-------|----|-------|---------|---------|-------|
   1  18.751 BB    0.4242  553.47186   20.21572  50.5895
   2  29.960 BB    0.8173  540.57367   10.11172  49.4105

Totals :                  1094.04553   30.32744

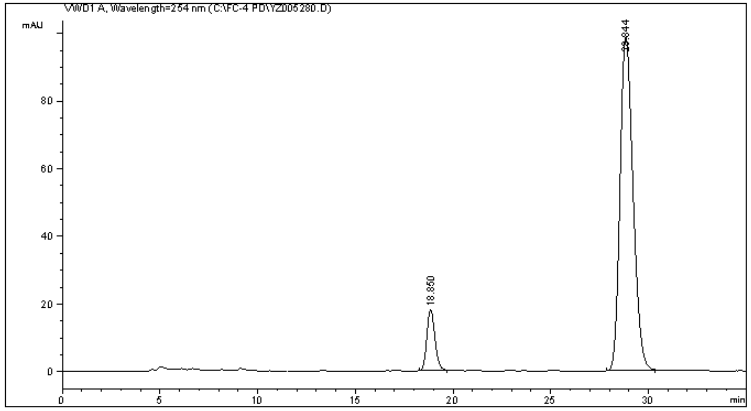
==========================================================================
                        *** End of Report ***
```



cis-(±)-**3e**

Data File C:\FC-4 PD\YZ005280.D
Sample Name: FC-6-25G

```
==========================================================================
Acq. Operator   : ZHOU
Acq. Instrument : Instrument 1                    Location : Vial 1
Injection Date  : 11/16/2013 2:13:53 PM
Acq. Method     : C:\HPCHEM\1\METHODS\DEMOCAL2.M
Last changed    : 11/16/2013 2:33:12 PM by ZHOU
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed    : 3/19/2014 2:25:16 PM by Z
                  (modified after loading)
Sample Info     : OD-H, H/i-PrOH =70/30, 0.70 mL/min, 30 oC, 254nm
```




```
==========================================================================
                        Area Percent Report
==========================================================================

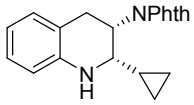
Sorted By             :      Signal
Multiplier:                   :      1.0000
Dilution:                     :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: VWD1 A, Wavelength=254 nm

Peak RetTime Type  Width     Area      Height     Area
  #   [min]       [min]  mAU   *s   [mAU   ]      %
----|-------|----|-------|---------|---------|-------|
   1  18.850 BB    0.4476  521.99036   18.07144  10.2492
   2  28.844 BB    0.7169 4570.97607   98.61848  89.7508

Totals :                  5092.96643  116.68992

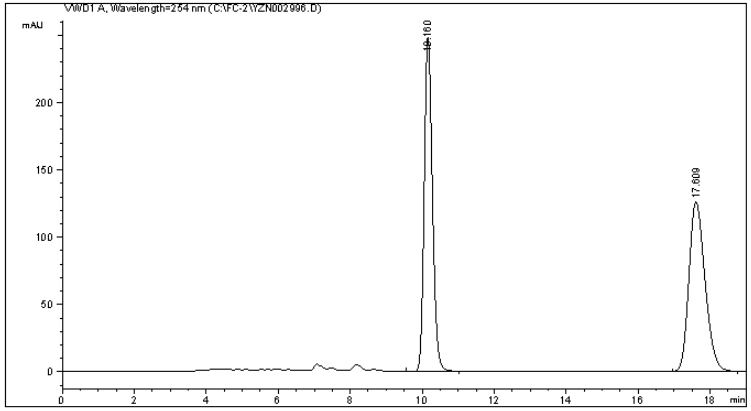
==========================================================================
                        *** End of Report ***
```



cis-(−)-**3e**

Data File C:\FC-2\YZN002996.D
Sample Name: FC-5-15H

```
==========================================================================
Acq. Operator   : WH
Acq. Instrument : Instrument 1                    Location : Vial 1
Injection Date  : 6/14/2013 4:15:31 PM
Acq. Method     : C:\CHEM32\1\METHODS\DEF LC.M
Last changed    : 6/14/2013 4:13:10 PM by WH
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed    : 10/9/2013 10:19:15 PM by B
                  (modified after loading)
Sample Info     : OD-H, H/i-PrOH = 70/30, 0.7 mL/min, 30 oC, 254 nm
```




```
==========================================================================
                        Area Percent Report
==========================================================================

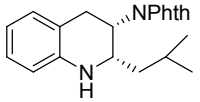
Sorted By             :      Signal
Multiplier:                   :      1.0000
Dilution:                     :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: VWD1 A, Wavelength=254 nm

Peak RetTime Type  Width     Area      Height     Area
  #   [min]       [min]  mAU   *s   [mAU   ]      %
----|-------|----|-------|---------|---------|-------|
   1  10.160 BB    0.2457 3930.91138  248.50368  50.1263
   2  17.609 BB    0.4798 3911.09814  126.08517  49.8737

Totals :                  7842.00952  374.58884

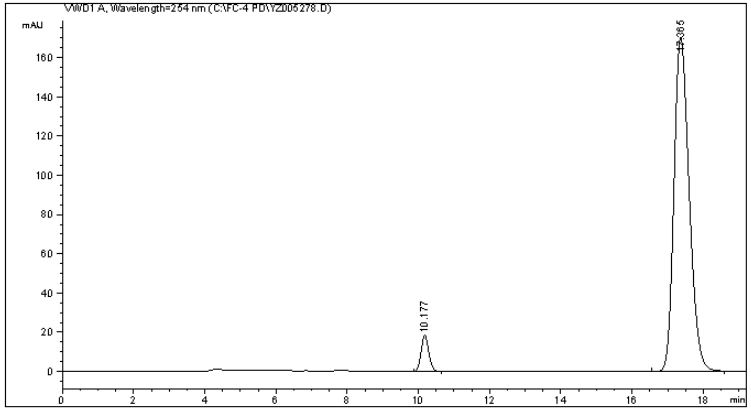
==========================================================================
                        *** End of Report ***
```



cis-(±)-**3f**

Data File C:\FC-4 PD\YZ005278.D
Sample Name: FC-6-25F

```
==========================================================================
Acq. Operator   : ZHOU
Acq. Instrument : Instrument 1                    Location : Vial 1
Injection Date  : 11/16/2013 1:12:40 PM
Acq. Method     : C:\HPCHEM\1\METHODS\DEMOCAL2.M
Last changed    : 11/16/2013 11:40:55 AM by ZHOU
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed    : 3/19/2014 2:13:30 PM by Z
                  (modified after loading)
Sample Info     : OD-H, H/i-PrOH =70/30, 0.70 mL/min, 30 oC, 254nm
```




```
==========================================================================
                        Area Percent Report
==========================================================================

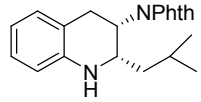
Sorted By             :      Signal
Multiplier:                   :      1.0000
Dilution:                     :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: VWD1 A, Wavelength=254 nm

Peak RetTime Type  Width     Area      Height     Area
  #   [min]       [min]  mAU   *s   [mAU   ]      %
----|-------|----|-------|---------|---------|-------|
   1  10.177 BB    0.2342  279.06879   18.50447   5.2374
   2  17.365 BB    0.4575 5049.33252  170.54918  94.7626

Totals :                  5328.40131  189.05365

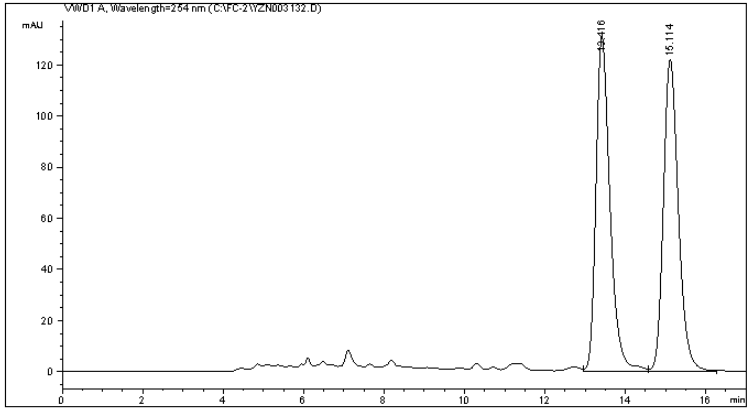
==========================================================================
                        *** End of Report ***
```



cis-(–)-**3f**

Data File C:\FC-2\YZN003132.D
Sample Name: FC-5-31F

