# *Supporting Information*

A One-Pot Process for the Enantioselective Synthesis of Tetrahydroquinolines and Tetrahydroisoquinolines *via* Asymmetric Reductive Amination (ARA)

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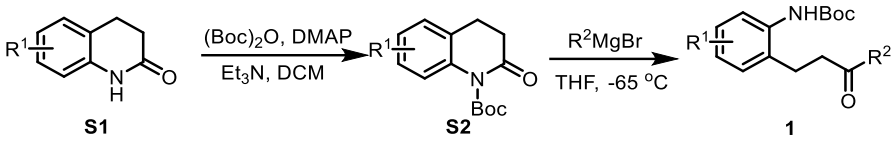
## Contents

# 1. General information

Unless otherwise mentioned, all experiments were carried out under an atmosphere of argon in a glovebox or using standard Schlenk techniques. Solvents were dried with standard procedures and degassed with $N_2$. Flash column chromatography was performed using Tsingdao silica gel (60, particle size 300-400 mesh). NMR spectra were recorded on a Bruker DPX 400 spectrometer at 400 MHz for $^1$H NMR, 101 MHz for $^{13}$C NMR or a Bruker DPX 500 spectrometer at 500 MHz for $^1$H NMR, 126 MHz for $^{13}$C NMR. Chemical shifts ($\delta$) are reported in ppm and respectively referenced to internal standard $Me_4Si$ and solvent signals ($Me_4Si$, 0 ppm for $^1$H NMR in $CDCl_3$; 77.0 ppm in $CDCl_3$ for $^{13}$C NMR). HPLC and UPLC analysis was carried out on Angilent 1200 Series instrument using chiral columns.

# 2. General procedure for the preparation of substrates

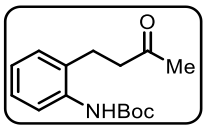



Step 1：

**S1** (10 mmol) and $Et_3N$ (11 mmol) were dissolved in dichloromethane (30 mL) at 0 °C, followed by addition of $(Boc)_2O$ (12 mmol) and DMAP (0.5 mmol). The resulting solution was warmed to rt and stirred for 6 h. The reaction was quenched with saturated $NH_4Cl$ aqueous solution (20 mL). The organic layer was extracted with dichloromethane (10 mL × 2), combined, dried over anhydrous $NaSO_4$, and then concentrated under reduced pressure. The crude product was further purified by column chromatography to quantitatively provide pure **S2**.

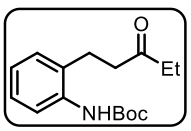
Step 2:

$R^2MgBr$ (1.3 equiv) was added dropwise to a solution of **S2** (3 mmol) in dried THF (10 mL) at -65 °C. The resulting mixture was then stirred overnight. After warming up to rt, the reaction was quenched with saturated $NH_4Cl$ aqueous solution (15 mL) and extracted with EtOAc (10 mL × 2). The combined organic layers were dried over anhydrous $Na_2SO_4$ and concentrated under reduced pressure. The crude product was purified by column chromatography to give **1**.



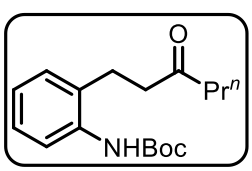

***tert*-butyl (2-(3-oxobutyl)phenyl)carbamate (1a)**[1]: an oil, 500 mg, 63% yield $^1$H NMR (500 MHz, $CDCl_3$) δ 7.72 (d, *J* = 5.9 Hz, 1H), 7.60 (s, 1H), 7.20 (m, 1H), 7.16-7.09 (m, 1H), 7.09-7.01 (m, 1H), 2.85 (m, 4H), 2.33-2.02 (m, 3H), 1.56 (s, 9H). $^{13}$C{$^1$H} NMR (126 MHz, $CDCl_3$) δ 209.2, 153.8, 136.0, 131.9, 129.4, 126.9, 124.2, 123.2, 80.0, 44.6, 29.9, 28.4, 24.0 ppm.

***tert*-butyl (2-(3-oxopentyl)phenyl)carbamate (1b):** an oil, 465 mg, 56% yield




$^1$H NMR (500 MHz, $CDCl_3$) δ 7.71 (d, *J* = 7.7 Hz, 1H), 7.50 (s, 1H), 7.23-7.18 (m, 1H), 7.12 (dd, *J* = 7.6, 1.5 Hz, 1H), 7.04 (td, *J* = 7.5, 1.2 Hz, 1H), 2.84 (m, 4H), 2.42 (q, *J* = 7.3 Hz, 2H), 1.56 (s, 9H), 1.05 (t, *J* = 7.3 Hz, 3H). $^{13}$C{$^1$H} NMR (126 MHz, $CDCl_3$) δ 211.8, 153.8, 136.0, 132.0, 129.3, 126.9, 124.2, 123.3, 80.0, 43.1, 36.0, 28.4, 27.9, 24.1 ppm. HRMS Calculated for $C_{16}H_{24}NO_3$ $[M+H]^+$ 278.1751; found 278.1741.

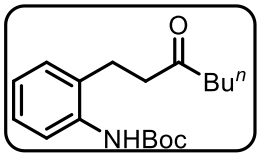
***tert*-butyl (2-(3-oxohexyl)phenyl)carbamate (1c)**: an oil, 611 mg, 70% yield




$^1$H NMR (500 MHz, $CDCl_3$) δ 7.71 (d, *J* = 7.7 Hz, 1H), 7.49 (s, 1H),

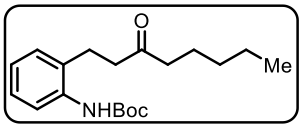
7.24-7.16 (m, 1H), 7.11 (dd, *J* = 7.6, 1.5 Hz, 1H), 7.04 (td, *J* = 7.5, 1.1 Hz, 1H), 2.91-2.72 (m, 4H), 2.37 (t, *J* = 7.4 Hz, 2H), 1.60 (dt, *J* = 7.4, 7.4 Hz, 2H), 1.56 (s, 9H), 0.88 (t, *J* = 7.4 Hz, 3 H). $^{13}C\{^1H\}$ NMR (126 MHz, $CDCl_3$) δ 211.4, 153.8, 136.0, 131.9, 129.3, 126.9, 124.2, 123.7, 80.0, 44.8, 43.5, 28.4, 24.1, 17.3, 13.6 ppm. HRMS Calculated for $C_{17}H_{26}NO_3$ $[M+H]^+$ 292.1907; found 292.1896.

***tert*-butyl (2-(3-oxoheptyl)phenyl)carbamate (1d)**: an oil, 530 mg, 58% yield



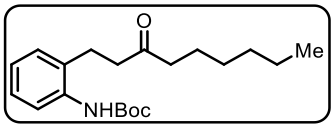

$^1H$ NMR (500 MHz, $CDCl_3$) δ 7.71 (d, *J* = 7.6 Hz, 1H), 7.50 (s, 1H), 7.20 (t, *J* = 7.7 Hz, 1H), 7.11 (d, *J* = 7.5 Hz, 1H), 7.04 (t, *J* = 7.4 Hz, 1H), 2.83 (s, 4H), 2.39 (t, *J* = 7.5 Hz, 2H), 1.56 (s, 9H), 1.54-1.49 (m, 2H), 1.34-1.20 (m, 2H), 0.89 (t, *J* = 7.5 Hz, 3H). $^{13}C\{^1H\}$ NMR (126 MHz, $CDCl_3$) δ 211.6, 153.8, 136.0, 131.9, 129.3, 126.9, 124.2, 123.3, 80.0, 43.4, 42.7, 28.4, 25.9, 24.1, 22.2, 13.8 ppm. HRMS Calculated for $C_{18}H_{28}O_3N$ $[M+H]^+$ 306.2064; found 306.2053.

***tert*-butyl (2-(3-oxooctyl)phenyl)carbamate (1e)**: an oil, 440 mg, 46% yield



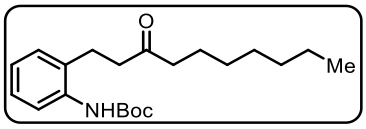

$^1H$ NMR (500 MHz, $CDCl_3$) δ 7.71 (d, *J* = 7.7 Hz, 1H), 7.50 (s, 1H), 7.25-7.17 (m, 1H), 7.11 (dd, *J* = 7.6, 1.6 Hz, 1H), 7.04 (td, *J* = 7.5, 1.2 Hz, 1H), 2.83 (m, 4H), 2..38 (t, *J* = 7.6 Hz, 2H), 1.60-1.51 (m, 11H), 1.30 (m, 2H), 1.26-1.17 (m, 2H), 0.88 (t, *J* = 7.2 Hz, 3H). $^{13}C\{^1H\}$ NMR (126 MHz, $CDCl_3$) δ 211.6, 153.8, 136.0, 131.9, 129.3, 126.9, 124.2, 123.3, 80.0, 43.4, 42.9, 31.3, 28.4, 24.1, 23.5, 22.4, 13.9 ppm. HRMS Calculated for $C_{19}H_{30}O_3N$ $[M+H]^+$ 320.2220; found 320.2210.

***tert*-butyl (2-(3-oxononyl)phenyl)carbamate (1f)**: an oil, 660 mg, 66% yield



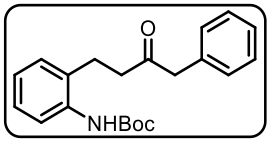

$^1H$ NMR (500 MHz, $CDCl_3$) δ 7.71 (d, *J* = 7.6 Hz, 1H), 7.51 (s, 1H), 7.23 - 7.15 (m, 1H), 7.11 (dd, *J* = 7.6, 1.5 Hz, 1H), 7.04 (td, *J* = 7.5, 1.2 Hz, 1H), 2.83 (t, *J* = 3.7 Hz, 4H), 2.38 (t, *J* = 7.5 Hz, 2H), 1.56 (m, 11H), 1.35 - 1.11 (m,6 H), 0.88 (t, *J* = 7.0 Hz, 3H). $^{13}C\{^1H\}$ NMR (126 MHz, $CDCl_3$) δ 211.6, 153.8, 136.0, 132.0, 129.3, 126.9, 124.2, 123.3, 80.0, 43.4, 43.0, 31.5, 28.8, 28.4, 24.1, 23.8, 22.4, 14.0 ppm. HRMS Calculated for $C_{20}H_{32}O_3N$ $[M+H]^+$ 334.2377; found 334.2365.

***tert*-butyl (2-(3-oxodecyl)phenyl)carbamate (1g)**: an oil, 560 mg, 54% yield



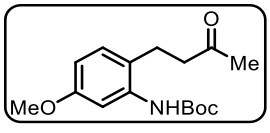

$^1H$ NMR (500 MHz, $CDCl_3$) δ 7.71 (d, *J* = 7.8 Hz, 1H), 7.50 (s, 1H), 7.23-7.16 (m, 1H), 7.11 (dd, *J* = 7.7, 1.5 Hz, 1H), 7.04 (td, *J* = 7.5, 1.2 Hz, 1H), 2.83 (m, 4H), 2.38 (t, *J* = 7.5 Hz, 2H), 1.56 (m, 11H), 1.33 - 1.16 (m, 8H), 0.89 (t, *J* = 7.0 Hz, 3H). $^{13}C\{^1H\}$ NMR (126 MHz, $CDCl_3$) δ 211.6, 153.8, 136.0, 131.9 , 129.3, 126.9, 124.2, 123.3, 80.0, 43.4, 43.0, 31.6, 29.0, 29.0, 28.4, 24.1, 23.9, 22.5, 14.0 ppm. HRMS Calculated for $C_{21}H_{34}O_3N$ $[M+H]^+$ 348.2533; found 348.2522.

***tert*-butyl (2-(3-oxo-4-phenylbutyl)phenyl)carbamate (1h)**: a white solid, 750 mg, 74% yield




$^1H$ NMR (500 MHz, $CDCl_3$) δ 7.67 (d, *J* = 7.7 Hz, 1H), 7.38-7.22 (m, 4H), 7.22-7.15 (m, 1H), 7.15-7.10 (m, 2H), 7.06-6.96 (m, 2H), 3.65 (s, 2H), 2.83 (m, 2H), 2.79 (m, 2H), 1.52 (s, 9H). $^{13}C\{^1H\}$ NMR (126 MHz, $CDCl_3$) δ 208.7, 153.8, 135.9, 133.8, 131.7, 130.6, 129.3, 128.4, 127.1, 126.9, 124.2, 123.3, 80.1, 50.2, 42.7, 28.4, 24.2 ppm. HRMS Calculated for $C_{21}H_{26}O_3N$ $[M+H]^+$ 340.1907; found 340.1896.

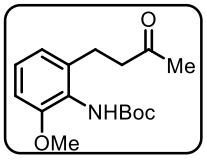
***tert*-butyl (5-methoxy-2-(3-oxobutyl)phenyl)carbamate (1i)**: an oil, 550 mg, 63% yield




$^1H$ NMR (500 MHz, $CDCl_3$) δ 7.64 (s, 1H), 7.42 (s, 1H), 6.99 (d, *J* = 8.5 Hz, 1H), 6.60 (dd, *J* = 8.5, 2.7 Hz, 1H), 3.80 (s, 3H), 2.83 (t, *J* = 6.4 Hz,

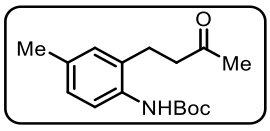
2H), 2.76 (t, *J* = 6.4 Hz, 2H), 2.15 (s, 3H), 1.56 (s, 9H). $^{13}C\{^1H\}$ NMR (126 MHz, $CDCl_3$) δ 209.4, 158.5, 153.5, 137.0, 130.0, 123.1, 110.5, 107.2, 80.1, 55.3, 44.8, 30.0, 28.4, 23.3 ppm. HRMS Calculated for $C_{16}H_{24}O_4N$ $[M+H]^+$ 294.1700; found 294.1692.

***tert*-butyl (2-methoxy-6-(3-oxobutyl)phenyl)carbamate (1j)**: an oil, 410 mg, 47% yield



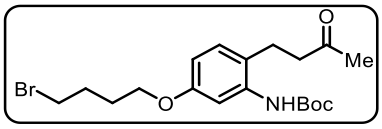

$^1H$ NMR (500 MHz, $CDCl_3$) δ 7.49 (s, 1H), 7.25 (s, 1H), 6.75 (dd, *J* = 8.8, 3.0 Hz, 1H), 6.67 (d, *J* = 2.9 Hz, 1H), 3.78 (s, 3H), 2.85 (m, 2H), 2.83-2.78 (m, 2H), 2.15 (s, 3H), 1.54 (s, 9H). $^{13}C\{^1H\}$ NMR (126 MHz, $CDCl_3$) δ 208.9, 156.7, 154.4, 134.9, 128.9, 125.9, 114.8, 111.8, 79.8, 55.4, 44.5, 30.0, 28.4, 24.4 ppm. HRMS Calculated for $C_{16}H_{24}O_4N$ $[M+H]^+$ 294.1700; found 294.1692.

***tert*-butyl (4-methyl-2-(3-oxobutyl)phenyl)carbamate (1k)**: an oil, 420 mg, 58% yield



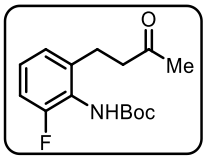

$^1H$ NMR (500 MHz, $CDCl_3$) δ 7.61-7.50 (m, 1H), 7.41 (s, 1H), 7.01 (dd, *J* = 8.2, 1.6 Hz, 1H), 6.92 (d, *J* = 1.5 Hz, 1H), 2.87-2.84 (m, 2H), 2.82-2.77 (m, 2H), 2.29 (s, 3H), 2.15 (s, 3H), 1.55 (s, 9H). $^{13}C\{^1H\}$ NMR (126 MHz, $CDCl_3$) δ 209.1, 154.0, 133.8, 133.3, 132.1, 130.0, 127.6, 123.6, 79.9, 44.6, 30.0, 28.4, 24.1, 20.8 ppm. HRMS Calculated for $C_{16}H_{24}O_3N$ $[M+H]^+$ 278.1751; found 278.1741.

***tert*-butyl (5-(4-bromobutoxy)-2-(3-oxobutyl)phenyl)carbamate (1l)**: an oil, 530 mg, 63% yield



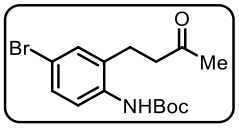

$^1H$ NMR (500 MHz, $CDCl_3$) δ 7.63 (s, 1H), 7.40 (s, 1H), 6.96 (d, *J* = 8.5 Hz, 1H), 6.56 (dd, *J* = 8.4, 2.6 Hz, 1H), 3.97 (t, *J* = 6.0 Hz, 2H), 3.47 (t, *J* = 6.7 Hz, 2H), 2.81 (t, *J* = 6.4 Hz, 2H), 2.74 (t, *J* = 6.5 Hz, 2H), 2.13 (s, 3H), 2.05 (dt, *J* = 14.5, 6.7 Hz, 2H), 1.97-1.85 (m, 2H), 1.54 (s, 9H). $^{13}C\{^1H\}$ NMR (126 MHz, $CDCl_3$) δ 209.4, 157.8, 153.5, 137.0, 130.1, 123.1, 110.6, 107.9, 80.1, 66.8, 44.8, 33.6, 30.0, 29.5, 28.4, 27.9, 23.3 ppm. HRMS Calculated for $C_{19}H_{29}O_4NBr$ $[M+H]^+$ 414.1274; found 414.1260.

***tert*-butyl (2-fluoro-6-(3-oxobutyl)phenyl)carbamate (1m)**: an oil, 530 mg, 63% yield



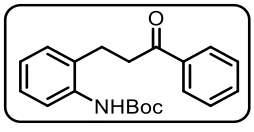

$^1H$ NMR (500 MHz, $CDCl_3$) δ 7.12 (m, 1H), 7.02-6.85 (m, 2H), 6.70 (s, 1H), 2.88 (dd, *J* = 10.5, 3.8 Hz, 2H), 2.81 (dd, *J* = 10.5, 3.8 Hz, 2H), 2.12 (s, 3H), 1.50 (s, 9H). $^{13}C\{^1H\}$ NMR (126 MHz, $CDCl_3$) δ 208.5, 158.24 (d, *J* = 248.4 Hz), 154.0, 140.0, 127.79 (d, *J* = 22.7 Hz), 127.47 (d, *J* = 8.7 Hz), 124.60 (d, *J* = 3.3 Hz), 113.86 (d, *J* = 20.9 Hz), 80.4, 44.3, 29.9, 28.2, 24.68 (d, *J* = 2.5 Hz) ppm. HRMS Calculated for $C_{15}H_{21}O_3NF$ $[M+H]^+$ 282.1500; found 282.1491.

***tert*-butyl (4-bromo-2-(3-oxobutyl)phenyl)carbamate (1n)**: a white solid, 798 mg, 78% yield



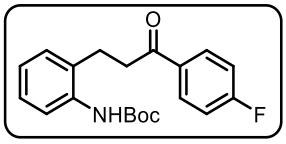

$^1H$ NMR (500 MHz, $CDCl_3$) δ 7.74 (s, 1H), 7.64 (d, *J* = 7.9 Hz, 1H), 7.30 (dd, *J* = 8.7, 2.4 Hz, 1H), 7.23 (d, *J* = 2.3 Hz, 1H), 2.88 (t, *J* = 6.2 Hz, 2H), 2.79 (t, *J* = 6.2 Hz, 2H), 2.17 (s, 3H), 1.55 (s, 9H). $^{13}C\{^1H\}$ NMR (126 MHz, $CDCl_3$) δ 209.0, 153.6, 135.3, 133.8, 132.1, 129.9, 124.7, 116.6, 80.3, 44.4, 29.9, 28.3, 23.7 ppm. HRMS Calculated for $C_{15}H_{21}O_3NBr$ $[M+H]^+$ 342.0699; found 342.0688.

***tert*-butyl (2-(3-oxo-3-phenylpropyl)phenyl)carbamate (1o)**[2]: an oil, 690 mg, 71% yield



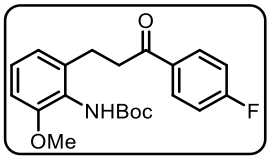

$^1H$ NMR (500 MHz, $CDCl_3$) δ 7.99 (dd, *J* = 8.2, 1.1 Hz, 2H), 7.75 (d, *J* = 7.3 Hz, 1H), 7.65-7.56 (m, 2H), 7.47 (t, *J* = 7.7 Hz, 2H), 7.25-7.16 (m, 2H), 7.07 (m, 1H), 3.41 (t, *J* = 6.7 Hz, 2H), 3.04 (t, *J* = 6.7 Hz, 2H), 1.56 (s, 9H). $^{13}C\{^1H\}$ NMR (126 MHz, $CDCl_3$) δ 199.9, 153.8, 136.5, 136.1, 133.4, 132.0, 129.5, 128.6, 128.1, 127.0, 124.2, 123.3, 80.1, 39.6, 28.4, 24.4 ppm.

***tert*-butyl (2-(3-(4-fluorophenyl)-3-oxopropyl)phenyl)carbamate (1p)**[2]: a white solid, 500 mg, 49% yield



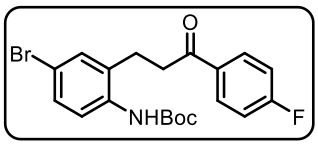
$^1$H NMR (500 MHz, $CDCl_3$) δ 8.09-7.91 (m, 2H), 7.73 (d, *J* = 7.6 Hz, 1H), 7.57 (s, 1H), 7.21 (m, 2H), 7.14 (t, *J* = 8.6 Hz, 2H), 7.06 (td, *J* = 7.6, 1.2 Hz, 1H), 3.37 (t, *J* = 6.7 Hz, 2H), 3.03 (t, *J* = 6.7 Hz, 2H), 1.56 (s, 9H). $^{13}$C{$^1$H} NMR (126 MHz, $CDCl_3$) δ 198.3, 165.9 (d, *J* = 255.3 Hz), 153.8, 136.0, 132.9 (d, *J* = 3.1 Hz), 132.0, 130.8 (d, *J* = 9.4 Hz), 129.5, 127.0, 124.3, 123.4, 115.7 (d, *J* = 21.9 Hz), 80.1, 39.5, 28.4, 24.4 ppm.

***tert*-butyl (2-(3-(4-fluorophenyl)-3-oxopropyl)-6-methoxyphenyl)carbamate (1q)**: a white solid, 650 mg, 58% yield

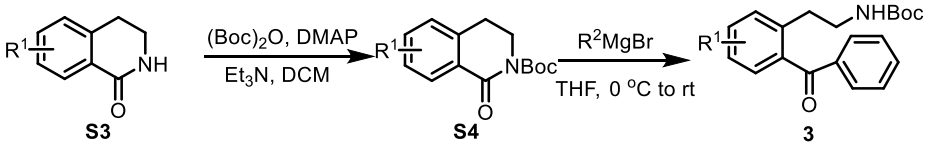


$^1$H NMR (500 MHz, $CDCl_3$) δ 7.98 (dd, *J* = 8.8, 5.4 Hz, 2H), 7.47 (s, 1H), 7.18 (s, 1H), 7.11 (t, *J* = 8.6 Hz, 2H), 6.82 - 6.69 (m, 2H), 3.76 (s, 3H), 3.33 (t, *J* = 6.8 Hz, 2H), 2.98 (t, *J* = 6.8 Hz, 2H), 1.51 (s, 9H). $^{13}$C{$^1$H} NMR (126 MHz, $CDCl_3$) δ 198.1, 165.8 (d, *J* = 255.2 Hz), 156.8, 154.4, 133.0 (d, *J* = 3.0 Hz), 130.7 (d, *J* = 9.3 Hz), 128.9, 127.7, 126.2, 115.7 (d, *J* = 21.9 Hz), 115.0, 111.8, 79.9, 55.4, 39.5, 28.4, 24.9 ppm. HRMS Calculated for $C_{21}H_{25}O_4NF$ $[M+H]^+$ 374.1762; found 374.1751.

***tert*-butyl (4-bromo-2-(3-(4-fluorophenyl)-3-oxopropyl)phenyl)carbamate (1r)**: a white solid, 860 mg, 68% yield



$^1$H NMR (500 MHz, $CDCl_3$) δ 8.07-7.95 (m, 2H), 7.73 (s, 1H), 7.63 (d, *J* = 8.2 Hz, 1H), 7.30-7.28 (m, 2H), 7.13 (t, *J* = 8.6 Hz, 2H), 3.36 (t, *J* = 6.5 Hz, 2H), 2.97 (t, *J* = 6.5 Hz, 2H), 1.54 (s, 9H). $^{13}$C{$^1$H} NMR (126 MHz, $CDCl_3$) δ 198.0, 166.0 (d, *J* = 255.8 Hz), 153.6, 135.4, 134.0, 132.7 (d, *J* = 3.0 Hz), 132.2, 130.8 (d, *J* = 9.4 Hz), 129.9, 124.8, 116.8, 115.8 (d, *J* = 21.9 Hz), 80.4, 39.4, 28.4, 24.0 ppm. HRMS Calculated for $C_{20}H_{22}BrFNO_3$ $[M+H]^+$ 422.0761; found 422.0746.




**S3** were synthesized according to a known procedure[3].

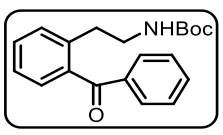
Step 1：

**S3** (10 mmol) and $Et_3N$ (11 mmol) were dissolved in dichloromethane (30 mL) at 0 °C, followed by addition of $(Boc)_2O$ (12 mmol) and DMAP (0.5 mmol). The resulting solution was warmed to rt and stirred for 6 h. The reaction was quenched with saturated $NH_4Cl$ aqueous solution (20 mL). The organic layer was extracted with dichloromethane (10 mL × 2), combined, dried over anhydrous $NaSO_4$, and then concentrated under reduced pressure. The crude product was further purified by column chromatography to quantitatively provide pure **S4**.

Step 2:

$R^2MgBr$ (1.3 equiv) was added dropwise to a solution of **S4** (3 mmol) in dried THF (10 mL) at 0 °C. The resulting mixture was then stirred overnight at rt. The reaction was quenched with saturated $NH_4Cl$ aqueous solution (15 mL) and extracted with EtOAc (10 mL × 2). The combined organic layers were dried over $Na_2SO_4$ and concentrated under reduced pressure. The crude product was purified by column chromatography to give **3**.

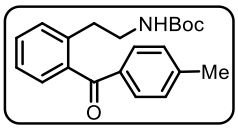
***tert*-butyl (2-benzoylphenethyl)carbamate (3a)**[4]: a white solid, 575 mg, 59% yield



$^1$H NMR (400 MHz, $CDCl_3$) δ 7.82 (d, *J* = 7.4 Hz, 2H), 7.62 (t, *J* = 7.4 Hz, 1H),

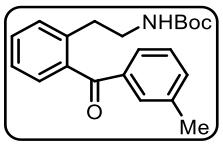
7.48 (t, *J* = 7.5 Hz, 3H), 7.41 (d, *J* = 7.5 Hz, 1H), 7.32 (dd, *J* = 10.8, 6.9 Hz, 2H), 5.03 (s, 1H), 3.40 (m, 2H), 2.88 (t, *J* = 6.8 Hz, 2H), 1.42 (s, 9H). $^{13}C\{^{1}H\}$ NMR (126 MHz, $CDCl_3$) δ 198.5, 155.9, 138.6, 138.5, 137.6, 133.3, 130.9, 130.6, 130.4, 129.0, 128.4, 125.7, 79.0, 42.1, 33.1, 28.4 ppm.

***tert*-butyl (2-(4-methylbenzoyl)phenethyl)carbamate (3b)**[4]: an oil, 488 mg, 48% yield



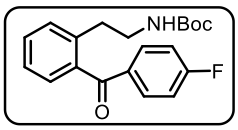

$^{1}H$ NMR (500 MHz, $CDCl_3$) δ 7.72 (d, *J* = 8.2 Hz, 2H), 7.51-7.43 (m, 1H), 7.40 (d, *J* = 7.6 Hz, 1H), 7.34-7.24 (m, 4H), 5.06 (s, 1H), 3.39 (m, 2H), 2.85 (t, *J* = 6.8 Hz, 2H), 2.44 (s, 3H), 1.41 (s, 9H). $^{13}C$ NMR (126 MHz, $CDCl_3$) δ 198.2, 156.0, 144.3, 138.8, 138.3, 135.0, 130.8, 130.5, 130.4, 129.2, 128.8, 125.6, 78.9, 42.1, 33.0, 28.4, 21.7 ppm.

***tert*-butyl (2-(3-methylbenzoyl)phenethyl)carbamate (3c)**[4]: an oil, 478 mg, 47% yield



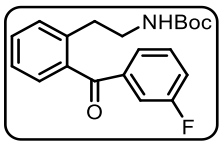

$^{1}H$ NMR (500 MHz, $CDCl_3$) δ 7.66 (s, 1H), 7.57 (d, *J* = 7.6 Hz, 1H), 7.47 (td, *J* = 7.6, 1.8 Hz, 1H), 7.42 (m, 2H), 7.36 (d, *J* = 7.6 Hz, 1H), 7.32 (m, 2H), 5.05 (s, 1H), 3.48-3.31 (m, 2H), 2.87 (t, *J* = 6.8 Hz, 2H), 2.42 (s, 3H), 1.42 (s, 9H). $^{13}C\{^{1}H\}$ NMR (126 MHz, $CDCl_3$) δ 198.7, 156.0, 138.7, 138.5, 138.3, 137.6, 134.2, 130.8, 130.6, 130.5, 129.0, 128.3, 127.8, 125.6, 78.9, 42.1, 33.1, 28.4, 21.3 ppm.

***tert*-butyl (2-(4-fluorobenzoyl)phenethyl)carbamate (3d)**[4]: an oil, 576 mg, 56% yield



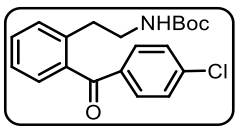

$^{1}H$ NMR (400 MHz, $CDCl_3$) δ 7.90 - 7.81 (m, 2H), 7.53-7.45 (m, 1H), 7.41 (d, *J* = 7.7 Hz, 1H), 7.34-7.30 (m, 1H), 7.15 (t, *J* = 8.6 Hz, 2H), 5.00 (s, 1H), 3.40 (q, *J* = 6.6 Hz, 2H), 2.86 (t, *J* = 6.9 Hz, 2H), 1.42 (s, 9H). $^{13}C\{^{1}H\}$ NMR (101 MHz, $CDCl_3$) δ 196.8, 165.9 (d, *J* = 255.8 Hz), 155.9, 138.5, 138.2, 134.0 (d, *J* = 2.9 Hz), 133.0 (d, *J* = 9.4 Hz), 130.9, 130.7, 128.8, 125.7, 115.6 (d, *J* = 22.0 Hz), 79.0, 42.1, 33.1, 28.4 ppm.

***tert*-butyl (2-(3-fluorobenzoyl)phenethyl)carbamate (3e)**[4]: an oil, 545 mg, 53% yield



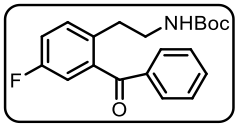

$^{1}H$ NMR (500 MHz, $CDCl_3$) δ 7.55 (m, 2H), 7.51-7.39 (m, 3H), 7.31 (m, 3H), 4.99 (s, 1H), 3.40 (m, 2H), 2.88 (t, *J* = 6.8 Hz, 2H), 1.41 (s, 9H). $^{13}C\{^{1}H\}$ NMR (126 MHz, $CDCl_3$) δ 197.0, 162.6 (d, *J* = 248.4 Hz), 155.9, 139.8 (d, *J* = 6.2 Hz), 138.8, 137.8), 131.1, 131.0 (d, *J* = 11.5 Hz), 130.1 (d, *J* = 7.6 Hz), 129.1, 126.3 (d, *J* = 2.9 Hz), 125.8, 120.3 (d, *J* = 21.5 Hz), 116.8 (d, *J* = 22.3 Hz), 79.0, 42.1, 33.2, 28.3 ppm.

***tert*-butyl (2-(4-chlorobenzoyl)phenethyl)carbamate (3f)**[4]: an oil, 594 mg, 55% yield



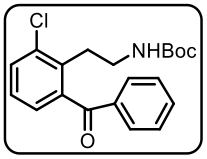

$^{1}H$ NMR (500 MHz, $CDCl_3$) δ 7.76 (d, *J* = 8.5 Hz, 2H), 7.52-7.43 (m, 3H), 7.41 (d, *J* = 7.4 Hz, 1H), 7.30 (d, *J* = 4.0 Hz, 2H), 5.00 (s, 1H), 3.39 (m, 2H), 2.86 (t, *J* = 6.8 Hz, 2H), 1.41 (s, 9H). $^{13}C\{^{1}H\}$ NMR (126 MHz, $CDCl_3$) δ 197.1, 155.9, 139.9, 138.7, 138.0, 136.0, 131.7, 131.0, 130.9, 128.9, 128.8, 125.8, 79.0, 42.1, 33.2, 28.4 ppm.

***tert*-butyl (2-benzoyl-4-fluorophenethyl)carbamate (3g)**: an oil, 370 mg, 54% yield




$^{1}H$ NMR (500 MHz, $CDCl_3$) δ 7.80 (d, *J* = 7.3 Hz, 2H), 7.62 (t, *J* = 7.4 Hz, 1H), 7.48 (t, *J* = 7.8 Hz, 2H), 7.40-7.31 (m, 1H), 7.16 (td, *J* = 8.4, 2.7 Hz, 1H), 7.01 (dd, *J* = 8.7, 2.7 Hz, 1H), 4.93 (s, 1 H), 3.35 (dd, *J* = 12.5, 6.3 Hz, 2H), 2.81 (t, *J* = 6.8 Hz, 2H), 1.40 (s, 9H). $^{13}C\{^{1}H\}$ NMR (126 MHz, $CDCl_3$) δ 197.0, 160.4 (d, *J* = 247.4 Hz), 155.9, 140.0 (d, *J* = 5.9 Hz), 136.9, 134.1 (d, *J* = 2.6 Hz), 133.7, 132.6 (d, *J* = 7.6 Hz), 130.3, 128.6, 117.5 (d, *J* = 20.9 Hz), 115.6 (d, *J* = 22.6 Hz), 79.1, 42.0, 32.5, 28.3 ppm. HRMS Calculated for $C_{20}H_{23}O_3NF$ $[M+H]^+$ 344.1657; found 344.1646.

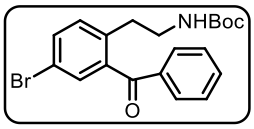
***tert*-butyl (2-benzoyl-6-chlorophenethyl)carbamate (3h):** an oil, 396 mg, 55% yield




$^{1}H$ NMR (500 MHz, $CDCl_3$) δ 7.79 (d, *J* = 7.2 Hz, 2H), 7.65-7.56 (m, 1H), 7.53

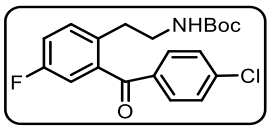
(dd, *J* = 7.8, 1.2 Hz, 1H), 7.47 (t, *J* = 7.8 Hz, 2H), 7.24 (t, *J* = 7.7 Hz, 1H), 7.19 (dd, *J* = 7.6, 1.3 Hz, 1H), 5.07 (s, 1H), 3.42 (d, *J* = 6.1 Hz, 2H), 2.98 (t, *J* = 6.7 Hz, 2H), 1.38 (s, 9H). $^{13}C\{^1H\}$ NMR (126 MHz, $CDCl_3$) δ 197.4, 155.9, 140.9, 137.1, 136.1, 135.8, 133.7, 131.6, 130.4, 128.6, 127.0, 126.9, 78.9, 40.0, 30.8, 28.3 ppm. HRMS Calculated for $C_{20}H_{23}O_3NCl$ $[M+H]^+$ 360.1361; found 360.1348.

***tert*-butyl (2-benzoyl-4-bromophenethyl)carbamate (3i):** an oil, 363 mg, 45% yield



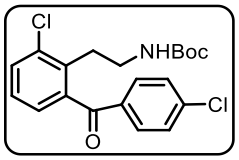

$^1H$ NMR (500 MHz, $CDCl_3$) δ 7.82-7.77 (m, 2H), 7.66-7.61 (m, 1H), 7.58 (dd, *J* = 8.3, 2.1 Hz, 1H), 7.49 (t, *J* = 7.8 Hz, 2H), 7.43 (d, *J* = 2.1 Hz, 1H), 7.27 (d, *J* = 6.4 Hz, 1H), 4.90 (s, 1H), 3.35 (dd, *J* = 12.5, 6.2 Hz, 2H), 2.79 (t, *J* = 6.8 Hz, 2H), 1.40 (s, 9H). $^{13}C\{^1H\}$ NMR (126 MHz, $CDCl_3$) δ 196.7, 155.9, 140.4, 137.3, 136.8, 133.7, 133.4, 132.5, 131.3, 130.3, 128.6, 119.5, 79.1, 41.8, 32.7, 28.3 ppm. HRMS Calculated for $C_{20}H_{23}O_3NBr$ $[M+H]^+$ 404.0856; found 404.0842.

***tert*-butyl (2-(4-chlorobenzoyl)-4-fluorophenethyl)carbamate (3j)**: an oil, 430 mg, 47% yield



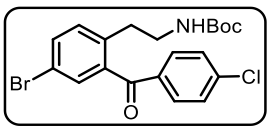

$^1H$ NMR (500 MHz, $CDCl_3$) δ 7.77 (d, *J* = 8.5 Hz, 2H), 7.48 (d, *J* = 8.5 Hz, 2H), 7.42-7.34 (m, 1H), 7.19 (td, *J* = 8.3, 2.7 Hz, 1H), 7.01 (dd, *J* = 8.6, 2.7 Hz, 1H), 4.89 (s, 1H), 3.35 (dd, *J* = 12.5, 6.3 Hz, 2H), 2.81 (t, *J* = 6.8 Hz, 2H), 1.41 (s, 9H). $^{13}C\{^1H\}$ NMR (126 MHz, $CDCl_3$) δ 195.7, 160.4 (d, *J* = 247.6 Hz), 155.9, 140.4, 139.5 (d, *J* = 6.3 Hz), 135.2, 134.2 (d, *J* = 3.8 Hz), 132.7 (d, *J* = 7.6 Hz), 131.6, 129.0, 117.8 (d, *J* = 20.9 Hz), 115.5 (d, *J* = 22.6 Hz), 79.1, 42.0, 32.5, 28.3 ppm. HRMS Calculated for $C_{20}H_{22}O_3NClF$ $[M+H]^+$ 378.1267; found 378.1253.

***tert*-butyl (2-chloro-6-(4-chlorobenzoyl)phenethyl)carbamate (3k)**: an oil, 413 mg, 53% yield




$^1H$ NMR (500 MHz, $CDCl_3$) δ 7.76 (d, *J* = 8.5 H, 2H), 7.55 (dd, *J* = 8.0, 1.1 Hz, 1H), 7.46 (d, *J* = 8.6 Hz, 2H), 7.28 (d, *J* = 9.3 Hz, 1H), 7.19 (dd, *J* = 7.6, 1.2 Hz, 1H), 5.02 (s, 1H), 3.43 (dd, *J* = 12.1, 5.9 Hz, 2H), 2.99 (t, *J* = 6.7 Hz, 2H), 1.40 (s, 9H). $^{13}C\{^1H\}$ NMR (126 MHz, $CDCl_3$) δ 196.1, 155.8, 140.4, 140.4, 136.3, 135.9, 135.4, 131.8, 131.8, 128.9, 127.0, 126.9, 78.9, 40.0, 30.8, 28.3 ppm. HRMS Calculated for $C_{20}H_{22}O_3NCl_2$ $[M+H]^+$ 394.0971; found 394.0957.

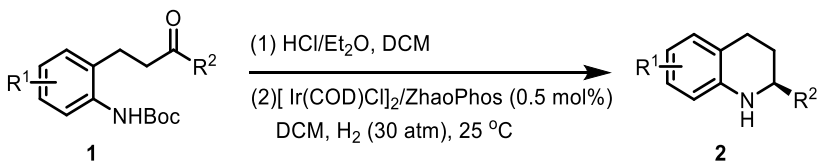
***tert*-butyl (4-bromo-2-(4-chlorobenzoyl)phenethyl)carbamate (3l)**: an oil, 360 mg, 41% yield




$^1H$ NMR (500 MHz, $CDCl_3$) δ 7.74 (d, *J* = 8.5 Hz, 2H), 7.58 (dd, *J* = 8.3, 2.1 Hz, 1H), 7.46 (d, *J* = 8.5 Hz, 2H), 7.41 (d, *J* = 2.0 Hz, 1H), 7.27 (d, *J* = 8.0 Hz, 1H), 4.87 (s, 1H), 3.34 (dd, *J* = 12.4, 6.2 Hz, 2H), 2.78 (t, *J* = 6.8 Hz, 2H), 1.40 (s, 9H). $^{13}C\{^1H\}$ NMR (126 MHz, $CDCl_3$) δ 195.5, 155.9, 140.4, 139.9, 137.5, 135.2, 133.7, 132.7, 131.7, 131.2, 129.0, 119.6, 79.2, 41.8, 32.8, 28.3 ppm. HRMS Calculated for $C_{20}H_{22}O_3NBrCl$ $[M+H]^+$ 438.0466; found 438.0453.

## 3. General procedure for one-pot N-Boc deprotection and asymmetric reductive amination

**Part 1：Asymmetric reductive amination for synthesizing tetrahydroquinolines**

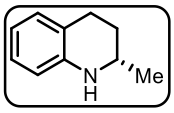



To a 2.5 mL vial was added the catalyst precursor $[Ir(COD)Cl]_2$ (3.4 mg, 0.005 mmol), ZhaoPhos (9.5 mg, 0.011 mmol) and anhydrous $CH_2Cl_2$ (0.3 mL) under argon atmosphere. The

mixture was stirred for 0.5 h at room temperature to give a clear solution.

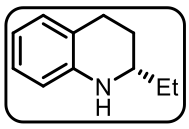
A mixture of substrate **1** (0.2 mmol) and HCl (2 M in $Et_2O$) (4 equiv.) was dissolved in $CH_2Cl_2$ (1 mL) and then stirred at rt for 6 h. All volatiles were removed, and the crude intermediate was transferred to a nitrogen-filled glovebox. An aliquot of the above *in situ* prepared catalyst solution (60 μL, 0.001mmol) was transferred to a vial containing crude intermediate via a syringe, followed by addition of 0.8 mL more DCM. The vial was placed in an autoclave which was then charged with 30 atm of $H_2$. The reaction was stirred at 25 °C for 24 h. After carefully releasing the hydrogen, the solution was neutralized with aqueous sodium bicarbonate solution (5 mL), and then extracted with DCM (5 mL×2). The combined organic phases were concentrated and passed through a short column of silica gel with EtOAc/Petroleum ether (1/20) as eluents to give the chiral tetrahydroquinoline products. The obtained products were pure enough for NMR analysis and determination of the enantiomeric excess.

**(*S*)-2-methyl-1,2,3,4-tetrahydroquinoline (2a)[5]:**



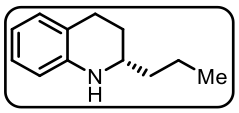

an oil, 28.5 mg, 97% yield, 97% ee; $[\alpha]^{20}_D$ = -76.5 (*c* 0.15, $CHCl_3$); $^1H$ NMR (500 MHz, $CDCl_3$) δ 6.95 (t, *J* = 6.7 Hz, 2H), 6.60 (t, *J* = 7.3 Hz, 1H), 6.46 (d, *J* = 8.2 Hz, 1H), 3.58-3.24 (m, 2H), 2.86-2.80 (m, 1H), 2.75-2.61 (m, 1H), 1.94-1.89 (m, 1H), 1.65-1.47 (m, 1H), 1.20 (d, *J* = 6.3 Hz, 3H). $^{13}C\{^1H\}$ NMR (126 MHz, $CDCl_3$) δ 144.8, 129.3, 126.7, 121.1, 117.0, 114.0, 47.2, 30.1, 26.6, 22.6 ppm. Enantiomeric excess was determined by HPLC (OJ-H column, hexane/*i*PrOH 95/5, 0.80 mL/min, 254 nm): $t_1$ = 14.1 min (major), $t_2$ = 15.6 min (minor).

**(*S*)-2-ethyl-1,2,3,4-tetrahydroquinoline (2b)[5]:**



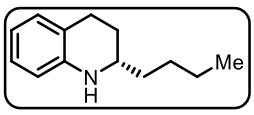

an oil, 30.6 mg, 95% yield; 97% ee; $[\alpha]^{20}_D$ = -68.9 (*c* 0.21, $CHCl_3$);$^1H$ NMR (500 MHz, $CDCl_3$) δ 6.95 (t, *J* = 7.5 Hz, 2H), 6.59 (t, *J* = 7.6Hz, 1H), 6.47 (d, *J* = 7.7 Hz, 1H), 3.71 (brs, 1 H), 3.23 -3.11 (m, 1H), 2.84-2.77 (m, 1H), 2.72 (m, 1H), 2.01-1.92 (m, 1H), 1.64-1.55 (m, 1H), 1.55-1.48 (m, 2H), 0.98 (t, *J* = 7.5 Hz, 3H). $^{13}C\{^1H\}$ NMR (126 MHz, $CDCl_3$) δ 144.7, 129.2, 126.7, 121.4, 116.9, 114.0, 53.0, 29.4, 27.6, 26.4, 10.1 ppm. Enantiomeric excess was determined by HPLC (OJ-H column, hexane/*i*PrOH 95/5, 0.80 mL/min, 254 nm): $t_1$ = 12.0 min (major), $t_2$ = 13.1 min (minor).

**(*S*)-2-propyl-1,2,3,4-tetrahydroquinoline (2c)[5]:**



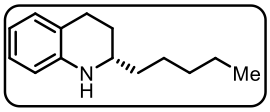

an oil, 33.2 mg, 95% yield; 96% ee; $[\alpha]^{20}_D$ = -77.5 (*c* 0.18, $CHCl_3$); $^1H$ NMR (500 MHz, $CDCl_3$) δ 7.01 (t, *J* = 7.4 Hz, 2H), 6.76- 6.60 (m, 1H), 6.52 (d, *J* = 7.7 Hz, 1H), 3.78 (s, 1H), 3.30 (m, 1H), 2.86 (m 1H), 2.78 (dt, *J* = 16.3, 4.7 Hz, 1H), 2.11-1.92 (m, 1H), 1.65 (m 1H), 1.59 -1.42 (m, 4H), 1.02 (t, *J* = 7.0 Hz, 3H). $^{13}C\{^1H\}$ NMR (126 MHz, $CDCl_3$) δ 144.7, 129.3, 126.7, 121.4, 116.9, 114.0, 51.3, 38.9, 28.1, 26.4, 18.9, 14.2 ppm. Enantiomeric excess was determined by HPLC (OJ-H column, hexane/*i*PrOH 95/5, 0.80 mL/min, 254 nm): $t_1$ = 10.8 min (major), $t_2$ = 13.3 min (minor).

**(*S*)-2-butyl-1,2,3,4-tetrahydroquinoline (2d)[5]:**



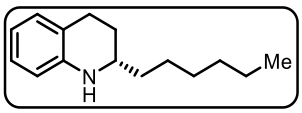

an oil, 36.6 mg, 97% yield; 97% ee; $[\alpha]^{20}_D$ = -70.4 (*c* 0.15, $CHCl_3$); $^1H$ NMR (500 MHz, $CDCl_3$) δ 7.01 (t, *J* = 7.5 Hz, 2H), 6.65 (t, *J* = 7.4, 1 H), 6.53 (d, *J* = 7.8 Hz, 1H), 3.81 (s, 1H), 3.37-3.23 (m, 1H), 2.87 (m 1H), 2.78 (m 1H), 2.11-1.95 (m, 1 H), 1.65 (m, 1H), 1.55 (m, 2H), 1.50-1.35 (m, 4H), 1.00 (t, *J* = 7.6, 3H). $^{13}C\{^1H\}$ NMR (126 MHz, $CDCl_3$) δ 144.7, 129.3, 126.7, 121.4, 116.9, 114.0, 51.6, 36.4, 28.1, 27.9, 26.4, 22.9, 14.1 ppm. Enantiomeric excess was determined by HPLC (OJ-H column, hexane/*i*PrOH 95/5, 0.80 mL/min, 254 nm): $t_1$ = 9.3 min (major), $t_2$ = 10.8 min (minor).