```
==========================================================================
Acq. Operator   : YZ
Acq. Instrument : Instrument 1                    Location : Vial 1
Injection Date  : 7/1/2013 10:55:21 AM
Acq. Method     : C:\CHEM32\1\METHODS\DEF LC.M
Last changed    : 7/1/2013 10:30:28 AM by YZ
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed    : 10/9/2013 10:22:50 PM by B
                  (modified after loading)
Sample Info     : OD-H, H/i-PrOH = 70/30, 0.6 mL/min, 30 oC, 254nm
```




```
==========================================================================
                        Area Percent Report
==========================================================================

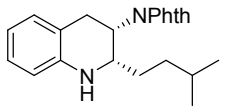
Sorted By             :      Signal
Multiplier:                   :      1.0000
Dilution:                     :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: VWD1 A, Wavelength=254 nm

Peak RetTime Type  Width     Area      Height     Area
  #   [min]      [min]  mAU   *s   [mAU   ]      %
----|-------|----|-------|----------|----------|--------|
   1  13.416 VV    0.3705 3171.39990  130.66174  50.3245
   2  15.114 VB    0.3943 3130.49976  121.86823  49.6755

Totals :                  6301.89966  252.52998

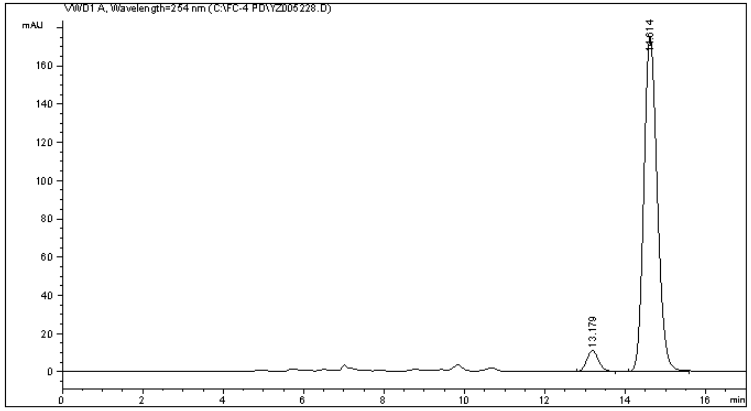
==========================================================================
                        *** End of Report ***
```



cis-(±)-**3g**

Data File C:\FC-4 PD\YZ005228.D
Sample Name: FC-6-25E

```
==========================================================================
Acq. Operator   : ZHOU
Acq. Instrument : Instrument 1                    Location : Vial 1
Injection Date  : 11/11/2013 1:07:27 PM
Acq. Method     : C:\HPCHEM\1\METHODS\DEMOCAL2.M
Last changed    : 11/11/2013 1:01:42 PM by ZHOU
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed    : 3/19/2014 2:21:21 PM by Z
                  (modified after loading)
Sample Info     : OD-H, H/i-PrOH = 70/30, 0.60 mL/min, 30 oC, 254 nm
```




```
==========================================================================
                        Area Percent Report
==========================================================================

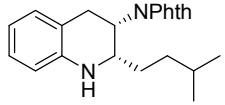
Sorted By             :      Signal
Multiplier:                   :      1.0000
Dilution:                     :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: VWD1 A, Wavelength=254 nm

Peak RetTime Type  Width     Area      Height     Area
  #   [min]      [min]  mAU   *s   [mAU   ]      %
----|-------|----|-------|----------|----------|--------|
   1  13.179 BB    0.3171  220.64961   10.86086   5.1799
   2  14.614 BB    0.3570 4039.04907  174.78802  94.8201

Totals :                  4259.69868  185.64889

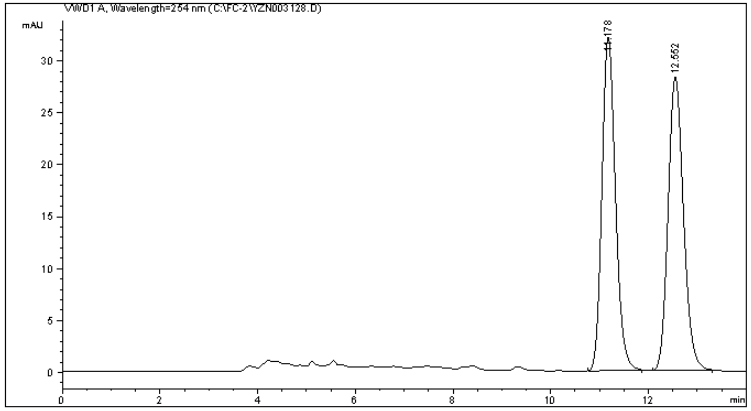
==========================================================================
                        *** End of Report ***
```



cis-(–)-**3g**

Data File C:\FC-2\YZN003128.D
Sample Name: FC-5-31A

```
==========================================================================
Acq. Operator   : YZ
Acq. Instrument : Instrument 1                    Location : Vial 1
Injection Date  : 6/30/2013 5:59:30 PM
Acq. Method     : C:\CHEM32\1\METHODS\DEF LC.M
Last changed    : 6/30/2013 5:57:42 PM by YZ
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed    : 10/9/2013 10:24:50 PM by B
                  (modified after loading)
Sample Info     : OD-H, H/i-PrOH = 70/30, 0.7 mL/min, 30 oC, 254nm
```




```
==========================================================================
                        Area Percent Report
==========================================================================

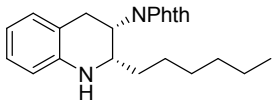
Sorted By             :      Signal
Multiplier:                   :      1.0000
Dilution:                     :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: VWD1 A, Wavelength=254 nm

Peak RetTime Type  Width     Area      Height     Area
  #   [min]      [min]  mAU   *s   [mAU   ]      %
----|-------|----|-------|---------|---------|-------|
   1  11.178 BB    0.2976  619.77832   32.16206  49.9698
   2  12.552 BB    0.3391  620.52863   28.26396  50.0302

Totals :                  1240.30695   60.42602

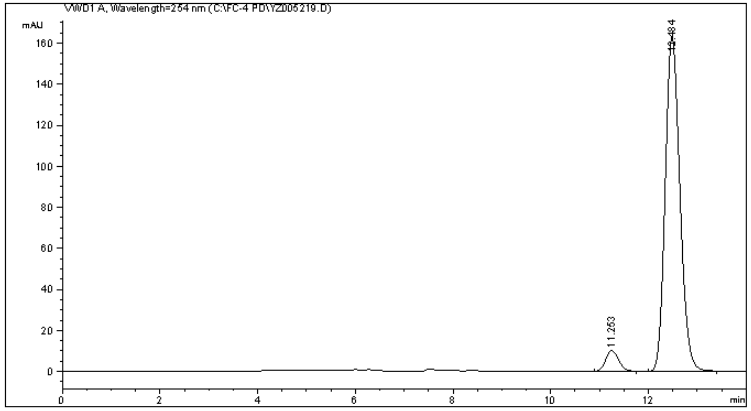
==========================================================================
                        *** End of Report ***
```



cis-(±)-**3h**

Data File C:\FC-4 PD\YZ005219.D
Sample Name: FC-6-21C

```
==========================================================================
Acq. Operator   : ZHOU
Acq. Instrument : Instrument 1                    Location : Vial 1
Injection Date  : 11/10/2013 3:17:46 AM
Acq. Method     : C:\HPCHEM\1\METHODS\DEMOCAL2.M
Last changed    : 11/10/2013 1:08:06 AM by ZHOU
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed    : 3/20/2014 6:50:36 PM by Z
                  (modified after loading)
Sample Info     : OD-H, H/i-PrOH = 70/30, 0.70 mL/min, 30 oC, 254 nm
```




```
==========================================================================
                        Area Percent Report
==========================================================================

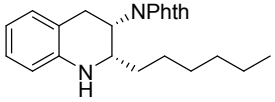
Sorted By             :      Signal
Multiplier:                   :      1.0000
Dilution:                     :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: VWD1 A, Wavelength=254 nm

Peak RetTime Type  Width     Area      Height     Area
  #   [min]      [min]  mAU   *s   [mAU   ]      %
----|-------|----|-------|---------|---------|-------|
   1  11.253 BB    0.2882  189.07195   10.17013   5.2442
   2  12.484 BB    0.3261 3416.27197  162.98039  94.7558

Totals :                  3605.34392  173.15053

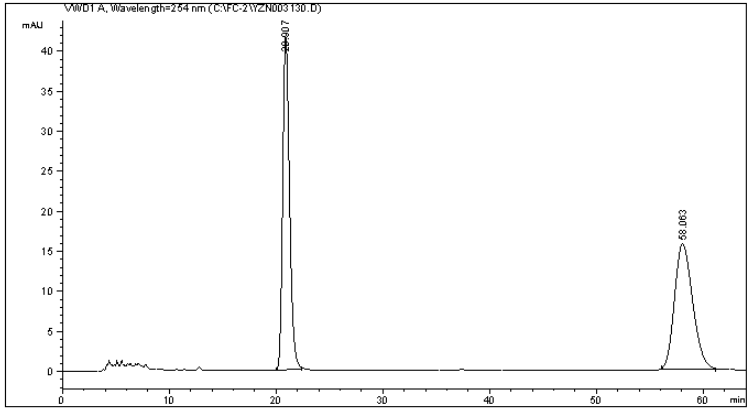
==========================================================================
                        *** End of Report ***
```



cis-(–)-**3h**

Data File C:\FC-2\YZN003130.D
Sample Name: FC-5-31D

```
==========================================================================
Acq. Operator   : YZ
Acq. Instrument : Instrument 1                    Location : Vial 1
Injection Date  : 7/1/2013 8:32:52 AM
Acq. Method     : C:\CHEM32\1\METHODS\DEF LC.M
Last changed    : 7/1/2013 8:32:15 AM by YZ
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed    : 10/9/2013 10:26:48 PM by B
                  (modified after loading)
Sample Info     : OD-H, H/i-PrOH = 70/30, 0.7 mL/min, 30 oC, 254nm
```




```
==========================================================================
                        Area Percent Report
==========================================================================

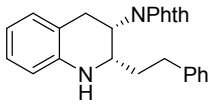
Sorted By             :      Signal
Multiplier:                   :      1.0000
Dilution:                     :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: VWD1 A, Wavelength=254 nm

Peak RetTime Type  Width     Area      Height     Area
  #   [min]       [min]  mAU   *s   [mAU   ]      %
----|-------|----|-------|----------|----------|-------|
   1  20.907 BB    0.6820 1851.19116   41.61592  50.2063
   2  58.063 BB    1.6967 1835.97693   15.66210  49.7937

Totals :                  3687.16809   57.27802

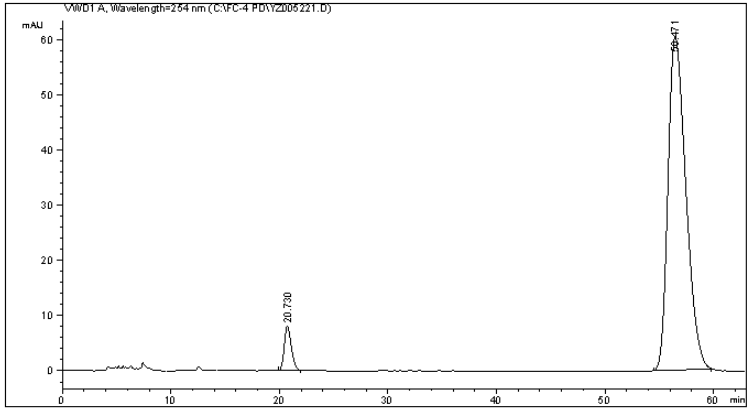

==========================================================================
                        *** End of Report ***
```



cis-(±)-**3i**

Data File C:\FC-4 PD\YZ005221.D
Sample Name: FC-6-21I

```
==========================================================================
Acq. Operator   : ZHOU
Acq. Instrument : Instrument 1                    Location : Vial 1
Injection Date  : 11/10/2013 7:28:50 AM
Acq. Method     : C:\HPCHEM\1\METHODS\DEMOCAL2.M
Last changed    : 11/10/2013 7:51:31 AM by ZHOU
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed    : 3/19/2014 2:11:40 PM by Z
                  (modified after loading)
Sample Info     : OD-H, H/i-PrOH = 70/30, 0.70 mL/min, 30 oC, 254 nm
```




```
==========================================================================
                        Area Percent Report
==========================================================================

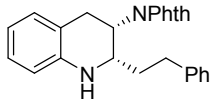
Sorted By             :      Signal
Multiplier:                   :      1.0000
Dilution:                     :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: VWD1 A, Wavelength=254 nm

Peak RetTime Type  Width     Area      Height     Area
  #   [min]       [min]  mAU   *s   [mAU   ]      %
----|-------|----|-------|----------|----------|-------|
   1  20.730 BB    0.6737  359.73199    8.03634   4.9467
   2  56.471 BB    1.7246 6912.45605   60.37128  95.0533

Totals :                  7272.18805   68.40762

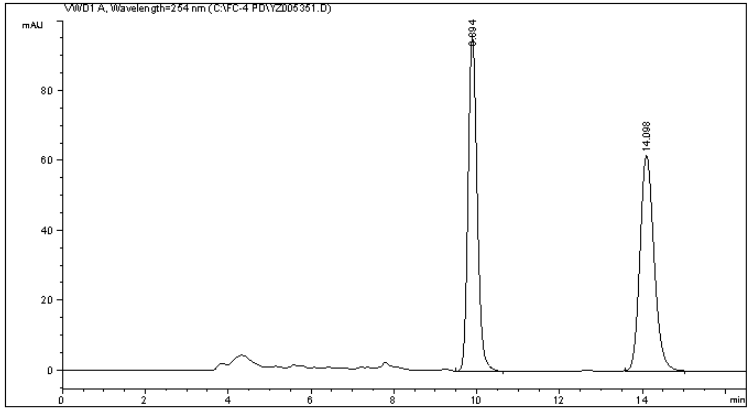

==========================================================================
                        *** End of Report ***
```



cis-(–)-**3i**

Data File C:\FC-4 PD\YZ005351.D
Sample Name: FC-6-44B

```
==========================================================================
Acq. Operator   : ZHOU
Acq. Instrument : Instrument 1                    Location : Vial 1
Injection Date  : 12/7/2013 11:33:21 AM
Acq. Method     : C:\HPCHEM\1\METHODS\DEMOCAL2.M
Last changed    : 12/7/2013 10:49:03 AM by ZHOU
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed    : 3/19/2014 2:47:56 PM by Z
                  (modified after loading)
Sample Info     : OD-H, H/i-PrOH = 70/30, 0.7 mL/min, 30 oC, 254 nm
```




```
==========================================================================
                        Area Percent Report
==========================================================================

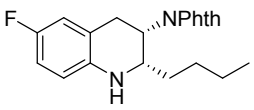
Sorted By             :      Signal
Multiplier:                   :      1.0000
Dilution:                     :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: VWD1 A, Wavelength=254 nm

Peak RetTime Type  Width     Area      Height     Area
  #   [min]       [min]  mAU   *s   [mAU   ]      %
----|-------|----|-------|---------|---------|-------|
   1   9.894 VB    0.2362 1460.19324   95.72971  49.9780
   2  14.098 BB    0.3666 1461.47852   61.70567  50.0220