**(*S*)-2-pentyl-1,2,3,4-tetrahydroquinoline (2e)[5]:**



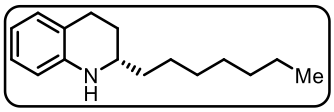
an oil, 38.6 mg, 95% yield; 97% ee; $[\alpha]^{20}_D$ = -67.9 (*c* 0.12, $CHCl_3$); $^1H$ NMR (500 MHz, $CDCl_3$) δ 7.01 (t, *J* = 7.5 Hz, 2H), 6.65 (td, *J* = 7.4, 0.9 Hz, 1H), 6.52 (d, *J* = 7.8 Hz, 1H), 3.80 (s, 1H), 3.36-3.23 (m, 1H), 2.86 (m, 1H), 2.78 (dt, *J* = 16.3, 4.7 Hz, 1H), 2.15-1.91 (m, 1H), 1.65 (m, 1H), 1.59-1.49 (m, 2H), 1.49-1.31 (m, 6H), 0.96 (t, *J* = 6.9 Hz, 3H). $^{13}C\{^1H\}$ NMR (126 MHz, $CDCl_3$) δ 144.6, 129.2, 126.6, 121.3, 116.8, 113.9, 51.5, 36.6, 31.9, 28.0, 26.4, 25.3, 22.6, 14.0 ppm. Enantiomeric excess was determined by HPLC (OJ-H column, hexane/*i*PrOH 95/5, 0.80 mL/min, 254 nm): $t_1$ = 8.5 min (major), $t_2$ = 9.2 min (minor).

**(*S*)-2-hexyl-1,2,3,4-tetrahydroquinoline (2f)[5]:**



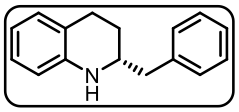
an oil, 41.6 mg, 96% yield; 94% ee; $[\alpha]^{20}_D$ = -78.3 (*c* 0.14, $CHCl_3$); $^1H$ NMR (500 MHz, $CDCl_3$) δ 7.02 (t, *J* = 7.5 Hz, 2H), 6.66 (td, *J* = 7.4, 0.9 Hz, 1H), 6.53 (d, *J* = 7.8 Hz, 1H), 3.82 (s, 1H), 3.38-3.22 (m, 1H), 2.87 (m, 1H), 2.79 (dt, *J* = 16.3, 4.7 Hz, 1H), 2.12-1.95 (m, 1H), 1.66 (m, 1H), 1.60-1.49 (m, 2H), 1.49-1.27 (m, 8H), 0.97 (t, *J* = 6.8 Hz, 3H). $^{13}C\{^1H\}$ NMR (126 MHz, $CDCl_3$) δ 144.7, 129.3, 126.7, 121.4, 116.9, 114.0, 51.6, 36.7, 31.9, 29.5, 28.1, 26.5, 25.7, 22.7, 14.1 ppm. Enantiomeric excess was determined by HPLC (OJ-H column, hexane/*i*PrOH 95/5, 0.80 mL/min, 254 nm): $t_1$ = 8.8 min (major), $t_2$ = 9.5 min (minor).

**(*S*)-2-heptyl-1,2,3,4-tetrahydroquinoline (2g):**



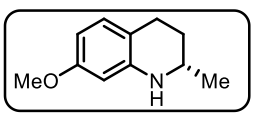
an oil, 43.9 mg, 95% yield; 92% ee; $[\alpha]^{20}_D$ = -68.2 (*c* 0.21, $CHCl_3$); $^1H$ NMR (500 MHz, $CDCl_3$) δ 7.00 (t, *J* = 7.5 Hz, 2H), 6.64 (t, *J* = 7.1 Hz, 1H), 6.51 (d, *J* = 7.8 Hz, 1H), 3.80 (s, 1H), 3.37-3.20 (m, 1H), 2.85 (m, 1H), 2.77 (dt, *J* = 16.3, 4.7 Hz, 1H), 2.12-1.82 (m, 1H), 1.76-1.58 (m, 1H), 1.58-1.49 (m, 2H), 1.49-1.27 (m, 10H), 0.94 (t, *J* = 6.9 Hz, 3H). $^{13}C\{^1H\}$ NMR (126 MHz, $CDCl_3$) δ 144.7, 129.2, 126.7, 121.4, 116.9, 114.0, 51.6, 36.7, 31.8, 29.7, 29.3, 28.1, 26.4, 25.7, 22.7, 14.1 ppm. Enantiomeric excess was determined by HPLC (OJ-H column, hexane/*i*PrOH 95/5, 0.80 mL/min, 254 nm): $t_1$ = 9.3 min (major), $t_2$ = 9.9 min (minor). HRMS Calculated for $C_{16}H_{26}N$ $[M+H]^+$ 232.2060; found 232.2052

**(*R*)-2-benzyl-1,2,3,4-tetrahydroquinoline (2h)[6]:**



an oil, 43.8 mg, 94% yield; 97% ee; $[\alpha]^{20}_D$ = -79.9 (*c* 0.21, $CHCl_3$); $^1H$ NMR (500 MHz, $CDCl_3$) δ 7.33 (dd, *J* = 10.2, 4.5 Hz, 2H), 7.29-7.20 (m, 3H), 6.93 (dd, *J* = 13.3, 7.0 Hz, 2H), 6.59 (td, *J* = 7.4, 1.0 Hz, 1H), 6.38 (d, *J* = 4.5Hz, 1H), 3.73 (s, 1H), 3.67-3.42 (m, 1H), 2.89-2.72 (m, 2H), 2.69 (dd, *J* = 13.3, 8.7 Hz, 1H), 2.03-1.98 (m, 1H), 1.75-1.68 (m, 1H). $^{13}C\{^1H\}$ NMR (126 MHz, $CDCl_3$) δ 144.4, 138.5, 129.3, 129.2 128.6, 126.7, 126.5, 121.3, 117.2, 114.2, 52.7, 43.0, 28.3, 26.2 ppm. Enantiomeric excess was determined by HPLC (OD-H column, hexane/*i*PrOH 85/15, 0.80 mL/min, 254 nm): $t_1$ = 6.4 min (minor), $t_2$ = 7.1 min (major).

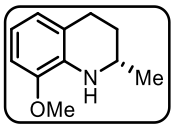
**(*S*)-7-methoxy-2-methyl-1,2,3,4-tetrahydroquinoline (2i):**



an oil, 33.2 mg, 94% yield; 96% ee; $[\alpha]^{20}_D$ = -69.6 (*c* 0.17, $CHCl_3$); $^1H$ NMR (500 MHz, $CDCl_3$) δ 6.89 (d, *J* = 8.2 Hz, 1H), 6.24 (dd, *J* = 8.2, 2.5 Hz, 1 H), 6.08 (d, *J* = 2.5 Hz, 1H), 3.76 (s, 4 H), 3.41 (m, 1H), 2.92-2.76 (m, 1H), 2.76-2.67 (m, 1H), 1.95 (m, 1H), 1.60 (m, 1H), 1.24 (d, *J* = 6.3 Hz, 3H). $^{13}C\{^1H\}$ NMR (126 MHz, $CDCl_3$) δ 158.8, 145.6, 129.9, 113.7, 102.9, 99.2, 55.1, 47.1, 30.4, 25.9, 22.6 ppm. Enantiomeric excess was determined by HPLC (AD-3 column, hexane/*i*PrOH 95/5, 0.50 mL/min, 254 nm): $t_1$ =

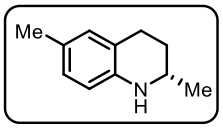
12.2 min (minor), $t_2$ = 13.5 min (major). HRMS Calculated for $C_{11}H_{16}ON$ $[M+H]^+$ 178.1226; found 178.1221.

**(*S*)-8-methoxy-2-methyl-1,2,3,4-tetrahydroquinoline (2j)**[7]**:**



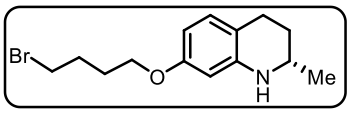
an oil, 33.9 mg, 96% yield; 95% ee; $[\alpha]^{20}_D$ = -63.5 (*c* 0.16, $CHCl_3$); $^1$H NMR (500 MHz, $CDCl_3$) δ 6.62 (m, 2H), 6.48 (d, *J* = 8.4 Hz, 1H), 3.75 (s, 3H), 3.43-3.30 (m, 1H), 2.91-2.84 (m, 1H), 2.76-2.71 (m, 1H), 1.97-1.91 (m, 1H), 1.73-1.53 (m, 1H), 1.23 (d, *J* = 6.3 Hz, 3H). $^{13}$C{$^1$H} NMR (126 MHz, $CDCl_3$) δ 151.8, 138.9, 122.5, 115.3, 114.6, 112.8, 55.8, 47.5, 30.3, 26.9, 22.5 ppm. Enantiomeric excess was determined by HPLC (OJ-H column, hexane/*i*PrOH 95/5, 0.80 mL/min, 254 nm): $t_1$ = 25.4 min (major), $t_2$ = 30.1 min (minor).

**(*S*)-2,6-dimethyl-1,2,3,4-tetrahydroquinoline (2k)**[5]**:**



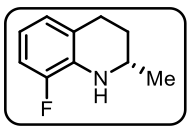
an oil, 31.2 mg, 97% yield; 95% ee; $[\alpha]^{20}_D$ = -68.4 (*c* 0.15, $CHCl_3$); $^1$H NMR (500 MHz, $CDCl_3$) δ 6.81 (m, 2H), 6.44 (d, *J* = 7.7 Hz, 1H), 3.42-3.36 (m, 1H), 2.88-2.79 (m, 1H), 2.75-2.70 (m, 1H), 2.23 (s, 3H), 1.97-1.92 (m, 1H), 1.65-1.60 (m, 1H), 1.23 (d, *J* = 6.3 Hz, 3H). $^{13}$C{$^1$H} NMR (126 MHz, $CDCl_3$) δ 142.4, 129.8, 127.2, 126.3, 121.2, 114.3, 47.3, 30.3, 26.6, 22.6, 20.4 ppm. Enantiomeric excess was determined by HPLC (OJ-H column, hexane/*i*PrOH 95/5, 0.80 mL/min, 254 nm): $t_1$ = 19.8 min (major), $t_2$ = 24.4 min (minor).

**(*S*)-7-(4-bromobutoxy)-2-methyl-1,2,3,4-tetrahydroquinoline (2l):**



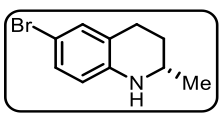
an oil, 51.2 mg, 86% yield; 97% ee; $[\alpha]^{20}_D$ = -79.3 (*c* 0.16, $CHCl_3$); $^1$H NMR (400 MHz, $CDCl_3$) δ 6.87 (dd, *J* = 8.2, 0.9 Hz, 1H), 6.21 (dd, *J* = 8.2, 2.5 Hz, 1H), 6.05 (d, *J* = 2.5 Hz, 1H), 3.94 (t, *J* = 6.1 Hz, 2H), 3.50 (t, *J* = 6.7 Hz, 2H), 3.45 - 3.32 (m, 1H), 2.78 (m, 1H), 2.69 (m, 1H), 2.07 (m, 2H), 1.98 -1.84 (m, 2H), 1.58 (m, 1H), 1.22 (d, *J* = 6.3 Hz, 3H). $^{13}$C{$^1$H} NMR (101 MHz, $CDCl_3$) δ 158.0, 145.5, 129.8, 113.8, 103.4, 99.8, 66.6, 47.1, 33.6, 30.3, 29.5, 27.9, 25.8, 22.5 ppm. Enantiomeric excess was determined by UPLC (OJ-3 column, hexane/*i*PrOH 65/35, 0.50 mL/min, 254 nm): $t_1$ = 7.1 min (major), $t_2$ = 8.8 min (minor). HRMS Calculated for $C_{14}H_{21}ONBr$ $[M+H]^+$ 298.0801; found 298.0793.

**(*S*)-8-fluoro-2-methyl-1,2,3,4-tetrahydroquinoline (2m):**



an oil, 31.0 mg, 94% yield; 98% ee; $[\alpha]^{20}_D$ = -67.9 (*c* 0.14, $CHCl_3$); $^1$H NMR (500 MHz, $CDCl_3$) δ 6.87 - 6.70 (m, 2H), 6.53 (td, *J* = 7.8, 5.4 Hz, 1H), 3.91 (s, 1H), 3.47-3.41 (m, 1H), 2.90-2.84 (m, 1H), 2.81-2.76 (m, 1H), 2.06 -1.94 (m, 1H), 1.74-1.60 (m, 1H), 1.29 (dd, *J* = 10.9, 6.3 Hz, 3H). $^{13}$C{$^1$H} NMR (126 MHz, $CDCl_3$) δ 150.7 (d, *J* = 237.3 Hz), 133.2 (d, *J* = 12.2 Hz), 124.2 (d, *J* = 2.8 Hz), 123.3 (d, *J* = 3.8 Hz), 115.6 (d, *J* = 7.4 Hz), 112.1 (d, *J* = 18.3 Hz), 46.6, 29.7, 26.2 (d, *J* = 2.9 Hz), 22.4 ppm. Enantiomeric excess was determined by HPLC (OJ-H column, hexane/*i*PrOH 95/5, 0.80 mL/min, 254 nm): $t_1$ = 6.2 min (major), $t_2$ = 6.6 min (minor). HRMS Calculated for $C_{10}H_{13}NF$ $[M+H]^+$ 166.1027; found 166.1021.

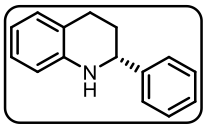
**(*S*)-6-bromo-2-methyl-1,2,3,4-tetrahydroquinoline (2n)**[5]**:**



an oil, 43.3 mg, 96% yield; 95% ee; $[\alpha]^{20}_D$ = -78.1 (*c* 0.18, $CHCl_3$); $^1$H NMR (500 MHz, $CDCl_3$) δ 7.07-7.04 (m, 1H), 7.01 (dd, *J* = 8.4, 2.3 Hz, 1H), 6.32 (d, *J* = 8.4 Hz, 1H), 3.67 (s, 1H), 3.42-3.29 (m, 1H), 2.81-2.75 (m, 1H), 2.71-2.61 (m, 1H), 1.92-1.87 (m, 1H), 1.59-1.46 (m, 1H), 1.19 (d, *J* = 6.3 Hz, 3H). $^{13}$C{$^1$H} NMR (126 MHz, $CDCl_3$) δ 143.8, 131.6, 129.3, 123.1, 115.4, 108.2, 47.1, 29.6, 26.4, 22.5 ppm. Enantiomeric excess

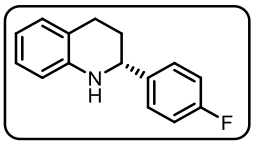
was determined by HPLC (OJ-H column, hexane/*i*PrOH 95/5, 0.80 mL/min, 254 nm): $t_1$ = 14.9 min (major), $t_2$ = 17.7 min (minor).

### (*R*)-2-phenyl-1,2,3,4-tetrahydroquinoline (2o)[5]:



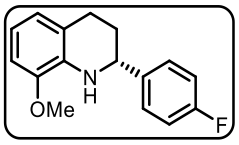
an oil, 35.5 mg, 85% yield; 80% ee; $[\alpha]^{20}_D$ = +23.8 (*c* 0.25, $CHCl_3$); $^1$H NMR (500 MHz, $CDCl_3$) δ 7.44 (d, *J* = 7.2 Hz, 2H), 7.40 (t, *J* = 7.5 Hz, 2H), 7.34 (t, *J* = 7.1 Hz, 1H), 7.06 (t, *J* = 7.7 Hz, 2H), 6.71 (t, *J* = 7.3 Hz, 1H), 6.59 (d, *J* = 7.8 Hz, 1H), 4.49 (dd, *J* = 9.4, 3.2 Hz, 1H), 4.10 (s, 1H), 3.01-2.94 (m, 1H), 2.81-2.76 (m, 1H), 2.20-2.15 (m, 1H), 2.12-1.94 (m, 1H). $^{13}$C{$^1$H} NMR (126 MHz, $CDCl_3$) δ 144.8, 144.7, 129.3, 128.6, 127.4, 126.9, 126.5, 120.9, 117.2, 114.0, 56.2, 31.0, 26.4 ppm. Enantiomeric excess was determined by HPLC (OD-H column, hexane/*i*PrOH 85/15, 0.80 mL/min, 250 nm): $t_1$ = 8.9 min (minor), $t_2$ = 10.8 min (major).

**(*R*)-2-(4-fluorophenyl)-1,2,3,4-tetrahydroquinoline (2p)[5]:**



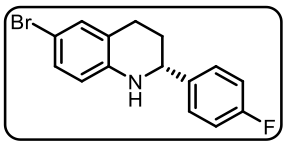
an oil, 39.0 mg, 86% yield; 84% ee; $[\alpha]^{20}_D$ = + 25.2 (*c* 0.16, $CHCl_3$); $^1$H NMR (500 MHz, $CDCl_3$) δ 7.34 (dd, *J* = 8.4, 5.6 Hz, 2H), 7.01 (dd, *J* = 16.9, 8.3 Hz, 4H), 6.65 (t, *J* = 7.4 Hz, 1H), 6.53 (d, *J* = 7.8 Hz, 1H), 4.41 (dd, *J* = 9.4, 3.1 Hz, 1H), 3.99 (s, 1H), 2.94-2.88 (m, 1H), 2.74-2.69 (m, 1H), 2.11-2.05 (m, 1H), 2.02 -1.77 (m, 1H). $^{13}$C{$^1$H} NMR (126 MHz, $CDCl_3$) δ 162.1 (d, *J* = 245.2 Hz), 144.5, 140.5 (d, *J* = 3.0 Hz), 129.3, 128.1 (d, *J* = 7.9 Hz), 126.9, 120.8, 117.3, 115.3 (d, *J* = 21.2 Hz), 114.0, 55.6, 31.1, 26.3 ppm. Enantiomeric excess was determined by HPLC (OD-H column, hexane/*i*PrOH 85/15, 0.80 mL/min, 250 nm): $t_1$ = 8.4 min (minor), $t_2$ = 12.2 min (major).

**(*R*)-2-(4-fluorophenyl)-8-methoxy-1,2,3,4-tetrahydroquinoline (2q):**



an oil, 45.2 mg, 88% yield; 85% ee; $[\alpha]^{20}_D$ = + 21.6 (*c* 0.18, $CHCl_3$); $^1$H NMR (500 MHz, $CDCl_3$) δ 7.41- 7.30 (m, 2H), 7.02 (t, *J* =8.6 Hz, 2H), 6.68 - 6.55 (m, 1H), 6.50 (d, *J* = 8.5 Hz, 2H), 4.34 (dd, *J* = 9.7, 2.9 Hz, 1H), 3.74 (s, 4H), 2.96-2.89 (m, 1H), 2.71 (dt, *J* = 16.6, 4.6 Hz, 1H), 2.26-2.02 (m, 1H), 1.98-1.90 (m, 1H). $^{13}$C{1H} NMR (126 MHz, $CDCl_3$) δ 162.1 (d, *J* = 245.0 Hz), 152.0, 140.6 (d, *J* = 3.0 Hz), 138.7, 128.1 (d, *J* = 7.9 Hz), 122.1, 115.4, 115.2, 114.6, 113.1, 55.9, 55.8, 31.3, 26.8 ppm. Enantiomeric excess was determined by HPLC (OD-H column, hexane/*i*PrOH 85/15, 0.80 mL/min, 250 nm): $t_1$ = 6.3 min (minor), $t_2$ = 8.5 min (major). HRMS Calculated for $C_{16}H_{17}ONF$ $[M+H]^+$ 258.1289; found 258.1280.

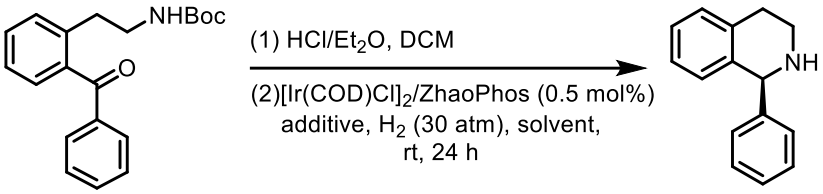
**(*R*)-6-bromo-2-(4-fluorophenyl)-1,2,3,4-tetrahydroquinoline (2r):**



an oil, 55 mg, 90% yield; 90% ee; $[\alpha]^{20}_D$ = + 25.6 (*c* 0.24, $CHCl_3$); $^1$H NMR (500 MHz, $CDCl_3$) δ 7.38-7.34 (m, 2H), 7.16-7.09 (m, 2H), 7.09-7.03 (m, 1H), 6.44 (d, *J* = 8.4 Hz, 1H), 4.43 (dd, *J* = 9.2, 3.2 Hz, 1H), 4.07 (s, 1H), 2.93-2.86 (m, 1H), 2.74-2.68 (m, 1H), 2.13-2.08 (m, 1H), 2.00 -1.85 (m, 1H). $^{13}$C{$^1$H} NMR (126 MHz, $CDCl_3$) δ 162.1 (d, *J* = 245.5 Hz), 143.5, 140.0 (d, *J* = 3.1 Hz), 131.7, 129.6, 128.0 (d, *J* = 8.0 Hz), 122.8, 115.5 (d, *J* = 8.0 Hz), 115.3, 108.7, 55.4, 30.5, 26.0 ppm. Enantiomeric excess was determined by HPLC (OD-H column, hexane/*i*PrOH 85/15, 0.80 mL/min, 254 nm): $t_1$ = 7.2 min (minor), $t_2$ = 13.6 min (major). HRMS Calculated for $C_{15}H_{14}NBrF$ $[M+H]^+$ 306.0288; found 306.0278.

**Part 2：Asymmetric reductive amination for synthesizing tetrahydroisoquinolines**

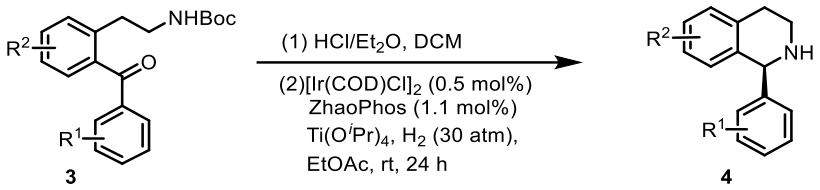
**Table S1.** Optimization of reaction conditions for the synthesis of THIQs.




| entry[a] | solvent | additive | conversion[b] | ee[c] |
|---|---|---|---|---|
| 1 | DCM | $Ti(O^iPr)_4$ | >95% | 75% |
| 2 | toluene | $Ti(O^iPr)_4$ | >95% | 78% |
| 3 | THF | $Ti(O^iPr)_4$ | >95% | 90% |
| 4 | $PhCF_3$ | $Ti(O^iPr)_4$ | 90% | 85% |
| 5 | dioxane | $Ti(O^iPr)_4$ | >95% | 85% |
| 6 | EtOH | $Ti(O^iPr)_4$ | 90% | 60% |
| 7 | $^i$PrOH | $Ti(O^iPr)_4$ | 92% | 55% |
| 8 | $^t$BuOMe | $Ti(O^iPr)_4$ | 81% | 81% |
| 9 | EtOAc | $Ti(O^iPr)_4$ | >95% | 93% |
| 10[d] | EtOAc | $Ti(O^iPr)_4$ | 95% | 93% |
| 11[e] | EtOAc | $Ti(O^iPr)_4$ | 94% | 93% |
| 12 | EtOAc | / | 0% | / |
| 13[f] | EtOAc | $Ti(O^iPr)_4$ | 0% | / |
| 14[g] | EtOAc | $Ti(O^iPr)_4$ | 0% | / |

[a] Reaction conditions: **2a** (0.1 mmol), $[Ir(cod)Cl]_2$ (0.5 mol%), ligand (1.1 mol%), additive (1.0 equiv.), solvent (0.6 mL); [b] Determined by $^1$H NMR analysis; [c] Determined by HPLC analysis of the corresponding benzamides. [d] 15 atm $H_2$; [e] 0.1 mol% $[Ir(cod)Cl]_2$ was used; [f] $[Rh(cod)Cl]_2$ was used; [g] $[Rh(NBD)Cl]_2$ was used.

**Procedure for asymmetric reductive amination for the synthesis of tetrahydroisoquinolines**

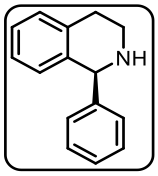



To a 2.5 mL vial was added the catalyst precursor $[Ir(COD)Cl]_2$ (3.4 mg, 0.005 mmol), ZhaoPhos (9.5 mg, 0.011 mmol) and anhydrous $CH_2Cl_2$ (0.3 mL) under argon atmosphere. The mixture was stirred for 0.5 h at room temperature to give a clear solution.

A mixture of substrate **3** (0.2 mmol) and HCl (2 M in $Et_2O$) (4 equiv.) was dissolved in $CH_2Cl_2$ (1 mL) and then stirred at rt for 6 h. All volatiles were removed, and the resulting crude intermediate was transferred to a nitrogen-filled glovebox. An aliquot of the above *in situ* prepared catalyst solution (60 μL, 0.001mmol) was transferred to a vial containing crude intermediate via a syringe, followed by addition of EtOAc (0.8 mL) and $Ti(^iOPr)_4$ (1.0 equiv). The vial was placed in an autoclave which was then charged with 30 atm of $H_2$. The reaction was stirred at 25 °C for 24 h. After carefully releasing the hydrogen, the solution was neutralized with aqueous sodium bicarbonate solution (5 mL), extracted with DCM (5 mL×2). The combined organic phases were dried over anhydrous $Na_2SO_4$, concentrated and passed through a short column of silica gel with

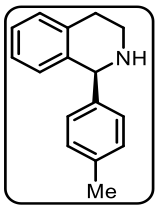
petroleum/EtOAc (3:1) as eluents to give the chiral tetrahydroisoquinoline products. The obtained products were pure enough for NMR analysis. The enantiomeric excesses were determined by HPLC analysis of the corresponding benzamides.

**(*S*)-1-phenyl-1,2,3,4-tetrahydroisoquinoline (4a)[4]:**



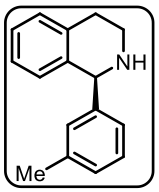

a white solid, 39.2 mg, 94% yield; 93% ee; $[\alpha]^{20}_D$ = + 11.2 (*c* 0.61, $CHCl_3$); $^1H$ NMR (500 MHz, $CDCl_3$) δ 7.35-7.30 (m, 2H), 7.29-7.23 (m, 3H), 7.14 (d, *J* = 4.2 Hz, 2H), 7.04 (dd, *J* = 8.1, 4.7 Hz, 1H), 6.75 (d, *J* = 7.7 Hz, 1H), 5.10 (s, 1H), 3.27 (dt, *J* = 8.7, 4.6 Hz, 1H), 3.20-2.97 (m, 1H), 2.83 (dt, *J* = 8.6, 3.8 Hz, 1H). $^{13}C\{^1H\}$ NMR (126 MHz, $CDCl_3$) δ 144.8, 138.2, 135.4, 129.0, 129.0, 128.45, 128.1, 127.4, 126.2, 125.6, 62.1, 42.2, 29.8 ppm. Enantiomeric excess was determined by HPLC for the corresponding benzamide (AD-3 column, hexane/*i*PrOH 70/30, 0.80 mL/min, 220 nm): $t_1$ = 11.2 min (major), $t_2$ = 13.6 min (minor).

**(*S*)-1-(p-tolyl)-1,2,3,4-tetrahydroisoquinoline (4b)[4]:**



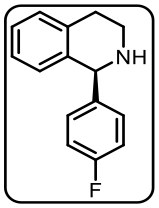

a white solid, 41.0 mg, 92% yield; 90% ee; $[\alpha]^{20}_D$ = + 8.3 (*c* 0.41, $CHCl_3$); $^1H$ NMR (500 MHz, $CDCl_3$) δ 7.18-7.10 (m, 6H), 7.03 (dt, *J* = 8.3, 4.2 Hz, 1H), 6.76 (d, *J* = 7.7 Hz, 1H), 5.07 (s, 1H), 3.27 (dt, *J* = 8.8, 4.6 Hz, 1H), 3.17-2.96 (m, 2H), 2.83 (dt, *J* = 8.4, 3.7 Hz, 1H), 2.34 (s, 3H). $^{13}C\{^1H\}$ NMR (126 MHz, $CDCl_3$) δ 141.9, 138.4, 137.0, 135.4, 129.1, 129.0, 128.8, 128.1, 126.2, 125.6, 61.7, 42.2, 29.8, 21.1 ppm. Enantiomeric excess was determined by HPLC for the corresponding benzamide (AD-3 column, hexane/*i*PrOH 70/30, 0.80 mL/min, 220 nm): $t_1$ = 9.1 min (major), $t_2$ = 13.3 min (minor).

**(*S*)-1-(m-tolyl)-1,2,3,4-tetrahydroisoquinoline (4c)[4]:**



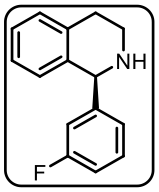

a white solid, 41.4 mg, 93% yield; 90% ee; $[\alpha]^{20}_D$ = + 7.6 (*c* 0.22, $CHCl_3$); $^1H$ NMR (500 MHz, $CDCl_3$) δ 7.23 (t, *J* = 10.3 Hz, 1H), 7.17 (d, *J* = 4.2 Hz, 2H), 7.12 (d, *J* = 6.1 Hz, 2H), 7.09-7.04 (m, 2H), 6.79 (d, *J* = 7.7 Hz, 1H), 5.09 (s, 1H), 3.38-3.27 (m, 1H), 3.21-3.02 (m, 2H), 2.86 (dt, *J* = 8.1, 7.5 Hz, 1H), 2.35 (s, 3H). $^{13}C\{^1H\}$ NMR (126 MHz, $CDCl_3$) δ 144.7, 138.3, 138.1, 135.4, 129.6, 129.0, 128.2, 128.2, 128.1, 126.2, 126.1, 125.6, 62.1, 42.4, 29.8, 21.4 ppm. Enantiomeric excess was determined by HPLC for the corresponding benzamide (AD-3 column, hexane/*i*PrOH 70/30, 1.0 mL/min, 220 nm): $t_1$ = 8.1 min, $t_2$ = 8.6 min (major).

**(*S*)-1-(4-fluorophenyl)-1,2,3,4-tetrahydroisoquinoline (4d)[4]:**




a white solid, 43.1 mg, 95% yield; 94% ee; $[\alpha]^{20}_D$ = + 9.6 (*c* 0.26, $CHCl_3$); $^1H$ NMR (500 MHz, $CDCl_3$) δ 7.27-7.21 (m, 2H), 7.15 (d, *J* = 4.0 Hz, 2H), 7.08-6.97 (m, 3H), 6.72 (d, *J* = 7.7 Hz, 1H), 5.09 (s, 1H), 3.26 (dt, *J* = 8.8, 4.7 Hz, 1H), 3.07 (m, 2H), 2.82 (dt, *J* = 8.3, 3.9 Hz, 1H). $^{13}C\{^1H\}$ NMR (126 MHz, $CDCl_3$) δ 162.1 (d, *J* = 245.5 Hz), 140.5, 138.0, 135.3, 130.5 (d, *J* = 8.0 Hz), 129.1, 128.0, 126.4, 125.7, 115.2 (d, *J* = 21.2 Hz), 61.3, 42.2, 29.6 ppm. Enantiomeric excess was determined by HPLC for the corresponding benzamide (AD-3 column, hexane/*i*PrOH 70/30, 0.80 mL/min, 220 nm): $t_1$ = 11.0 min (major), $t_2$ = 11.7 min (minor).

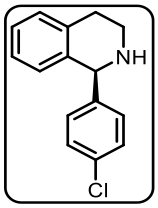
**(*S*)-1-(3-fluorophenyl)-1,2,3,4-tetrahydroisoquinoline (4e)[4]:**




a white solid, 42.2 mg, 94% yield; 88% ee; $[\alpha]^{20}_D$ = +13.3 (*c* 0.22, $CHCl_3$); $^1H$ NMR (500 MHz, $CDCl_3$) δ 7.31 (m, 1H), 7.23-7.16 (m, 2H), 7.13-7.05 (m, 2H), 7.00 m, 2H), 6.78 (d, *J* = 7.7 Hz, 1H), 5.13 (s, 1H), 3.28 (dt, *J* = 11.3, 4.9 Hz, 1H), 3.16-2.98 (m,

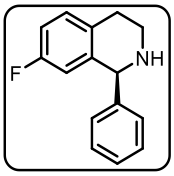
2H), 2.86 (dt, *J* = 16.1, 4.3 Hz, 1H). $^{13}C\{^{1}H\}$ NMR (126 MHz, $CDCl_3$) δ 162.9 (d, *J* = 245.9 Hz), 147.4 (d, *J* = 6.6 Hz), 137.5, 135.4, 129.8 (d, *J* = 8.1 Hz), 129.1, 128.0, 126.5, 125.7, 124.6 (d, *J* = 2.8 Hz), 115.8 (d, *J* = 21.4 Hz), 114.3 (d, *J* = 21.2 Hz), 61.5 (d, *J* = 1.6 Hz), 42.0, 29.6 ppm. Enantiomeric excess was determined by HPLC for the corresponding benzamide (AD-3 column, hexane/*i*PrOH 70/30, 1.0 mL/min, 220 nm): $t_1$ = 10.4 min (minor), $t_2$ = 11.3 min (major).

**(*S*)-1-(4-chlorophenyl)-1,2,3,4-tetrahydroisoquinoline (4f)[4]:**



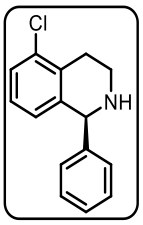

a white solid, 45.2 mg, 93% yield; 93% ee; $[\alpha]^{20}_D$ = + 17.8 (*c* 0.21, $CHCl_3$); $^1H$ NMR (500 MHz, $CDCl_3$) δ 7.29 (d, *J* = 8.4 Hz, 2H), 7.21 (d, *J* = 8.4 Hz, 2H), 7.15 (d, *J* = 4.1 Hz, 2H), 7.04 (dt, *J* = 8.3, 4.2 Hz, 1H), 6.71 (d, *J* = 7.7 Hz, 1H), 5.08 (s, 1H), 3.25 (dt, *J* = 11.1, 4.8 Hz, 1H), 3.06 (m, 2H), 2.82 (dt, *J* = 8.5, 4.0 Hz, 1H). $^{13}C$ NMR (126 MHz, $CDCl_3$) δ 143.3, 137.7, 135.4, 133.1, 130.3, 129.1, 128.5, 127.9, 126.4, 125.7, 61.4, 42.2, 29.6 ppm. Enantiomeric excess was determined by HPLC for the corresponding benzamide (AD-3 column, hexane/*i*PrOH 70/30, 0.80 mL/min, 210 nm): $t_1$ = 10.3 min (major), $t_2$ = 12.9 min (minor).

**(*S*)-7-fluoro-1-phenyl-1,2,3,4-tetrahydroisoquinoline (4g):**



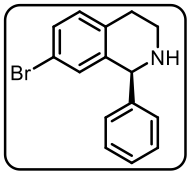

a white solid, 43.1 mg, 95% yield; 94% ee; $[\alpha]^{20}_D$ = +23.4 (*c* 0.63, $CHCl_3$); $^1H$ NMR (500 MHz, $CDCl_3$) δ 7.41-7.30 (m, 3H), 7.29 (dd, *J* = 5.9, 2.4 Hz, 2H), 7.12 (dd, *J* = 8.4, 5.8 Hz, 1H), 6.87 (td, *J* = 8.4, 2.6 Hz, 1H), 6.48 (dd, *J* = 9.9, 2.6 Hz, 1H), 5.08 (s, 1H), 3.37-3.19 (m, 1H), 3.10 (ddd, *J* = 11.8, 9.2, 4.3 Hz, 1H), 3.07-2.93 (m, 1H), 2.82 (dt, *J* = 16.0, 4.1 Hz, 1H). $^{13}C\{^{1}H\}$ NMR (126 MHz, $CDCl_3$) δ 160.8 (d, *J* = 243.4 Hz), 144.0, 140.1 (d, *J* = 6.5 Hz), 130.9 (d, *J* = 3.0 Hz), 130.3 (d, *J* = 7.6 Hz), 128.9, 128.5, 127.6, 114.3 (d, *J* = 21.5 Hz), 113.5 (d, *J* = 21.4 Hz), 62.2 (d, *J* = 1.7 Hz), 42.3, 29.0 ppm. Enantiomeric excess was determined by HPLC for the corresponding benzamide (AD-3 column, hexane/*i*PrOH 80/20, 1.0 mL/min, 210 nm): $t_1$ = 15.1 min (major), $t_2$ = 15.7 min (minor). HRMS Calculated for $C_{15}H_{15}NF$ $[M+H]^+$ 228.1183; found 228.1176.

**(*S*)-5-chloro-1-phenyl-1,2,3,4-tetrahydroisoquinoline (4h):**



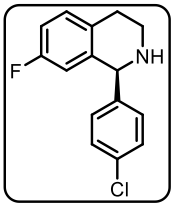

a white solid, 44.7 mg, 92% yield; 86% ee; $[\alpha]^{20}_D$ = +72.9 (*c* 0.96, $CHCl_3$); $^1H$ NMR (500 MHz, $CDCl_3$) δ 7.40-7.30 (m, 3H), 7.28-7.20 (m, 2H), 7.01 (t, *J* = 7.8 Hz, 1H), 6.70 (d, *J* = 7.8 Hz, 1H), 5.11 (s, 1H), 3.33 (dt, *J* = 12.2, 5.3 Hz, 1H), 3.22-3.03 (m, 1H), 3.03-2.69 (m, 2H). $^{13}C\{^{1}H\}$ NMR (126 MHz, $CDCl_3$) δ 144.2, 140.6, 134.4, 133.6, 128.9, 128.5, 127.6, 127.0, 126.6, 126.3, 62.1, 41.7, 27.7 ppm. Enantiomeric excess was determined by HPLC for the corresponding benzamide (AD-3 column, hexane/*i*PrOH 80/20, 1.0 mL/min, 210 nm): $t_1$ = 13.3 min (major), $t_2$ = 20.6 min (minor). HRMS Calculated for $C_{15}H_{15}NCl$ $[M+H]^+$ 244.0888; found 244.0881.

**(*S*)-7-bromo-1-phenyl-1,2,3,4-tetrahydroisoquinoline (4i):**



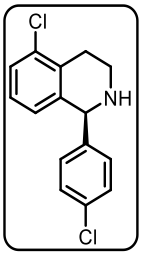

a white solid, 52.4 mg, 91% yield; 94% ee; $[\alpha]^{20}_D$ = -75.8 (*c* 0.76, $CHCl_3$); $^1H$ NMR (500 MHz, $CDCl_3$) δ 7.41-7.31 (m, 3H), 7.31 2 7.25 (m, 2H), 7.05 (d, *J* = 8.2 Hz, 1H), 6.92 (d, *J* = 1.7 Hz, 1H), 5.07 (s, 1H), 3.53-3.16 (m, 1H), 3.11-3.06 (m, 1H), 3.02-2.96 (m, 1H), 2.82-2.77 (m, 1H), 2.01-1.47 (m, 1H). $^{13}C\{^{1}H\}$ NMR (126 MHz, $CDCl_3$) δ 143.9, 140.4, 134.4, 130.7, 130.7, 129.4, 128.9, 128.6, 127.7, 119.2, 61.8, 42.0, 29.3 ppm. Enantiomeric excess was determined by HPLC for the corresponding benzamide (AD-3 column, hexane/*i*PrOH 70/30, 1.0 mL/min, 210 nm): $t_1$ = 8.1 min (major), $t_2$ =8.6 min (minor). HRMS Calculated for $C_{15}H_{15}NBr$ $[M+H]^+$ 288.0382; found 288.0374.

**(*S*)-1-(4-chlorophenyl)-7-fluoro-1,2,3,4-tetrahydroisoquinoline (4j):**



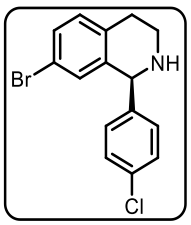

a white solid, 49.0 mg, 94% yield; 93% ee; $[\alpha]^{20}_D$ = +43.3 (*c* 0.69, $CHCl_3$); $^1H$ NMR (400 MHz, $CDCl_3$) δ 7.33 (d, *J* = 8.5 Hz, 2H), 7.23 (d, *J* = 8.4 Hz, 2H), 7.12 (dd, *J* = 8.5, 5.8 Hz, 1H), 6.91-6.85 (m, 1H), 6.45-6.42 (m, 1H), 5.05 (s, 1H), 3.35-3.21 (m, 1H), 3.12-3.06 (m, 1H), 3.05-2.97 (m, 1H), 2.83-2.77 (m, 1H). $^{13}C\{^1H\}$ NMR (101 MHz, $CDCl_3$) δ 160.8 (d, *J* = 243.7 Hz), 142.5, 139.6 (d, *J* = 6.4 Hz), 133.4, 130.9 (d, *J* = 3.0 Hz), 130.5 (d, *J* = 7.7 Hz), 130.2, 128.7, 114.2 (d, *J* = 21.6 Hz), 113.7 (d, *J* = 21.3 Hz), 61.5 (d, *J* = 1.8 Hz), 42.3, 28.9 ppm. Enantiomeric excess was determined by HPLC for the corresponding benzamide (AD-3 column, hexane/*i*PrOH 80/20, 0.5mL/min, 210 nm): $t_1$ = 24.8 min (major), $t_2$ =28.8 min (minor). HRMS Calculated for $C_{15}H_{14}NFCl$ $[M+H]^+$ 262.0793; found 262.0784.

**(*S*)-5-chloro-1-(4-chlorophenyl)-1,2,3,4-tetrahydroisoquinoline (4k):**




a white solid, 50.6 mg, 91% yield; 85% ee; $[\alpha]^{20}_D$ = +85.4 (*c* 0.85, $CHCl_3$); $^1H$ NMR (400 MHz, $CDCl_3$) δ 7.32 (d, *J* = 8.4 Hz, 2H), 7.27 (d, *J* = 8.0 Hz, 1H), 7.21 (d, *J* = 8.5 Hz, 2H), 7.02 (t, *J* = 7.8 Hz, 1H), 6.66 (d, *J* = 7.7 Hz, 1H), 5.08 (s, 1H), 3.33-3.27 (m, 1H), 3.15-3.08 (m, 1H), 2.94 (q, *J* = 5.6, 5.0 Hz, 2H). $^{13}C\{^1H\}$ NMR (101 MHz, $CDCl_3$) δ 142.71, 140.12, 134.56, 133.59, 133.38, 130.33, 128.65, 127.25, 126.45, 126.39, 61.42, 41.71, 27.67 ppm. Enantiomeric excess was determined by HPLC for the corresponding benzamide (AD-3 column, hexane/*i*PrOH 80/20, 1.0 mL/min, 220 nm): $t_1$ = 17.0 min (major), $t_2$ =24.1 min (minor). HRMS Calculated for $C_{15}H_{14}NCl_2$ $[M+H]^+$ 278.0498; found 278.0489.

**(*S*)-7-bromo-1-(4-chlorophenyl)-1,2,3,4-tetrahydroisoquinoline (4l):**



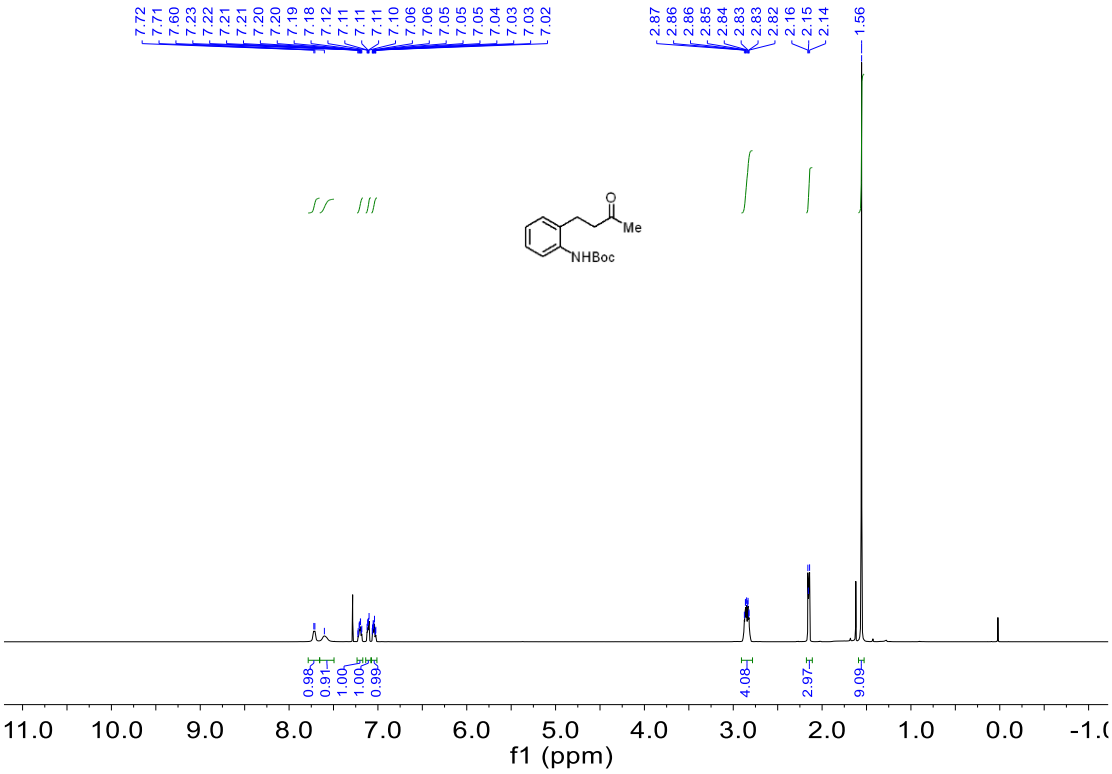

a white solid, 57.3 mg, 89% yield; 98% ee; $[\alpha]^{20}_D$ = -10.1 (*c* 0.96, $CHCl_3$);$^1H$ NMR (400 MHz, $CDCl_3$) δ 7.31 (d, *J* = 8.4 Hz, 2H), 7.29-7.24 (m, 1H), 7.19 (d, *J* = 8.4 Hz, 2H), 7.02 (d, *J* = 8.2 Hz, 1H), 6.84 (d, *J* = 2.1 Hz, 1H), 5.02 (s, 1H), 3.43-3.16 (m, 1H), 3.09-3.02 (m, 1H), 3.01-2.89 (m, 1H), 2.76 (dt, *J* = 16.2, 4.4 Hz, 1H). $^{13}C\{^1H\}$ NMR (101 MHz, $CDCl_3$) δ 142.4, 139.9, 134.3, 133.5, 130.8, 130.6, 130.2, 129.6, 128.7, 119.3, 61.2, 42.0, 29.2 ppm. Enantiomeric excess was determined by HPLC for the corresponding benzamide (AD-3 column, hexane/*i*PrOH 80/20, 0.5 mL/min, 210 nm): $t_1$ = 28.9 min (major), $t_2$ = 34.6 min (minor). HRMS Calculated for $C_{15}H_{14}NClBr$ $[M+H]^+$ 321.9993; found 321.9966.