Totals :                  2921.67175  157.43539

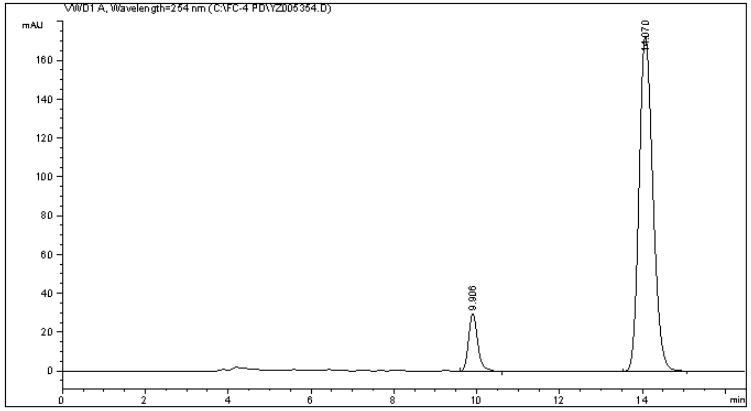
==========================================================================
                        *** End of Report ***
```



cis-(±)-**3j**

Data File C:\FC-4 PD\YZ005354.D
Sample Name: FC-6-44A

```
==========================================================================
Acq. Operator   : ZHOU
Acq. Instrument : Instrument 1                    Location : Vial 1
Injection Date  : 12/7/2013 12:41:56 PM
Acq. Method     : C:\HPCHEM\1\METHODS\DEMOCAL2.M
Last changed    : 12/7/2013 10:49:03 AM by ZHOU
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed    : 3/19/2014 2:47:56 PM by Z
                  (modified after loading)
Sample Info     : OD-H, H/i-PrOH = 70/30, 0.7 mL/min, 30 oC, 254 nm
```




```
==========================================================================
                        Area Percent Report
==========================================================================

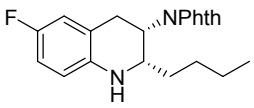
Sorted By             :      Signal
Multiplier:                   :      1.0000
Dilution:                     :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: VWD1 A, Wavelength=254 nm

Peak RetTime Type  Width     Area      Height     Area
  #   [min]       [min]  mAU   *s   [mAU   ]      %
----|-------|----|-------|---------|---------|-------|
   1   9.906 BB    0.2387  464.39185   29.78394  10.3754
   2  14.070 BB    0.3604 4011.52148  172.33759  89.6246

Totals :                  4475.91333  202.12153

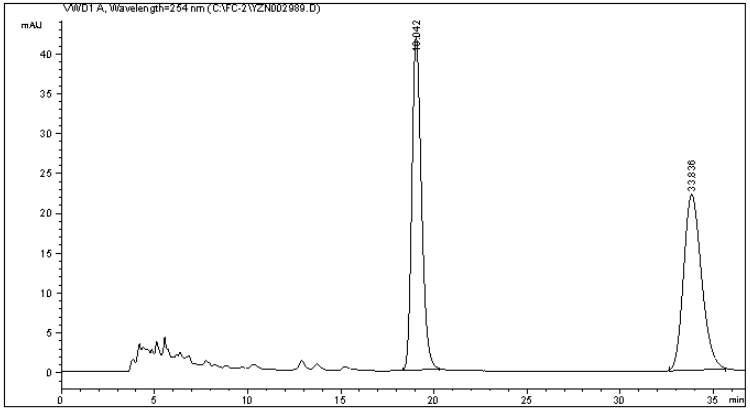
==========================================================================
                        *** End of Report ***
```



cis-(–)-**3j**

Data File C:\FC-2\YZN002989.D
Sample Name: FC-5-5F

```
==========================================================================
Acq. Operator   : WH
Acq. Instrument : Instrument 1                    Location : Vial 1
Injection Date  : 6/13/2013 6:02:46 PM
Acq. Method     : C:\CHEM32\1\METHODS\DEF LC.M
Last changed    : 6/13/2013 5:57:07 PM by WH
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed    : 10/9/2013 10:30:44 PM by B
                  (modified after loading)
Sample Info     : OD-H, H/i-PrOH = 70/30, 0.7 mL/min, 30 oC, 254 nm
```




```
==========================================================================
                        Area Percent Report
==========================================================================

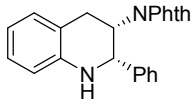
Sorted By             :      Signal
Multiplier:                   :      1.0000
Dilution:                     :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: VWD1 A, Wavelength=254 nm

Peak RetTime Type  Width     Area      Height     Area
  #   [min]      [min]  mAU   *s   [mAU   ]      %
----|-------|----|-------|---------|---------|-------|
   1  19.042 BB    0.5526 1498.45117   41.75992  50.4122
   2  33.836 BB    1.0161 1473.94409   22.03925  49.5878

Totals :                  2972.39526   63.79917

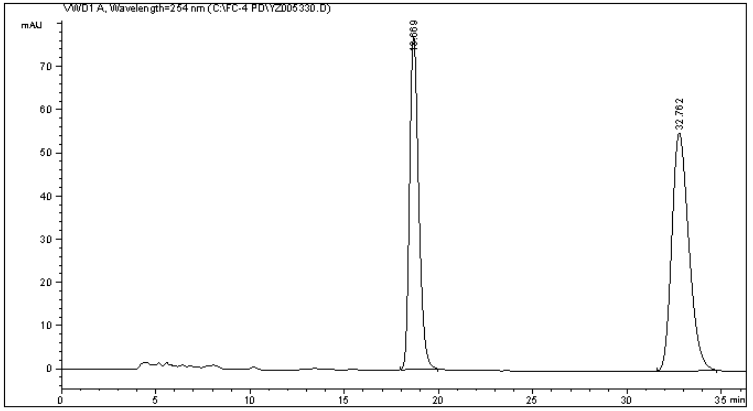
==========================================================================
                        *** End of Report ***
```



cis-(±)-**3k**

Data File C:\FC-4 PD\YZ005330.D
Sample Name: FC-6-21D

```
==========================================================================
Acq. Operator   : ZHOU
Acq. Instrument : Instrument 1                    Location : Vial 1
Injection Date  : 11/26/2013 2:04:16 AM
Acq. Method     : C:\HPCHEM\1\METHODS\DEMOCAL2.M
Last changed    : 11/26/2013 1:01:57 AM by ZHOU
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed    : 3/19/2014 2:09:40 PM by Z
                  (modified after loading)
Sample Info     : OD-H, H/i-PrOH = 70/30, 0.7 mL/min, 30 oC, 254 nm
```




```
==========================================================================
                        Area Percent Report
==========================================================================

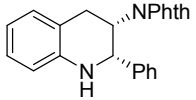
Sorted By             :      Signal
Multiplier:                   :      1.0000
Dilution:                     :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: VWD1 A, Wavelength=254 nm

Peak RetTime Type  Width     Area      Height     Area
  #   [min]      [min]  mAU   *s   [mAU   ]      %
----|-------|----|-------|---------|---------|-------|
   1  18.669 BB    0.5209 2613.06055   77.03931  43.0004
   2  32.762 BB    0.9669 3463.76855   55.16659  56.9996

Totals :                  6076.82910  132.20589

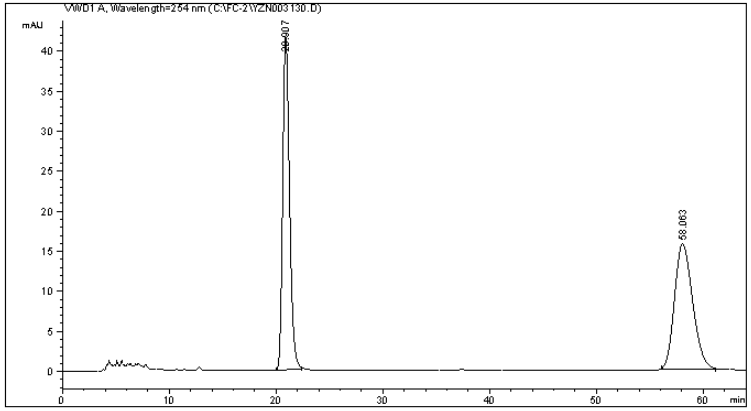
==========================================================================
                        *** End of Report ***
```



cis-(–)-**3k**

Data File C:\FC-2\YZN003130.D
Sample Name: FC-5-31D