**4. References:**

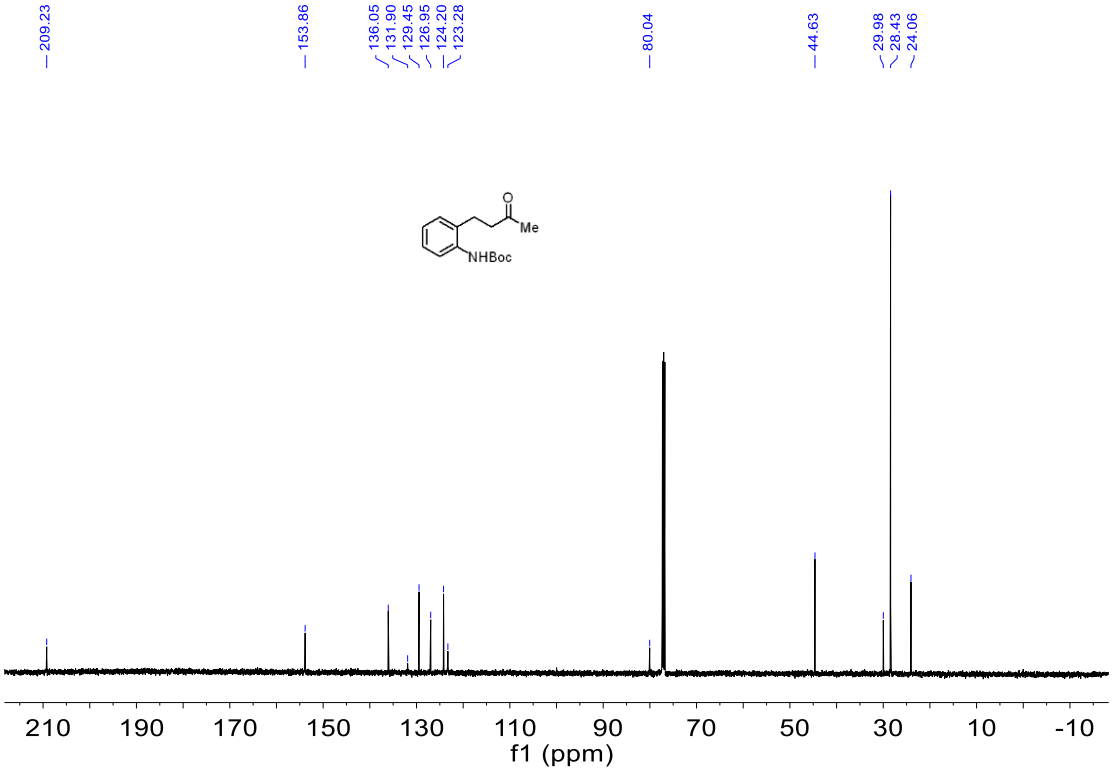

1. M. K. Sahoo; G. Jaiswal; J. Rana and E. Balaraman, *Chem. Eur. J.* **2017**, *23*,14167-14172
2. W.-C. Gao; S. Jiang; R.-L. Wang and C. Zhang, *Chem. Commun.*, **2013**, *49*, 4890-4892.
3. M. Ryo; O. Yoko; S. Kazuki and S. Mitsuru, *Tetrahedron Letters* **2015**, *56*, 3410-3412.
4. H. Zhou; Y. Liu; S. Yang; L. Zhou and M. Chang, *Angew. Chem. Int. Ed.* **2017**, *56*, 2725-2729.
5. C. Wang; C. Li; X. Wu; A. Pettman and J. Xiao, *Angew. Chem. Int. Ed.* **2009**, *48*, 6524-6528.
6. D.-W. Wang; X.-B. Wang; D.-S. Wang; S.-M. Lu; Y.-G. Zhou and Y.-X. Li *J. Org. Chem.* **2009**, *74*, 2780-2787.
7. J. Tang; G.-F. Jiang and Y.-G. Zhou, *Heterocycles*, **2010**, *82*, 887-893.

## 5. NMR Spectra

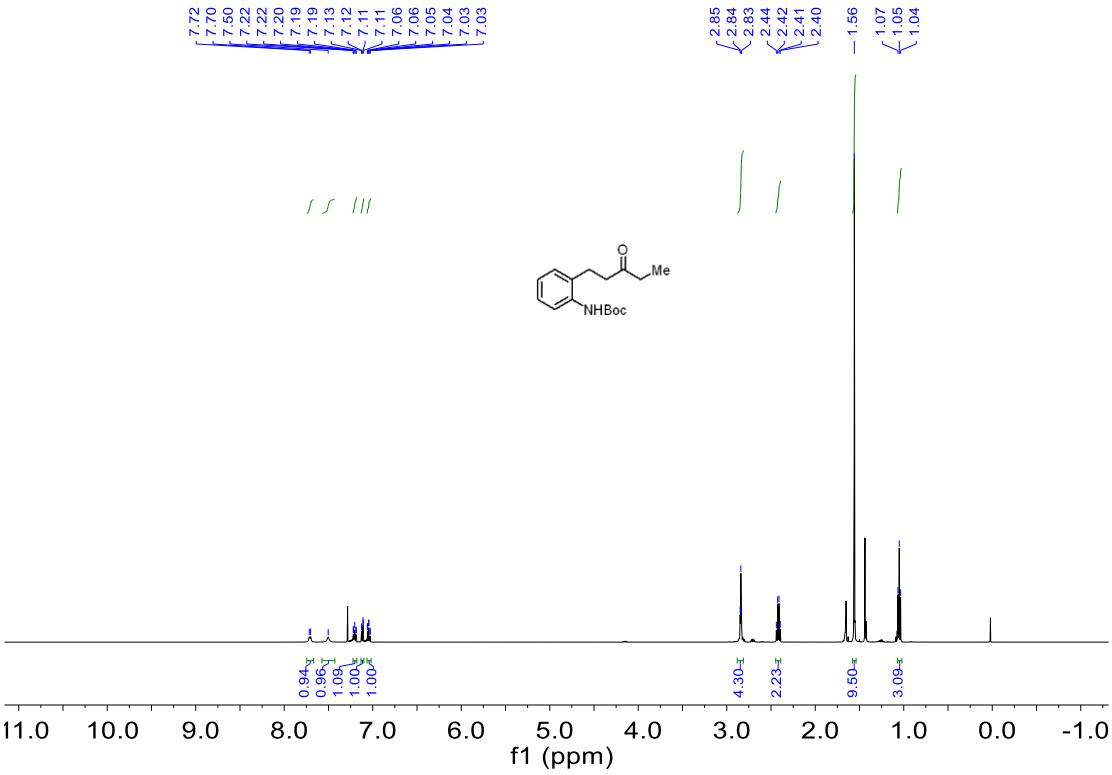
$^{1}$H NMR for **1a** (500 MHz, $CDCl_3$)



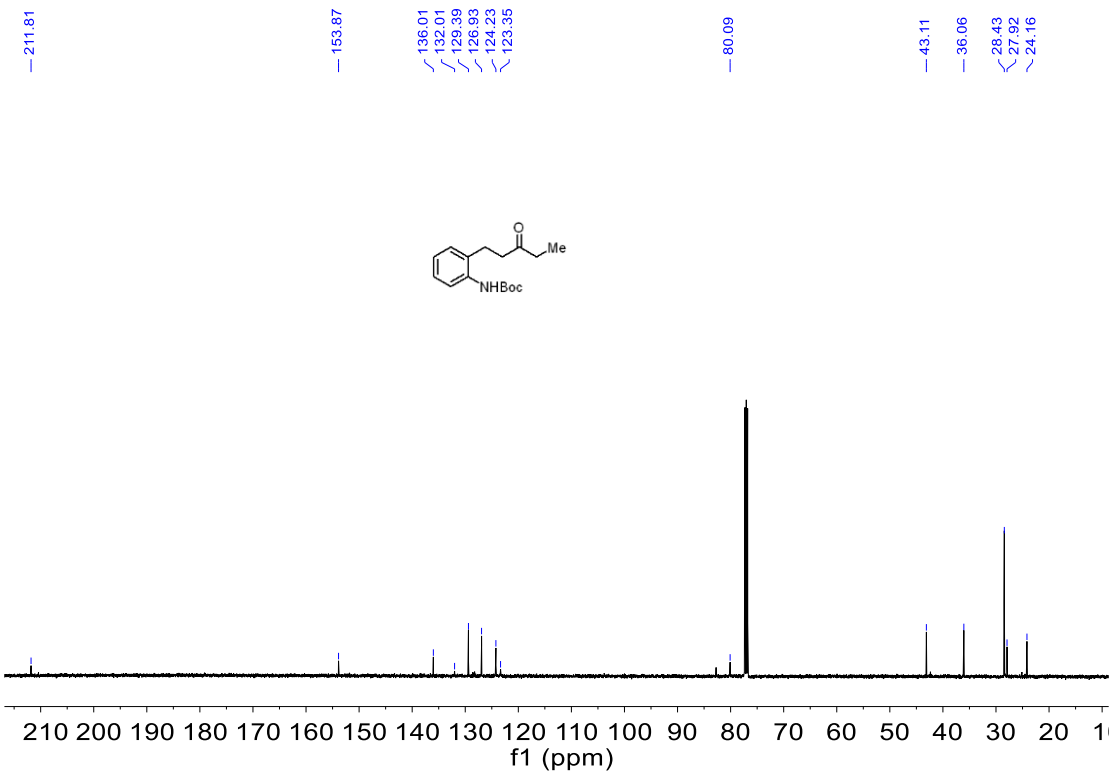

$^{13}$C NMR for **1a** (126 MHz, $CDCl_3$)



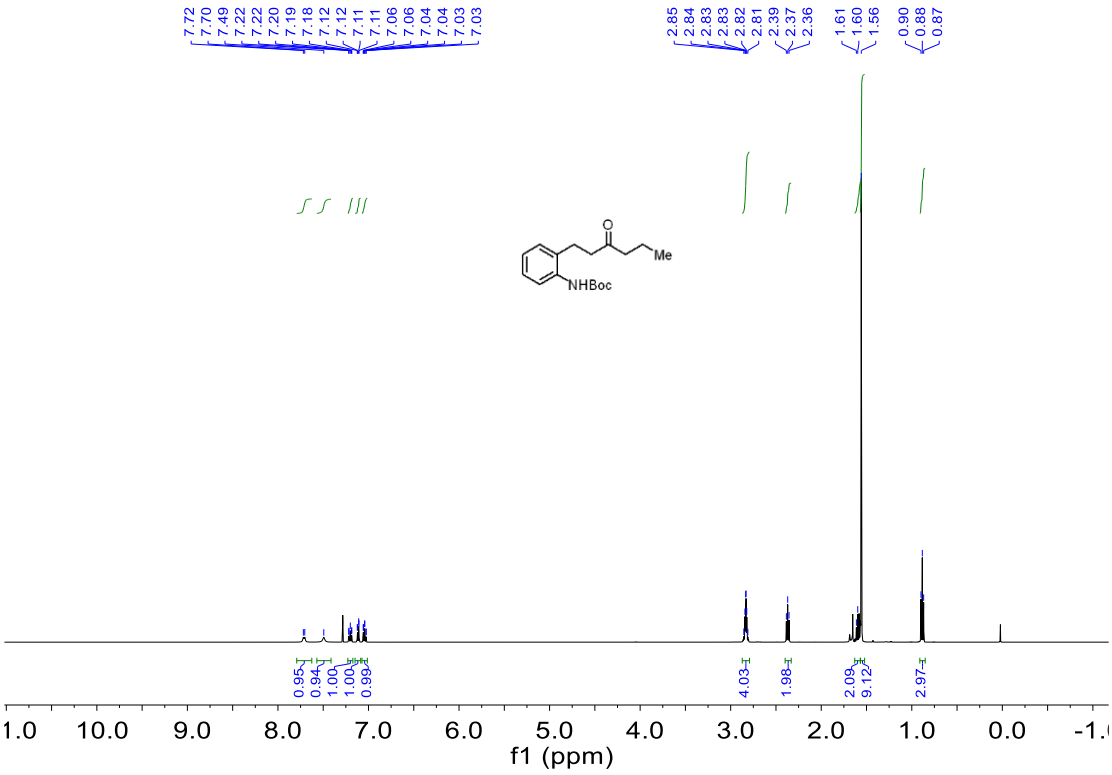
$^{1}$H NMR for **1b** (500 MHz, $CDCl_3$)



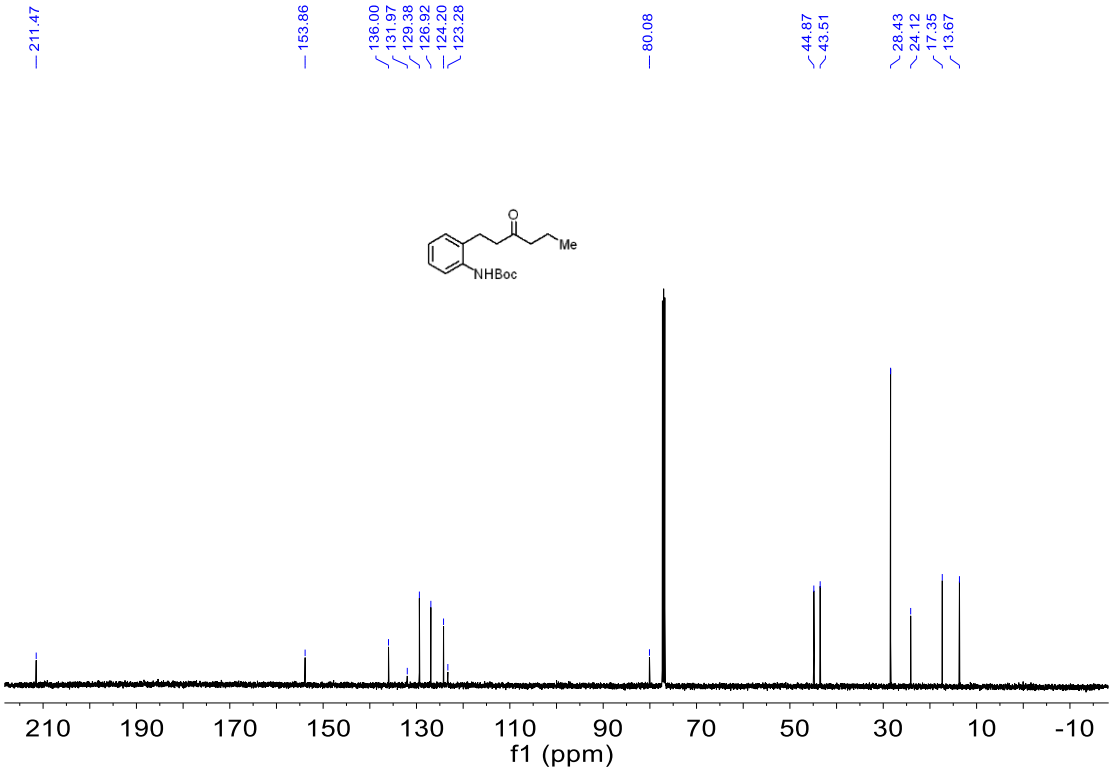

$^{13}$C NMR for **1b** (126 MHz, $CDCl_3$)



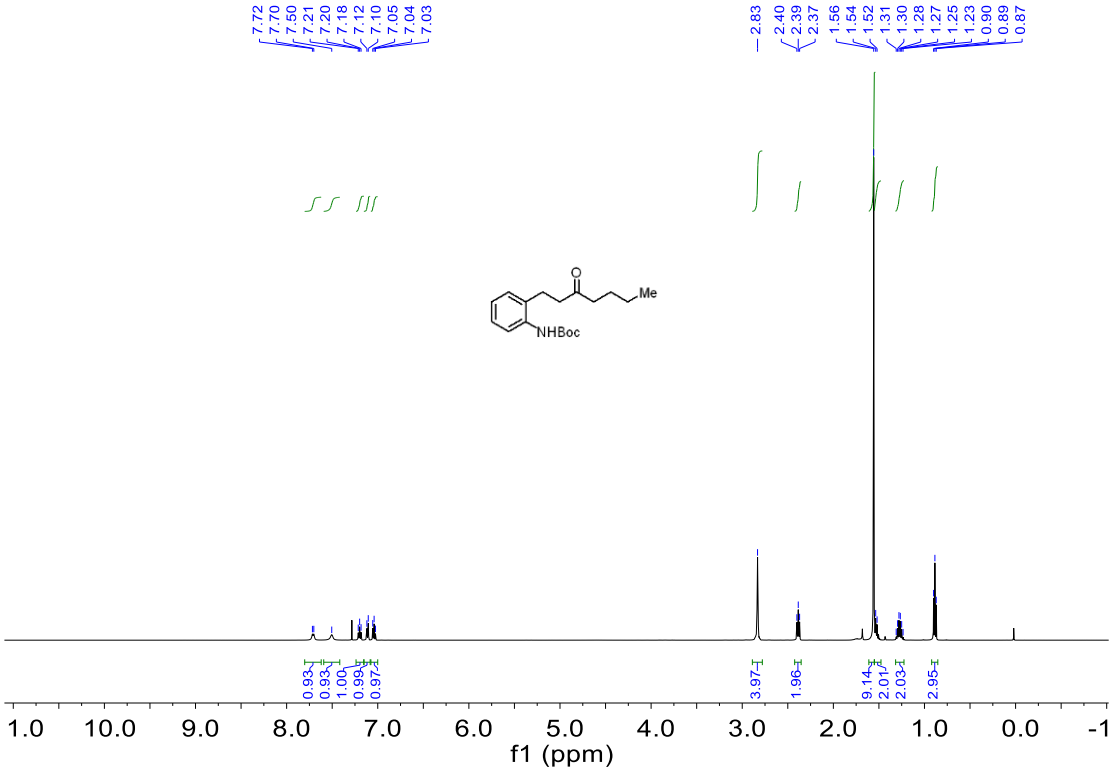
$^{1}$H NMR for **1c** (500 MHz, $CDCl_3$)



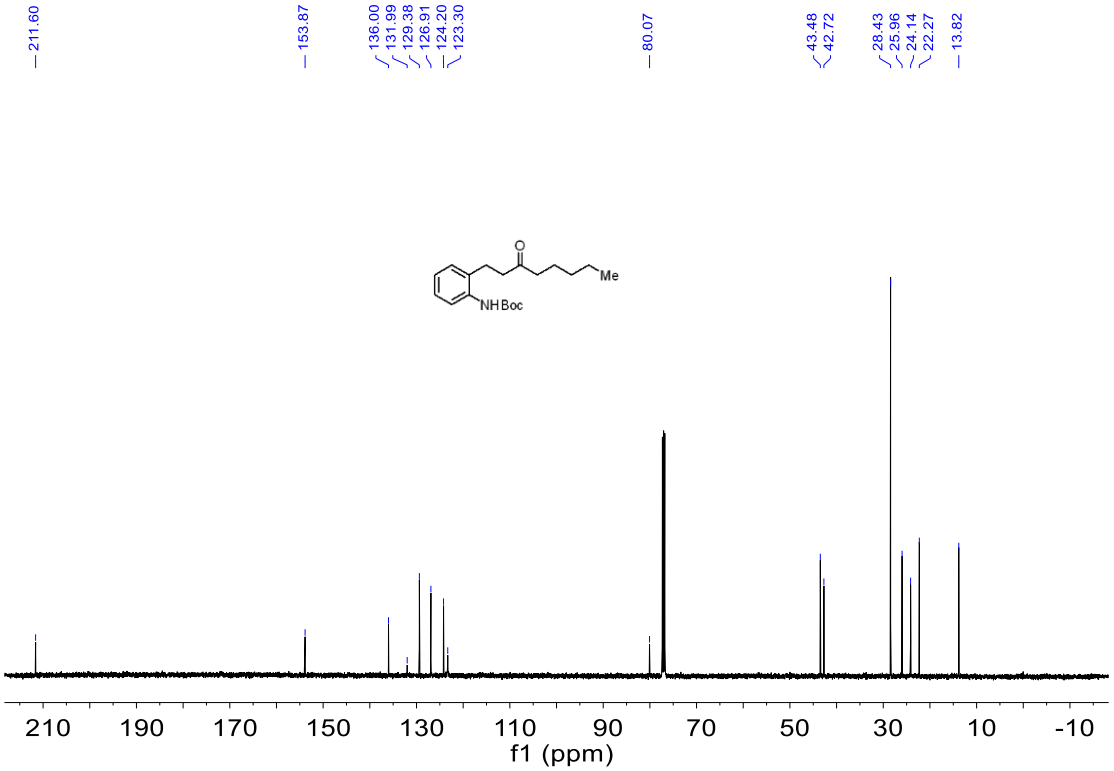

$^{13}$C NMR for **1c** (126 MHz, $CDCl_3$)



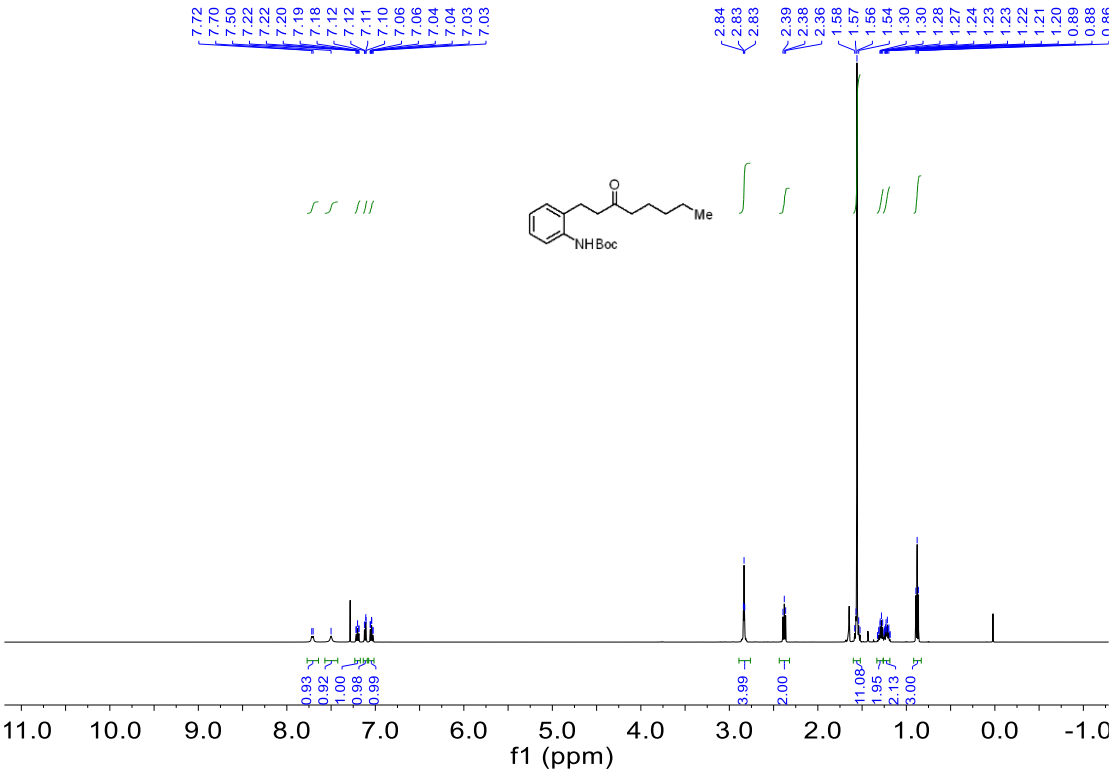
$^{1}$H NMR for **1d** (500 MHz, $CDCl_3$)



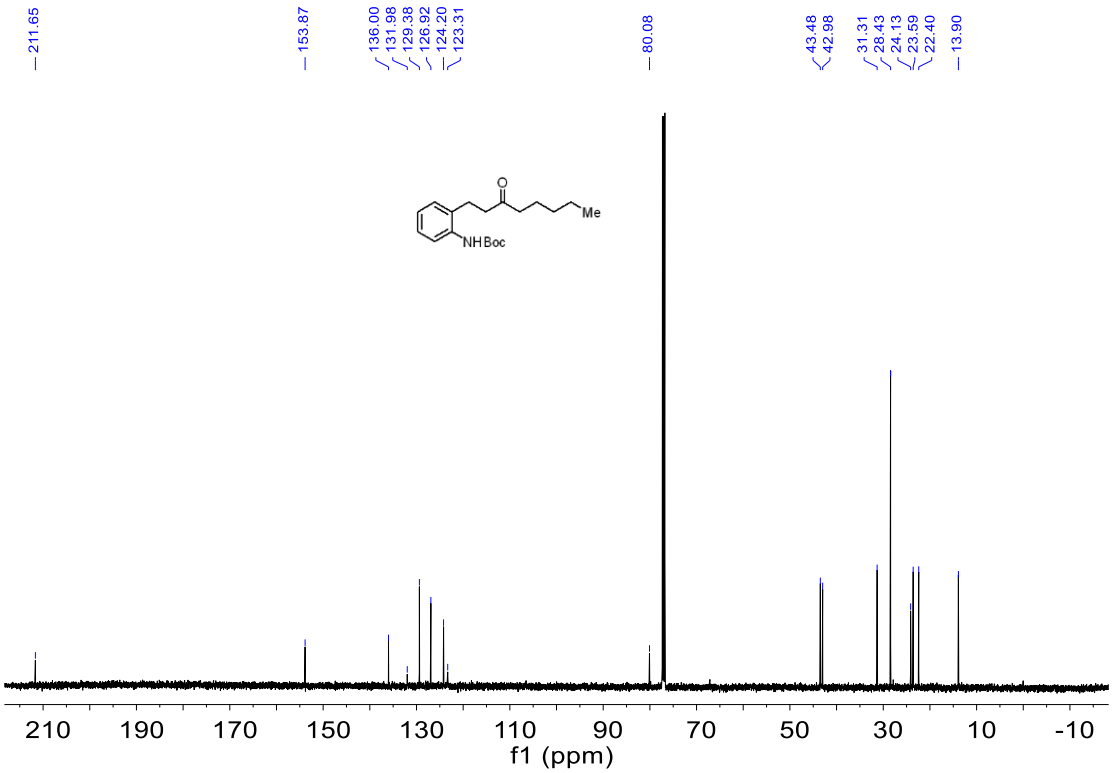

$^{13}$C NMR for **1d** (126 MHz, $CDCl_3$)



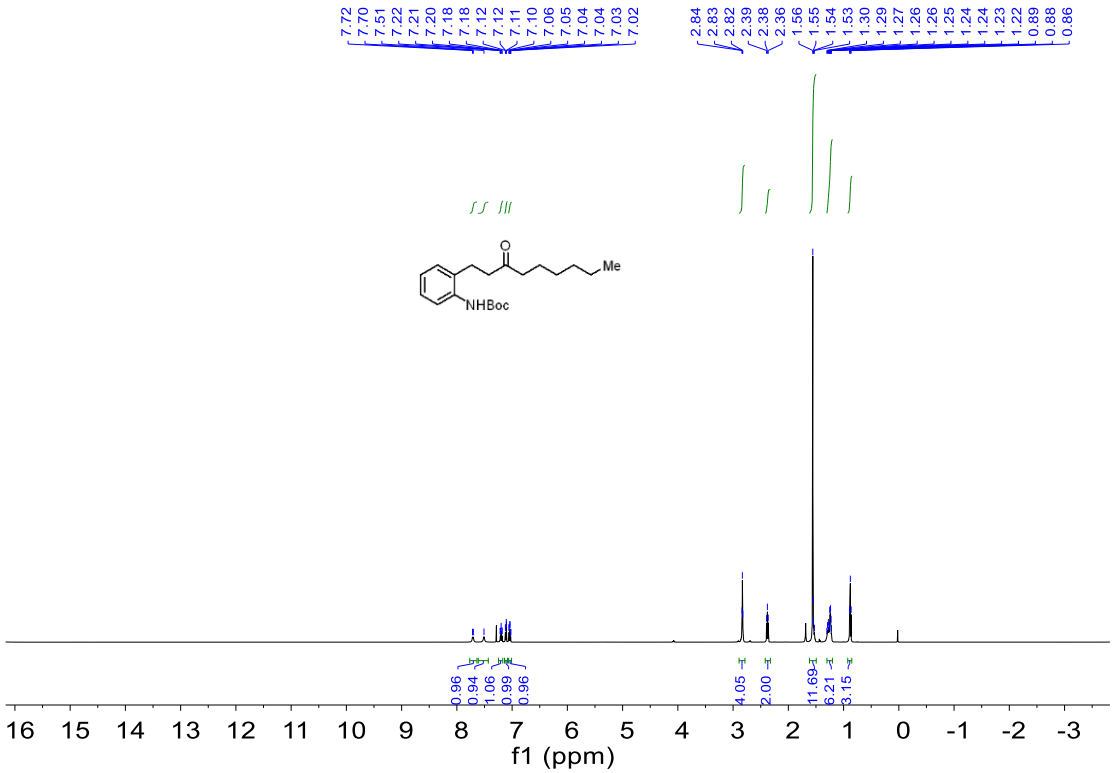
$^{1}$H NMR for **1e** (500 MHz, $CDCl_3$)



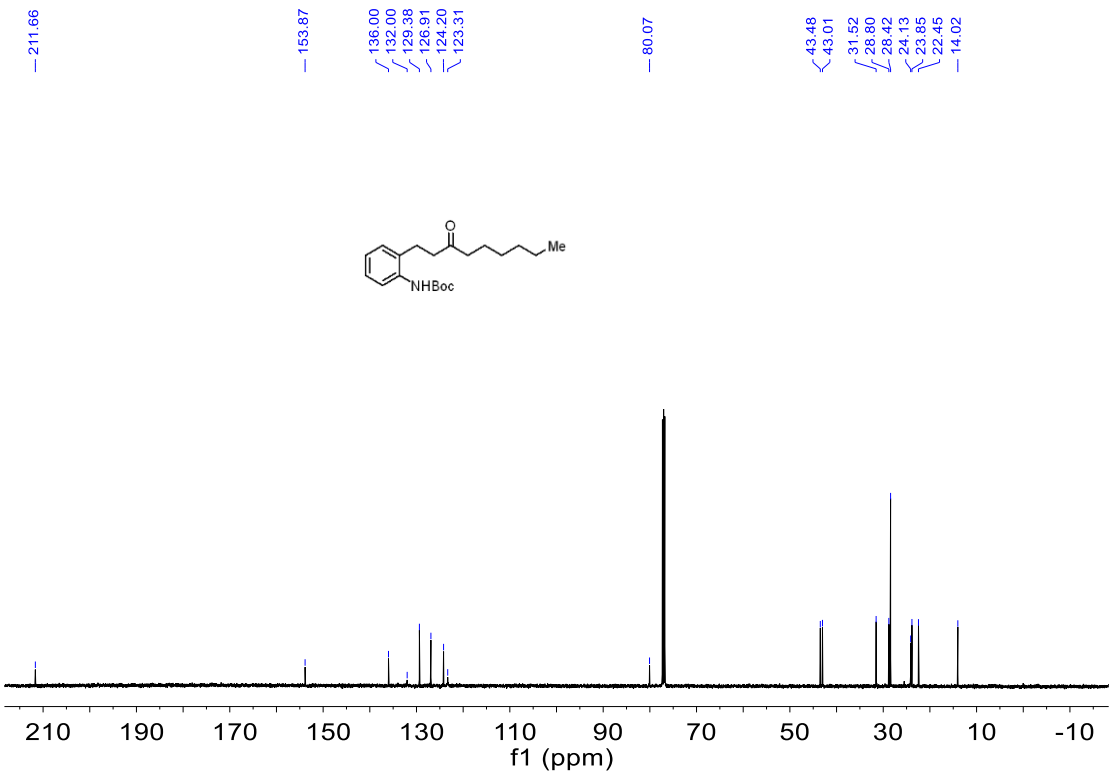

$^{13}$C NMR for **1e** (126 MHz, $CDCl_3$)



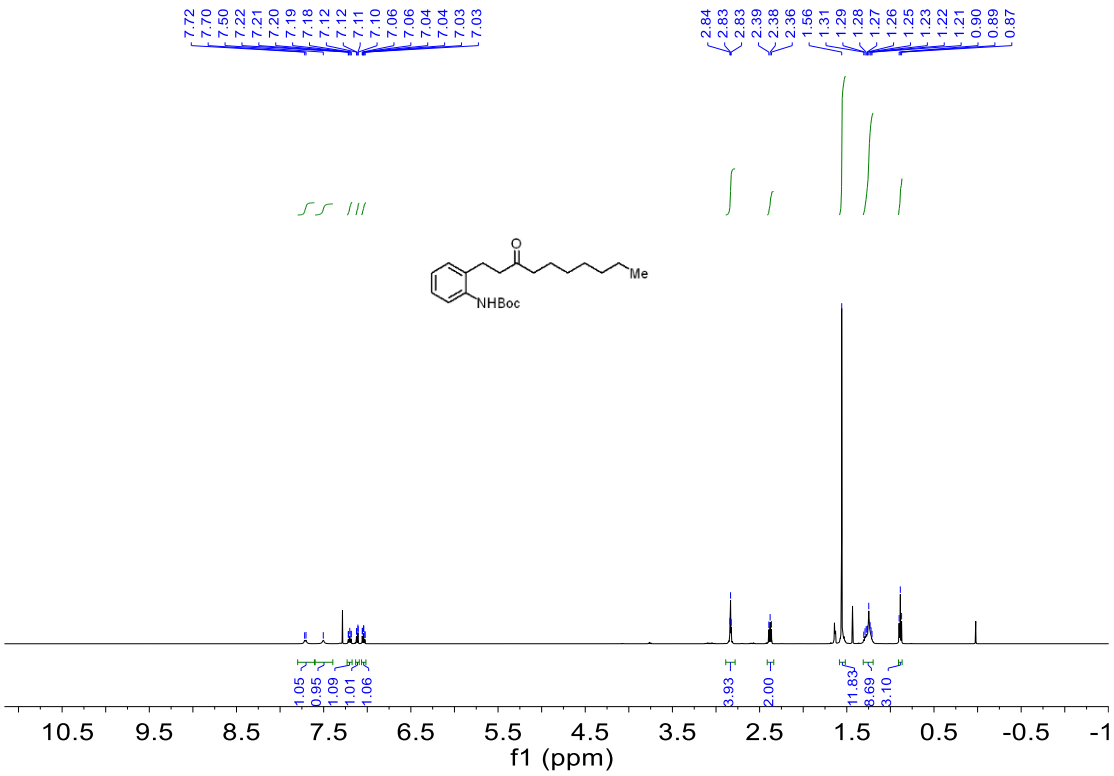
$^{1}$H NMR for **1f** (500 MHz, $CDCl_3$)



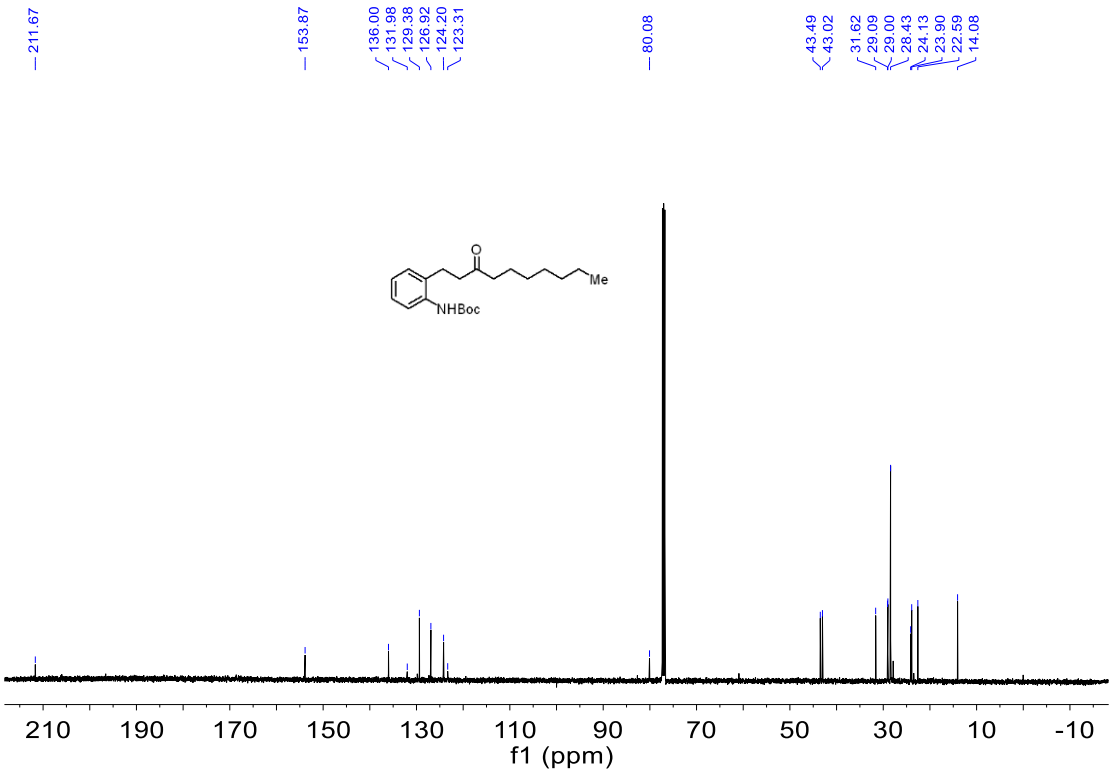

$^{13}$C NMR for **1f** (126 MHz, $CDCl_3$)



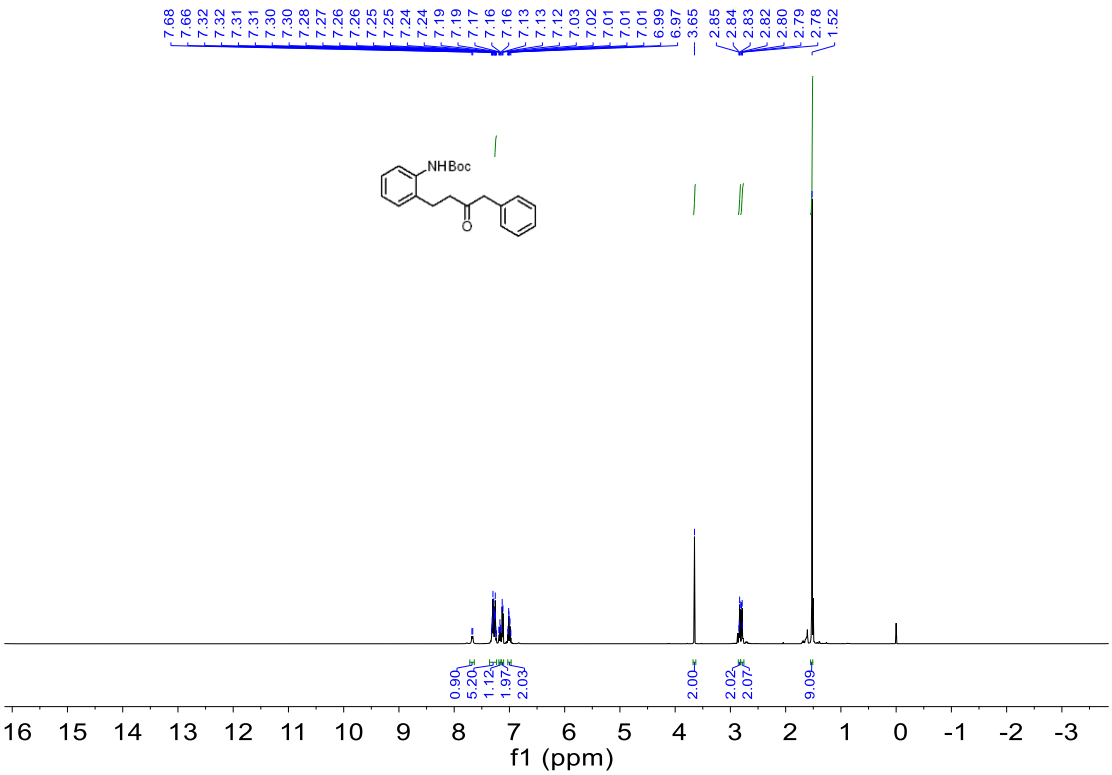
$^{1}$H NMR for **1g** (500 MHz, $CDCl_3$)



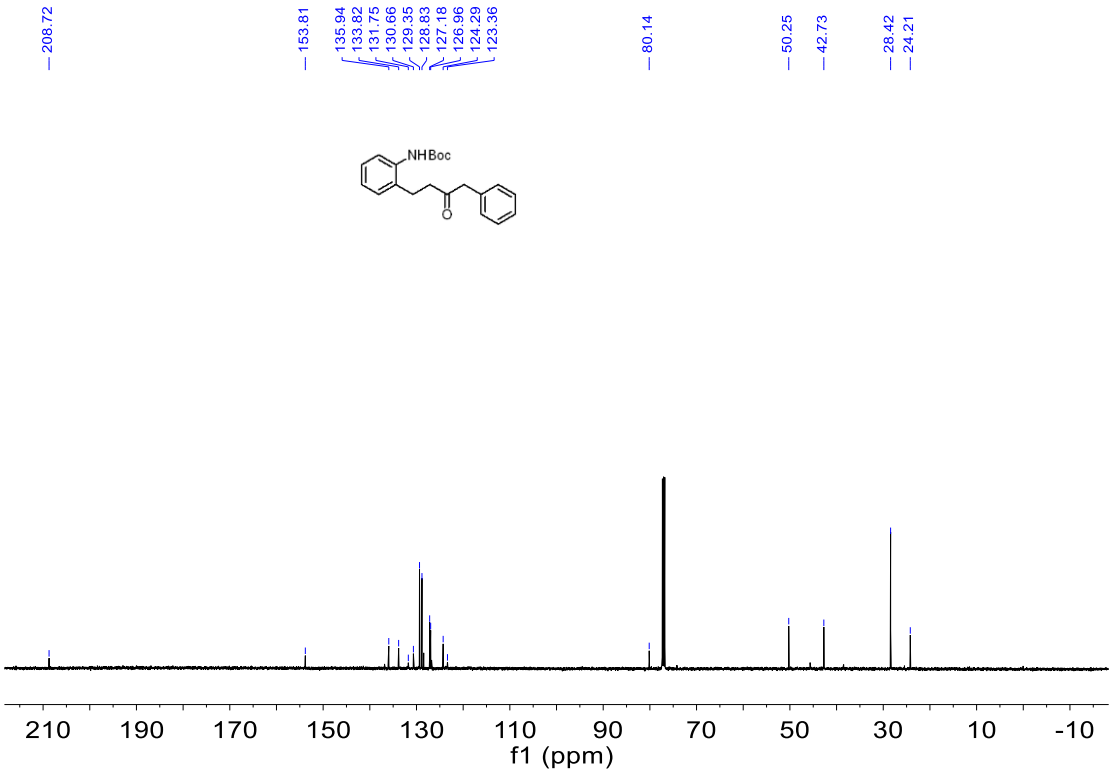

$^{13}$C NMR for **1g** (126 MHz, $CDCl_3$)



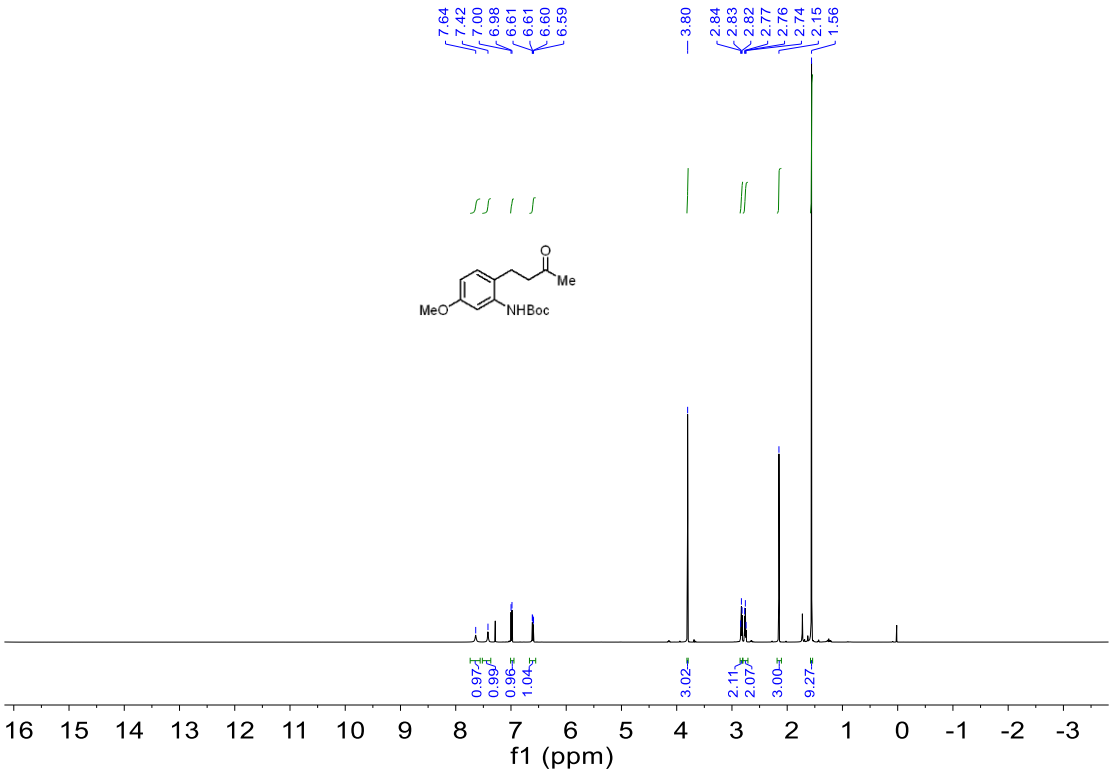
$^{1}$H NMR for **1h** (500 MHz, $CDCl_3$)



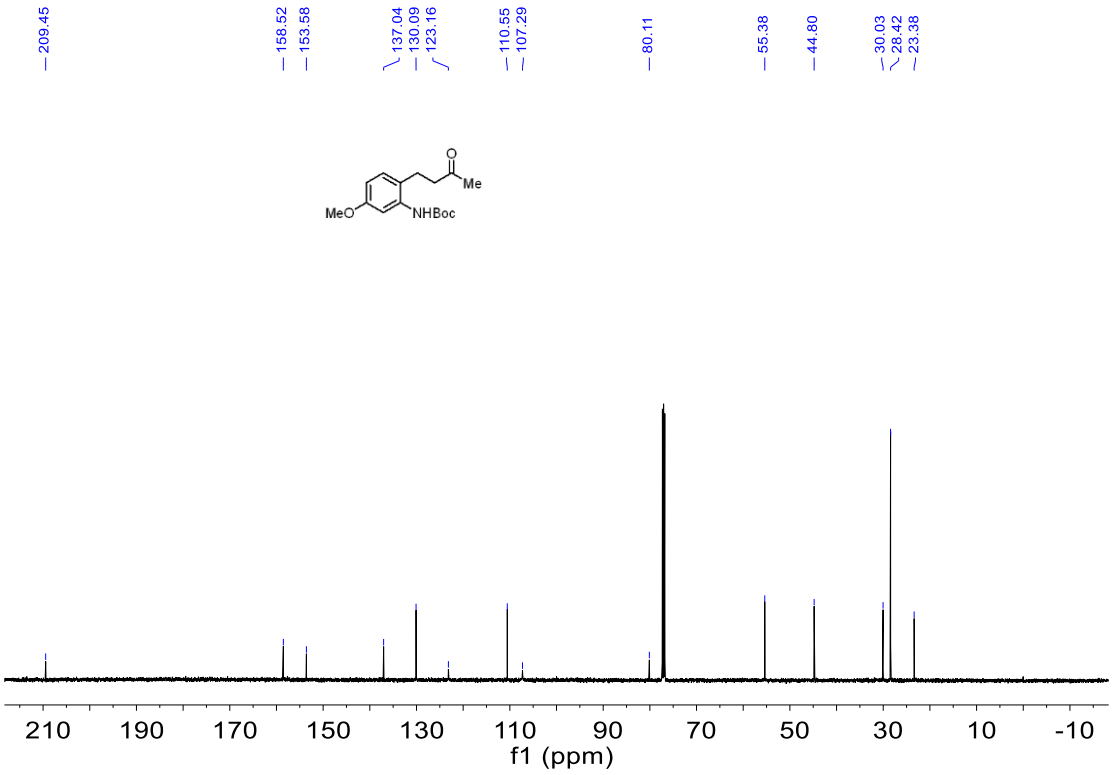

$^{13}$C NMR for **1h** (126 MHz, $CDCl_3$)



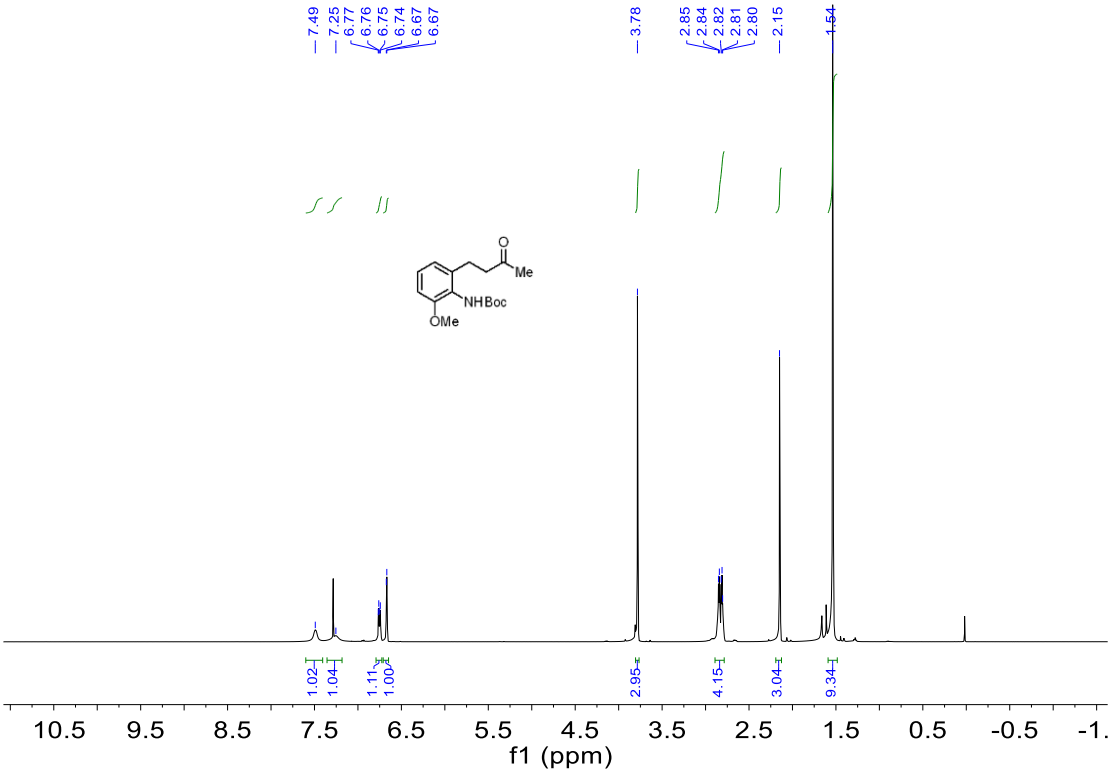
$^{1}$H NMR for **1i** (500 MHz, $CDCl_3$)



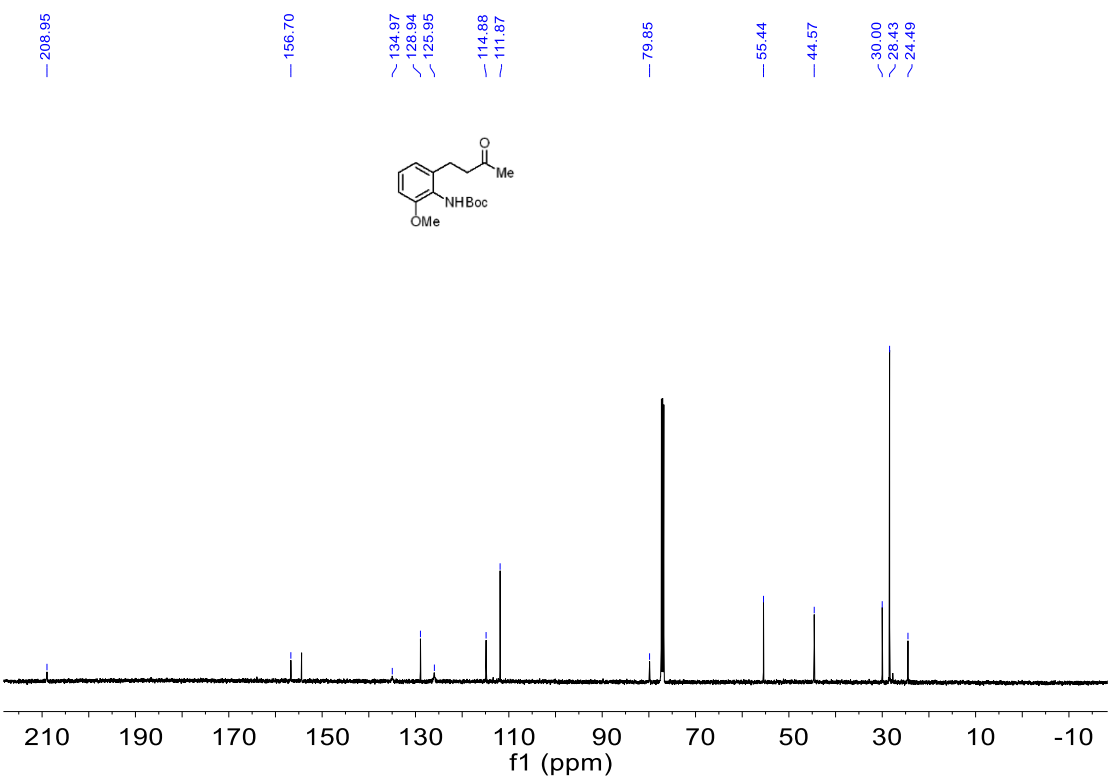

$^{13}$C NMR for **1i** (126 MHz, $CDCl_3$)



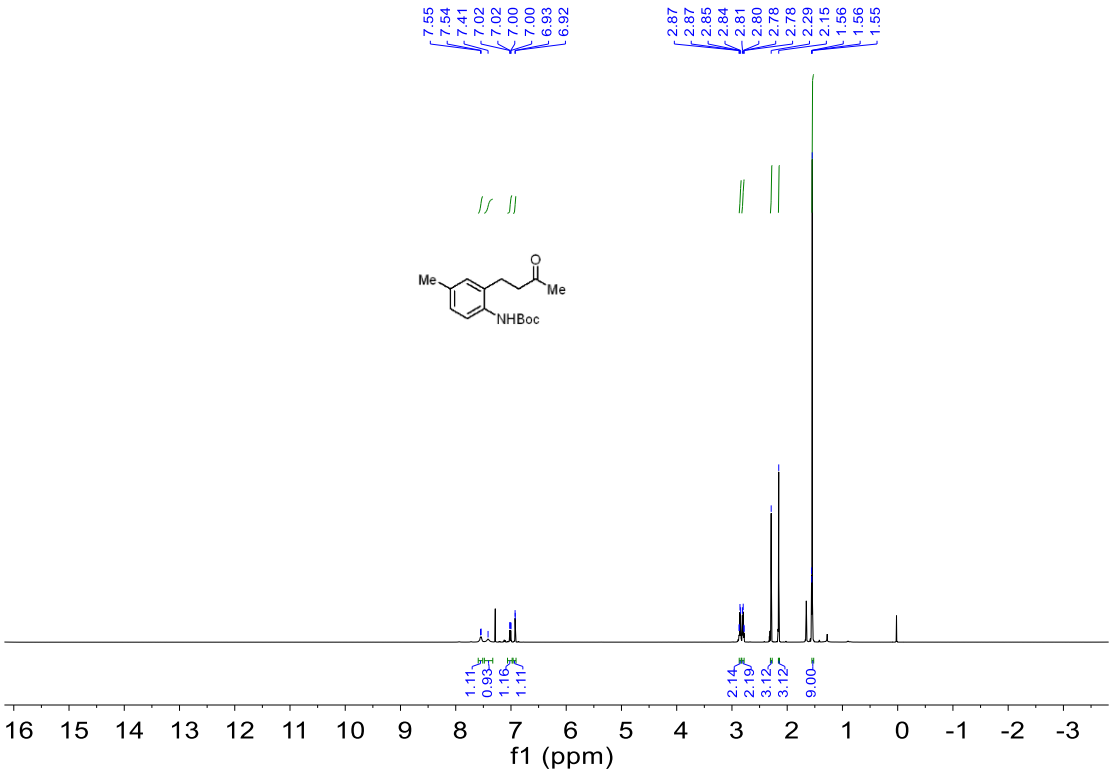
$^{1}$H NMR for **1j** (500 MHz, $CDCl_3$)



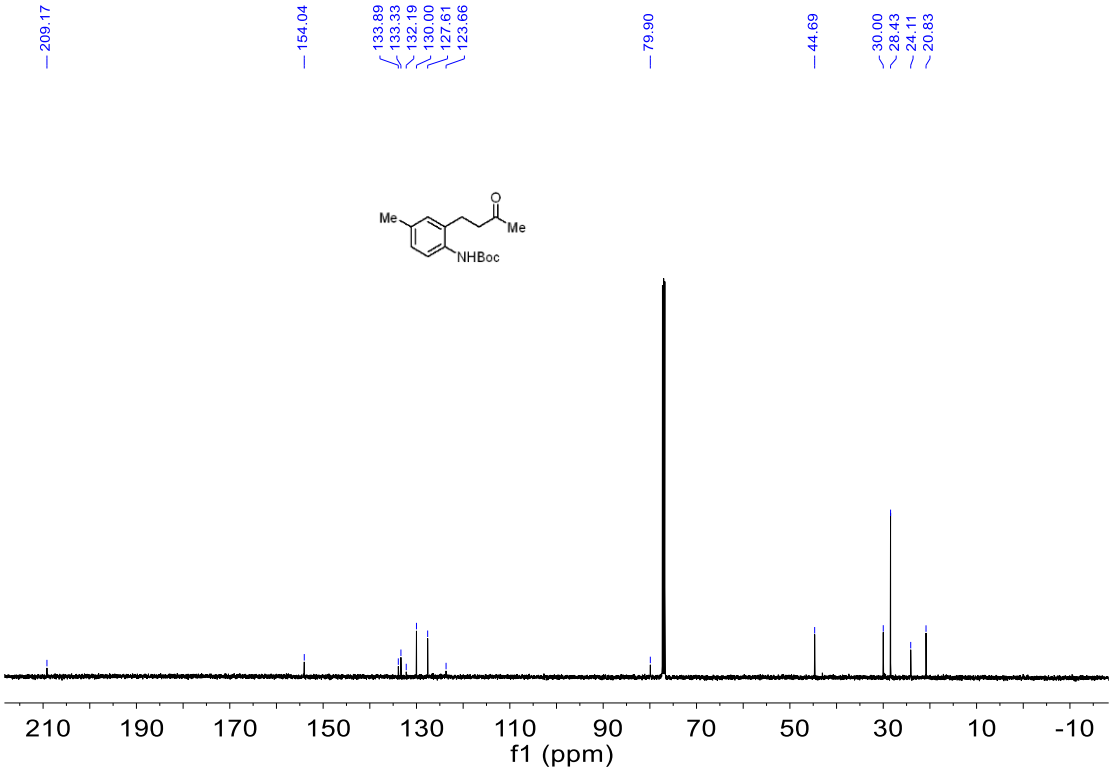

$^{13}$C NMR for **1j** (126 MHz, $CDCl_3$)



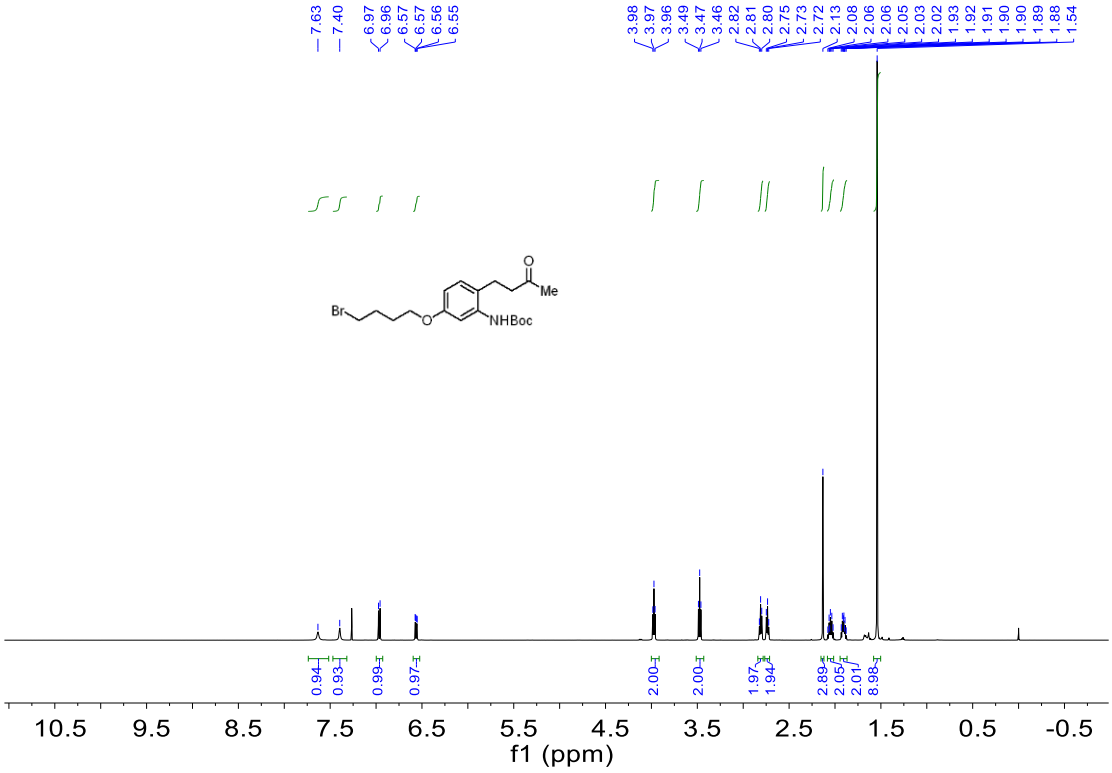
$^{1}$H NMR for **1k** (500 MHz, $CDCl_3$)



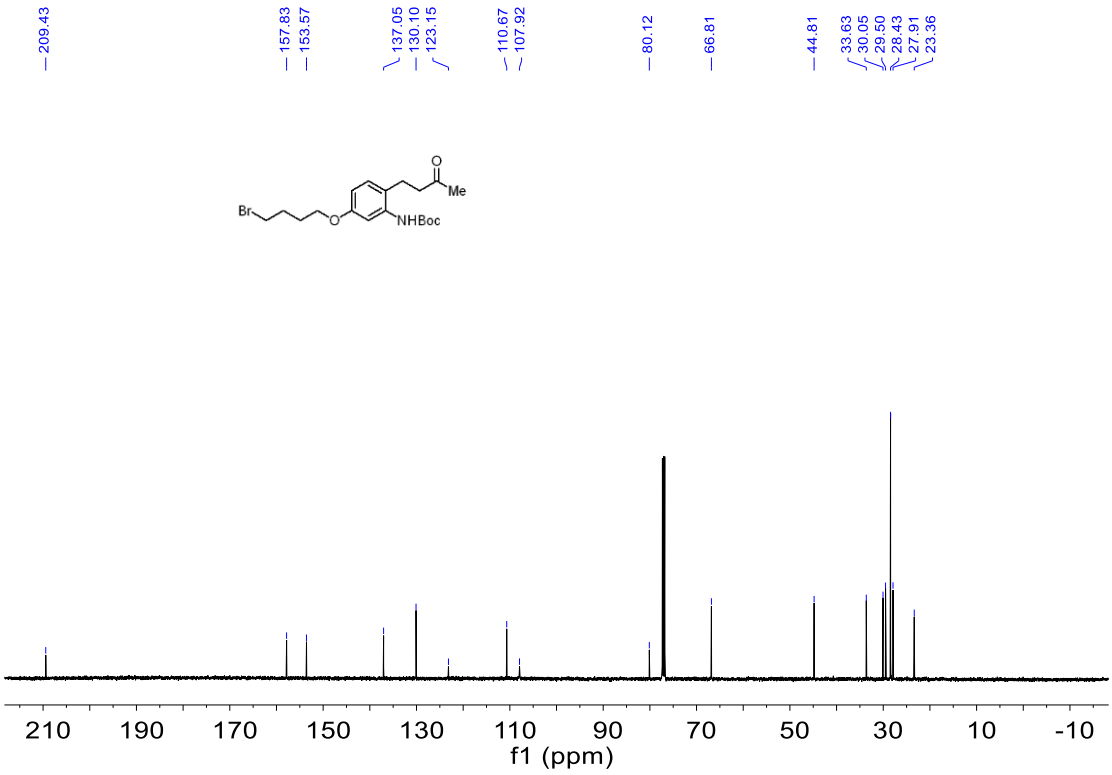

$^{13}$C NMR for **1k** (126 MHz, $CDCl_3$)



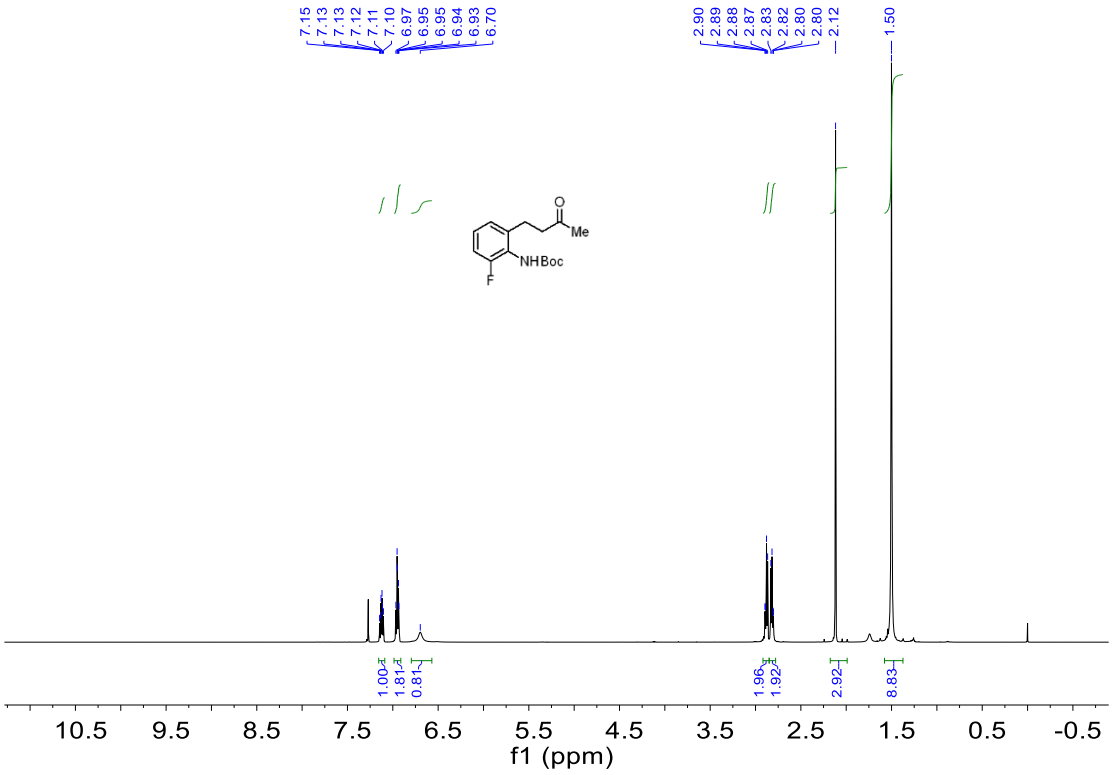
$^{1}$H NMR for **1l** (500 MHz, $CDCl_3$)



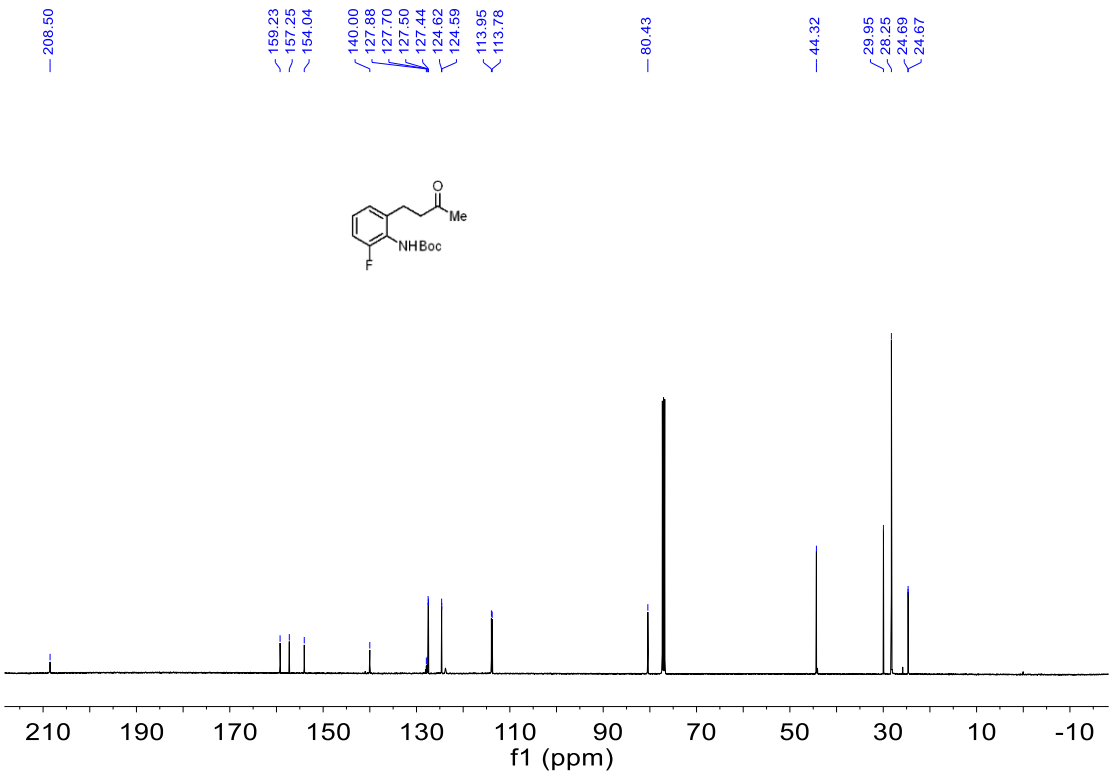

$^{13}$C NMR for **1l** (126 MHz, $CDCl_3$)



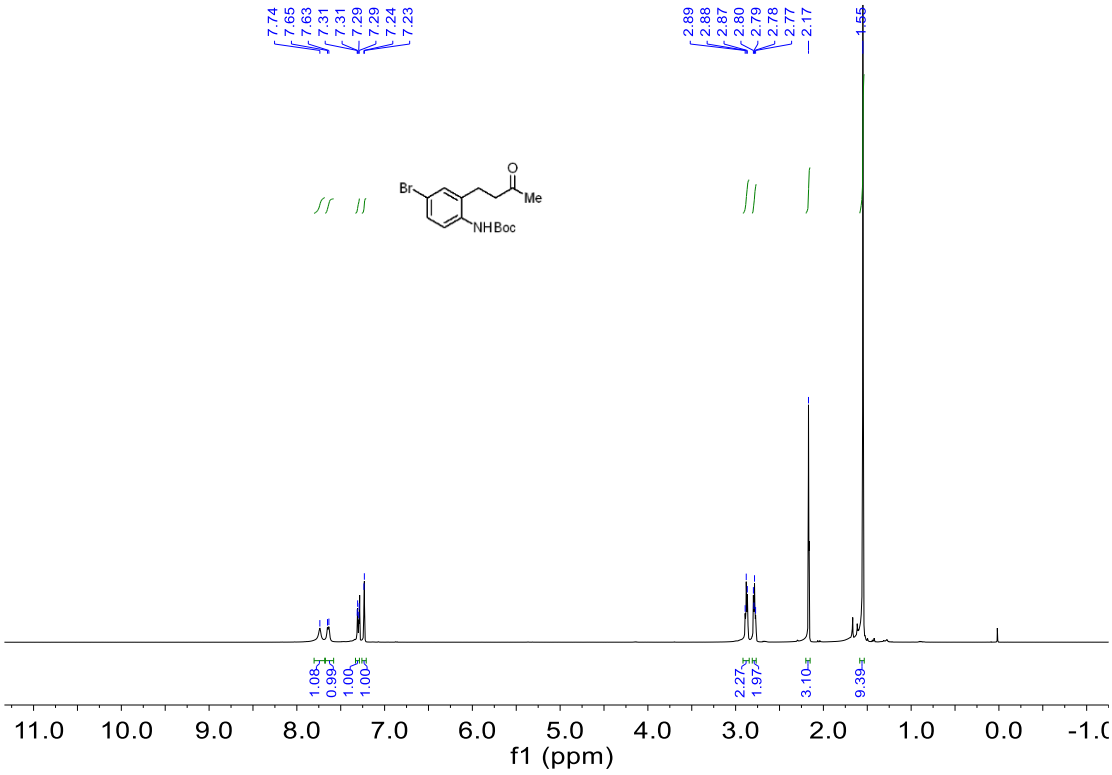
$^{1}$H NMR for **1m** (500 MHz, $CDCl_3$)



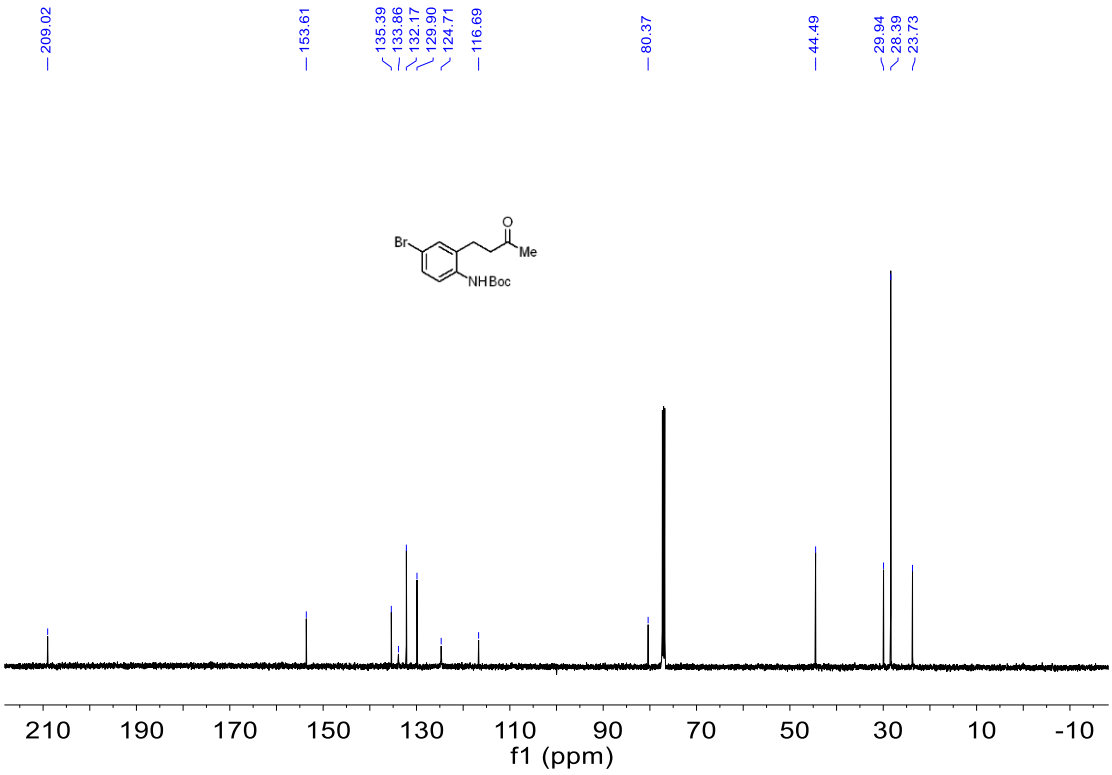

$^{13}$C NMR for **1m** (126 MHz, $CDCl_3$)



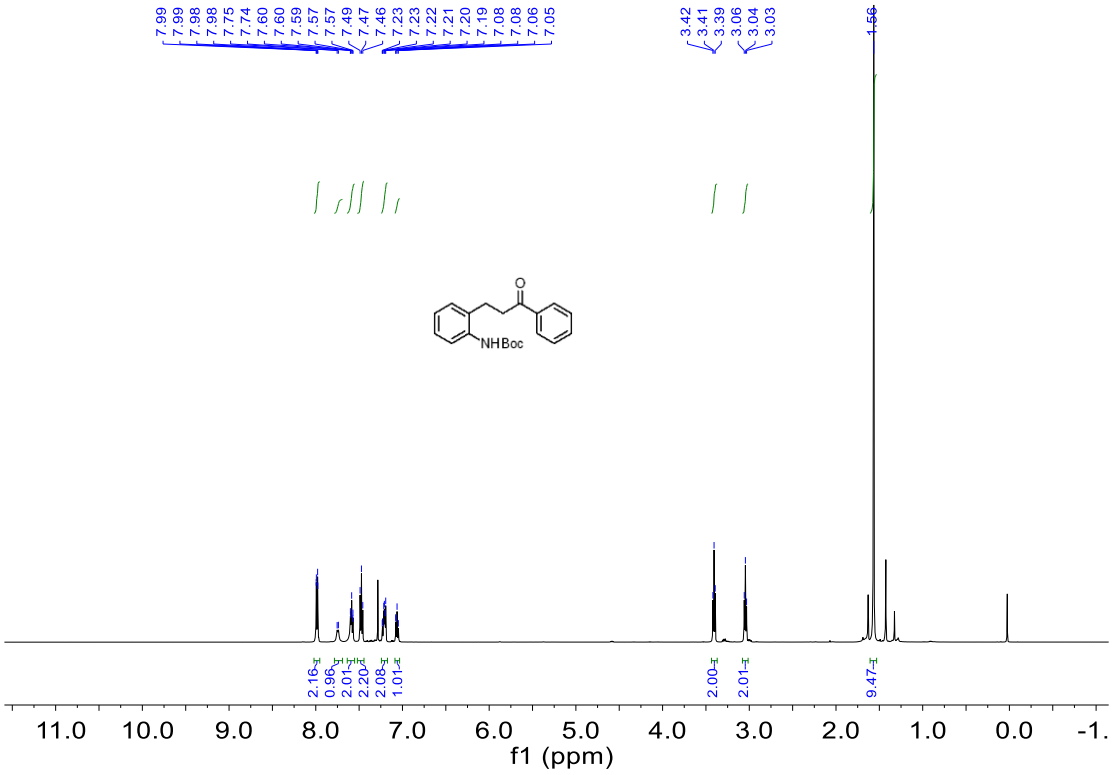
$^{1}$H NMR for **1n** (500 MHz, $CDCl_3$)



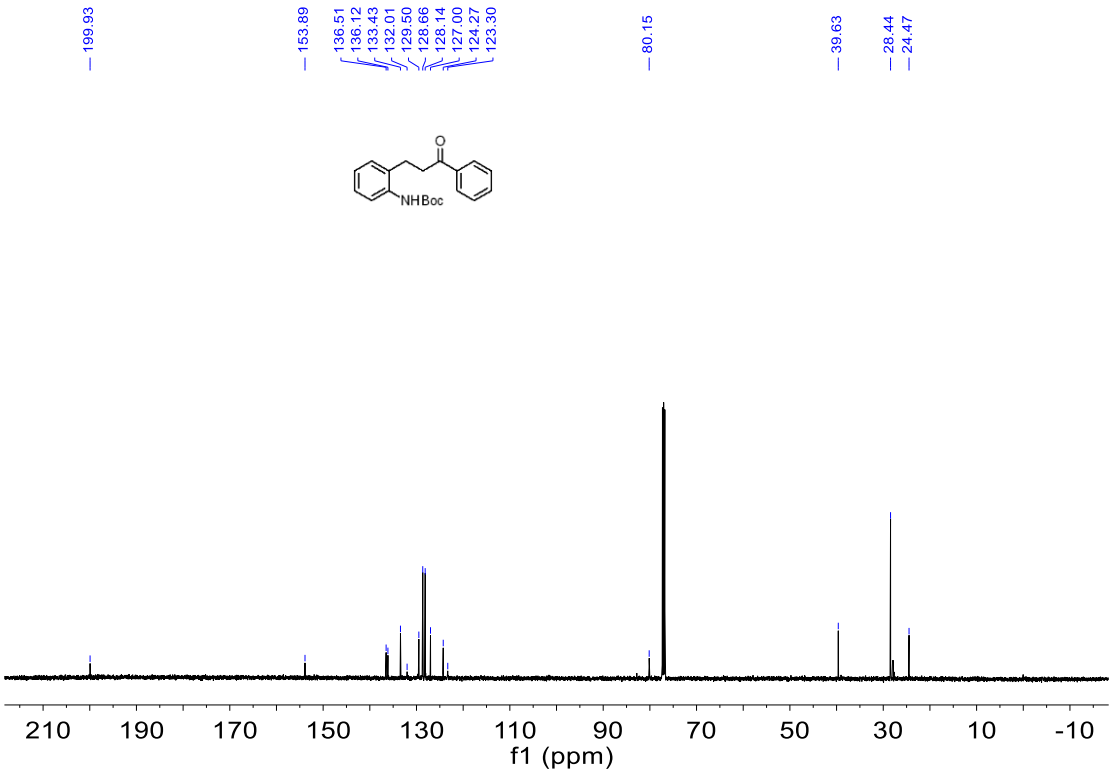

$^{13}$C NMR for **1n** (126 MHz, $CDCl_3$)



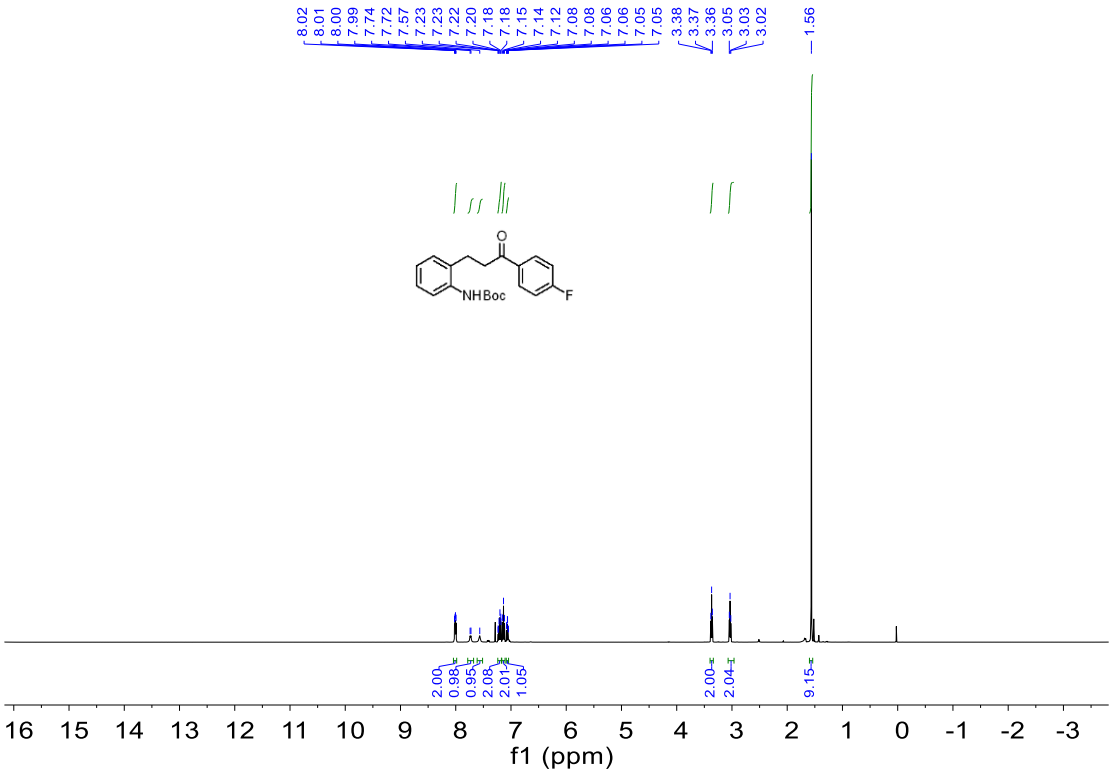
$^{1}$H NMR for **1o** (500 MHz, $CDCl_3$)



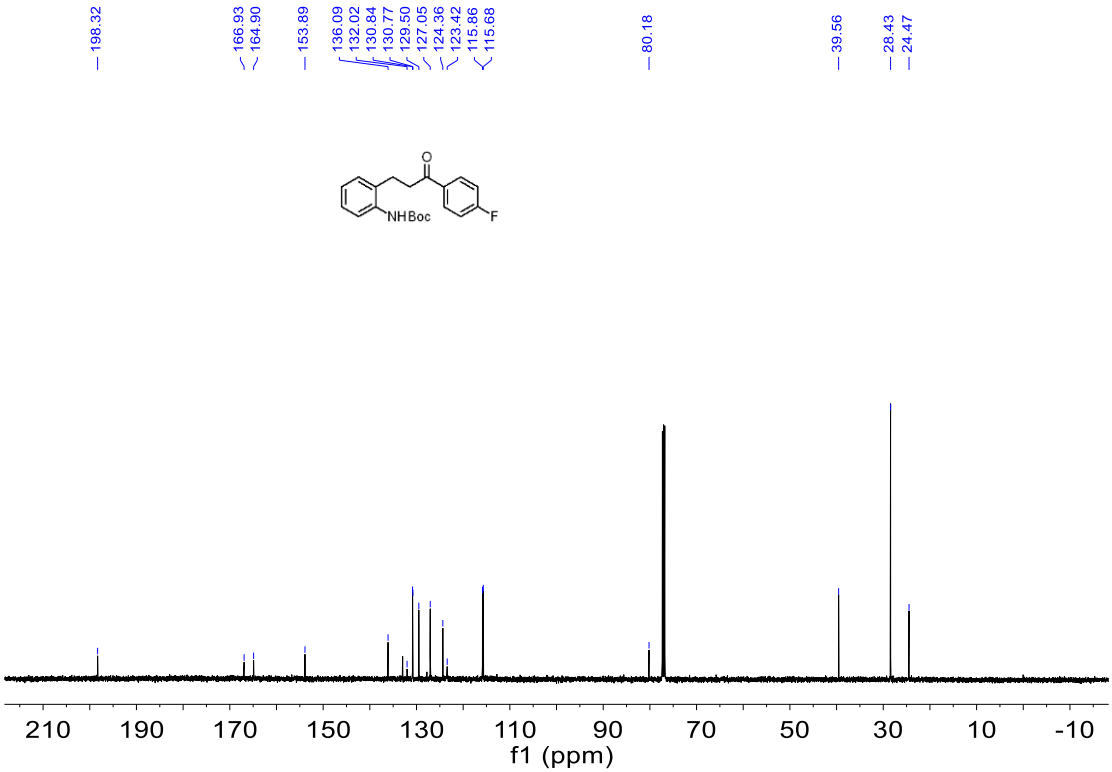

$^{13}$C NMR for **1o** (126 MHz, $CDCl_3$)



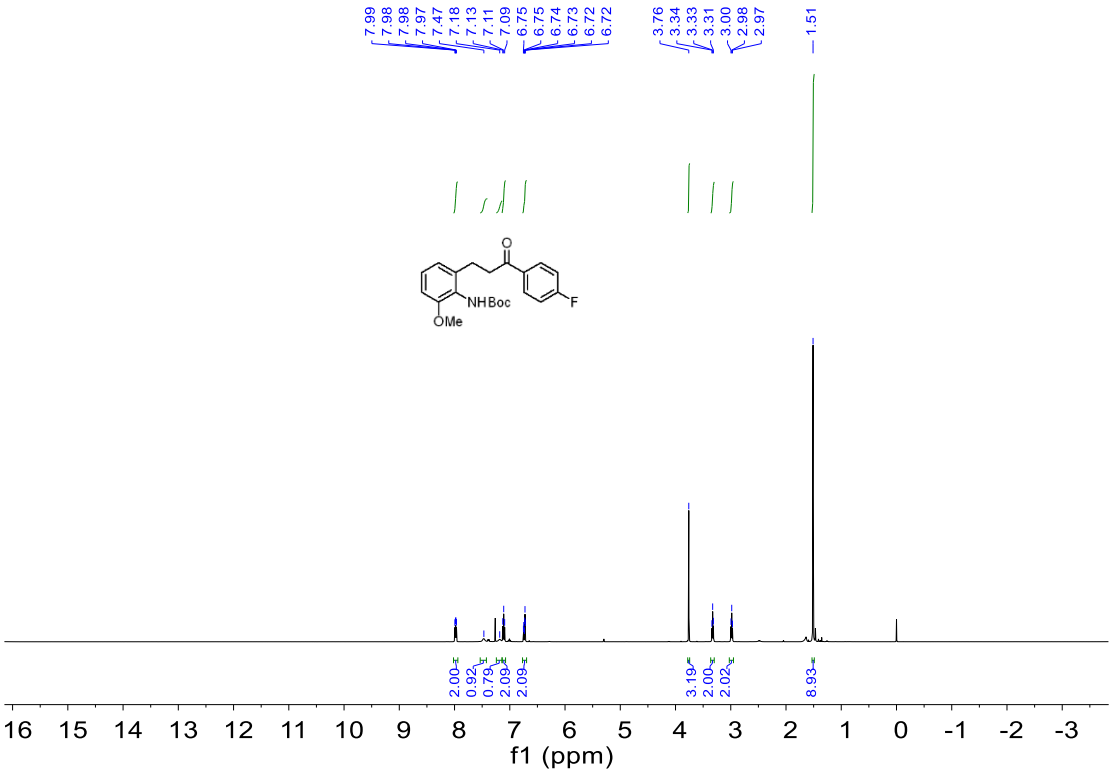
$^{1}$H NMR for **1p** (500 MHz, $CDCl_3$)



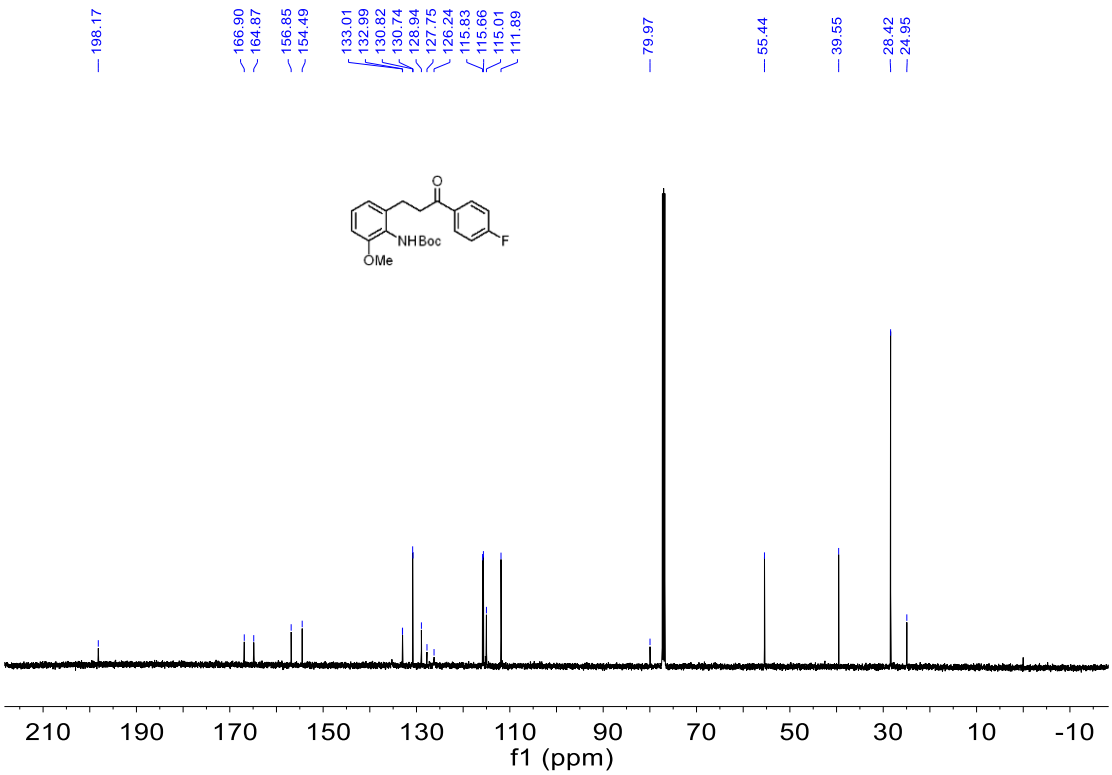

$^{13}$C NMR for **1p** (126 MHz, $CDCl_3$)



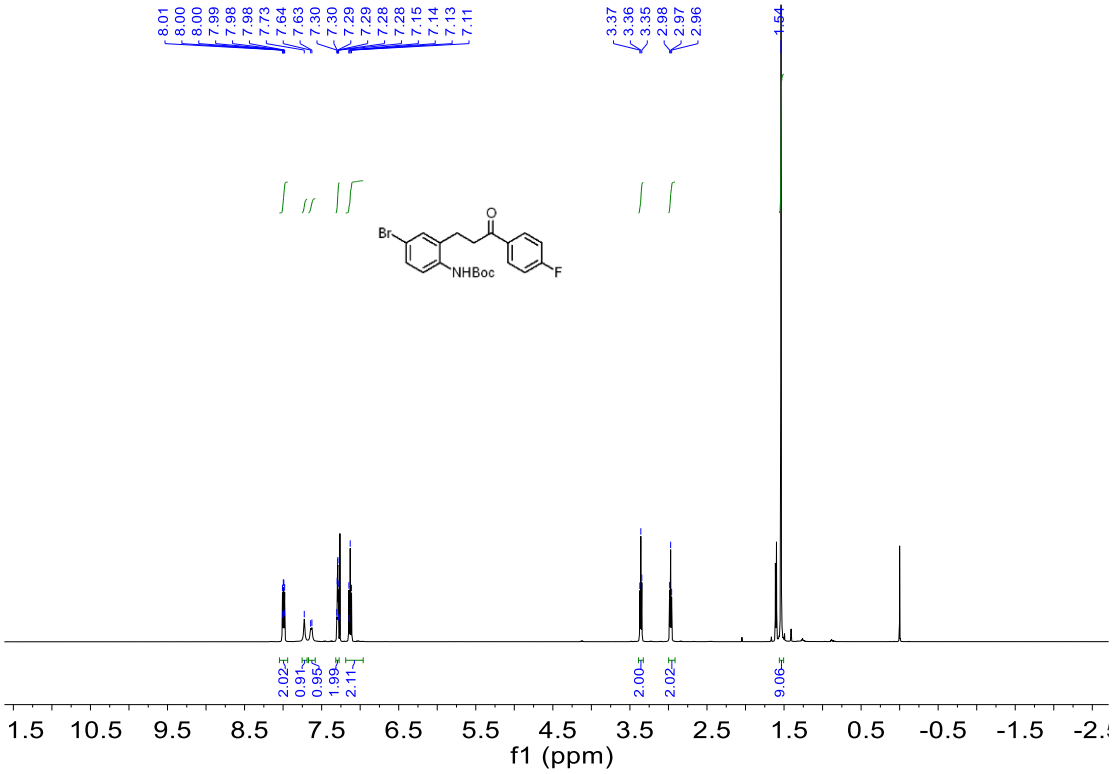
$^{1}$H NMR for **1q** (500 MHz, $CDCl_3$)



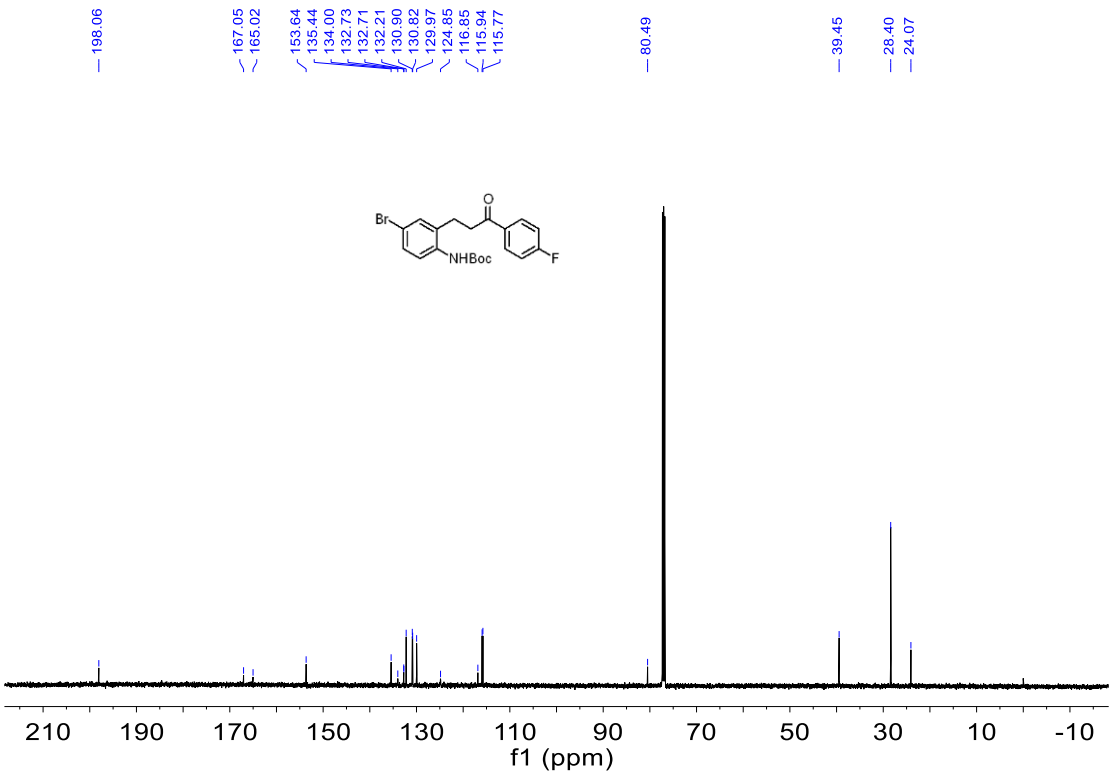

$^{13}$C NMR for **1q** (126 MHz, $CDCl_3$)