```
==========================================================================
Acq. Operator   : YZ
Acq. Instrument : Instrument 1                    Location : Vial 1
Injection Date  : 7/1/2013 8:32:52 AM
Acq. Method     : C:\CHEM32\1\METHODS\DEF LC.M
Last changed    : 7/1/2013 8:32:15 AM by YZ
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed    : 10/9/2013 10:26:48 PM by B
                  (modified after loading)
Sample Info     : OD-H, H/i-PrOH = 70/30, 0.7 mL/min, 30 oC, 254nm
```




```
==========================================================================
                        Area Percent Report
==========================================================================

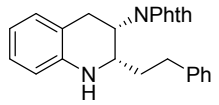
Sorted By             :      Signal
Multiplier:                   :      1.0000
Dilution:                     :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: VWD1 A, Wavelength=254 nm

Peak RetTime Type  Width     Area      Height     Area
  #   [min]       [min]  mAU   *s   [mAU   ]      %
----|-------|----|-------|----------|----------|--------|
   1  20.907 BB    0.6820 1851.19116   41.61592  50.2063
   2  58.063 BB    1.6967 1835.97693   15.66210  49.7937

Totals :                  3687.16809   57.27802

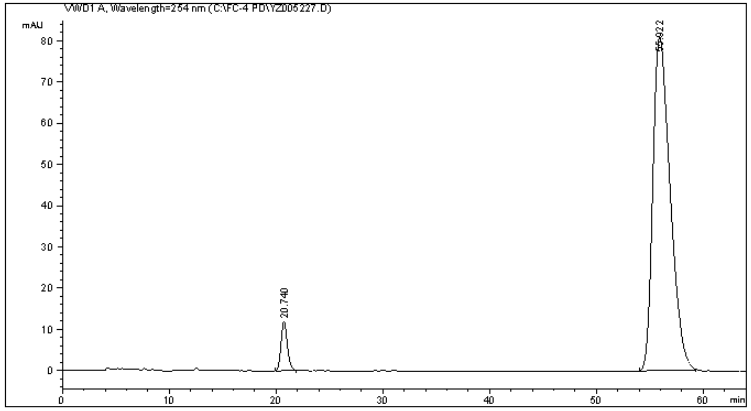
==========================================================================
                        *** End of Report ***
```



cis-(±)-**3i**

Data File C:\FC-4 PD\YZ005227.D
Sample Name: FC-6-25B

```
==========================================================================
Acq. Operator   : ZHOU
Acq. Instrument : Instrument 1                    Location : Vial 1
Injection Date  : 11/11/2013 11:53:30 AM
Acq. Method     : C:\HPCHEM\1\METHODS\DEMOCAL2.M
Last changed    : 11/11/2013 12:25:53 PM by ZHOU
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed    : 3/19/2014 2:26:54 PM by Z
                  (modified after loading)
Sample Info     : OD-H, H/i-PrOH = 70/30, 0.70 mL/min, 30 oC, 254 nm
```




```
==========================================================================
                        Area Percent Report
==========================================================================

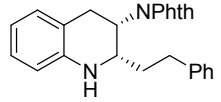
Sorted By             :      Signal
Multiplier:                   :      1.0000
Dilution:                     :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: VWD1 A, Wavelength=254 nm

Peak RetTime Type  Width     Area      Height     Area
  #   [min]       [min]  mAU   *s   [mAU   ]      %
----|-------|----|-------|----------|----------|--------|
   1  20.740 BB    0.6388  497.12738   11.93569   5.1738
   2  55.922 BB    1.6248 9111.40234   80.94560  94.8262

Totals :                  9608.52972   92.88129

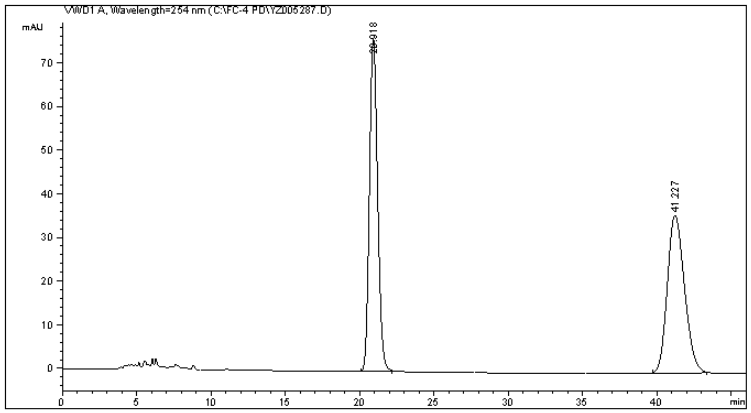
==========================================================================
                        *** End of Report ***
```



cis-(–)-**3i**
for the hydrogenation of **2l**

Data File C:\FC-4 PD\YZ005287.D
Sample Name: FC-6-30E

```
==========================================================================
Acq. Operator   : ZHOU
Acq. Instrument : Instrument 1                    Location : Vial 1
Injection Date  : 11/19/2013 10:39:56 AM
Acq. Method     : C:\HPCHEM\1\METHODS\DEMOCAL2.M
Last changed    : 11/19/2013 9:58:47 AM by ZHOU
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed    : 3/19/2014 2:29:07 PM by Z
                  (modified after loading)
Sample Info     : OD-H, H/i-PrOH = 70/30, 0.70 mL/min, 30 oC, 254nm
```




```
==========================================================================
                        Area Percent Report
==========================================================================

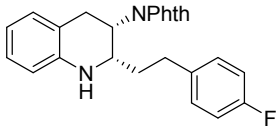
Sorted By             :      Signal
Multiplier:                   :      1.0000
Dilution:                     :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: VWD1 A, Wavelength=254 nm

Peak RetTime Type  Width     Area      Height     Area
  #   [min]       [min]  mAU   *s   [mAU   ]      %
----|-------|----|-------|---------|---------|-------|
   1  20.918 BB    0.5925 2914.56201   76.08921  50.0906
   2  41.227 BB    1.2247 2904.01489   36.12630  49.9094

Totals :                  5818.57690  112.21551

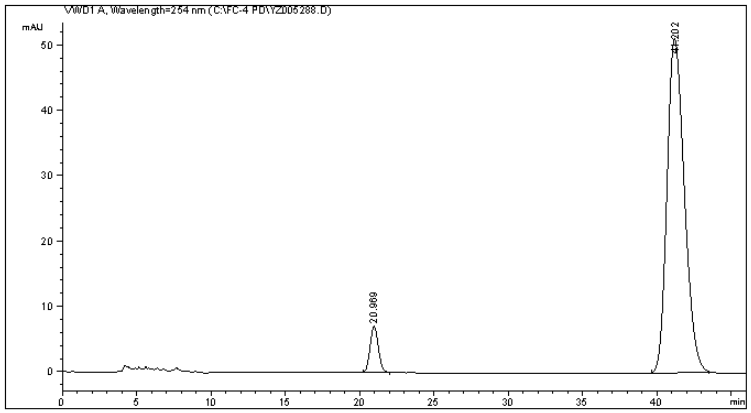
==========================================================================
                        *** End of Report ***
```



cis-(±)-**3m**

Data File C:\FC-4 PD\YZ005288.D
Sample Name: FC-6-30A

```
==========================================================================
Acq. Operator   : ZHOU
Acq. Instrument : Instrument 1                    Location : Vial 1
Injection Date  : 11/19/2013 11:27:03 AM
Acq. Method     : C:\HPCHEM\1\METHODS\DEMOCAL2.M
Last changed    : 11/19/2013 9:58:47 AM by ZHOU
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed    : 3/19/2014 2:29:07 PM by Z
                  (modified after loading)
Sample Info     : OD-H, H/i-PrOH = 70/30, 0.70 mL/min, 30 oC, 254nm
```




```
==========================================================================
                        Area Percent Report
==========================================================================

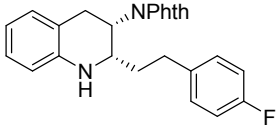
Sorted By             :      Signal
Multiplier:                   :      1.0000
Dilution:                     :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: VWD1 A, Wavelength=254 nm