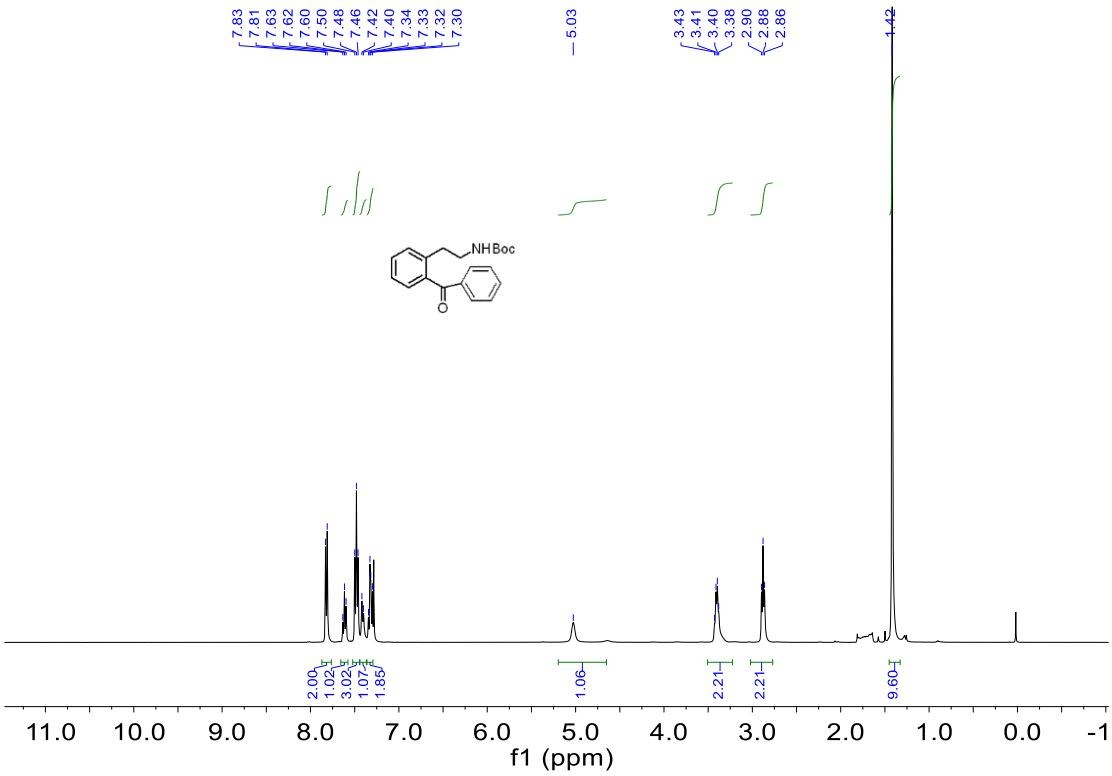
$^{1}$H NMR for **1r** (500 MHz, $CDCl_3$)



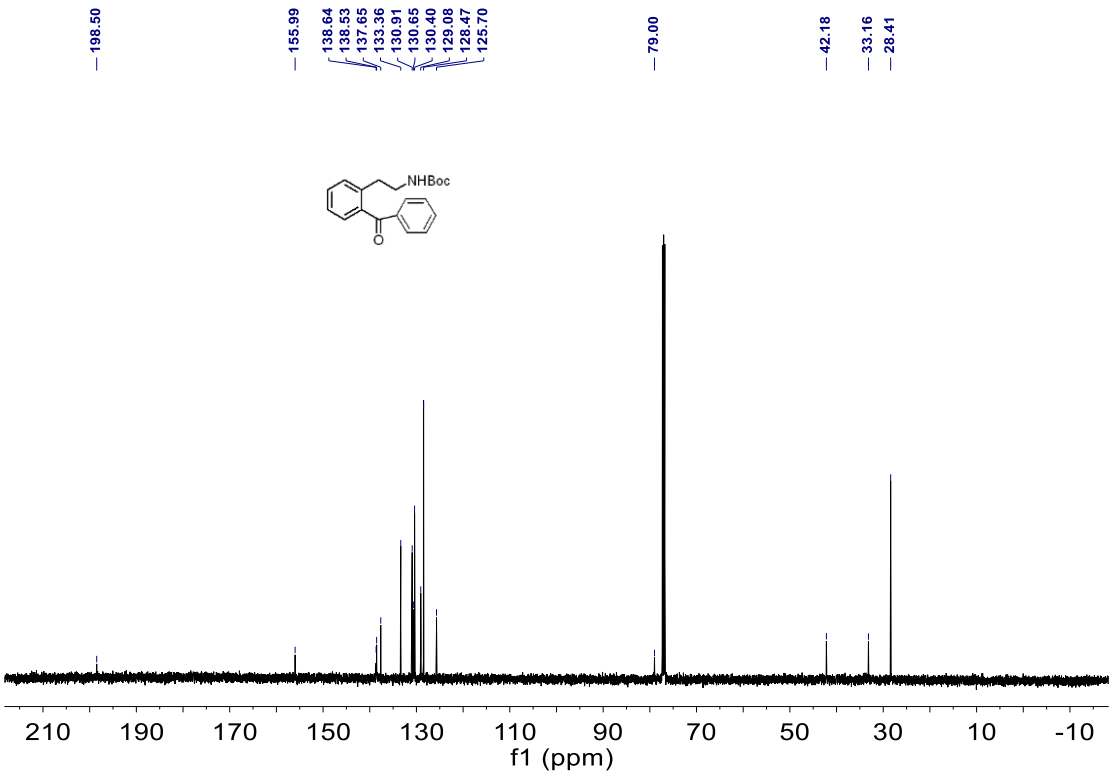

$^{13}$C NMR for **1r** (126 MHz, $CDCl_3$)



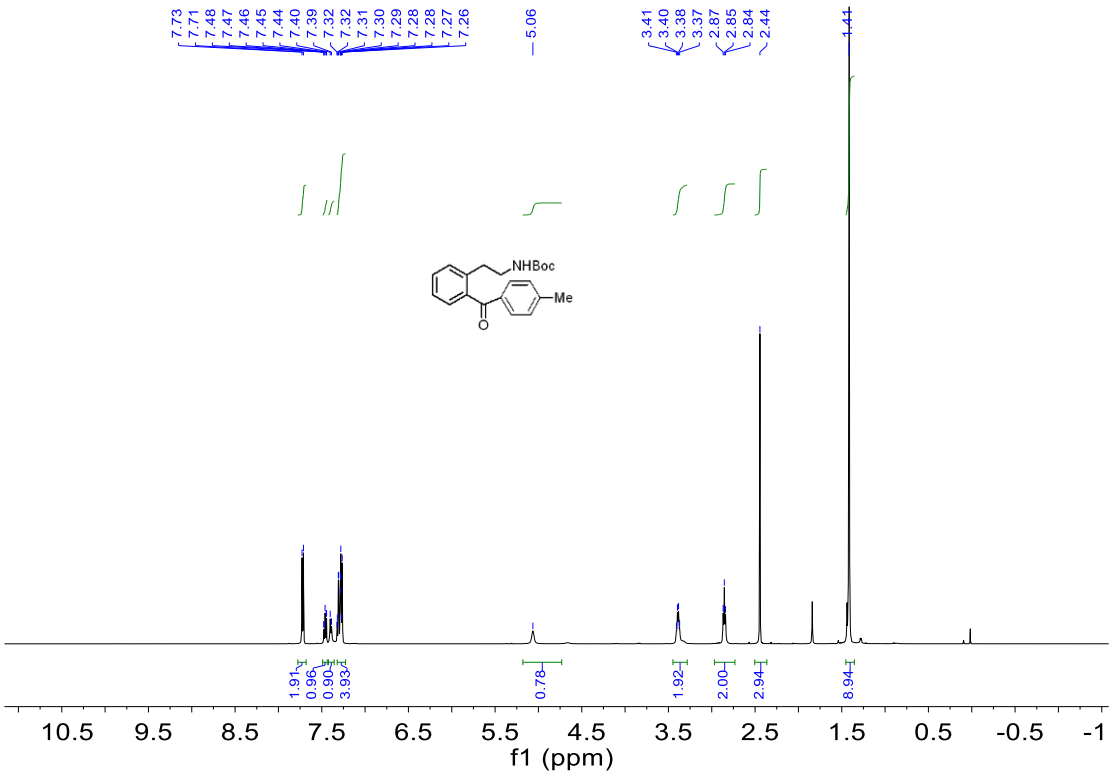
$^{1}$H NMR for **3a** (400 MHz, $CDCl_3$)



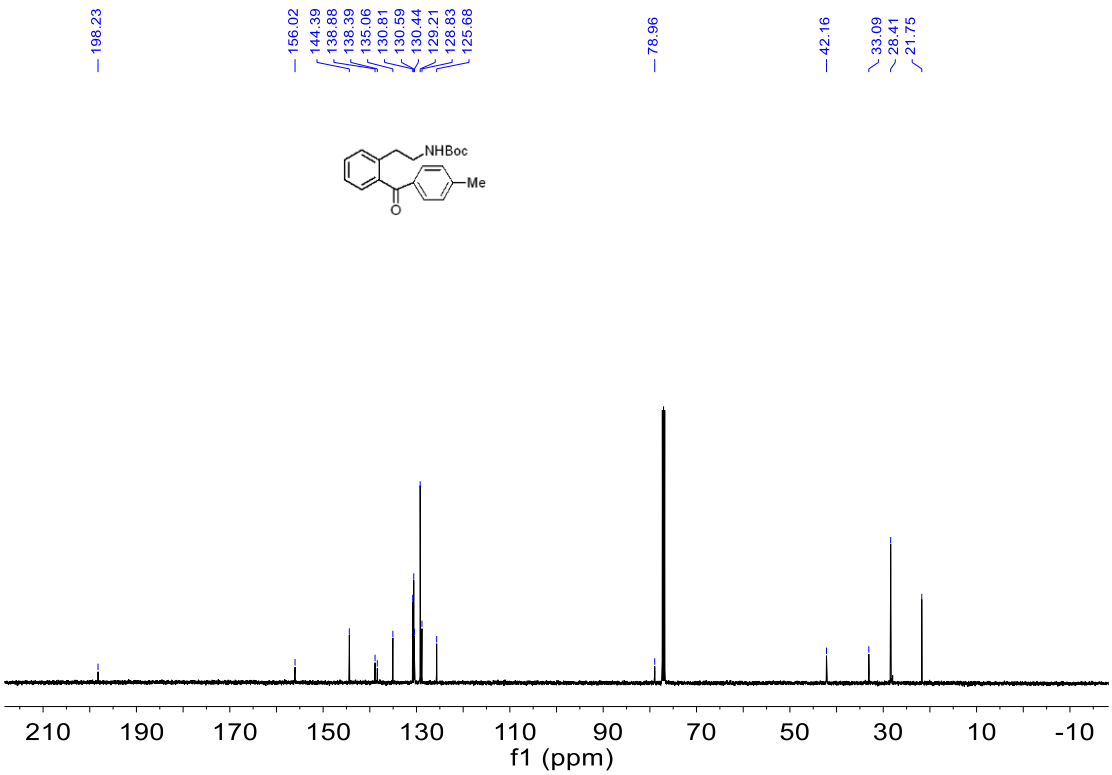

$^{13}$C NMR for **3a** (126 MHz, $CDCl_3$)



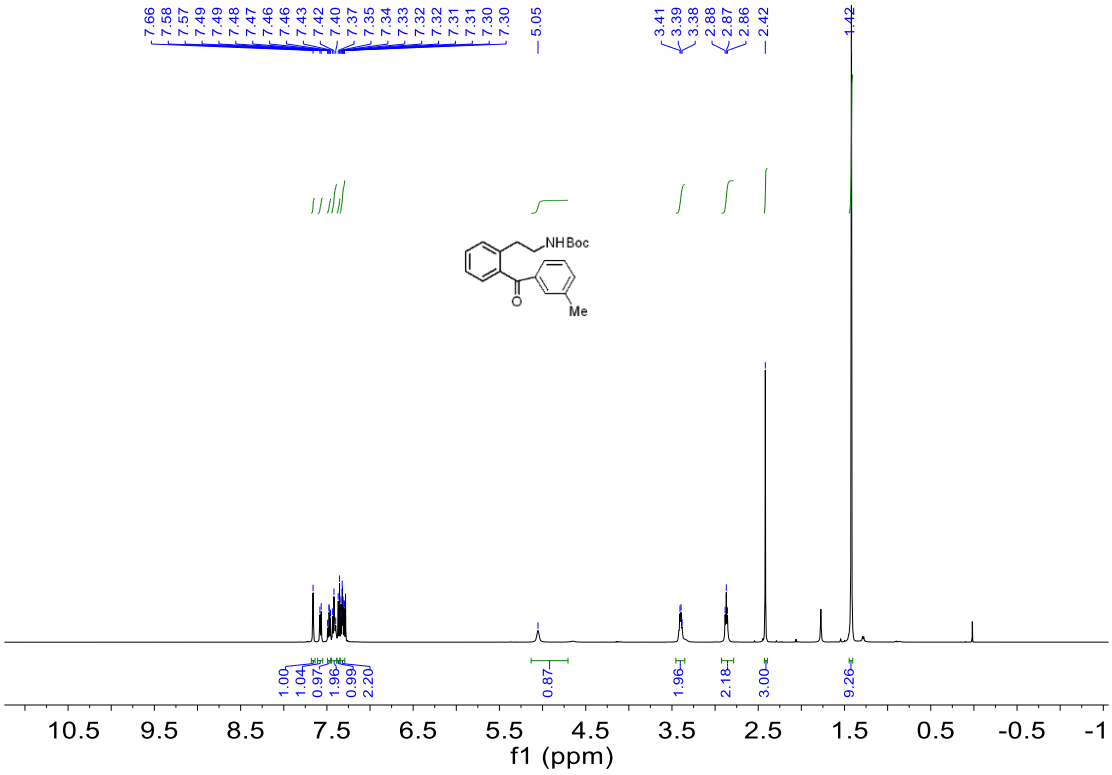
$^{1}$H NMR for **3b** (500 MHz, $CDCl_3$)



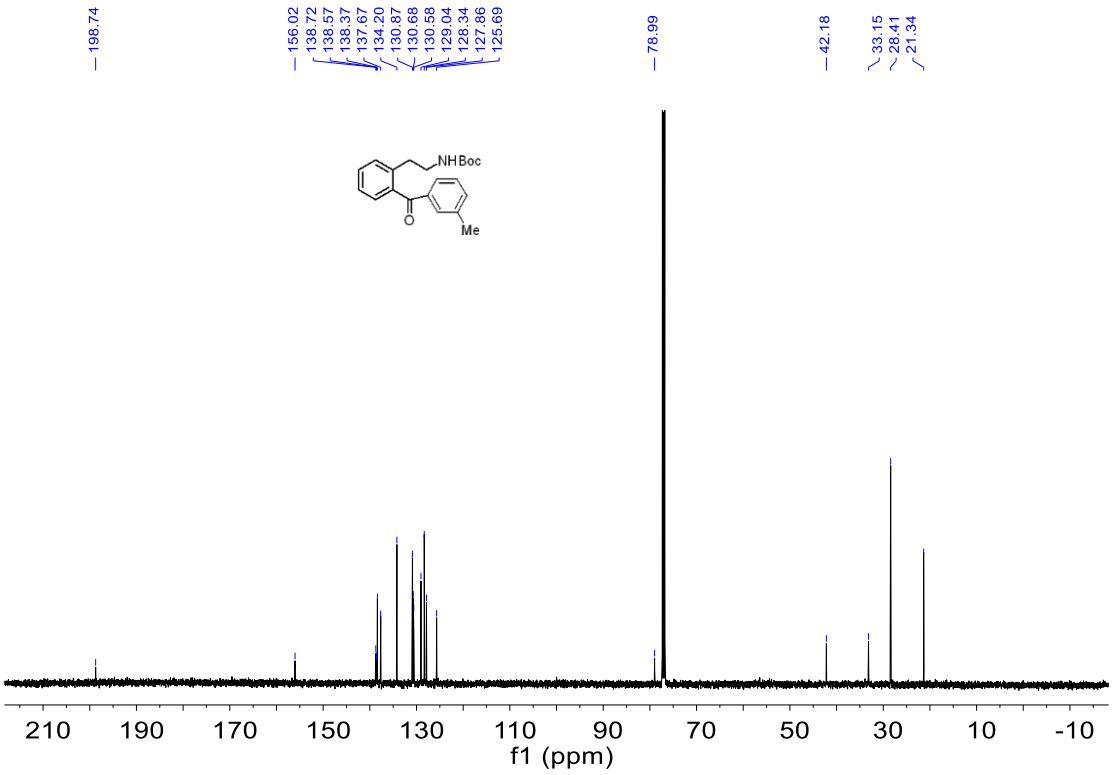

$^{13}$C NMR for **3b** (126 MHz, $CDCl_3$)



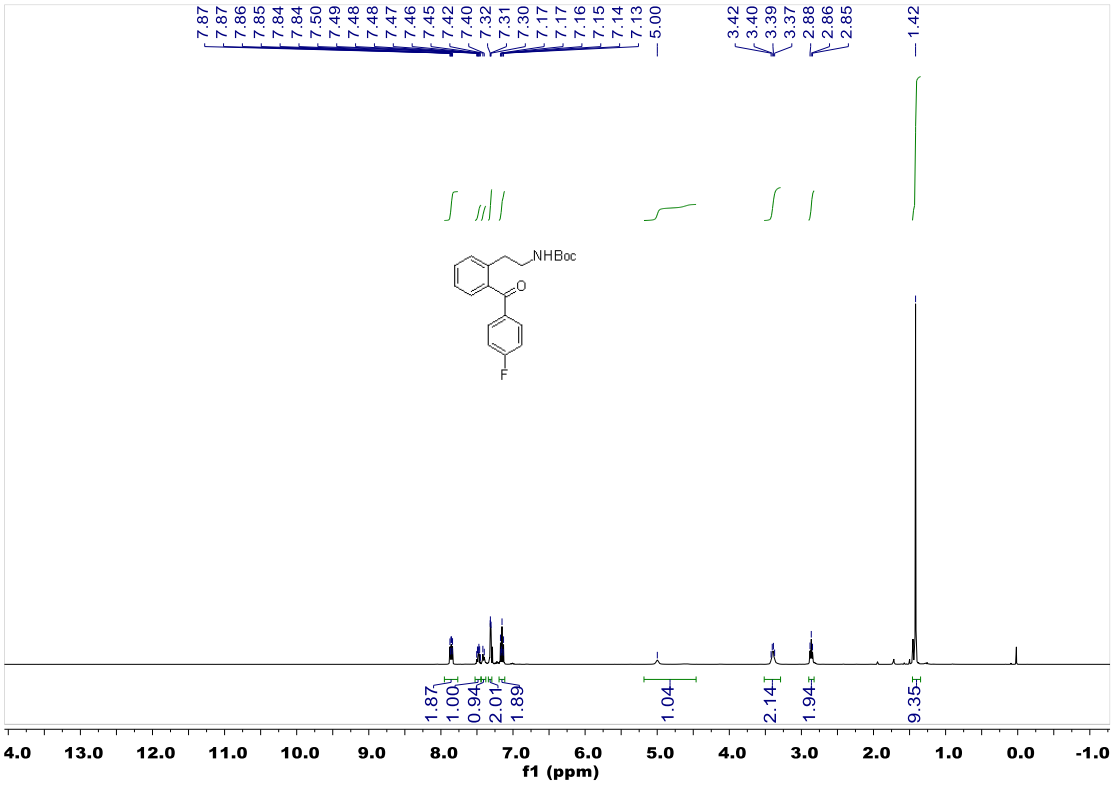
$^{1}$H NMR for **3c** (500 MHz, $CDCl_3$)



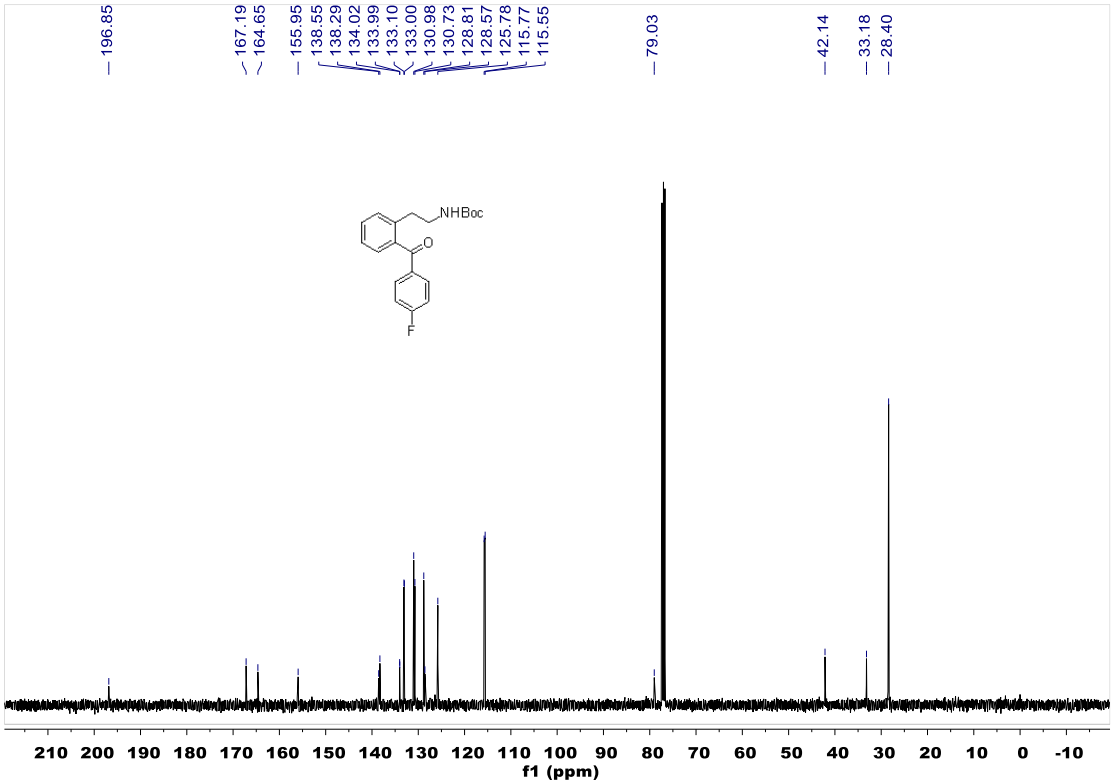

$^{13}$C NMR for **3c** (126 MHz, $CDCl_3$)



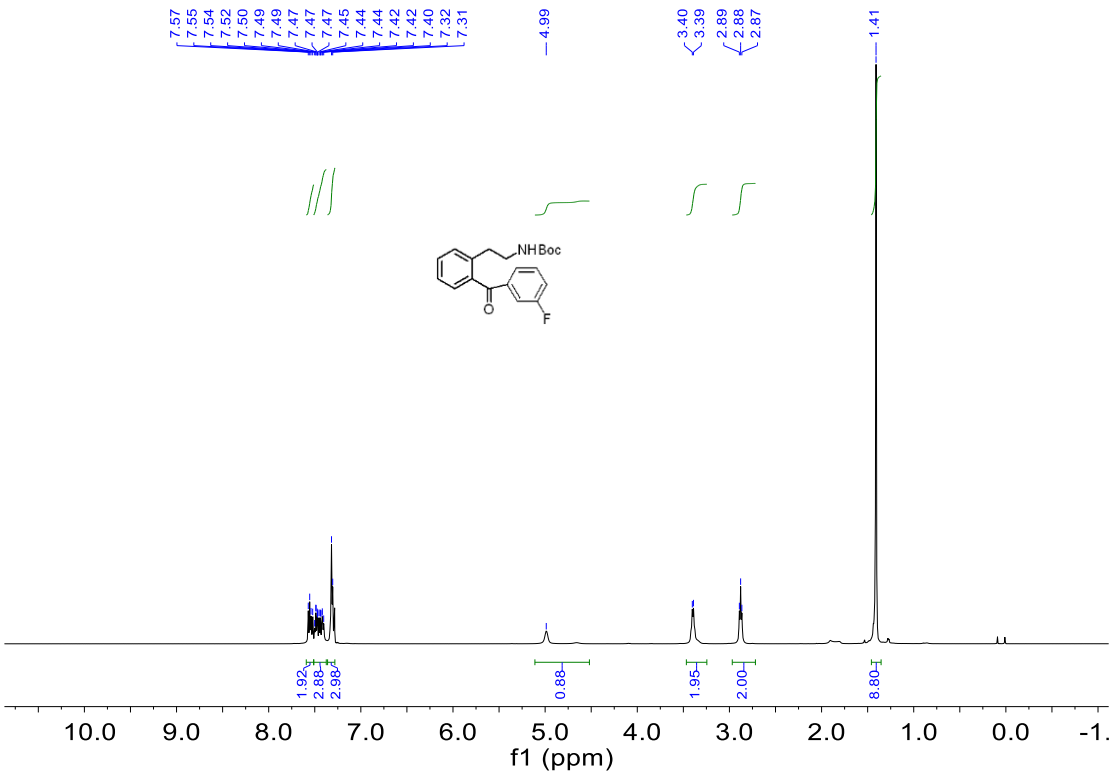
$^{1}$H NMR for **3d** (500 MHz, $CDCl_3$)



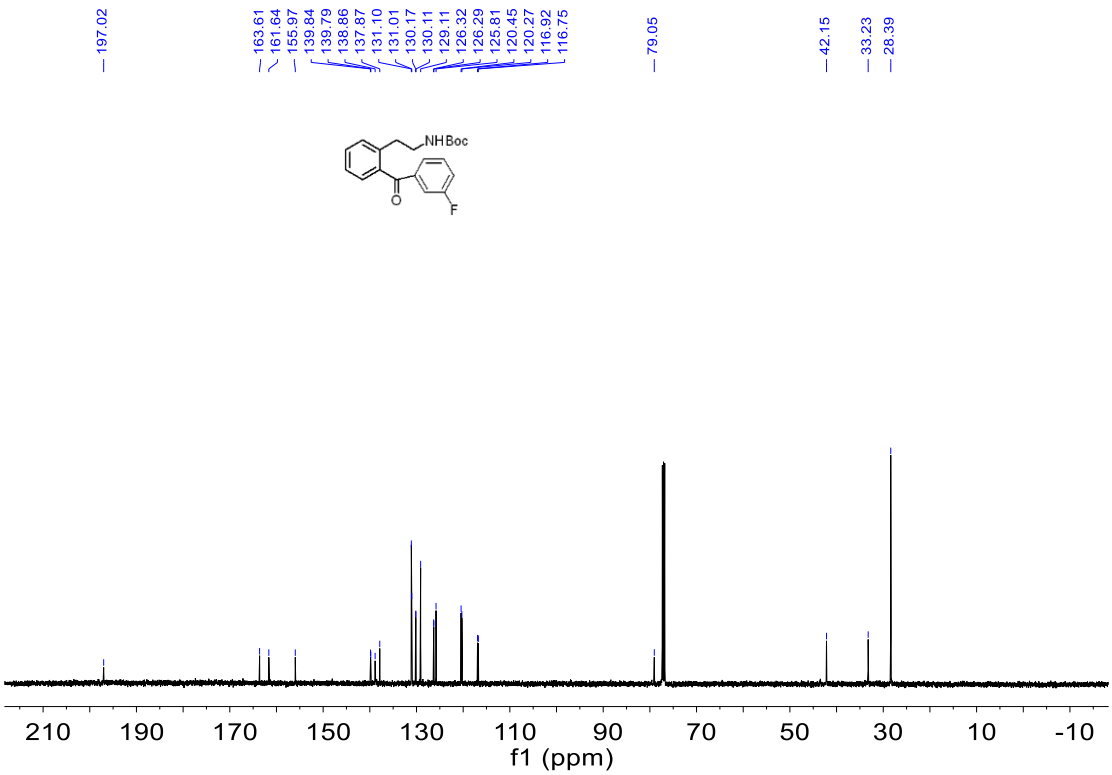

$^{13}$C NMR for **3d** (126 MHz, $CDCl_3$)



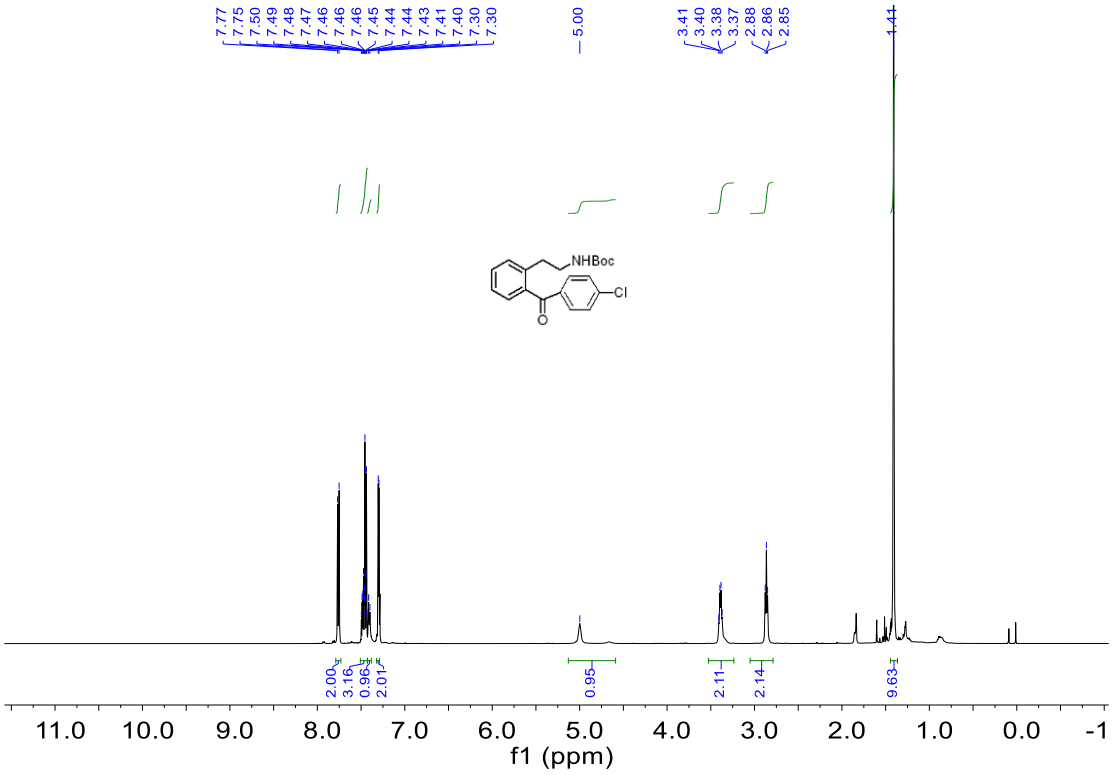
$^{1}$H NMR for **3e** (500 MHz, $CDCl_3$)



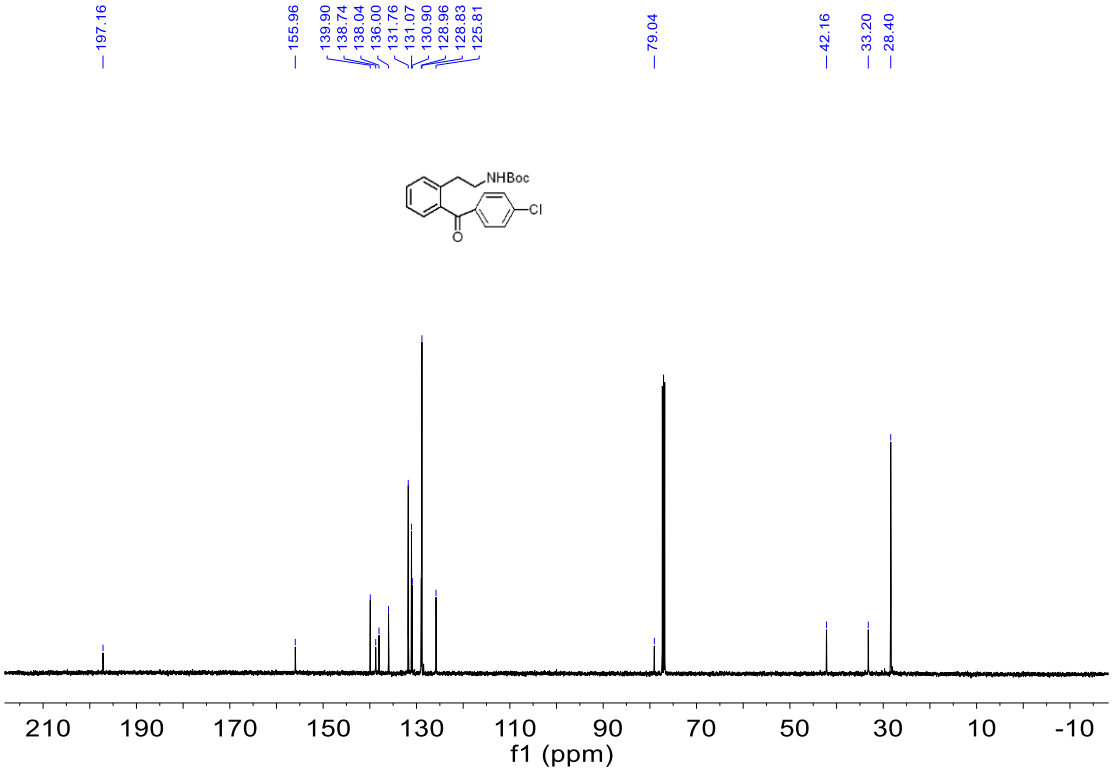

$^{13}$C NMR for **3e** (126 MHz, $CDCl_3$)



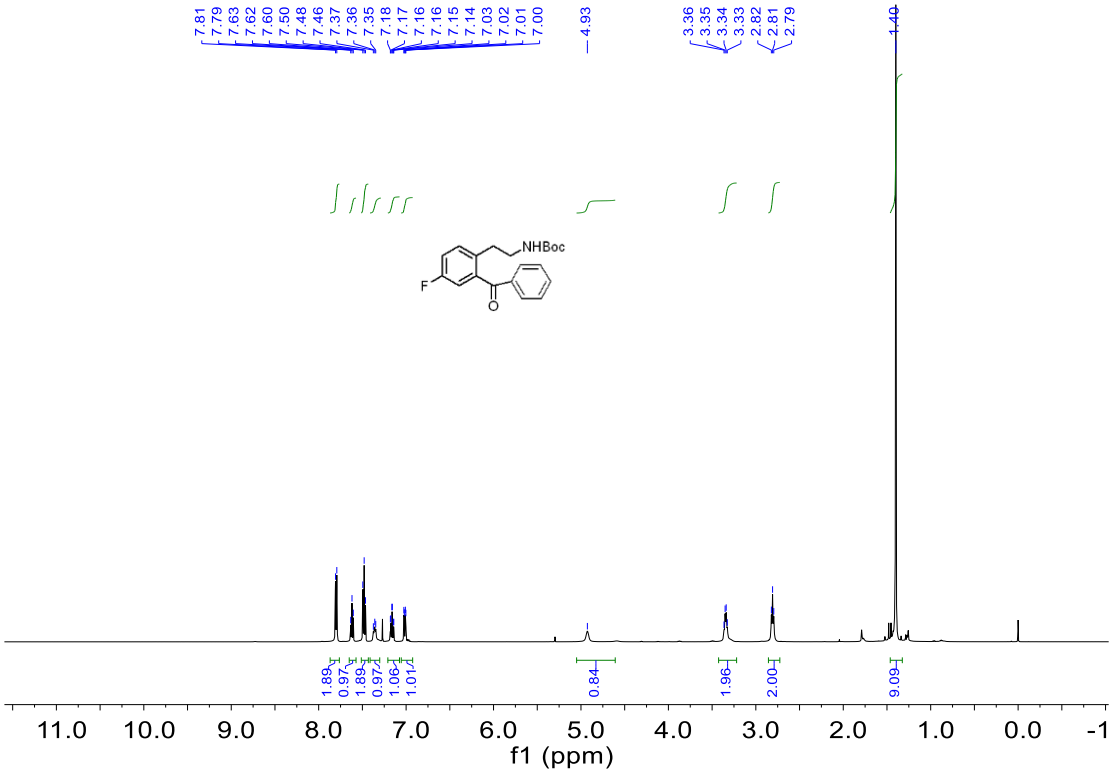
$^{1}$H NMR for **3f** (500 MHz, $CDCl_3$)



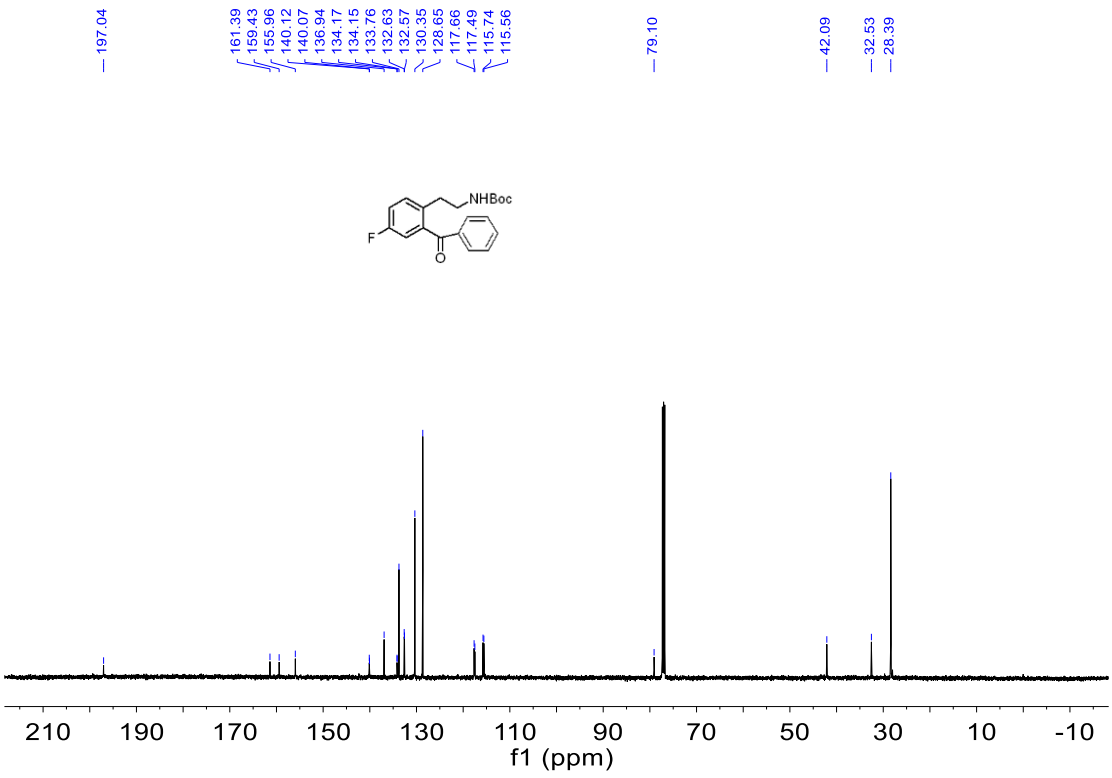

$^{13}$C NMR for **3f** (126 MHz, $CDCl_3$)



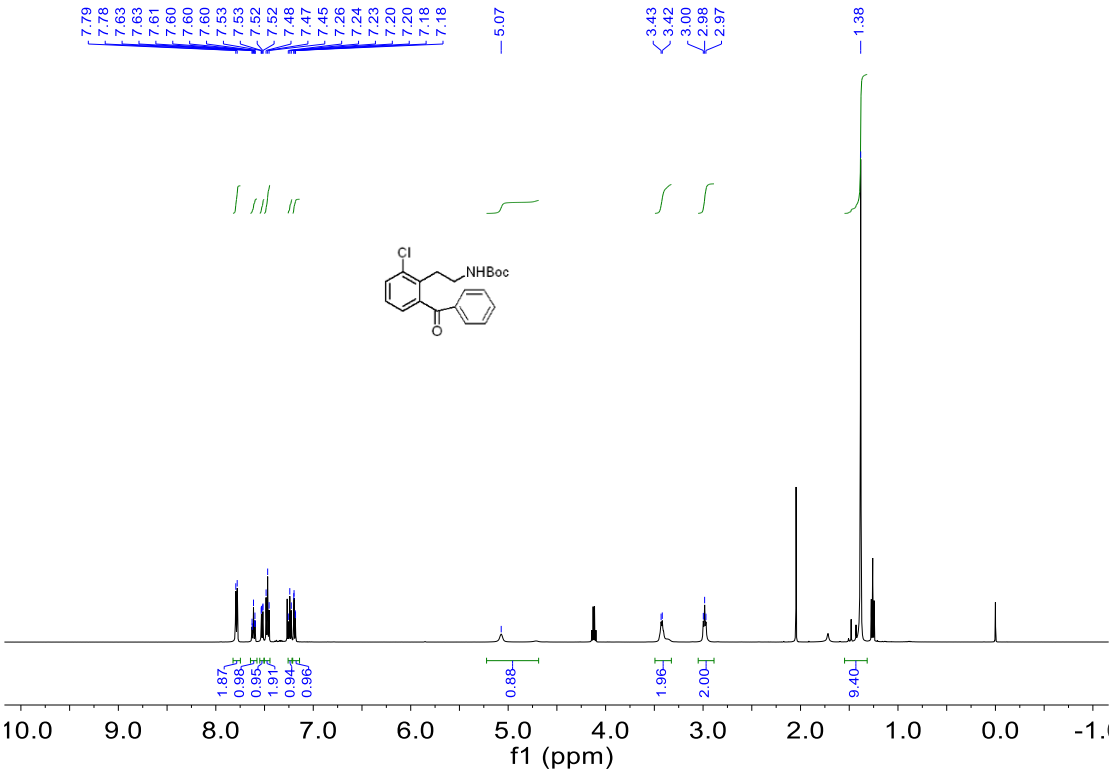
$^{1}$H NMR for **3g** (500 MHz, $CDCl_3$)



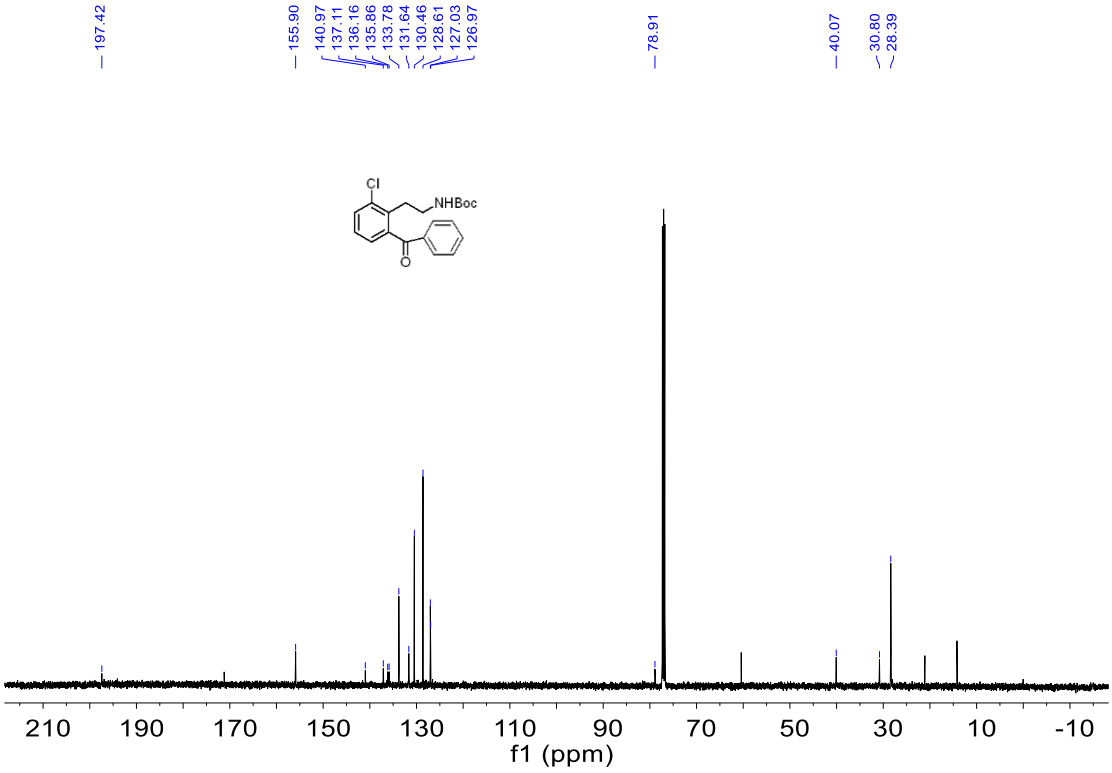

$^{13}$C NMR for **3g** (126 MHz, $CDCl_3$)



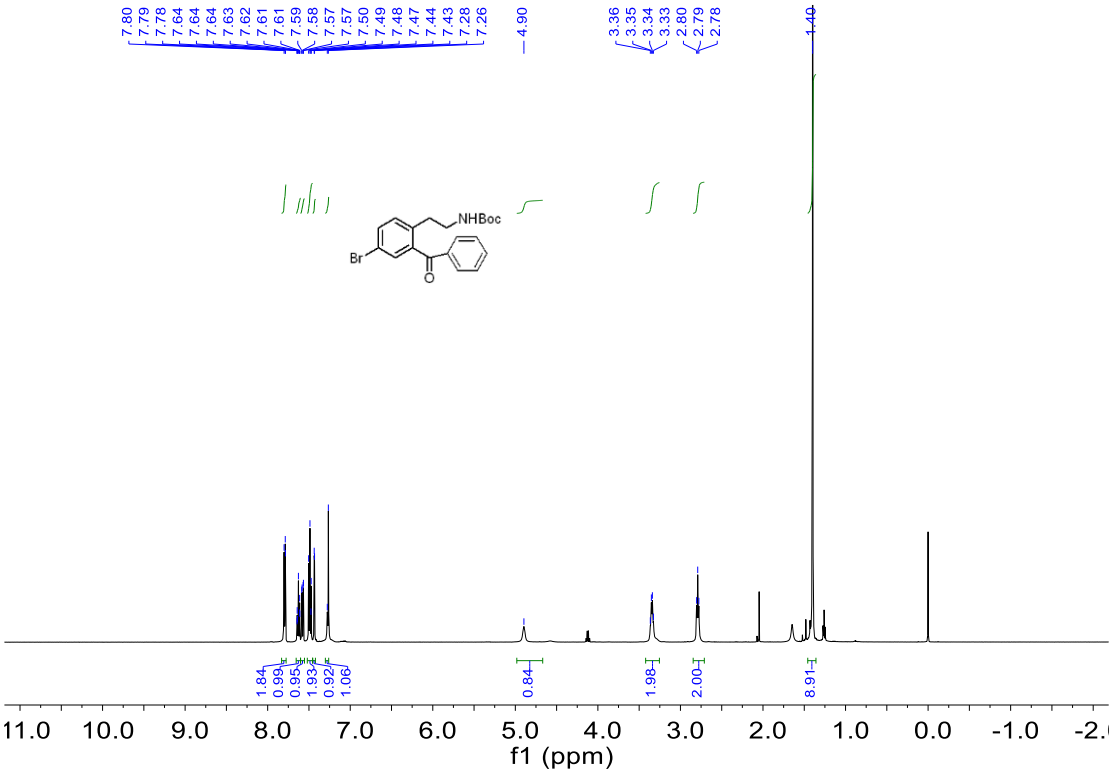
$^{1}$H NMR for **3h** (500 MHz, $CDCl_3$) (A trace amount of EtOAc)



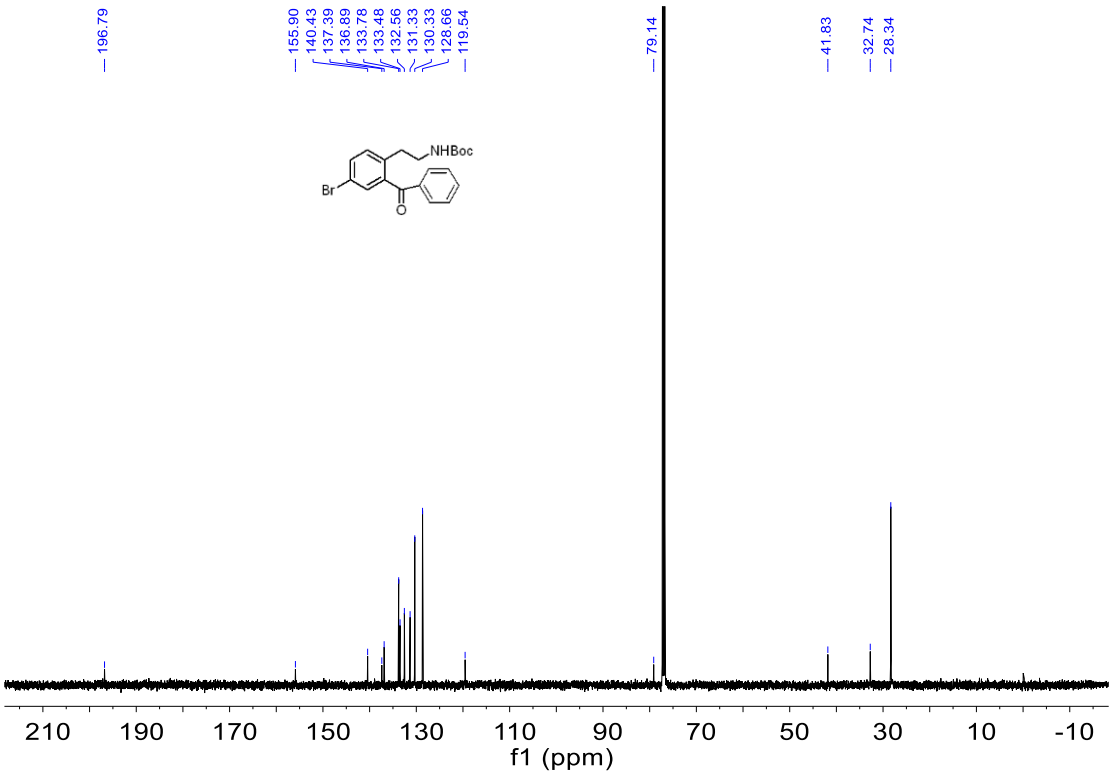

$^{13}$C NMR for **3h** (126 MHz, $CDCl_3$)



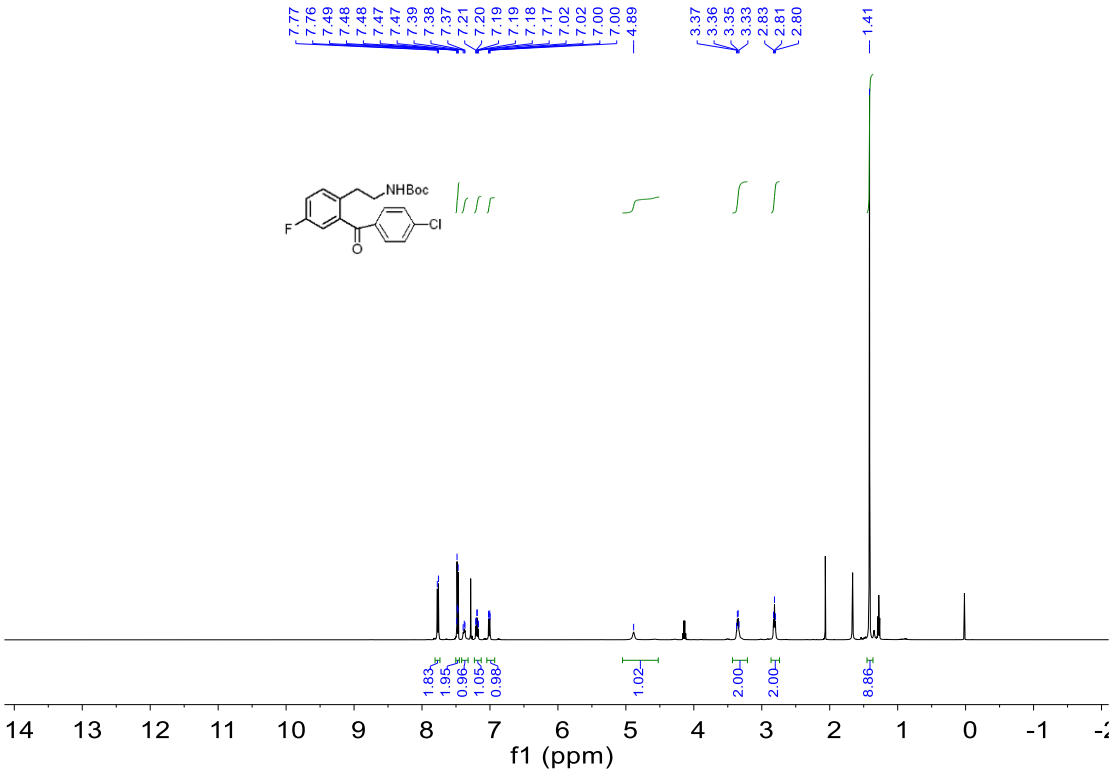
$^{1}$H NMR for **3i** (500 MHz, $CDCl_3$) (A trace amount of EtOAc)



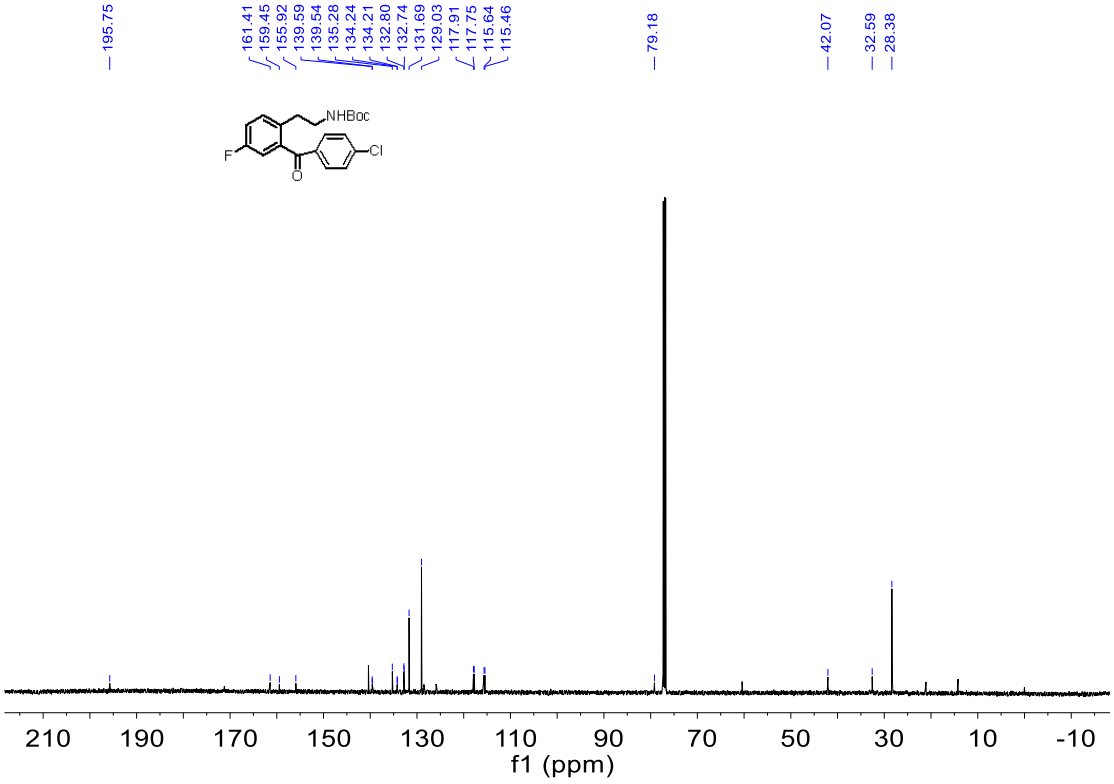

$^{13}$C NMR for **3i** (126 MHz, $CDCl_3$)



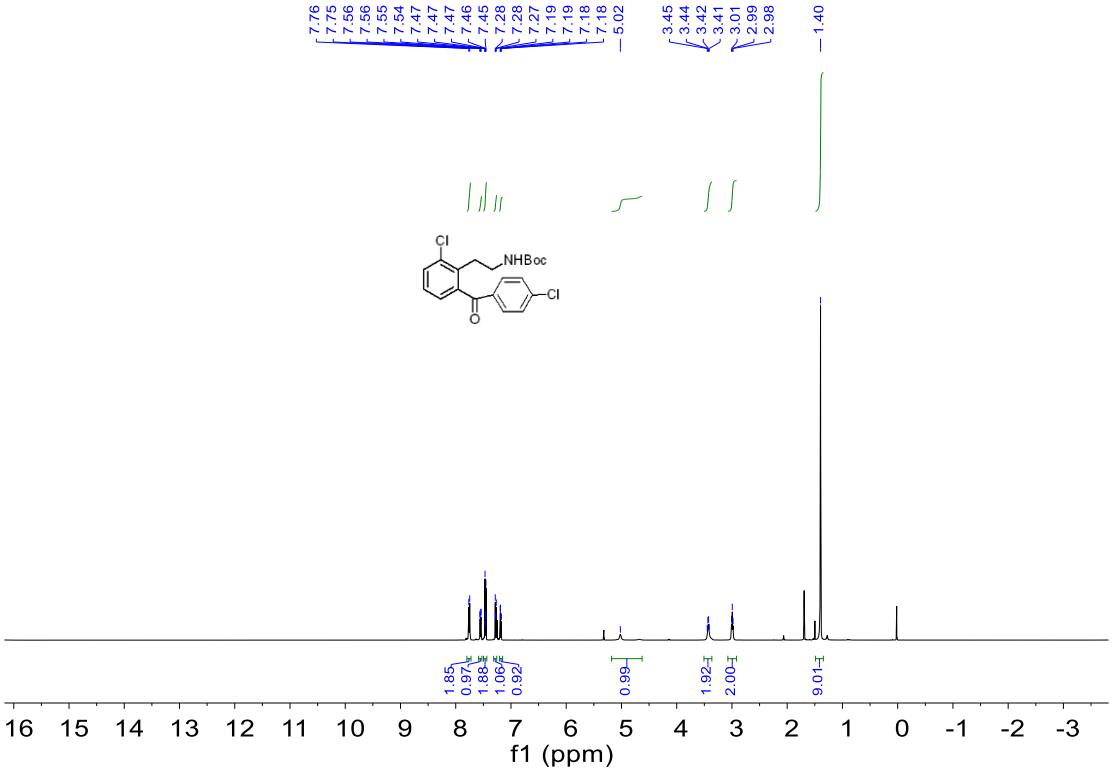
$^{1}$H NMR for **3j** (500 MHz, $CDCl_3$) (A trace amount of EtOAc)



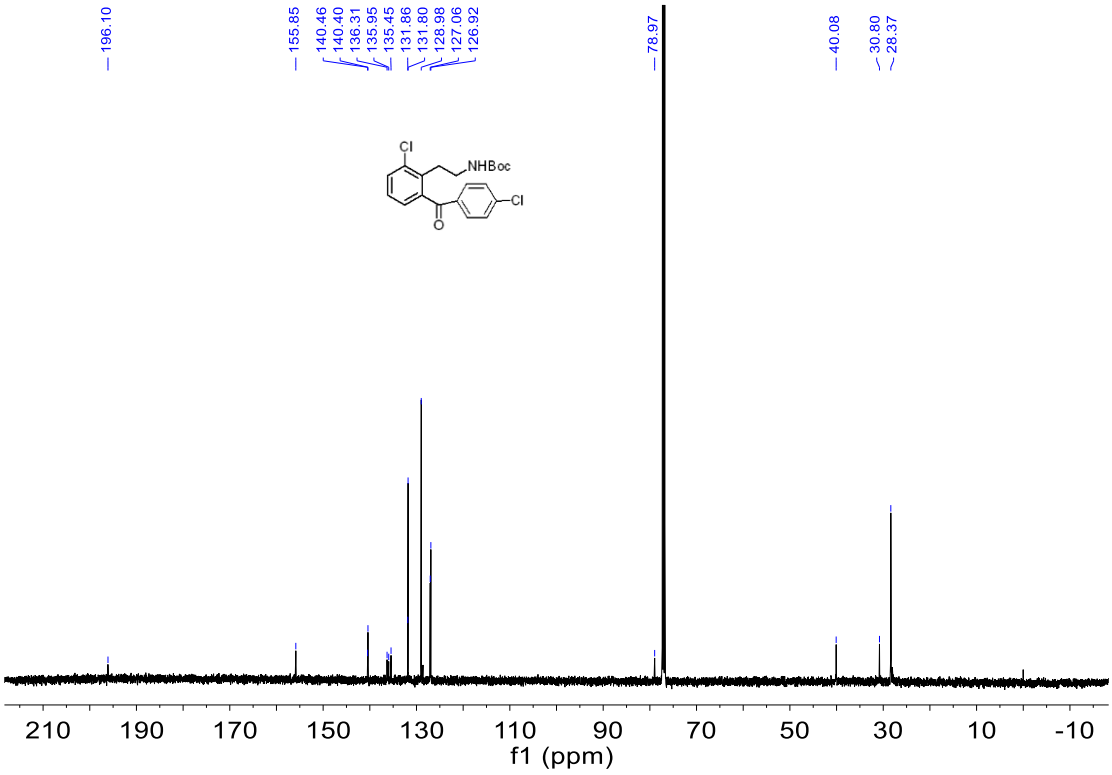

$^{13}$C NMR for **3j** (126 MHz, $CDCl_3$)



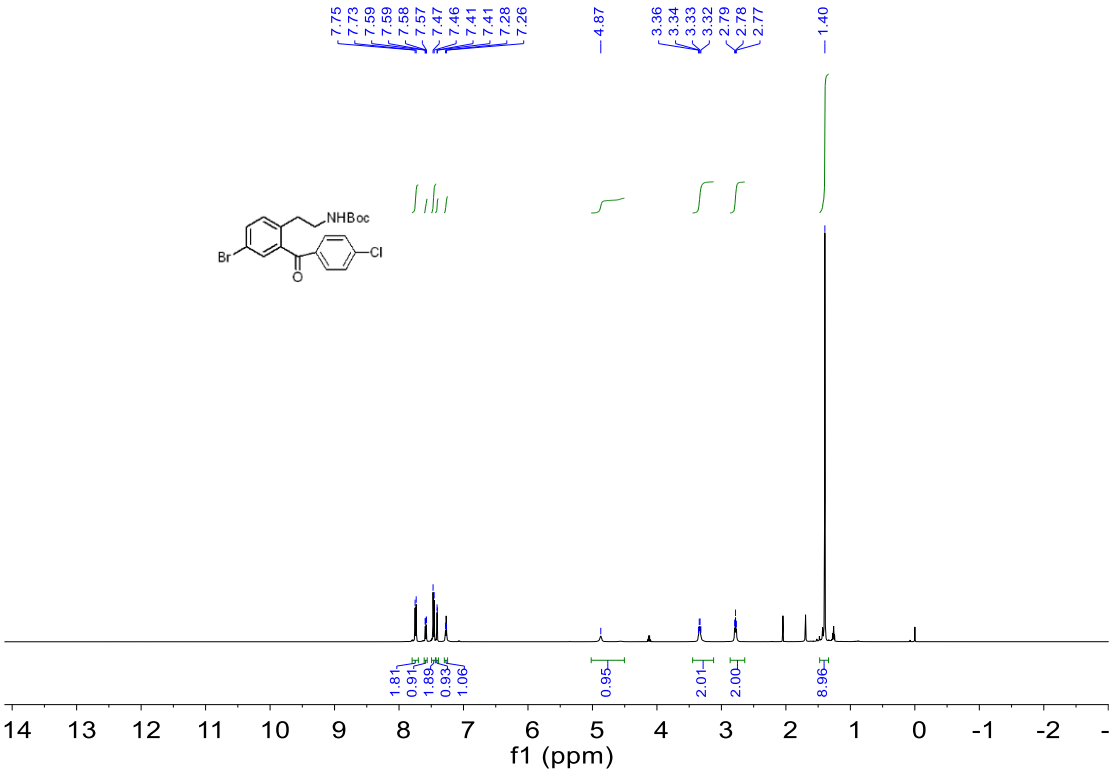
$^{1}$H NMR for **3k** (500 MHz, $CDCl_3$)



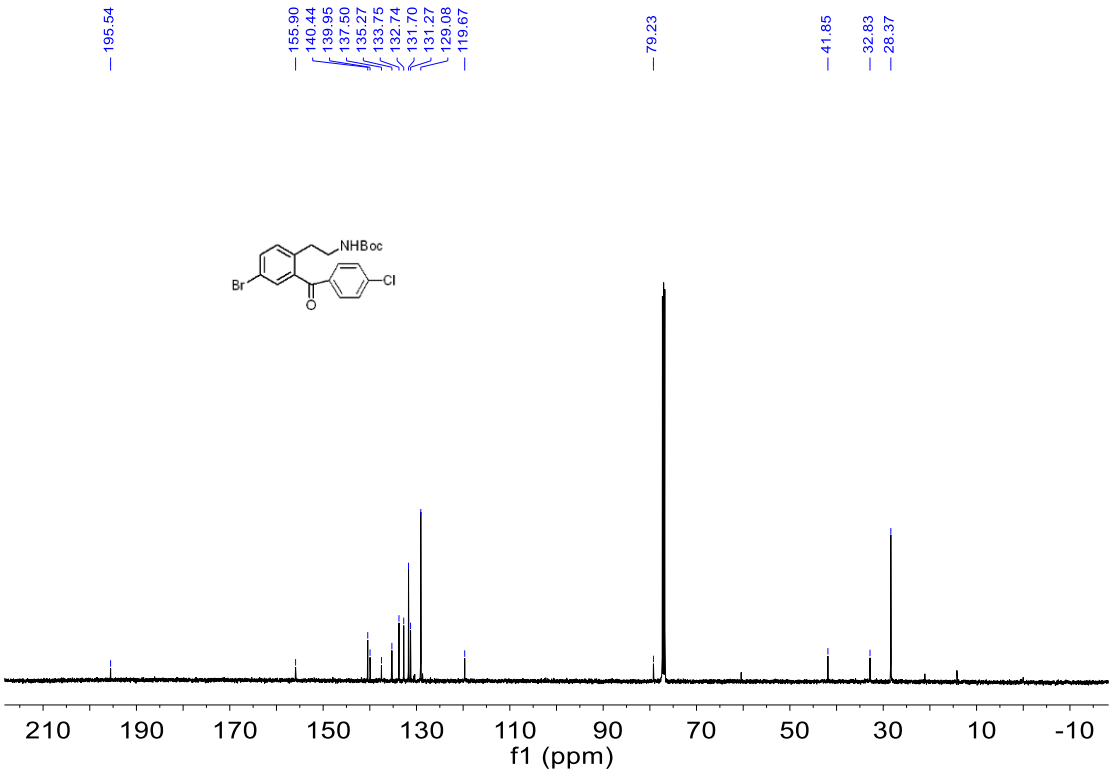

$^{13}$C NMR for **3k** (126 MHz, $CDCl_3$)



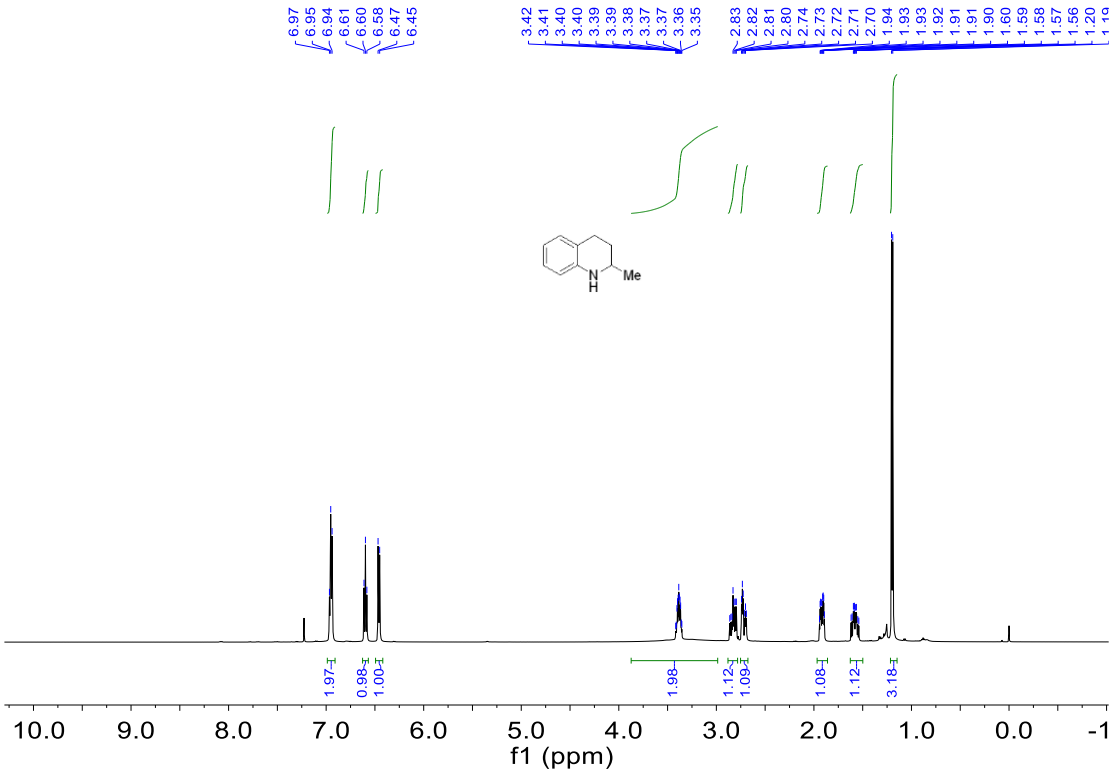
$^{1}$H NMR for **3l** (126 MHz, $CDCl_3$) (A trace amount of EtOAc)



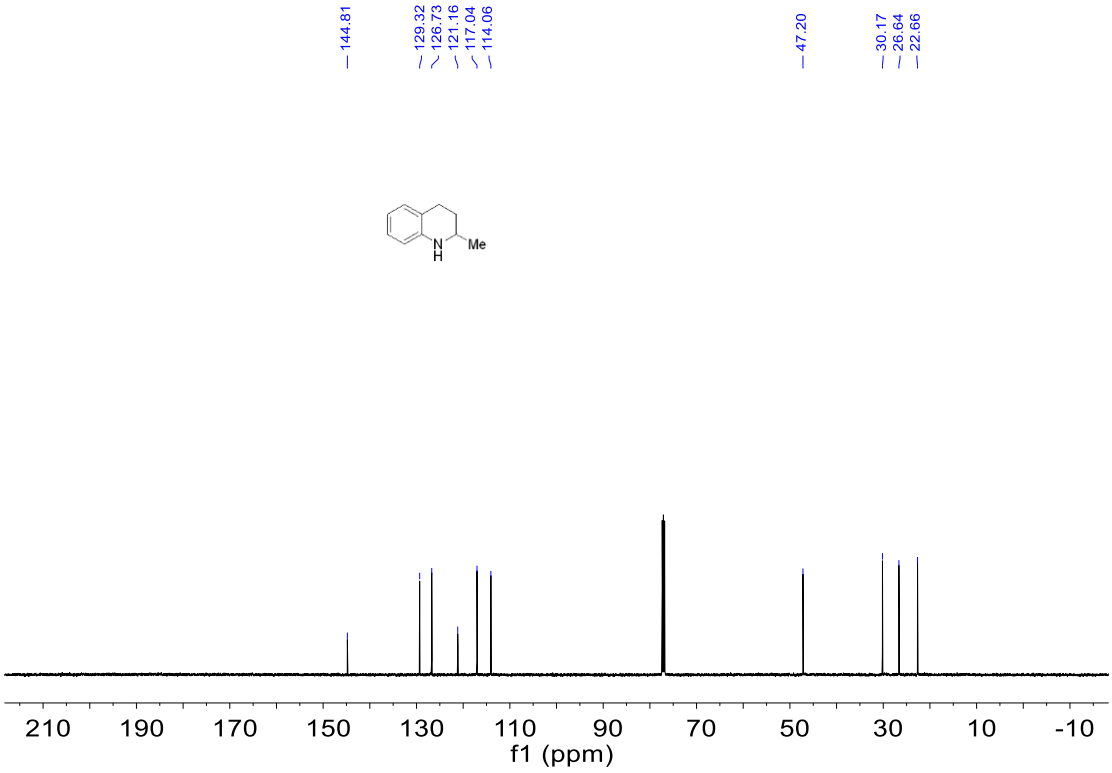

$^{13}$C NMR for **3l**



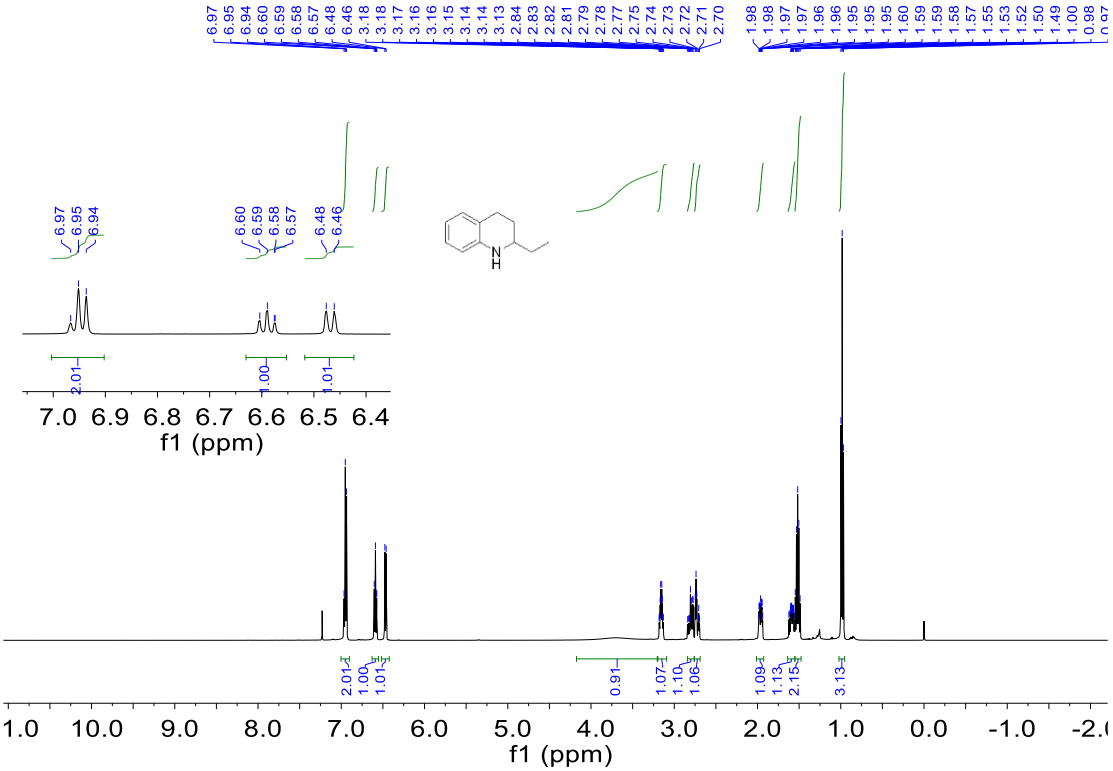
$^{1}$H NMR for **2a** (500 MHz, $CDCl_3$)



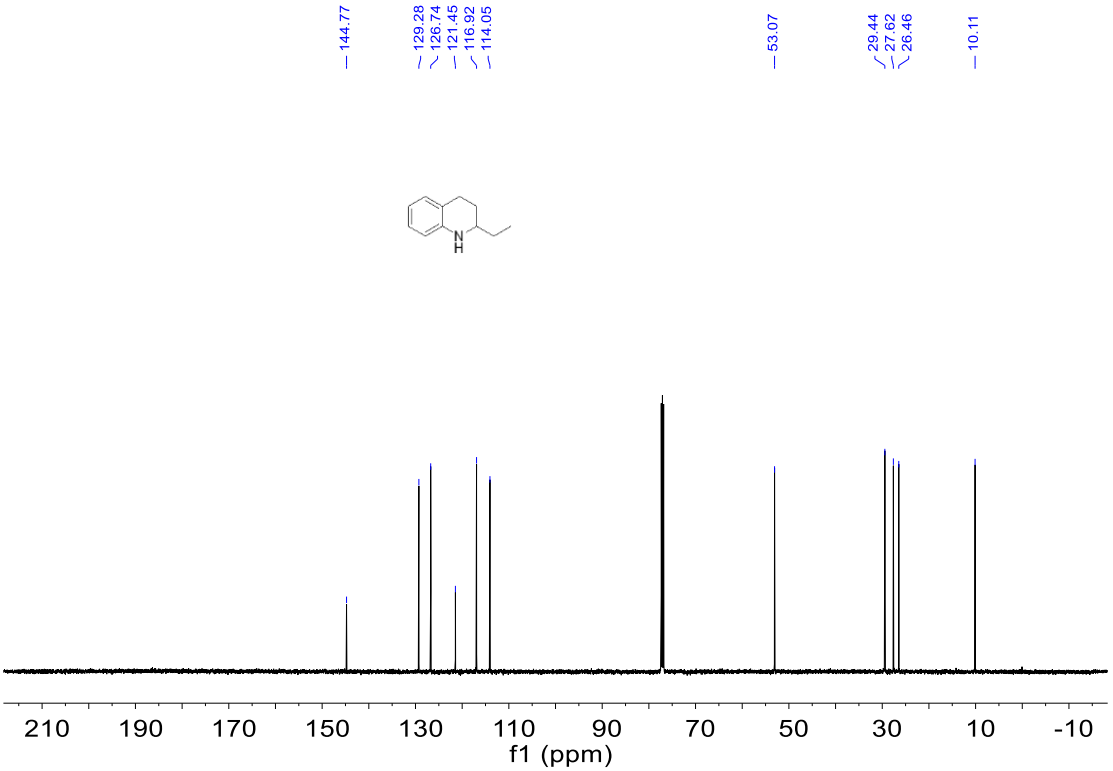

$^{13}$C NMR for **2a** (126 MHz, $CDCl_3$)



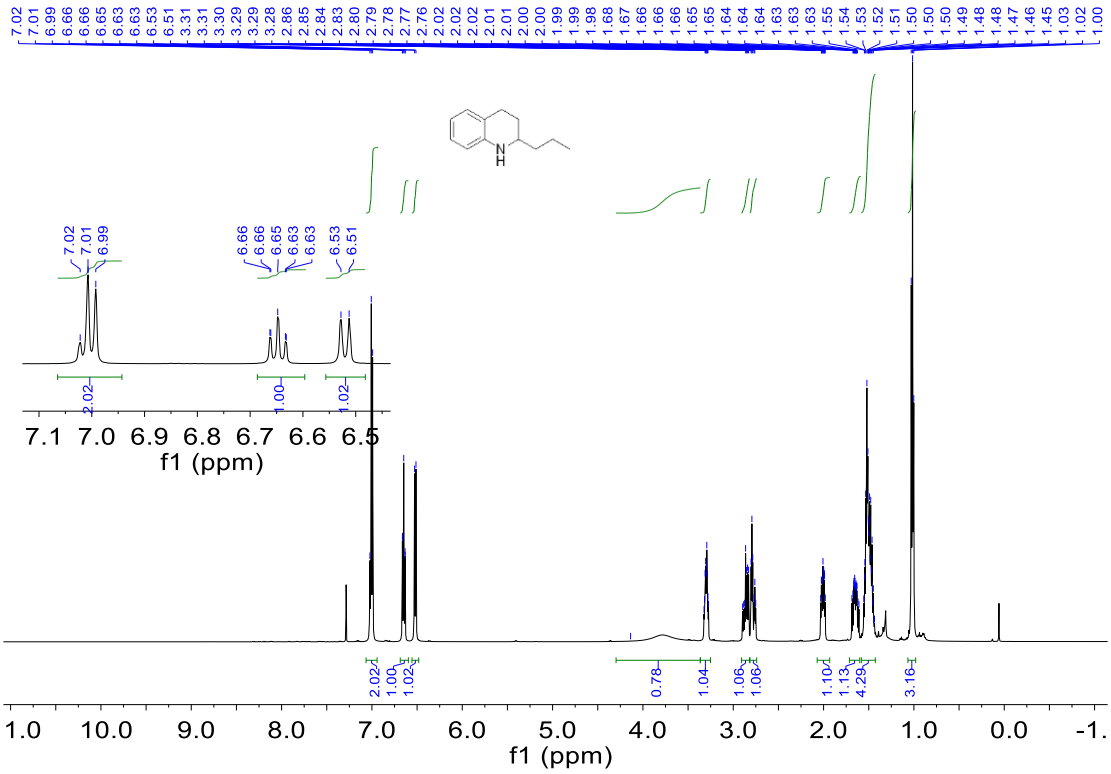
$^{1}$H NMR for **2b** (500 MHz, $CDCl_3$)



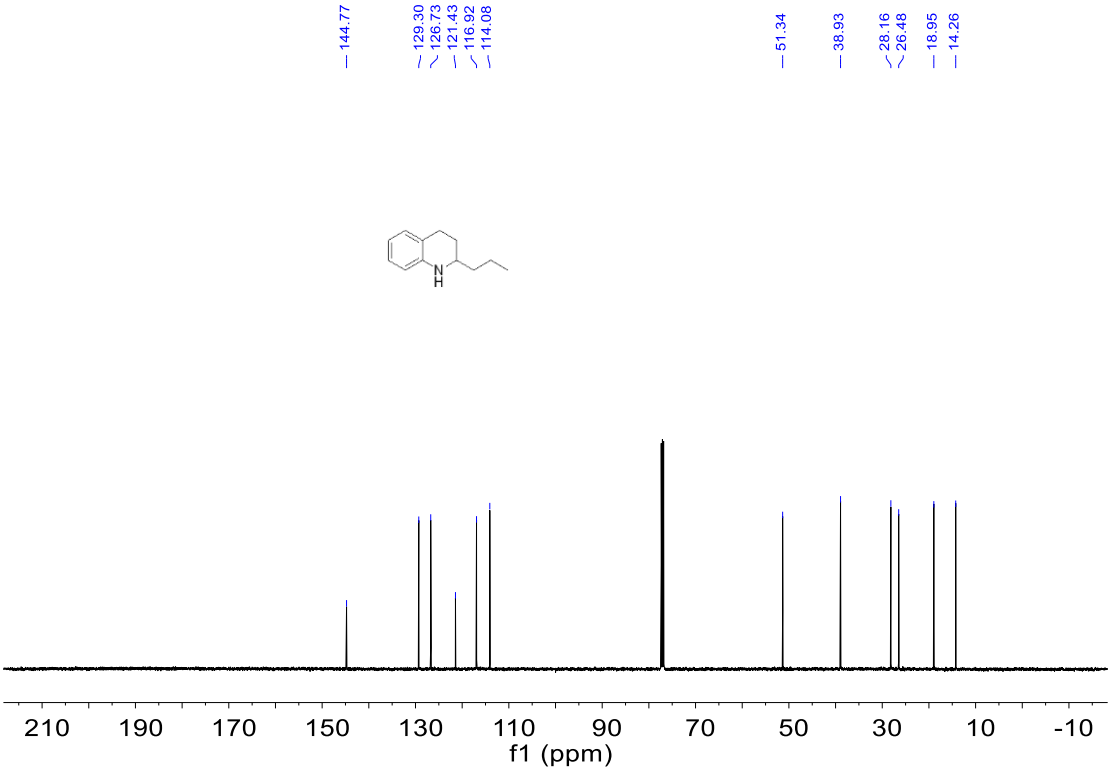

$^{13}$C NMR for **2b** (126 MHz, $CDCl_3$)



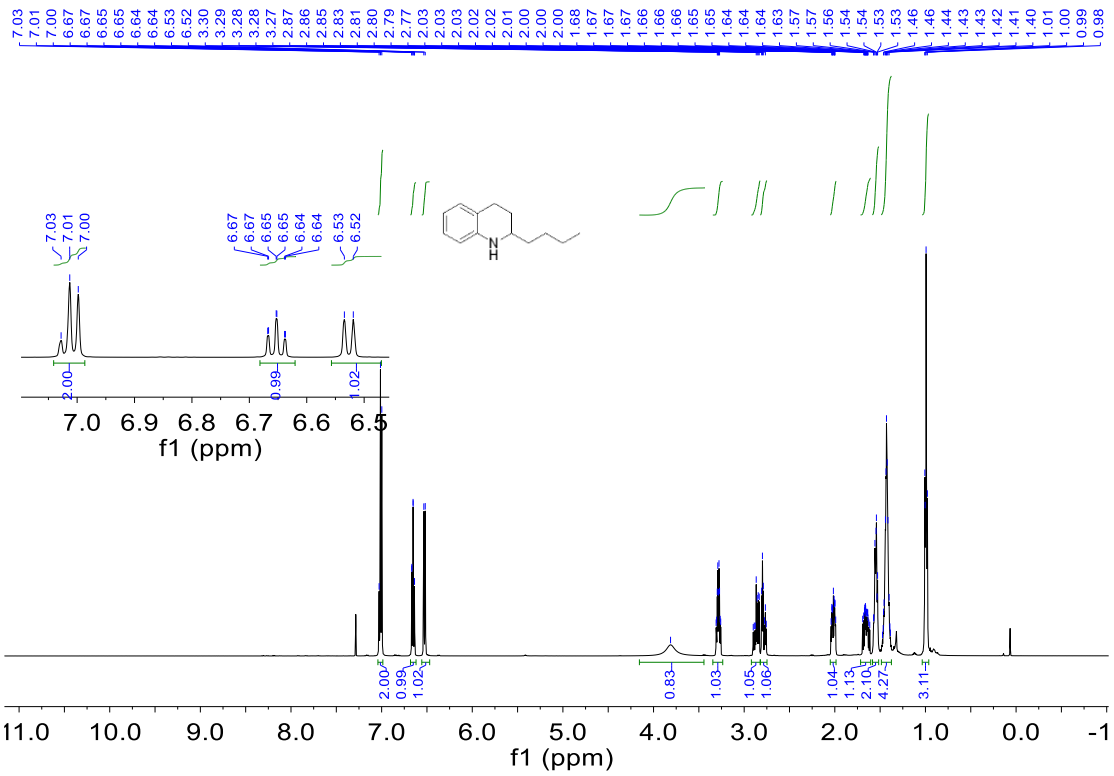
$^{1}$H NMR for **2c** (500 MHz, $CDCl_3$)



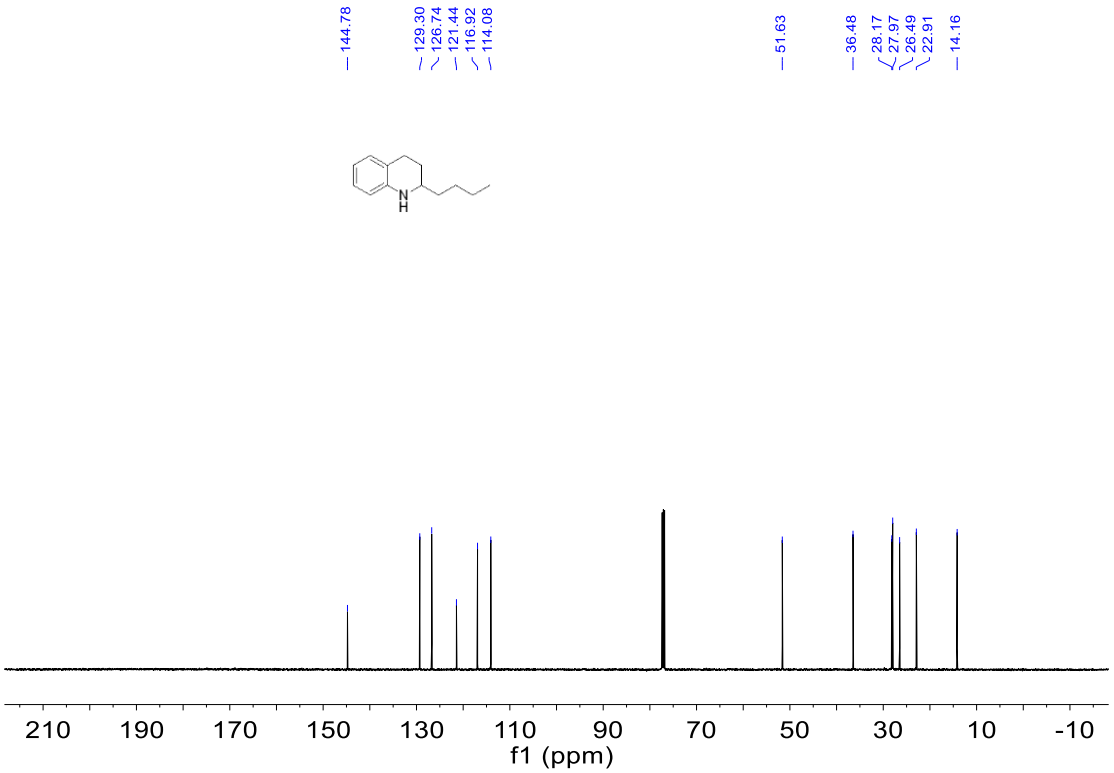

$^{13}$C NMR for **2c** (126 MHz, $CDCl_3$)



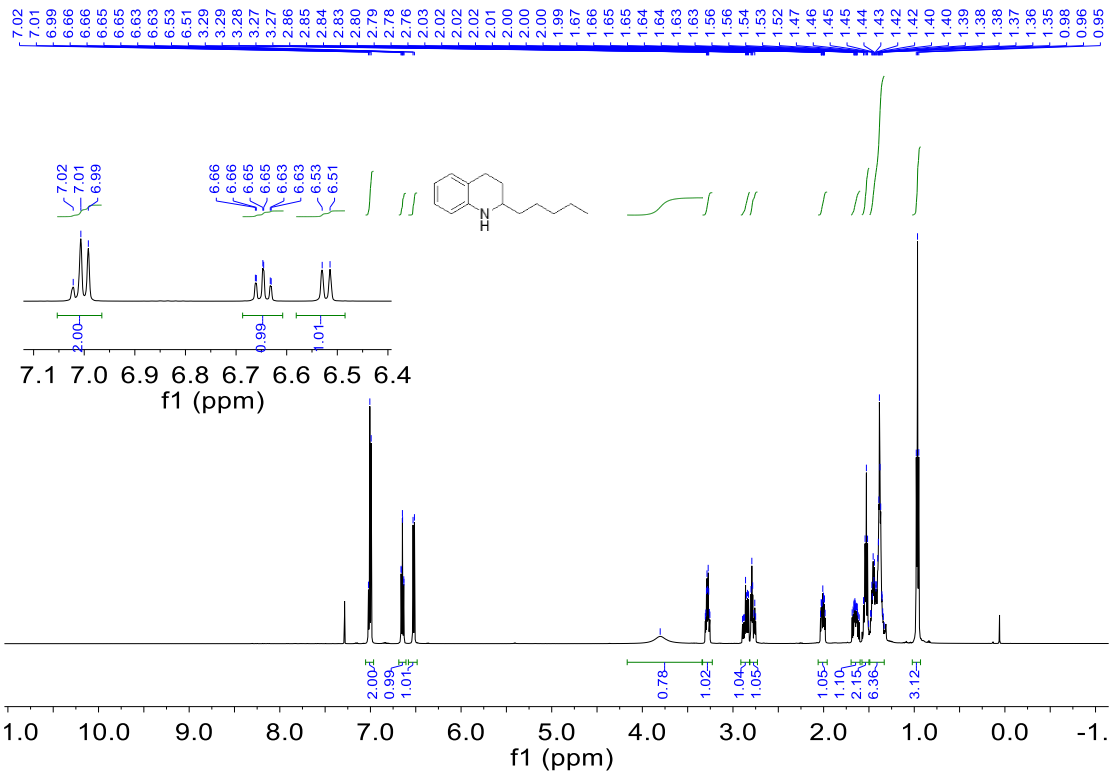
$^{1}$H NMR for **2d** (500 MHz, $CDCl_3$)



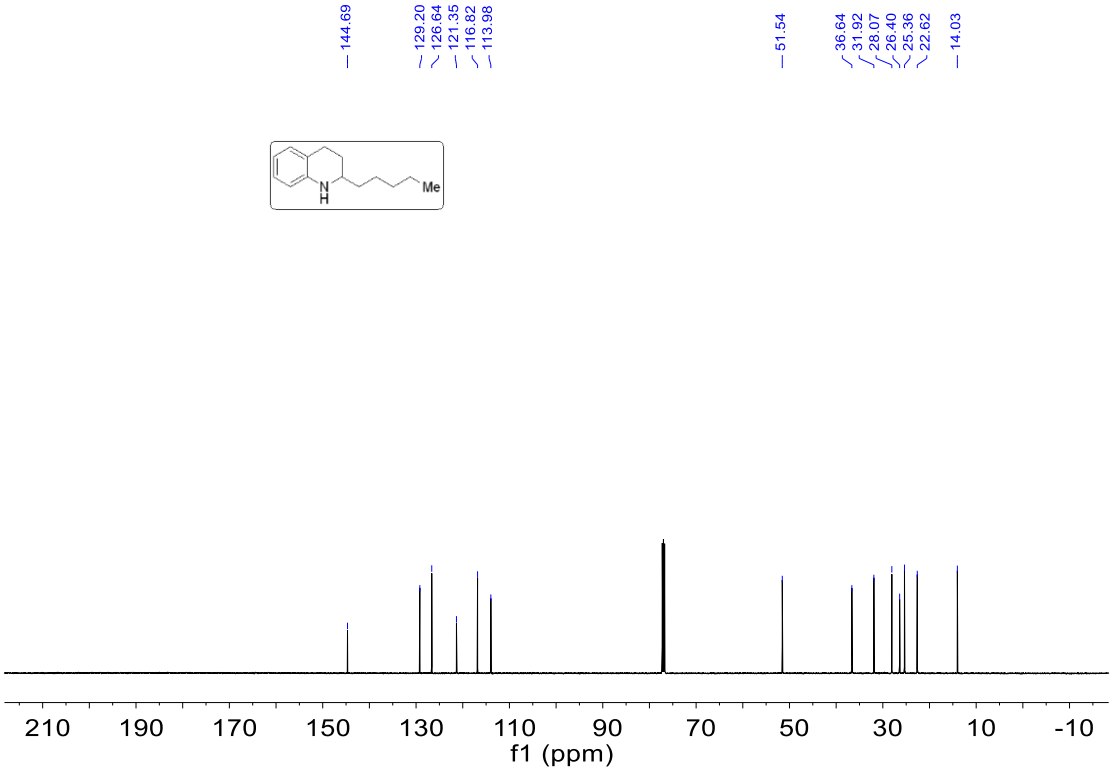

$^{13}$C NMR for **2d** (126 MHz, $CDCl_3$)



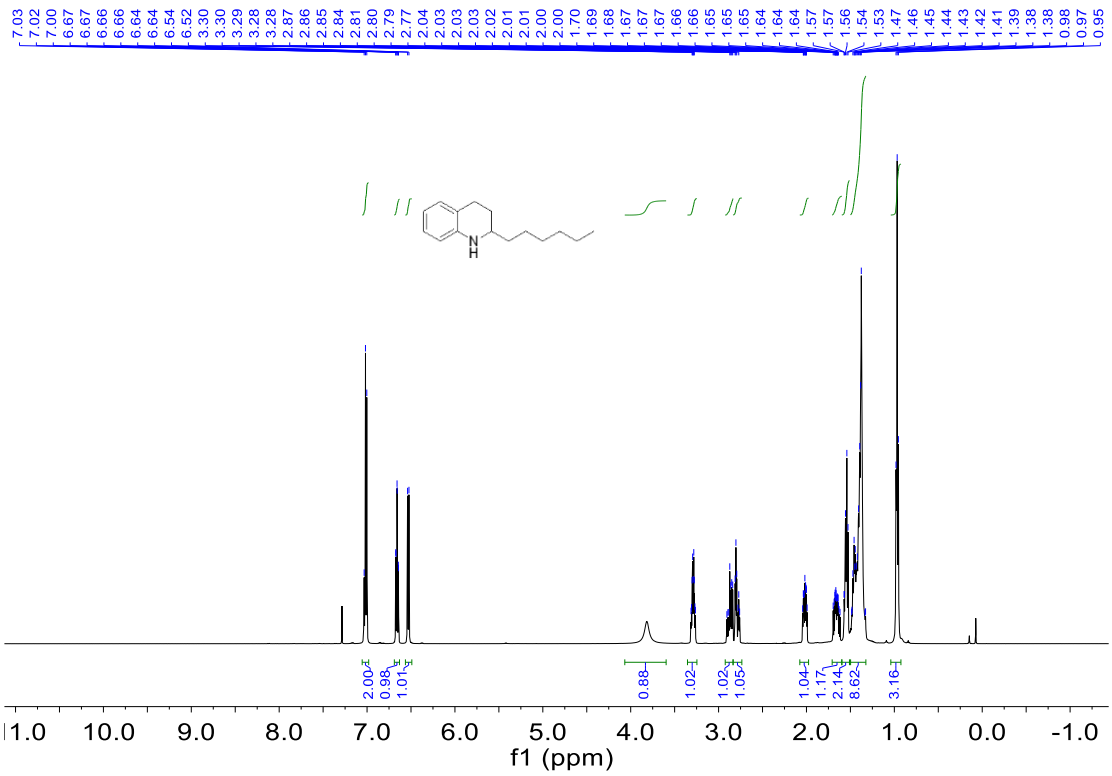
$^{1}$H NMR for **2e** (500 MHz, $CDCl_3$)