Peak RetTime Type  Width     Area      Height     Area
  #   [min]       [min]  mAU   *s   [mAU   ]      %
----|-------|----|-------|---------|---------|-------|
   1  20.969 BB    0.6110  275.91119    7.11668   6.2358
   2  41.202 BB    1.2611 4148.72705   51.13284  93.7642

Totals :                  4424.63824   58.24952

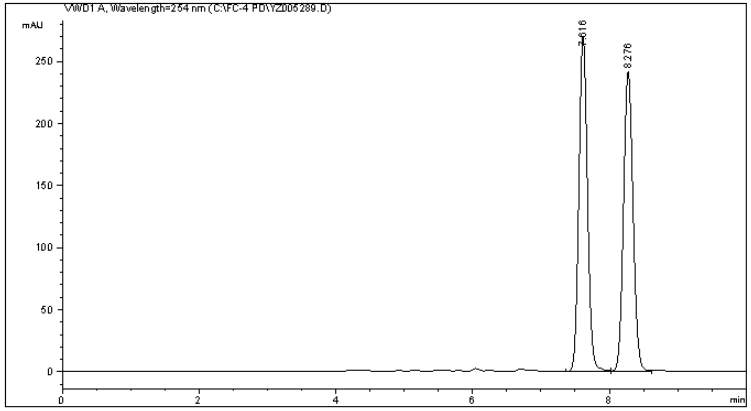
==========================================================================
                        *** End of Report ***
```



cis-(–)-**3m**

Data File C:\FC-4 PD\YZ005289.D
Sample Name: FC-6-30D2

```
==========================================================================
Acq. Operator   : ZHOU
Acq. Instrument : Instrument 1                    Location : Vial 1
Injection Date  : 11/19/2013 12:15:23 PM
Acq. Method     : C:\HPCHEM\1\METHODS\DEMOCAL2.M
Last changed    : 11/19/2013 9:58:47 AM by ZHOU
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed    : 3/19/2014 2:34:42 PM by Z
                  (modified after loading)
Sample Info     : OD-H, H/i-PrOH = 70/30, 0.70 mL/min, 30 oC, 254nm
```




```
==========================================================================
                        Area Percent Report
==========================================================================

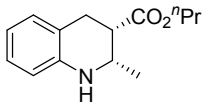
Sorted By             :      Signal
Multiplier:                   :      1.0000
Dilution:                     :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: VWD1 A, Wavelength=254 nm

Peak RetTime Type  Width     Area      Height     Area
  #   [min]       [min]  mAU   *s   [mAU   ]      %
----|-------|----|-------|---------|---------|-------|
   1   7.616 BV    0.1360 2367.75439  269.59491  50.2285
   2   8.276 VV    0.1512 2346.20776  241.50424  49.7715

Totals :                  4713.96216  511.09915

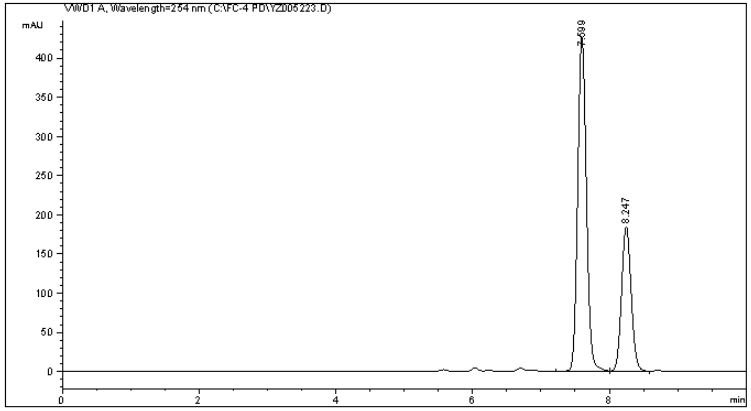
==========================================================================
                        *** End of Report ***
```



cis-(±)-**8a**

Data File C:\FC-4 PD\YZ005223.D
Sample Name: FC-6-25D2

```
==========================================================================
Acq. Operator   : ZHOU
Acq. Instrument : Instrument 1                    Location : Vial 1
Injection Date  : 11/11/2013 10:50:34 AM
Acq. Method     : C:\HPCHEM\1\METHODS\DEMOCAL2.M
Last changed    : 11/11/2013 9:56:12 AM by ZHOU
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed    : 3/19/2014 2:41:02 PM by Z
                  (modified after loading)
Sample Info     : OD-H, H/i-PrOH = 70/30, 0.70 mL/min, 30 oC, 254 nm
```




```
==========================================================================
                        Area Percent Report
==========================================================================

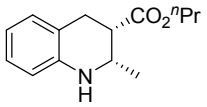
Sorted By             :      Signal
Multiplier:                   :      1.0000
Dilution:                     :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: VWD1 A, Wavelength=254 nm

Peak RetTime Type  Width     Area      Height     Area
  #   [min]       [min]  mAU   *s   [mAU   ]      %
----|-------|----|-------|---------|---------|-------|
   1   7.599 BV    0.1391 3816.40259  427.41977  67.5877
   2   8.247 VV    0.1529 1830.19141  185.53156  32.4123

Totals :                  5646.59399  612.95132

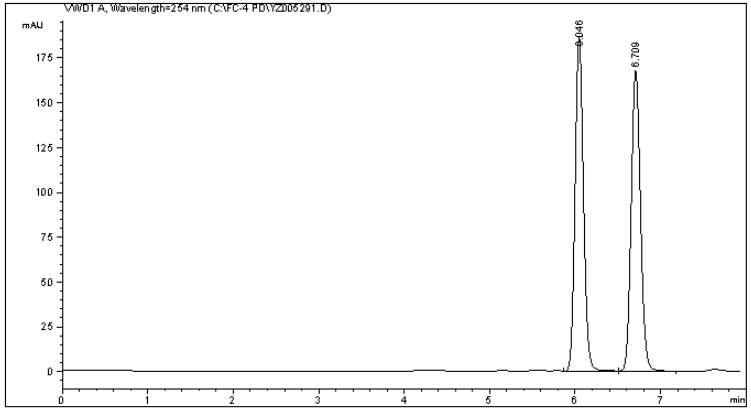
==========================================================================
                        *** End of Report ***
```



cis-(–)-**8a**

Data File C:\FC-4 PD\YZ005291.D
Sample Name: FC-6-25D1

```
======================================================================
Acq. Operator   : ZHOU
Acq. Instrument : Instrument 1                    Location : Vial 1
Injection Date  : 11/19/2013 12:56:39 PM
Acq. Method     : C:\HPCHEM\1\METHODS\DEMOCAL2.M
Last changed    : 11/19/2013 9:58:47 AM by ZHOU
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed    : 3/19/2014 2:42:41 PM by Z
                  (modified after loading)
Sample Info     : OD-H, H/i-PrOH = 70/30, 0.70 mL/min, 30 oC, 254nm
```




```
======================================================================
                        Area Percent Report
======================================================================

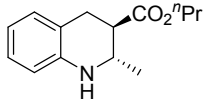
Sorted By             :      Signal
Multiplier:                   :      1.0000
Dilution:                     :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: VWD1 A, Wavelength=254 nm

Peak RetTime Type  Width     Area      Height     Area
  #   [min]       [min]  mAU   *s   [mAU   ]      %
----|-------|----|-------|---------|---------|-------|
   1   6.046 VV    0.1065 1285.61963  186.70485  50.2416
   2   6.709 VB    0.1176 1273.25513  167.97606  49.7584