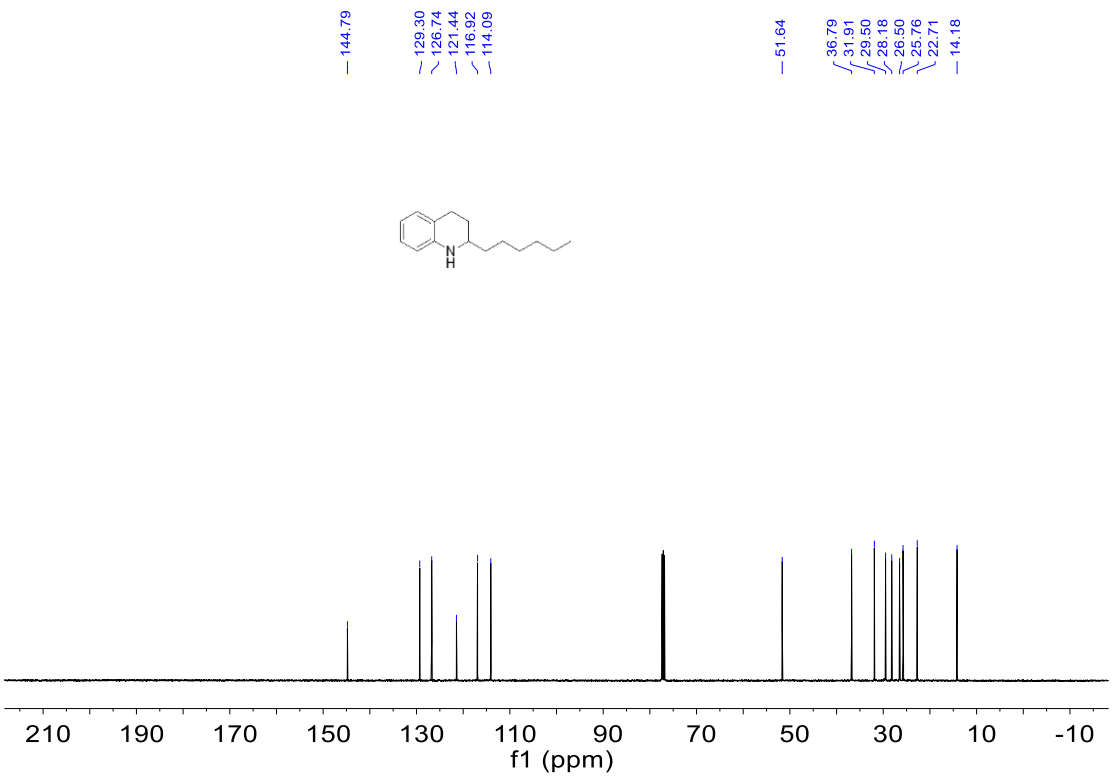

$^{13}$C NMR for **2e** (126 MHz, $CDCl_3$)



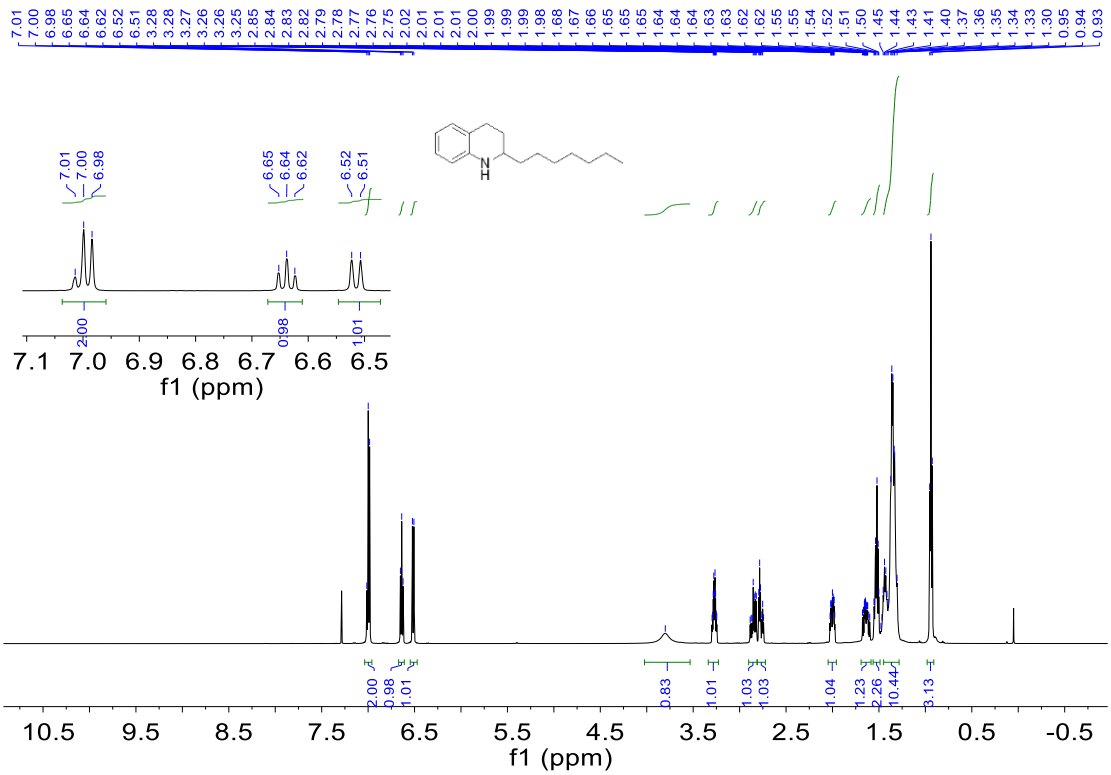
$^{1}$H NMR for **2f** (500 MHz, $CDCl_3$)



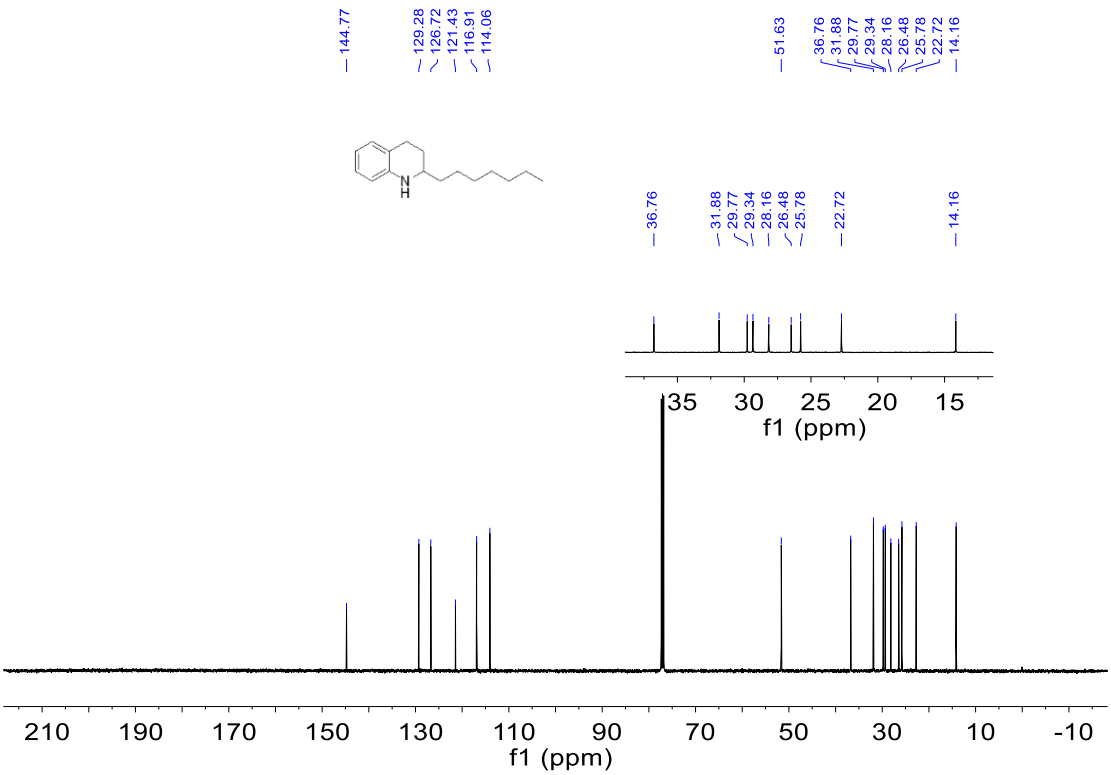

$^{13}$C NMR for **2f** (126 MHz, $CDCl_3$)



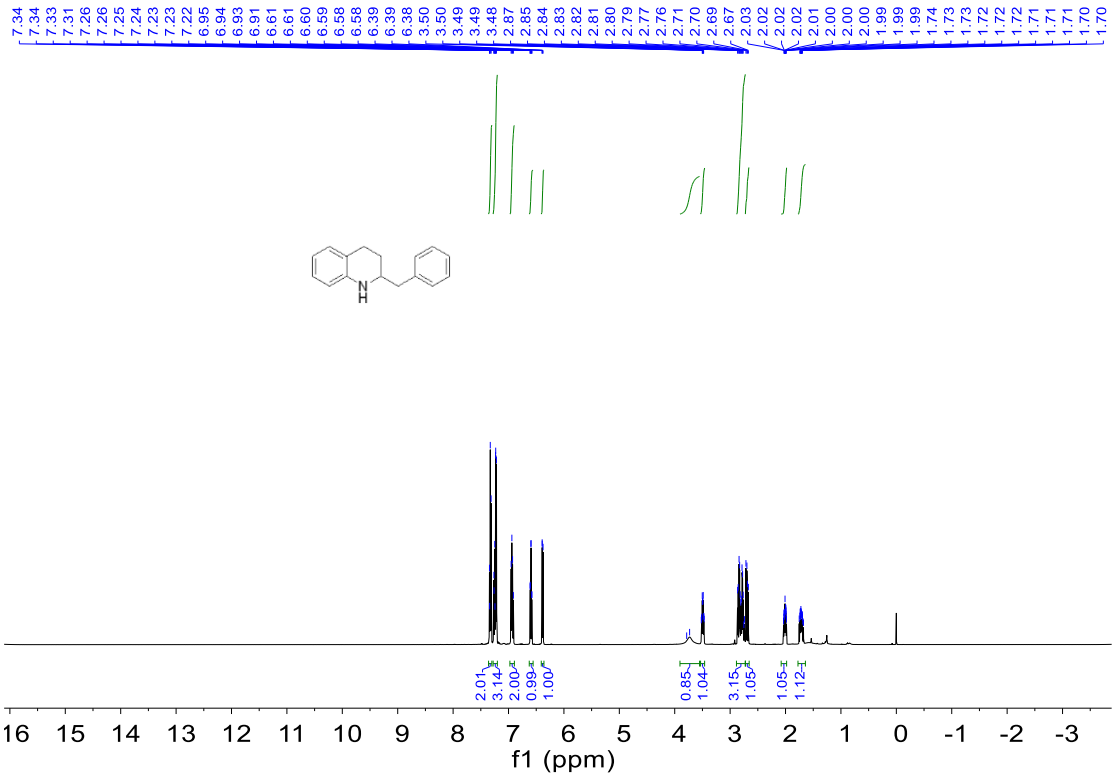
$^{1}$H NMR for **2g** (500 MHz, $CDCl_3$)



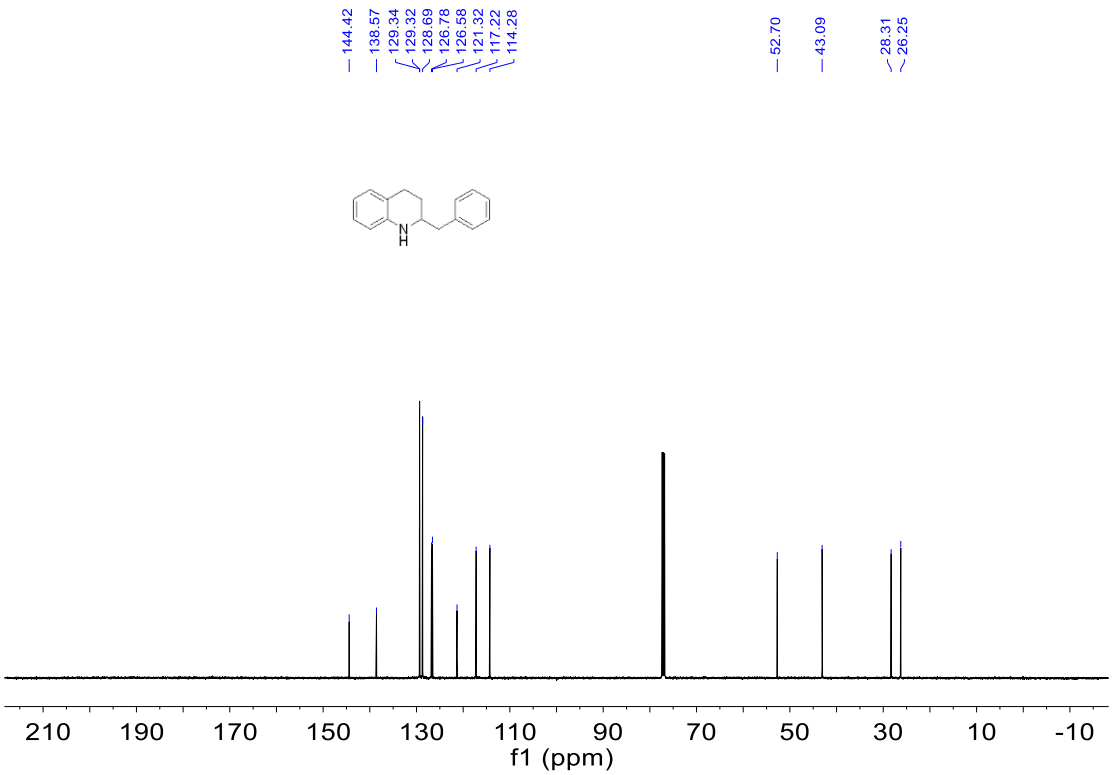

$^{13}$C NMR for **2g** (126 MHz, $CDCl_3$)



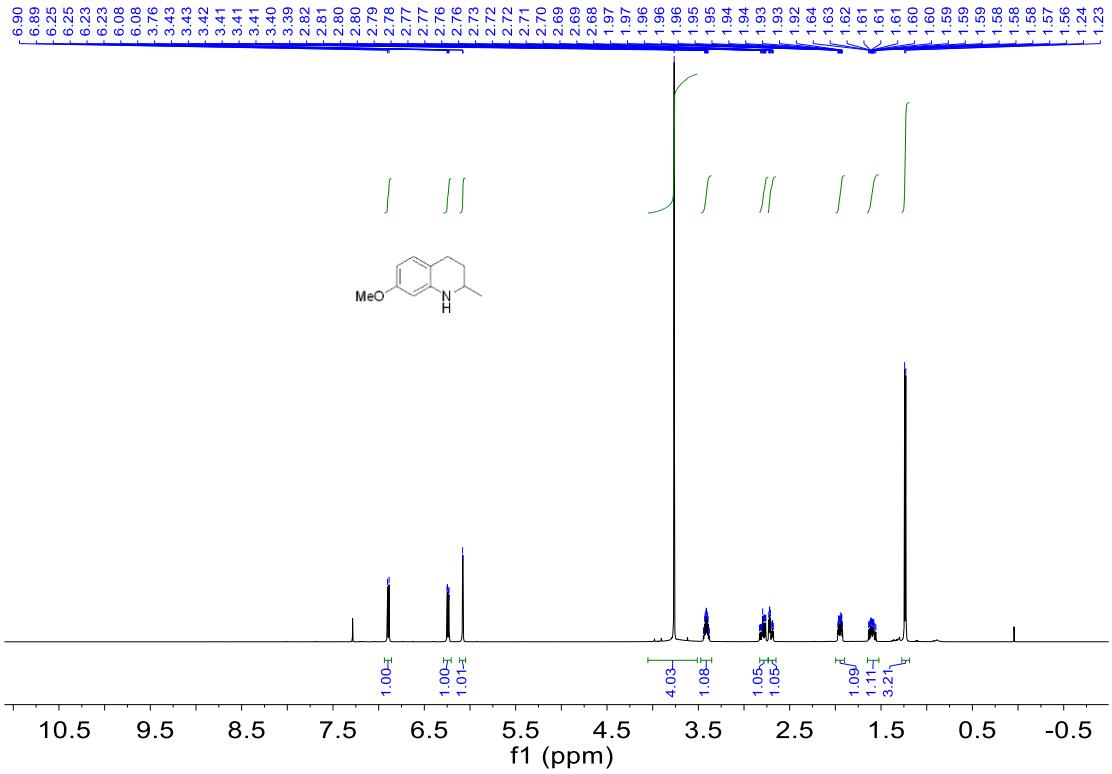
$^{1}$H NMR for **2h** (500 MHz, $CDCl_3$)



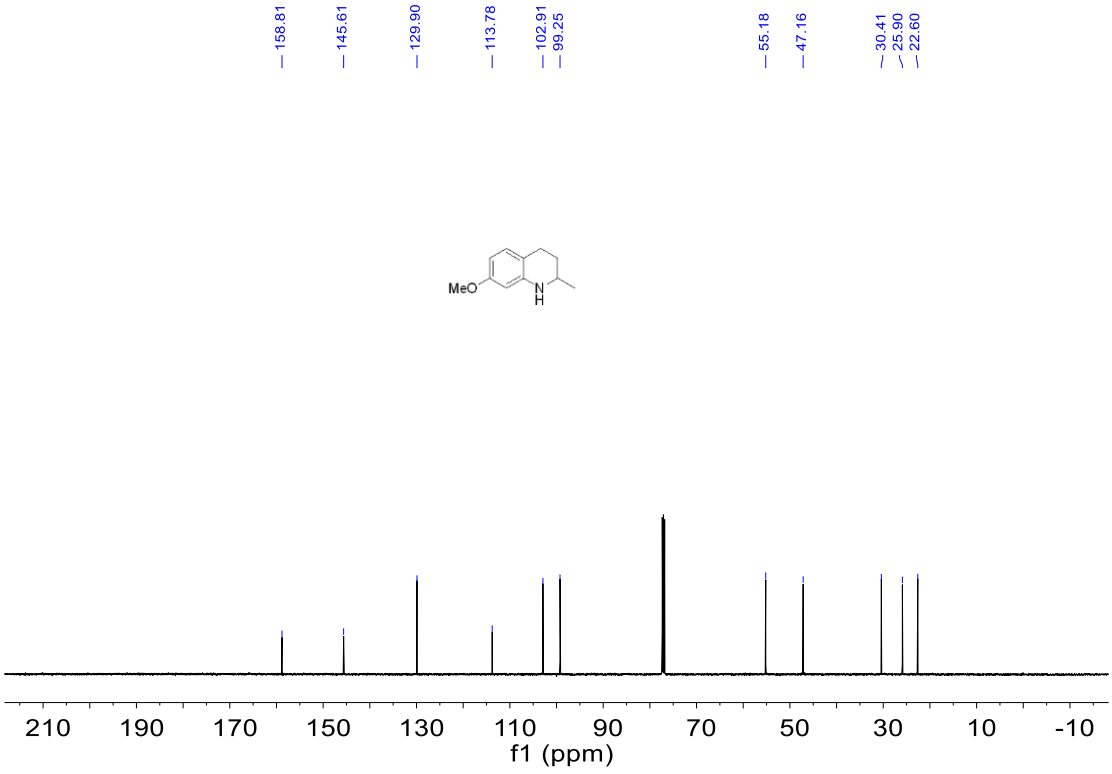

$^{13}$C NMR for **2h** (126 MHz, $CDCl_3$)



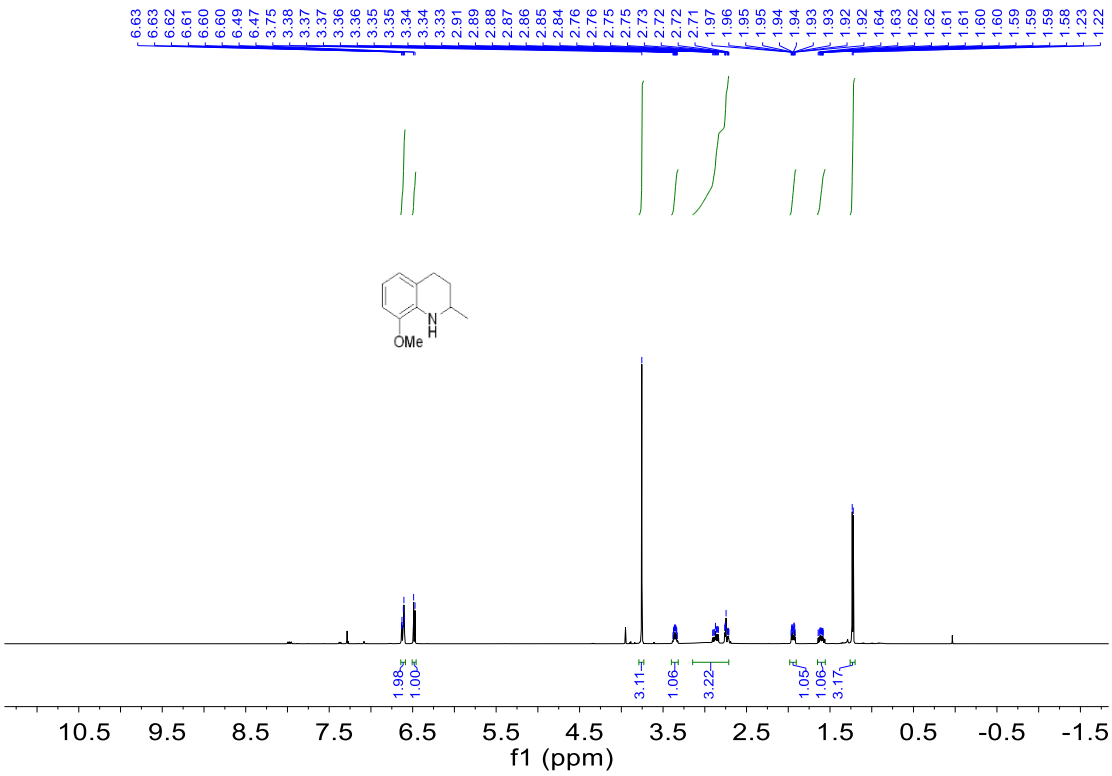
$^{1}$H NMR for **2i** (500 MHz, $CDCl_3$)



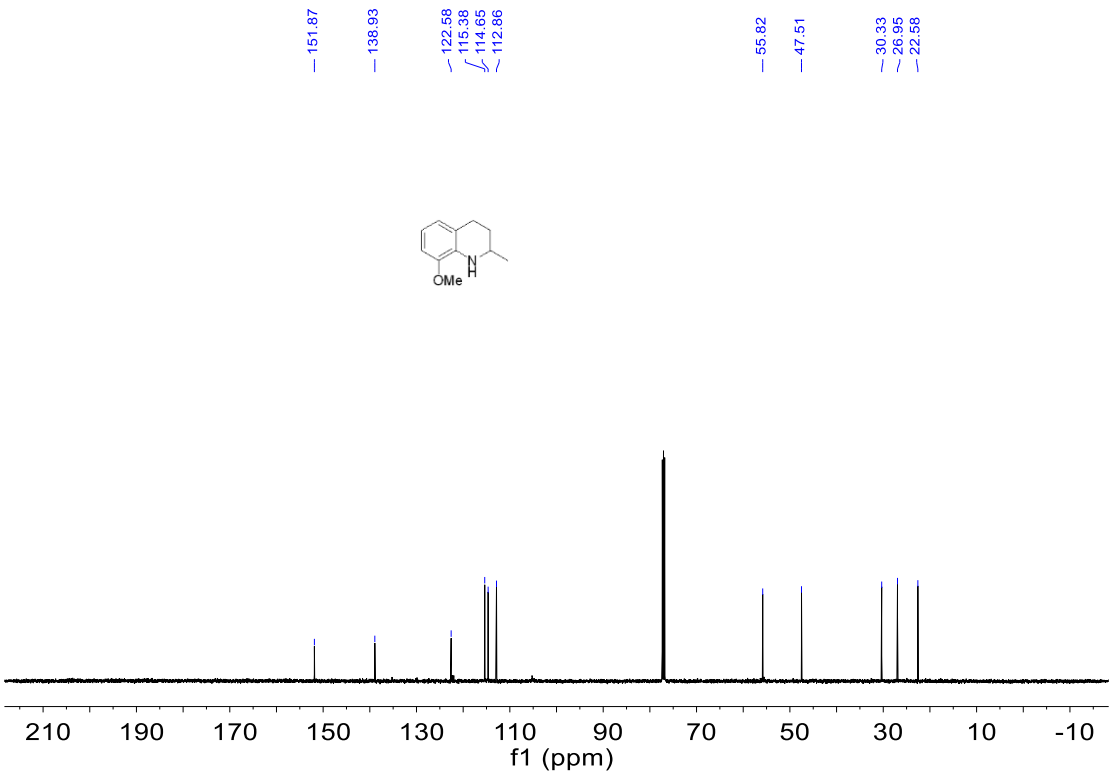

$^{13}$C NMR for **2i** (126 MHz, $CDCl_3$)



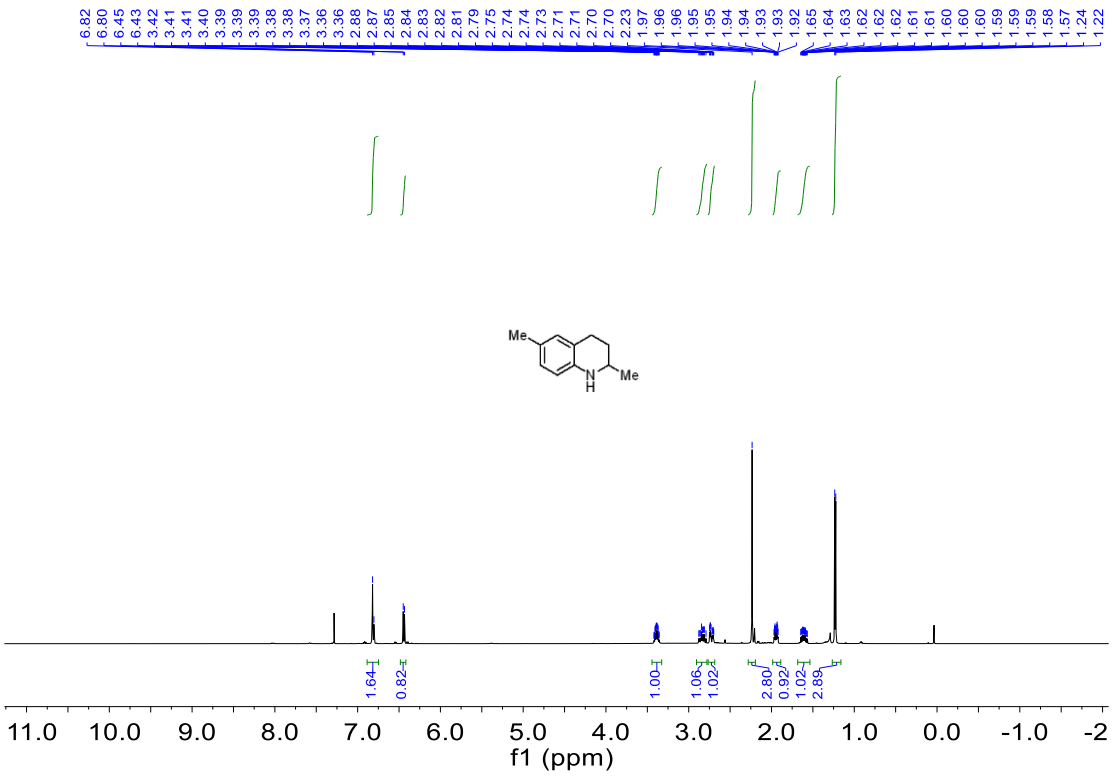
$^{1}$H NMR for **2j** (500 MHz, $CDCl_3$)



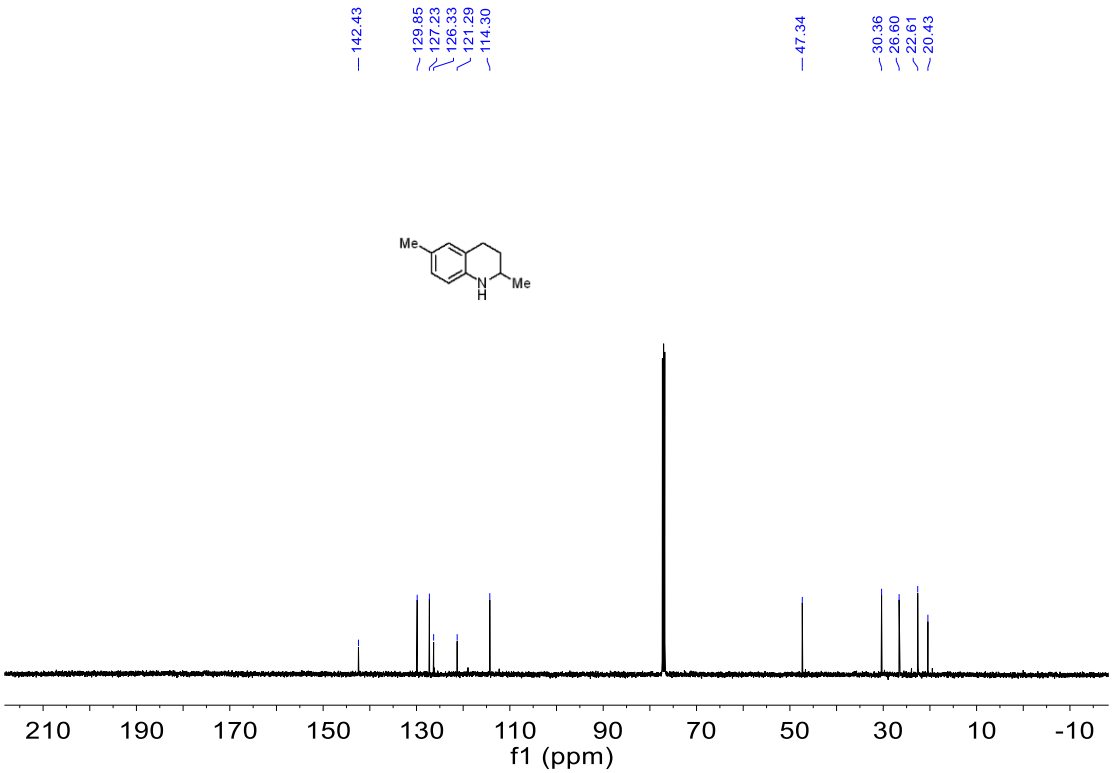

$^{13}$C NMR for **2j** (126 MHz, $CDCl_3$)



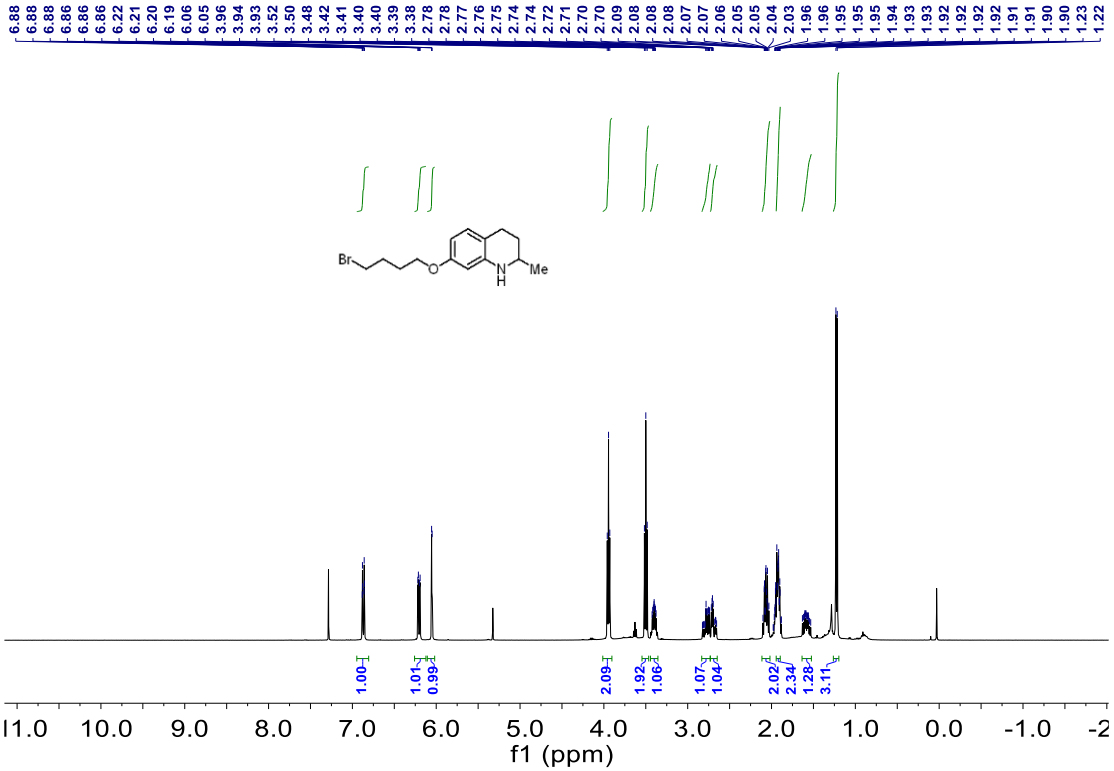
$^{1}$H NMR for **2k** (500 MHz, $CDCl_3$)



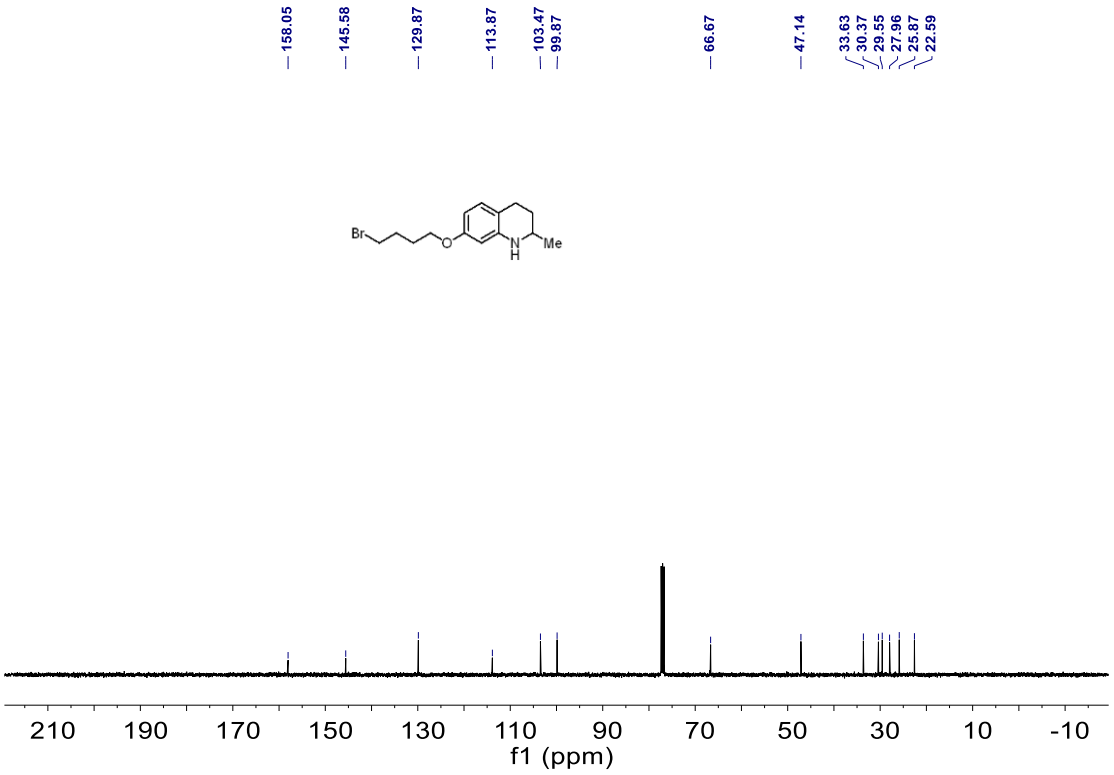

$^{13}$C NMR for **2k** (126 MHz, $CDCl_3$)



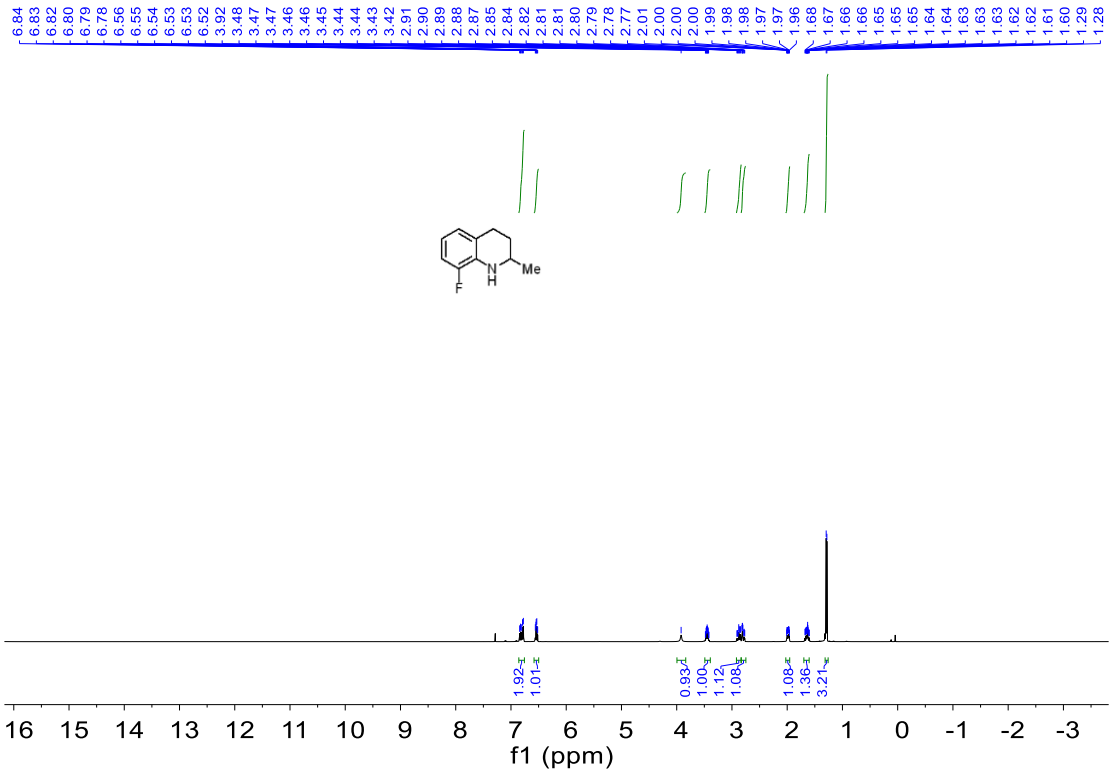
$^{1}$H NMR for **2l** (400 MHz, $CDCl_3$)



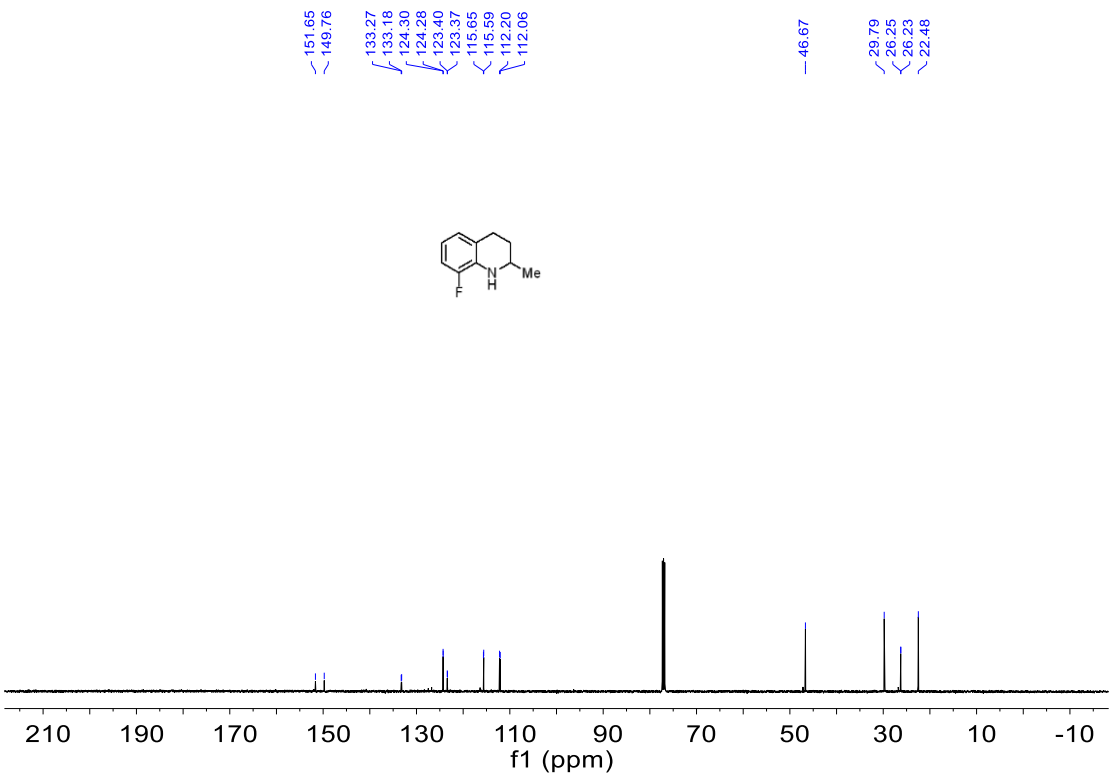

$^{13}$C NMR for **2l** (101 MHz, $CDCl_3$)



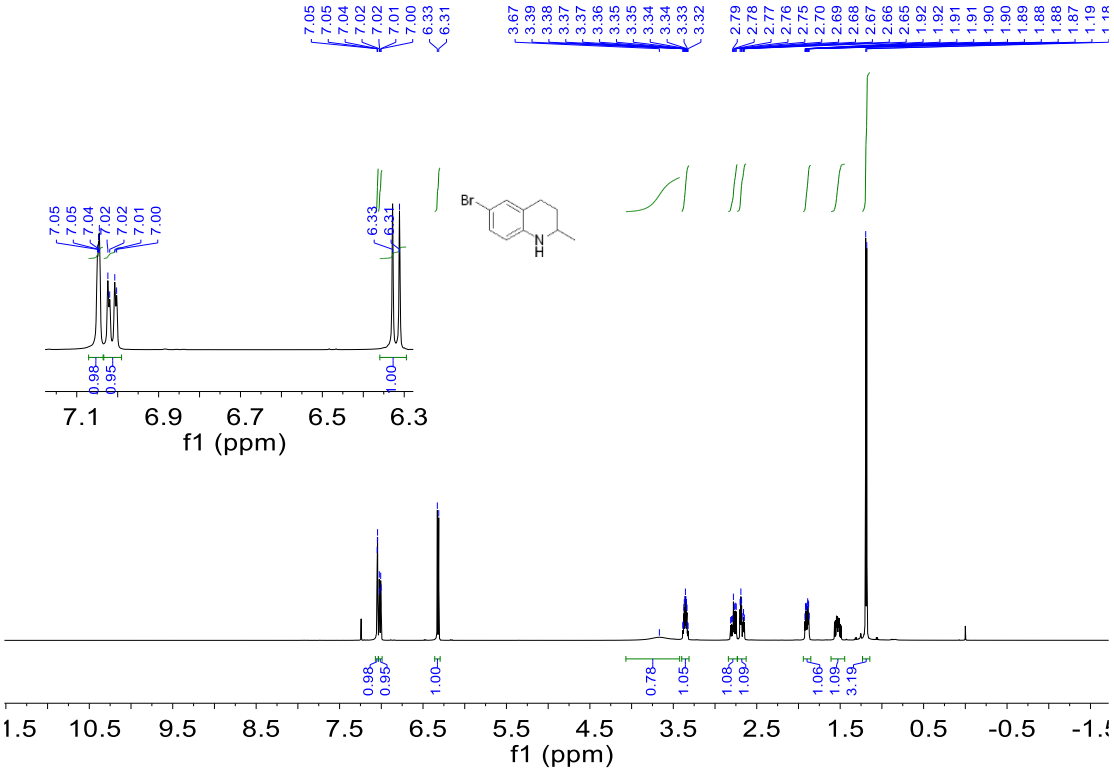
$^{1}$H NMR for **2m** (500 MHz, $CDCl_3$)



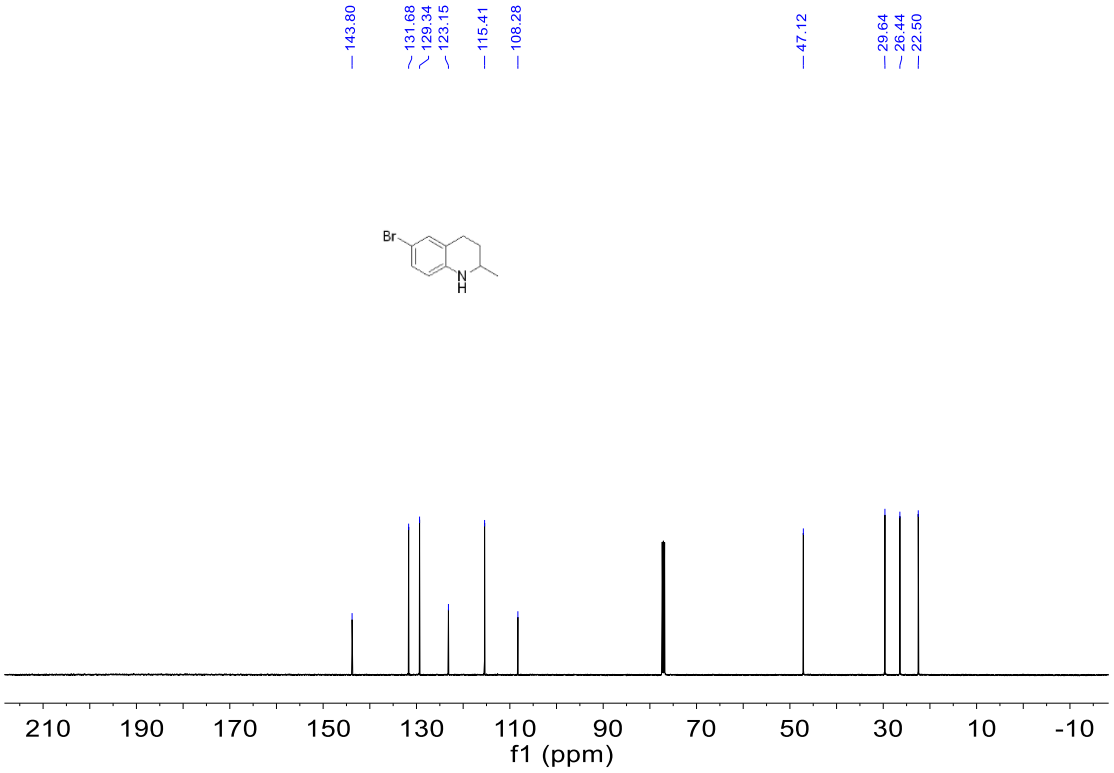

$^{13}$C NMR for **2m** (126 MHz, $CDCl_3$)



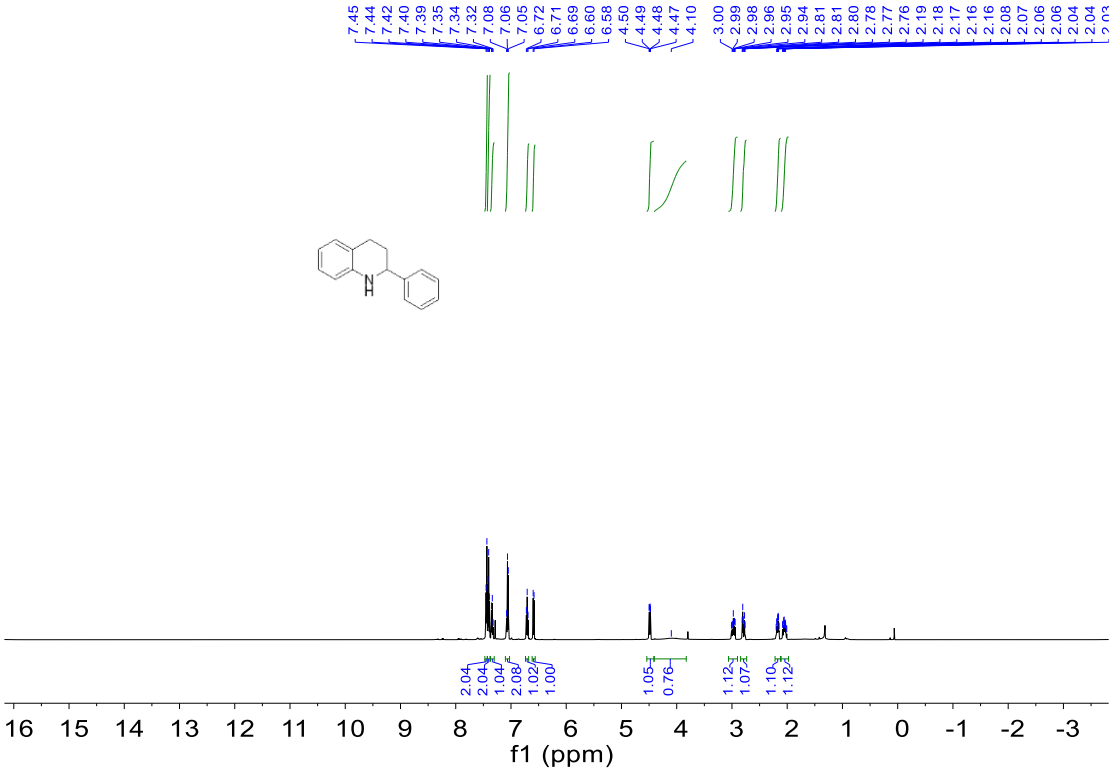
$^{1}$H NMR for **2n** (500 MHz, $CDCl_3$)