Totals :                  2558.87476  354.68091

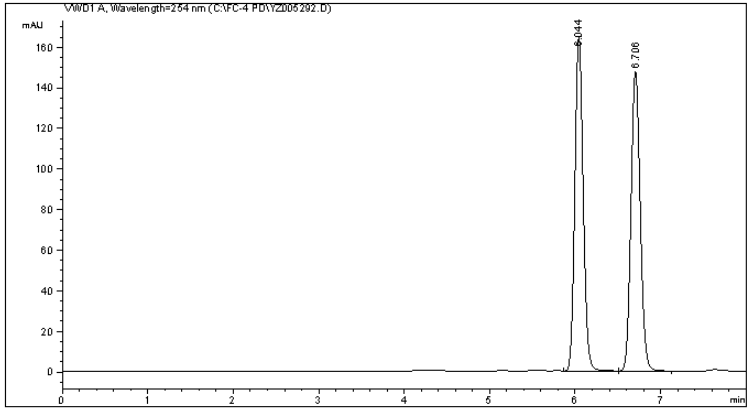
======================================================================
                        *** End of Report ***
```



trans-(±)-**8b**

Data File C:\FC-4 PD\YZ005292.D
Sample Name: FC-6-25D1

```
======================================================================
Acq. Operator   : ZHOU
Acq. Instrument : Instrument 1                    Location : Vial 1
Injection Date  : 11/19/2013 1:07:26 PM
Acq. Method     : C:\HPCHEM\1\METHODS\DEMOCAL2.M
Last changed    : 11/19/2013 9:58:47 AM by ZHOU
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed    : 3/19/2014 2:42:41 PM by Z
                  (modified after loading)
Sample Info     : OD-H, H/i-PrOH = 70/30, 0.70 mL/min, 30 oC, 254nm
```




```
======================================================================
                        Area Percent Report
======================================================================

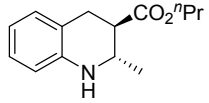
Sorted By             :      Signal
Multiplier:                   :      1.0000
Dilution:                     :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: VWD1 A, Wavelength=254 nm

Peak RetTime Type  Width     Area      Height     Area
  #   [min]       [min]  mAU   *s   [mAU   ]      %
----|-------|----|-------|---------|---------|-------|
   1   6.044 VV    0.1059 1125.61145  164.82405  50.1961
   2   6.706 VB    0.1171 1116.81885  148.07527  49.8039

Totals :                  2242.43030  312.89932

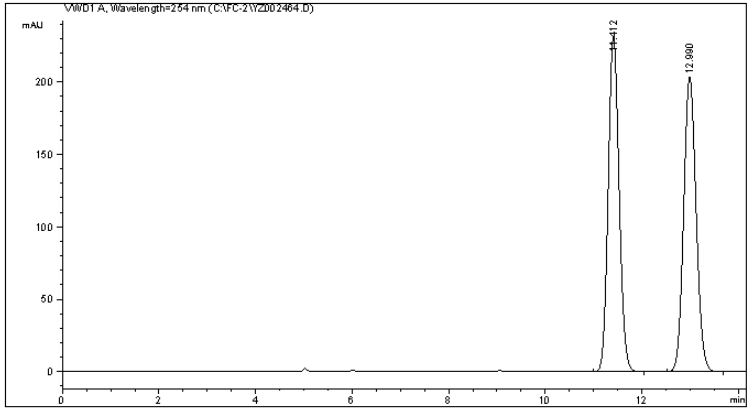
======================================================================
                        *** End of Report ***
```



trans-**8b**

Data File C:\FC-2\YZ002464.D
Sample Name: FC-2-76El

```
==========================================================================
Acq. Operator   : ZX
Acq. Instrument : Instrument 1                    Location : Vial 1
Injection Date  : 6/19/2012 12:50:34 AM
Acq. Method     : C:\HPCHEM\1\METHODS\SW.M
Last changed    : 6/19/2012 12:48:57 AM by ZX
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed    : 10/9/2013 10:02:48 PM by B
                  (modified after loading)
Sample Info     : AD-H, H/i-PrOH = 80/20, 0.9mL/min, 30 oC, 254 nm
```




```
==========================================================================
                        Area Percent Report
==========================================================================

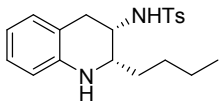
Sorted By             :      Signal
Multiplier:                   :      1.0000
Dilution:                     :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: VWD1 A, Wavelength=254 nm

Peak RetTime Type  Width     Area      Height     Area
  #   [min]       [min]  mAU   *s   [mAU   ]      %
----|-------|----|-------|---------|---------|--------|
   1  11.412 BB    0.2448 3639.69067  231.25813  49.9645
   2  12.990 BB    0.2789 3644.86841  203.44264  50.0355

Totals :                  7284.55908  434.70078

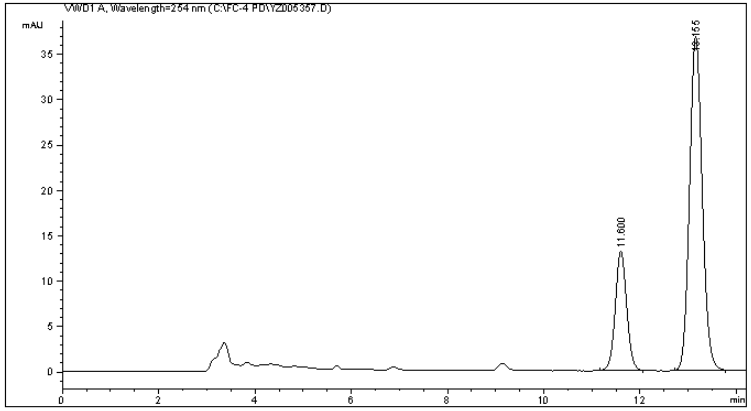
==========================================================================
                        *** End of Report ***
```



cis-(±)-**9a**

Data File C:\FC-4 PD\YZ005357.D
Sample Name: FC-6-44Cl

```
==========================================================================
Acq. Operator   : ZHOU
Acq. Instrument : Instrument 1                    Location : Vial 1
Injection Date  : 12/7/2013 2:13:58 PM
Acq. Method     : C:\HPCHEM\1\METHODS\DEMOCAL2.M
Last changed    : 12/7/2013 1:58:51 PM by ZHOU
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed    : 3/19/2014 2:59:08 PM by Z
                  (modified after loading)
Sample Info     : AD-H, H/i-PrOH = 80/20, 0.9 mL/min, 30 oC, 254 nm
```




```
==========================================================================
                        Area Percent Report
==========================================================================

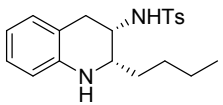
Sorted By             :      Signal
Multiplier:                   :      1.0000
Dilution:                     :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: VWD1 A, Wavelength=254 nm

Peak RetTime Type  Width     Area      Height     Area
  #   [min]       [min]  mAU   *s   [mAU   ]      %
----|-------|----|-------|---------|---------|--------|
   1  11.600 BB    0.2548  217.51920   13.20103  24.3205
   2  13.155 BB    0.2845  676.86627   36.79735  75.6795

Totals :                   894.38547   49.99838

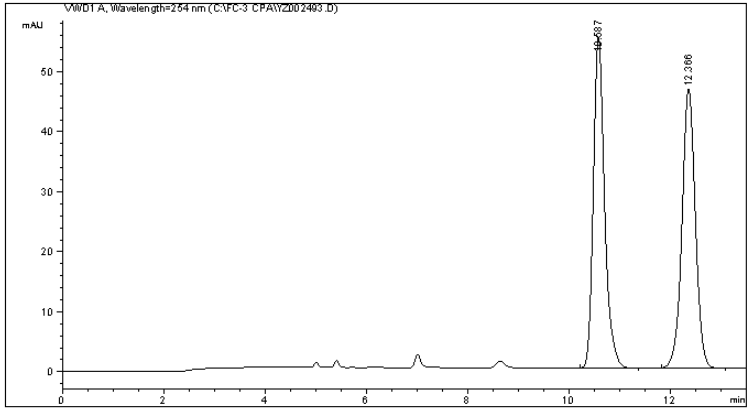
==========================================================================
                        *** End of Report ***
```



cis-(+)-**9a**

Data File C:\FC-3 CPA\YZ002493.D
Sample Name: FC-2-76E2

```
Acq. Operator   : ZX
Acq. Instrument : Instrument 1                    Location : Vial 1
Injection Date  : 6/19/2012 9:47:14 AM
Acq. Method     : C:\HPCHEM\1\METHODS\SW.M
Last changed    : 6/19/2012 9:44:21 AM by ZX
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed    : 3/18/2014 3:00:15 PM by Z
                  (modified after loading)
Sample Info     : AD-H, H/i-PrOH = 75/25, 0.8 mL/min, 30 oC, 254 nm
```



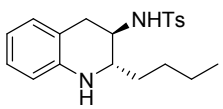
Area Percent Report

```
Sorted By             :      Signal
Multiplier:                   :      1.0000
Dilution:                     :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: VWD1 A, Wavelength=254 nm

Peak RetTime Type  Width     Area      Height     Area
  #   [min]       [min]  mAU   *s   [mAU   ]      %
----|-------|----|-------|---------|---------|-------|
   1  10.587 BB    0.2348  848.72638   55.16675  49.8889
   2  12.366 BB    0.2806  852.50793   46.54912  50.1111

Totals :                  1701.23431  101.71587
```

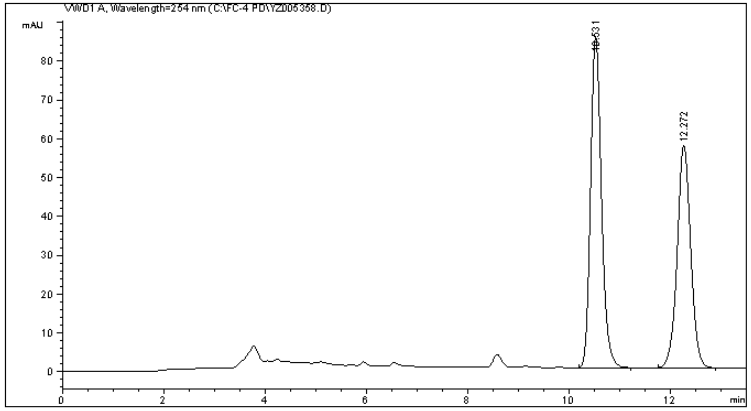


trans-(±)-**9b**

*** End of Report ***

Data File C:\FC-4 PD\YZ005358.D
Sample Name: FC-6-44C2

```
Acq. Operator   : ZHOU
Acq. Instrument : Instrument 1                    Location : Vial 1
Injection Date  : 12/7/2013 2:31:46 PM
Acq. Method     : C:\HPCHEM\1\METHODS\DEMOCAL2.M
Last changed    : 12/7/2013 2:29:01 PM by ZHOU
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed    : 3/19/2014 3:00:28 PM by Z
                  (modified after loading)
Sample Info     : AD-H, H/i-PrOH = 75/25, 0.8 mL/min, 30 oC, 254 nm
```



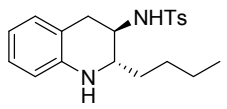
Area Percent Report

```
Sorted By             :      Signal
Multiplier:                   :      1.0000
Dilution:                     :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: VWD1 A, Wavelength=254 nm

Peak RetTime Type  Width     Area      Height     Area
  #   [min]       [min]  mAU   *s   [mAU   ]      %
----|-------|----|-------|---------|---------|-------|
   1  10.531 BB    0.2299 1275.60083   85.26829  54.5429
   2  12.272 BB    0.2819 1063.11169   57.30759  45.4571

Totals :                  2338.71252  142.57587
```

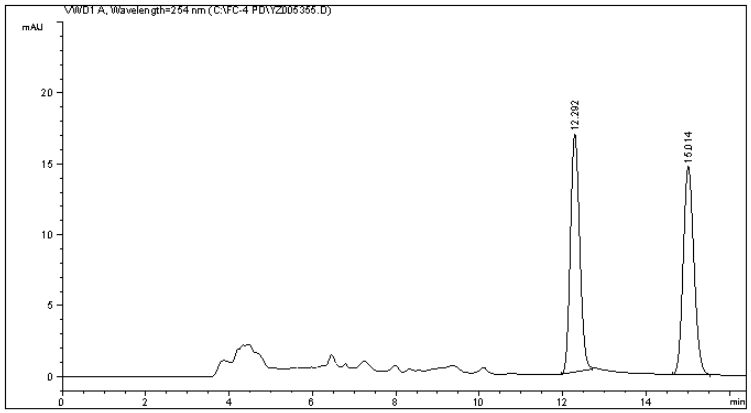


trans-**9b**

*** End of Report ***

Data File C:\FC-4 PD\YZ005355.D
Sample Name: FC-6-44E

```
==========================================================================
Acq. Operator   : ZHOU
Acq. Instrument : Instrument 1                    Location : Vial 1
Injection Date  : 12/7/2013 1:19:22 PM
Acq. Method     : C:\HPCHEM\1\METHODS\DEMOCAL2.M
Last changed    : 12/7/2013 12:58:33 PM by ZHOU
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed    : 3/19/2014 2:55:15 PM by Z
                  (modified after loading)
Sample Info     : OD-H, H/i-PrOH = 85/15, 0.7 mL/min, 30 oC, 254 nm
```




```
==========================================================================
                        Area Percent Report
==========================================================================

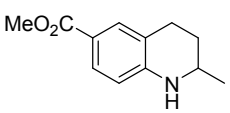
Sorted By             :      Signal
Multiplier:                   :      1.0000
Dilution:                     :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: VWD1 A, Wavelength=254 nm

Peak RetTime Type  Width     Area      Height     Area
  #   [min]       [min]  mAU   *s   [mAU   ]      %
----|-------|----|-------|---------|---------|-------|
   1  12.292 BB    0.2398  258.86624   16.77034  49.6381
   2  15.014 BB    0.2769  262.64081   14.69664  50.3619

Totals :                  521.50705   31.46698

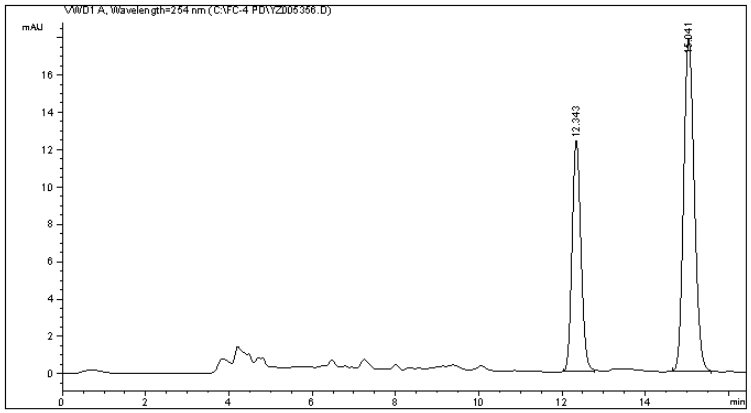
==========================================================================
                        *** End of Report ***
```



(±)-**10**

Data File C:\FC-4 PD\YZ005356.D
Sample Name: FC-6-44D

```
==========================================================================
Acq. Operator   : ZHOU
Acq. Instrument : Instrument 1                    Location : Vial 1
Injection Date  : 12/7/2013 1:40:39 PM
Acq. Method     : C:\HPCHEM\1\METHODS\DEMOCAL2.M
Last changed    : 12/7/2013 12:58:33 PM by ZHOU
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF LC.M
Last changed    : 3/19/2014 2:52:34 PM by Z
                  (modified after loading)
Sample Info     : OD-H, H/i-PrOH = 85/15, 0.7 mL/min, 30 oC, 254 nm
```




```
==========================================================================
                        Area Percent Report
==========================================================================

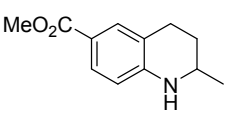
Sorted By             :      Signal
Multiplier:                   :      1.0000
Dilution:                     :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: VWD1 A, Wavelength=254 nm

Peak RetTime Type  Width     Area      Height     Area
  #   [min]       [min]  mAU   *s   [mAU   ]      %
----|-------|----|-------|---------|---------|-------|
   1  12.343 BB    0.2291  182.49448   12.35686  36.4806
   2  15.041 BB    0.2781  317.75693   17.80739  63.5194

Totals :                  500.25140   30.16425

==========================================================================
                        *** End of Report ***
```



(–)-**10**