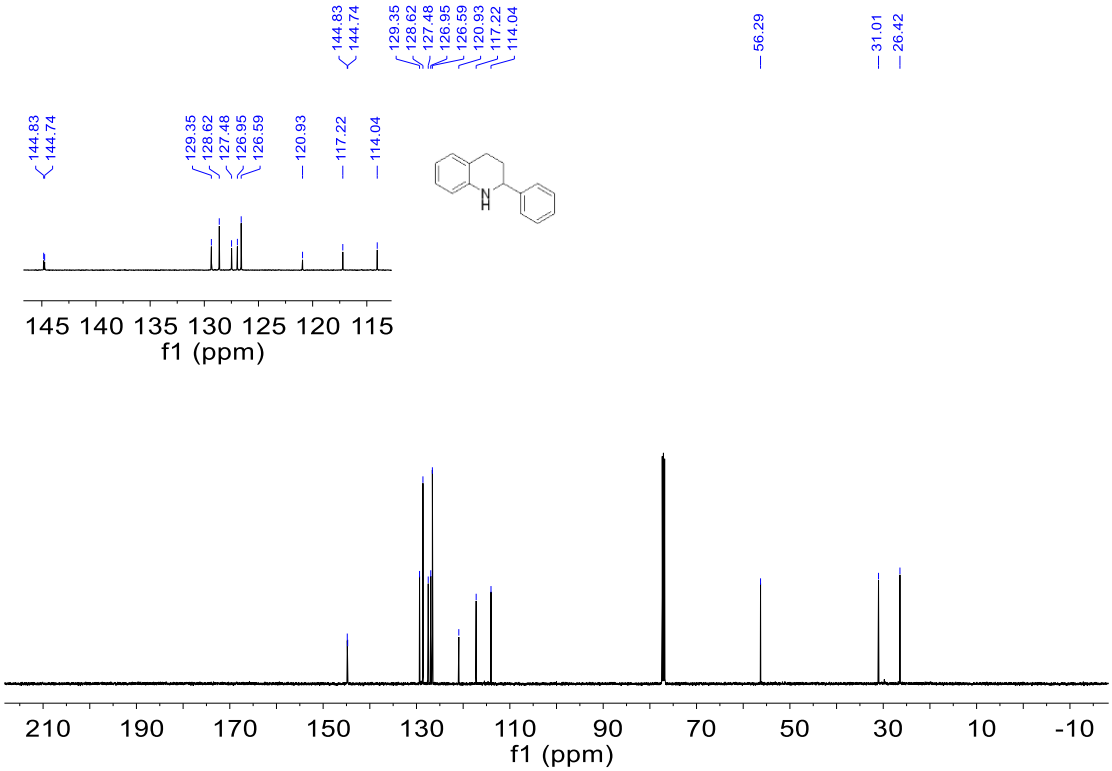

$^{13}$C NMR for **2n** (126 MHz, $CDCl_3$)



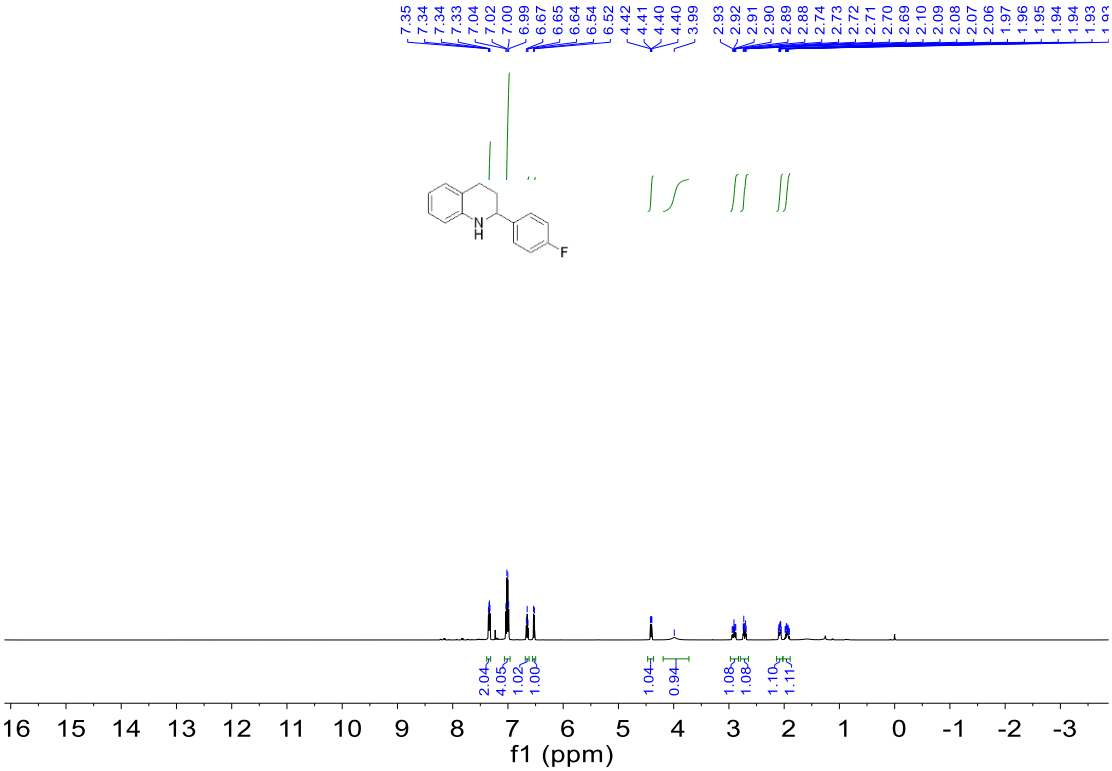
$^{1}$H NMR for **2o** (500 MHz, $CDCl_3$)



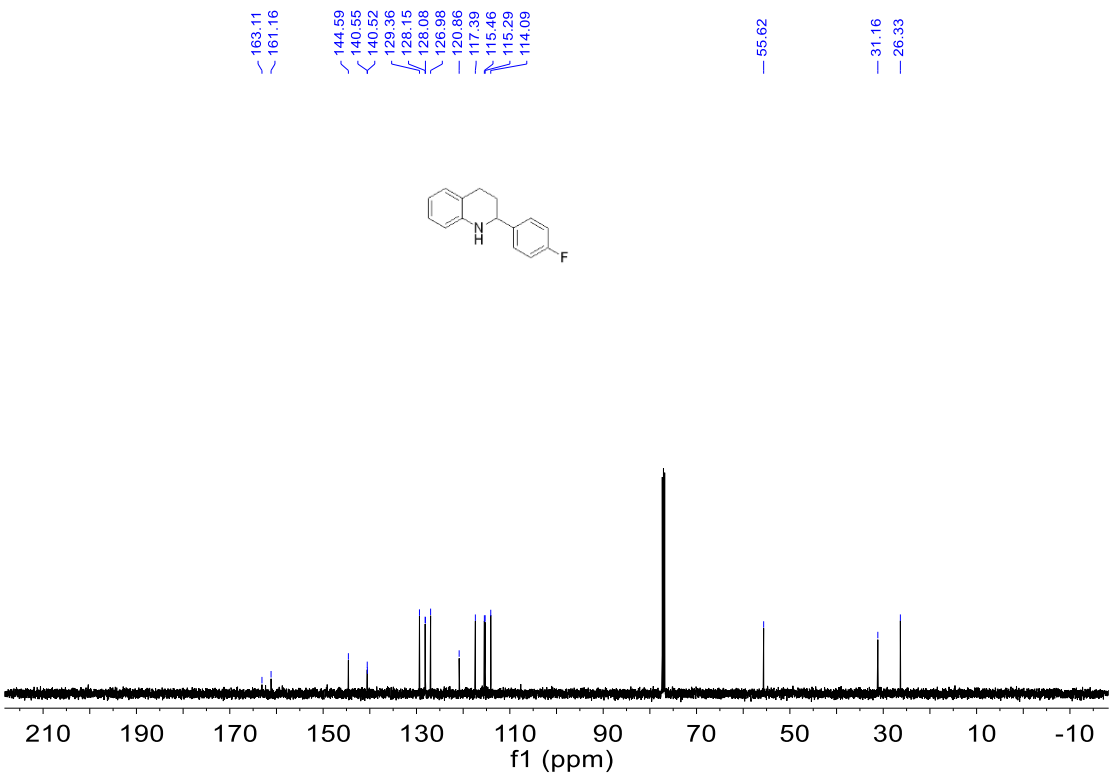

$^{13}$C NMR for **2o** (126 MHz, $CDCl_3$)



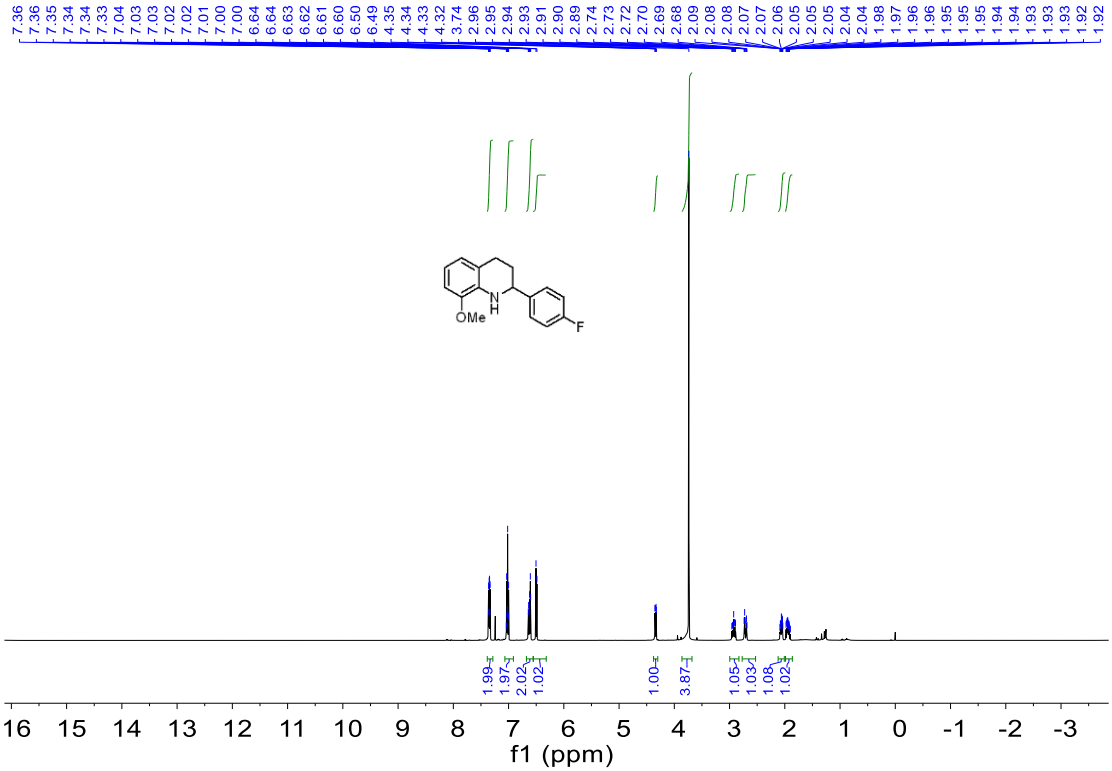
$^{1}$H NMR for **2p** (500 MHz, $CDCl_3$)



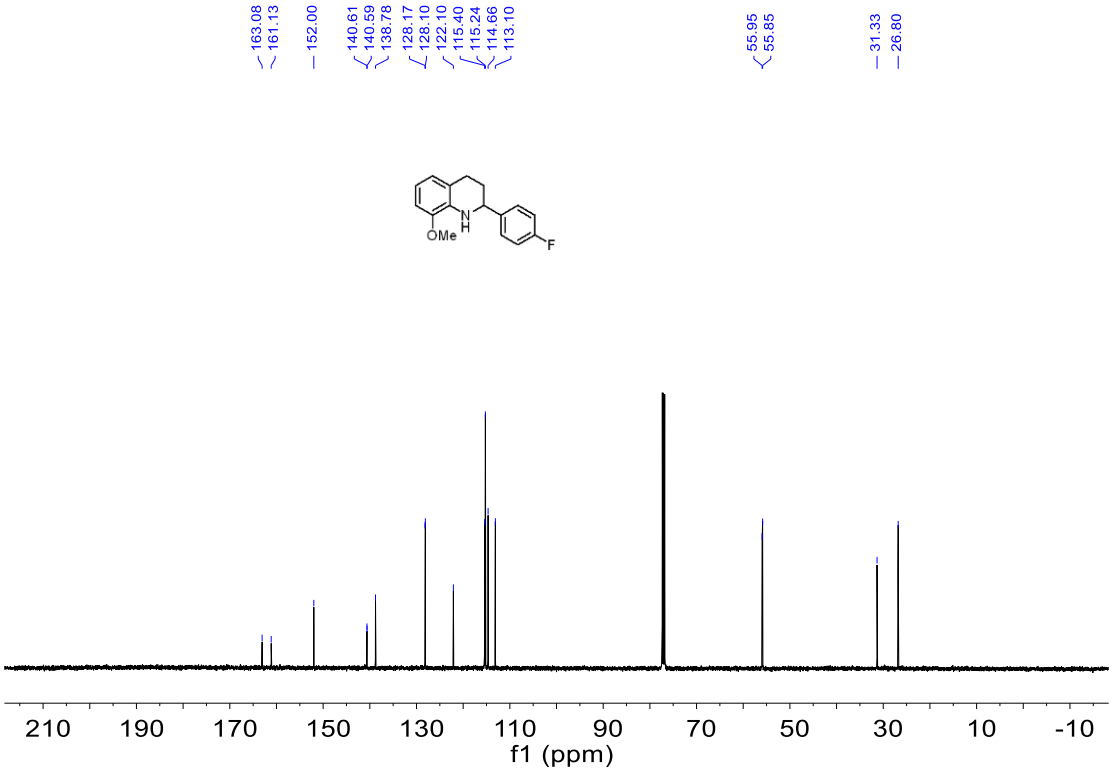

$^{13}$C NMR for **2p** (126 MHz, $CDCl_3$)



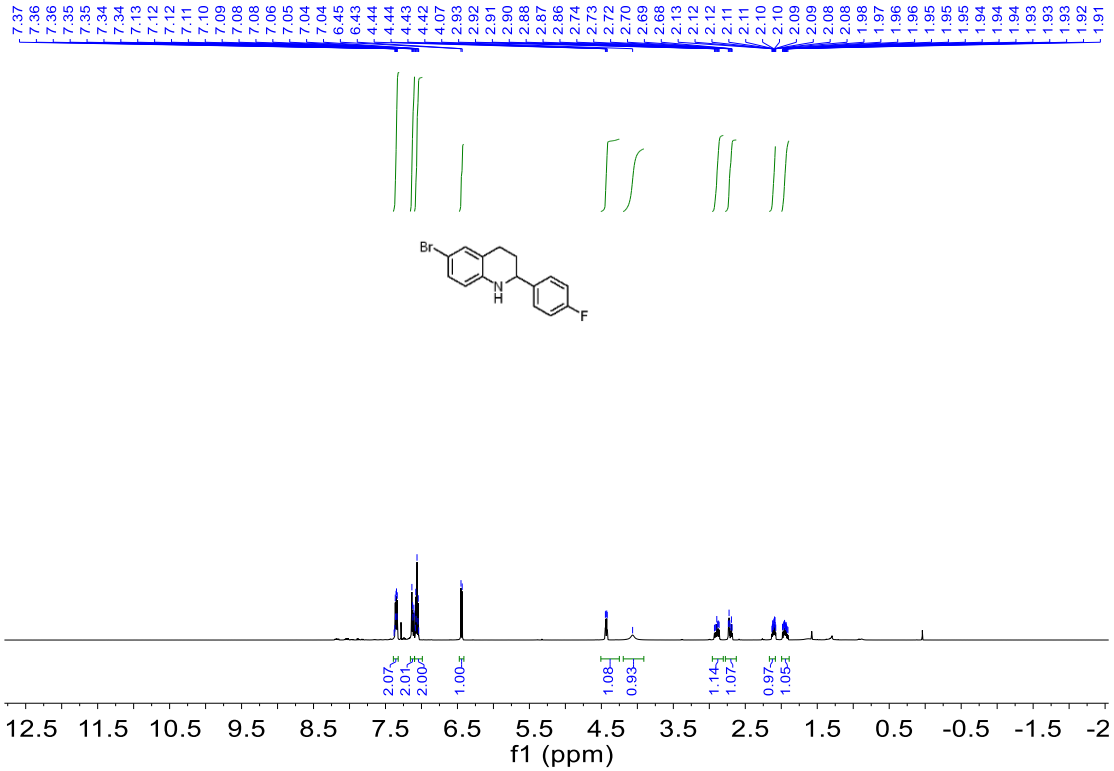
$^{1}$H NMR for **2q** (500 MHz, $CDCl_3$)



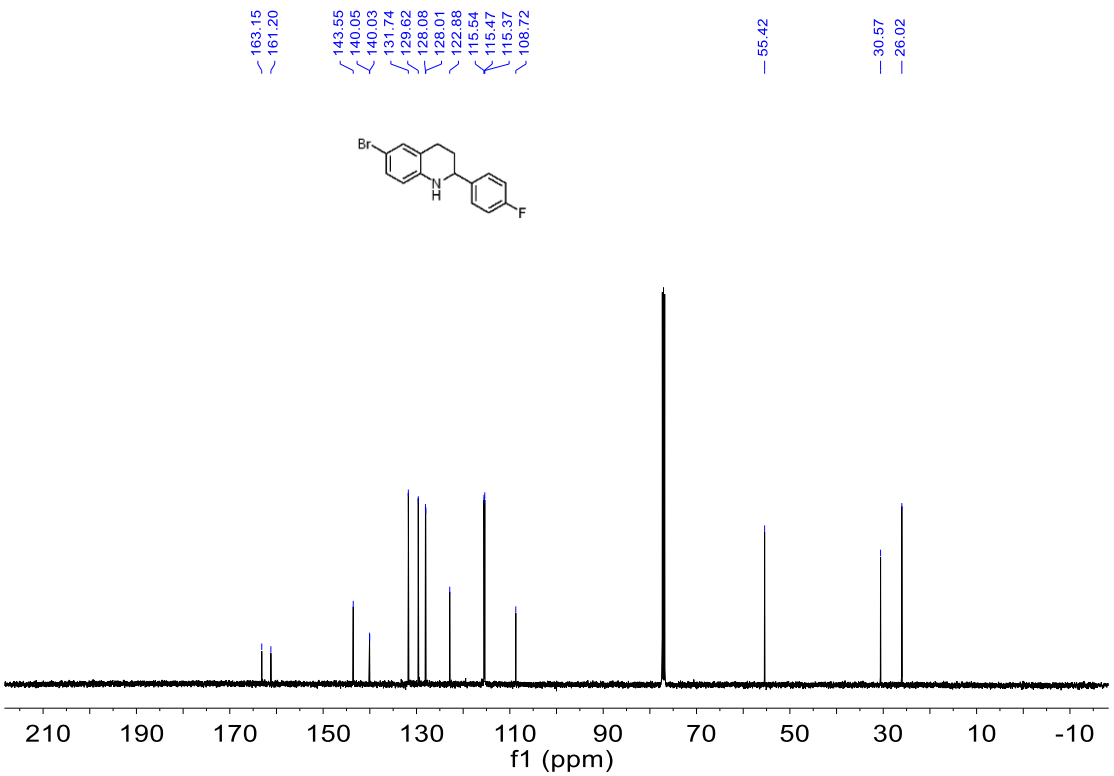

$^{13}$C NMR for **2q** (126 MHz, $CDCl_3$)



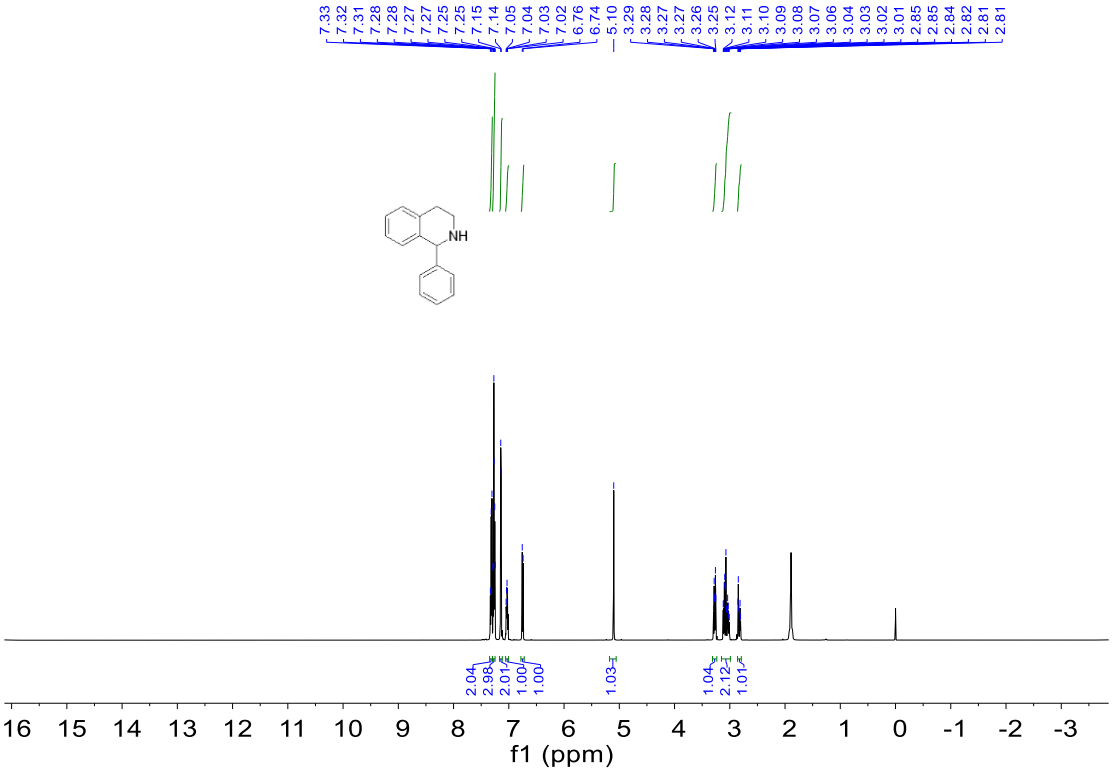
$^{1}$H NMR for **2r** (500 MHz, $CDCl_3$)



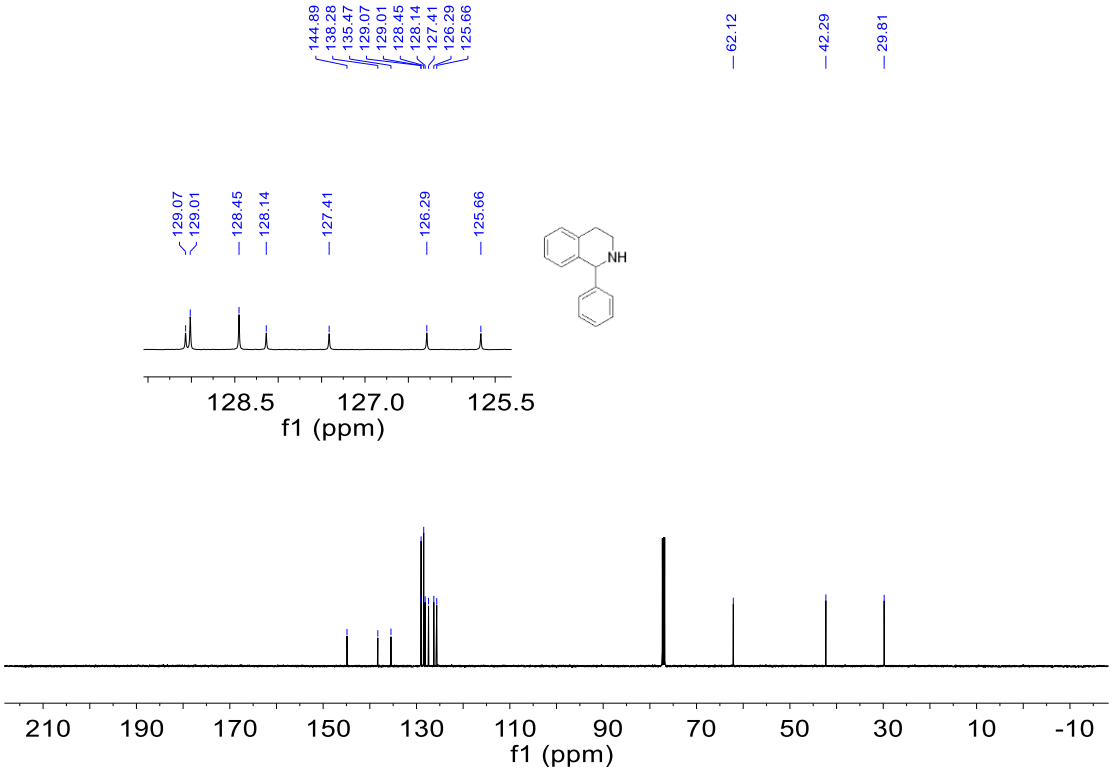

$^{13}$C NMR for **2r** (126 MHz, $CDCl_3$)



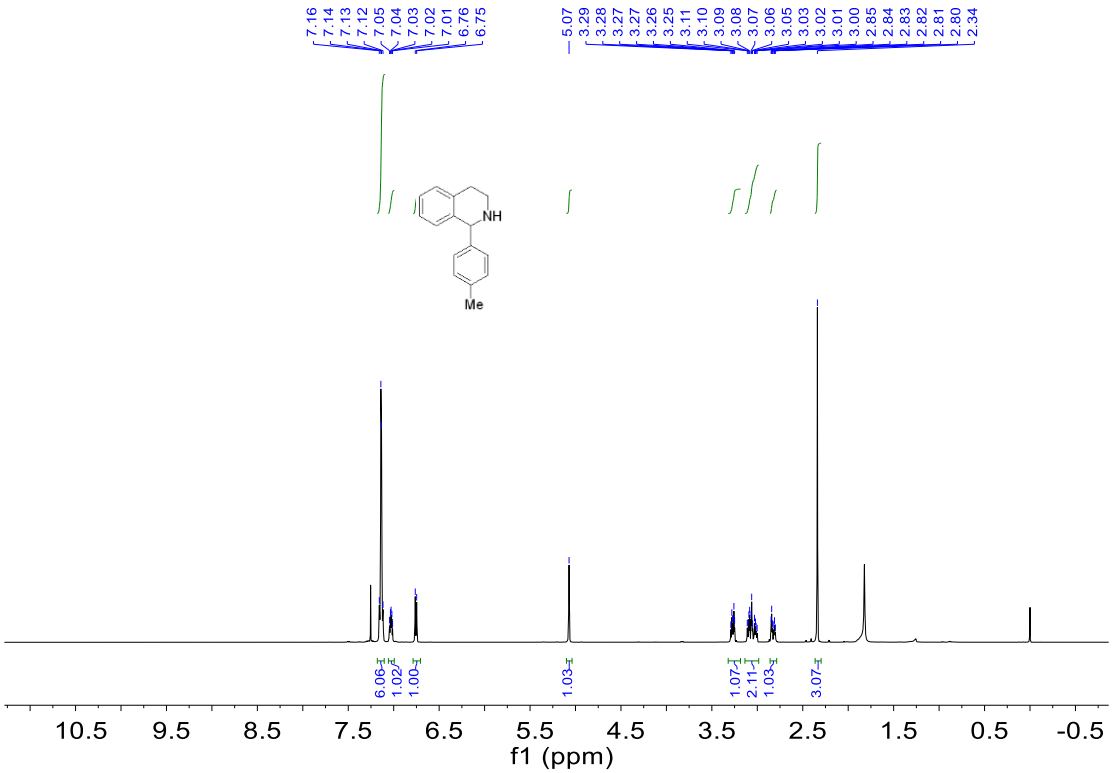
$^{1}$H NMR for **4a** (500 MHz, $CDCl_3$)



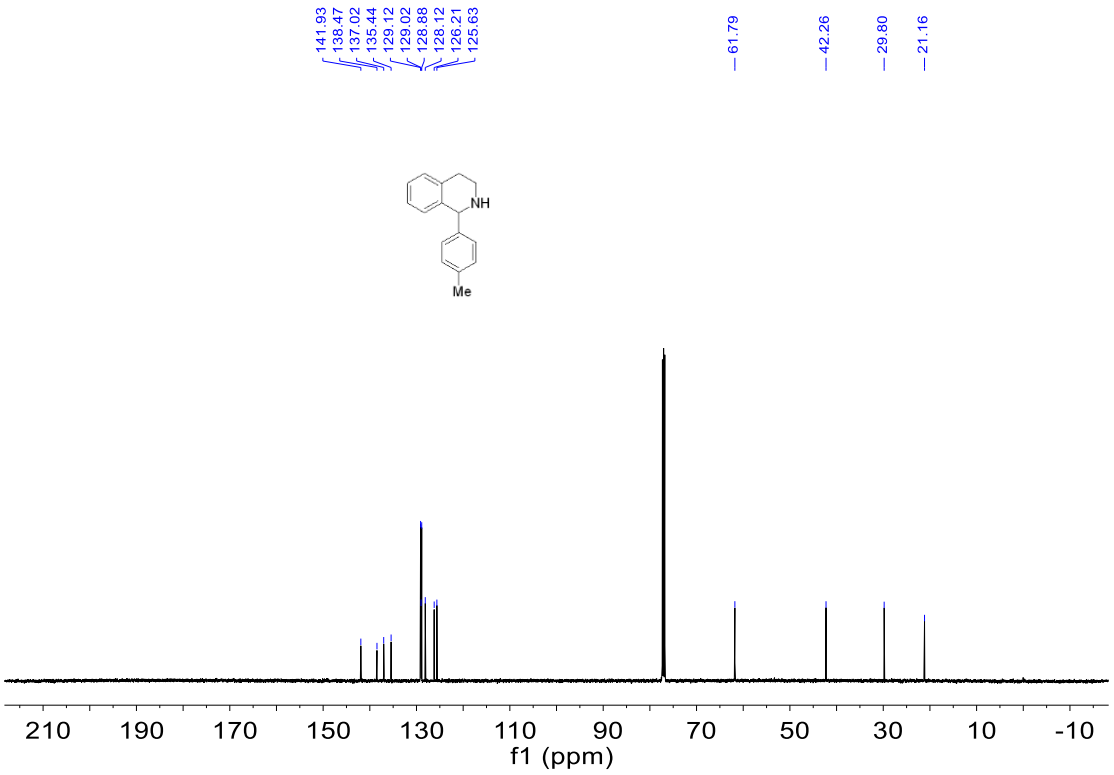

$^{13}$C NMR for **4a** (126 MHz, $CDCl_3$)



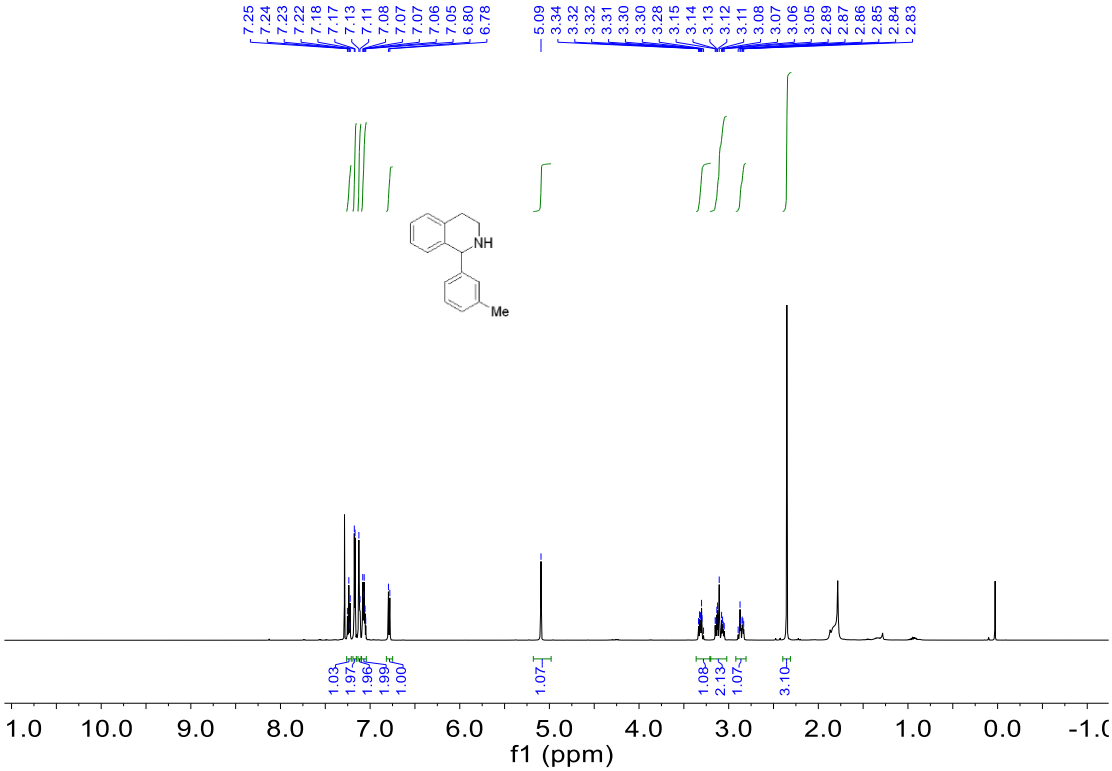
$^{1}$H NMR for **4b** (500 MHz, $CDCl_3$)



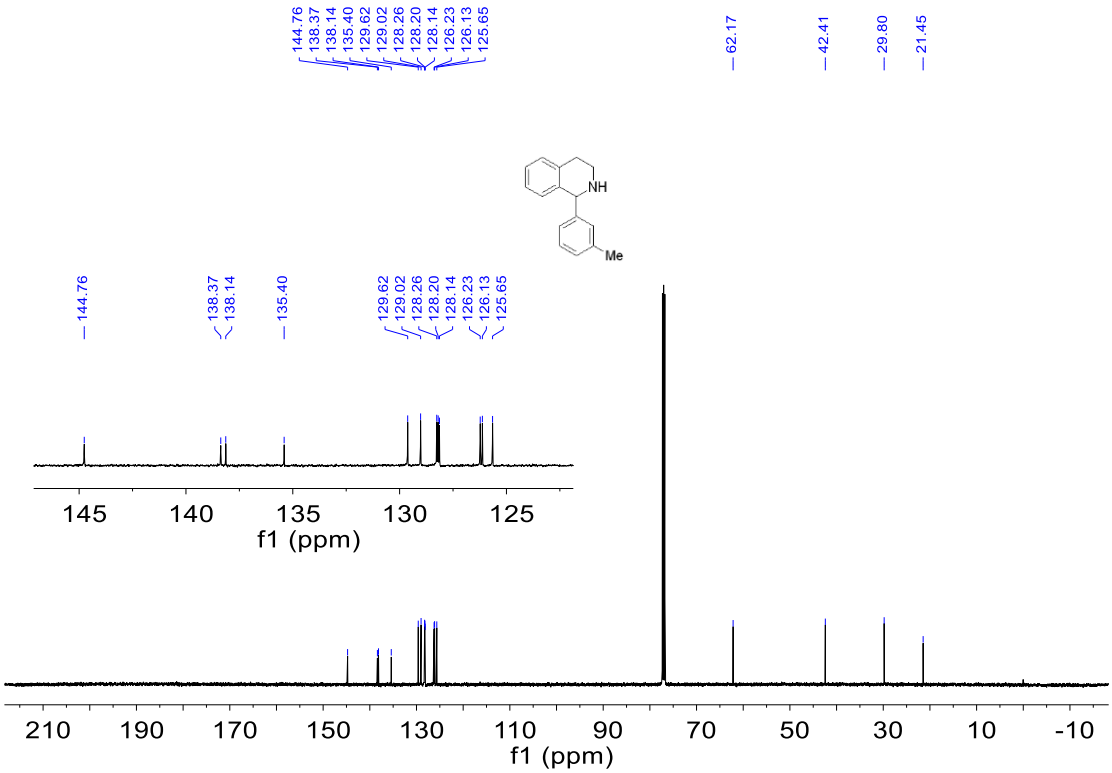

$^{13}$C NMR for **4b** (126 MHz, $CDCl_3$)



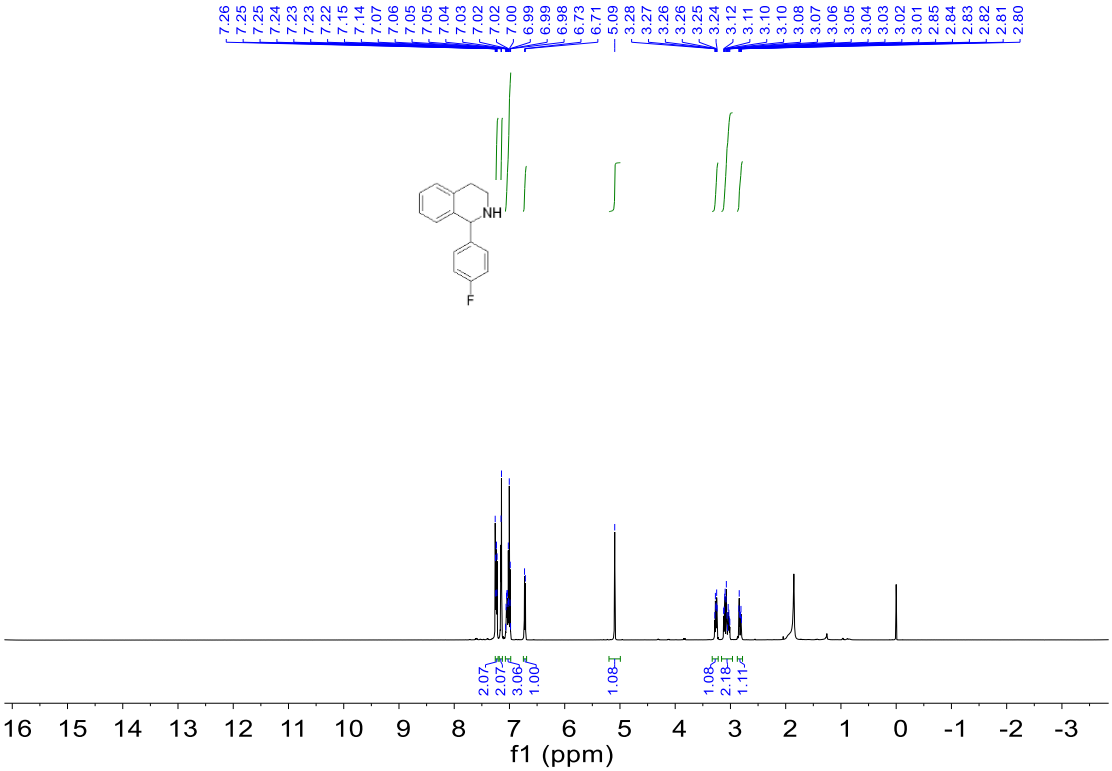
$^{1}$H NMR for **4c** (500 MHz, $CDCl_3$)



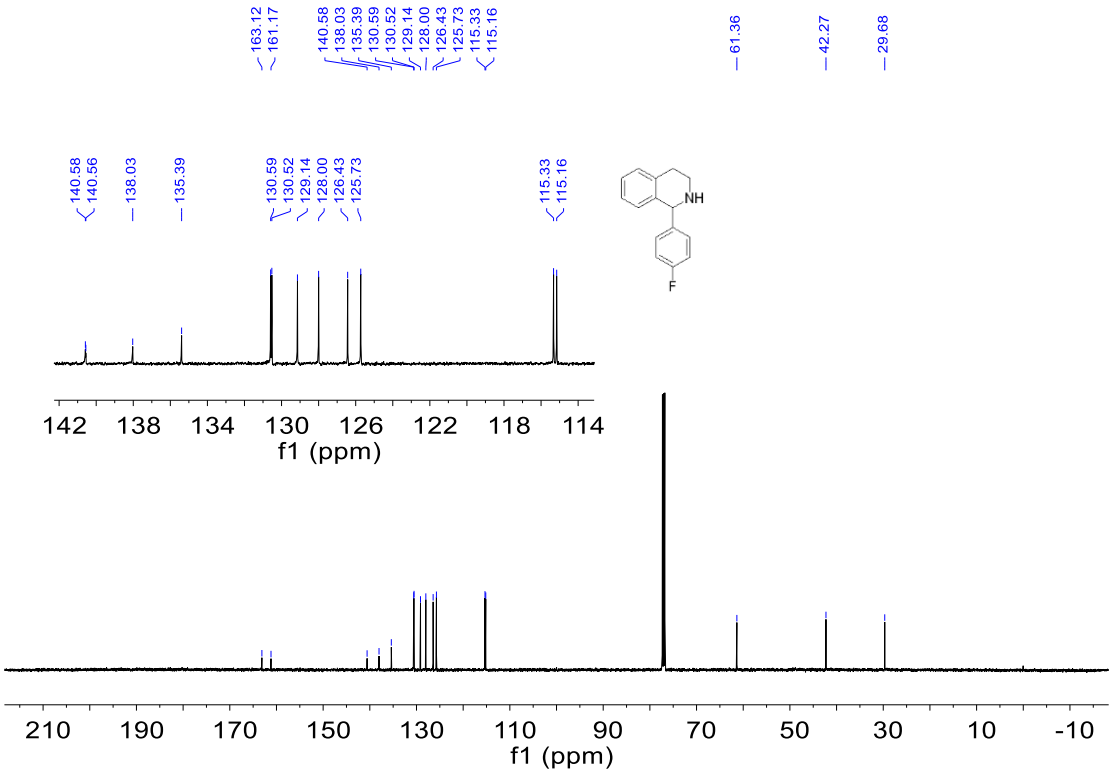

$^{13}$C NMR for **4c** (126 MHz, $CDCl_3$)



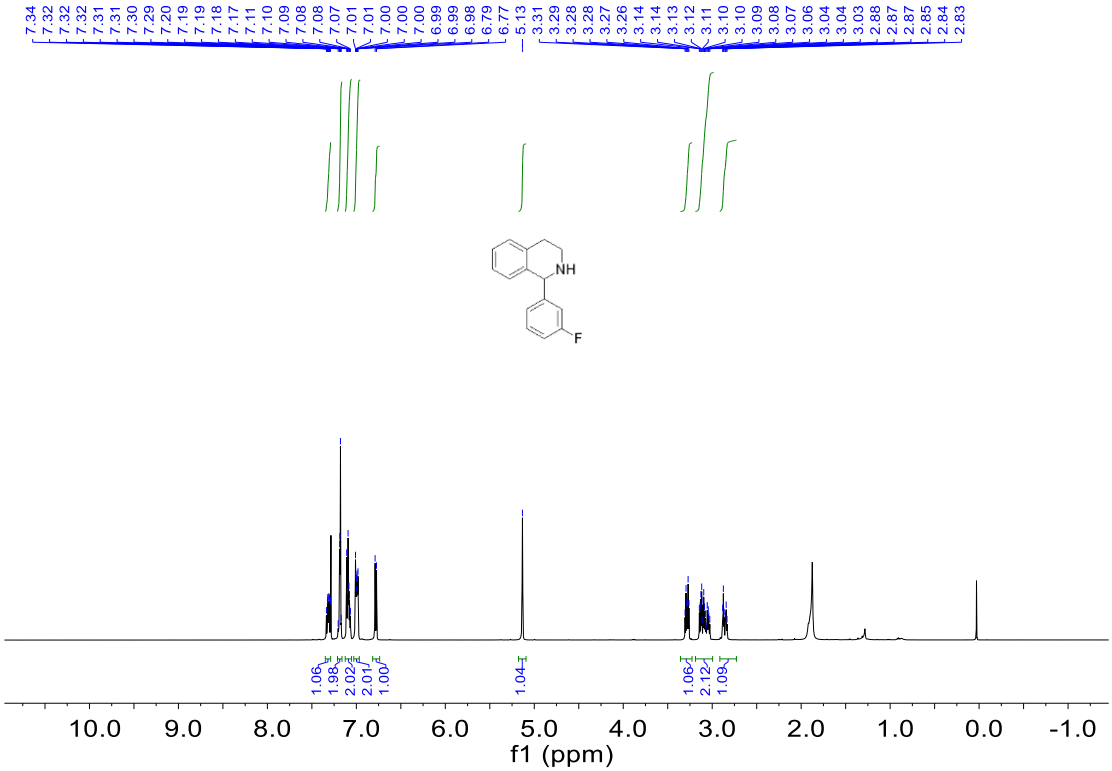
$^{1}$H NMR for **4d** (500 MHz, $CDCl_3$)



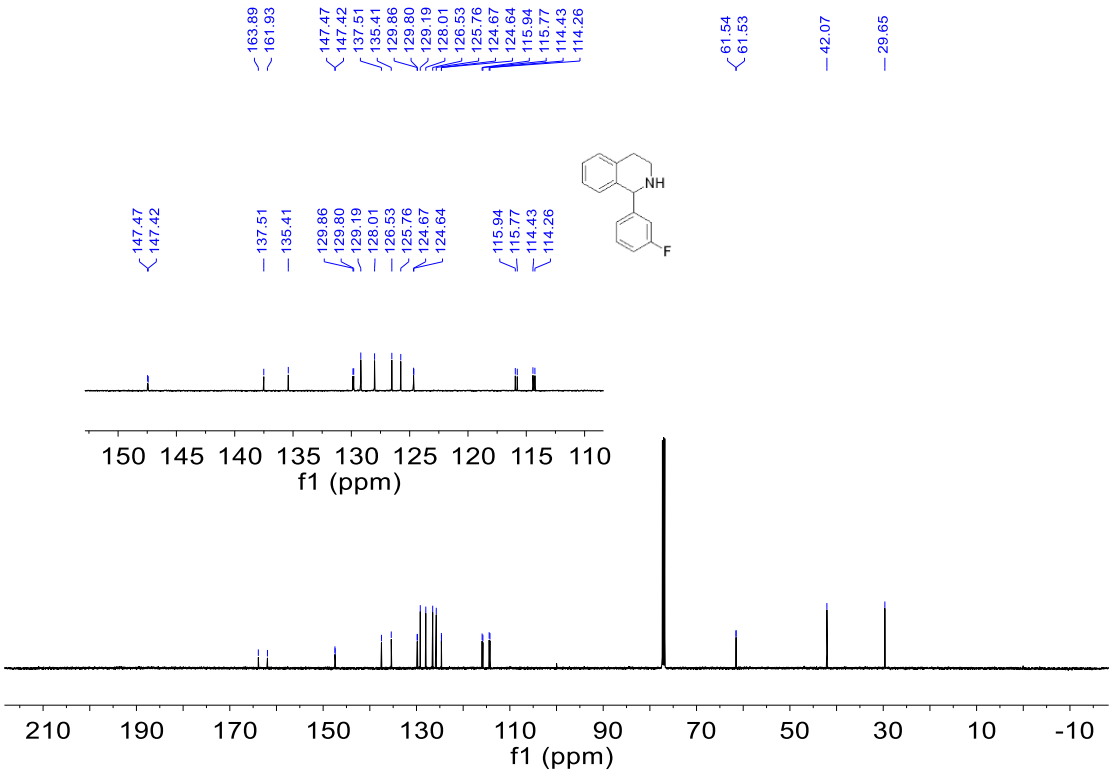

$^{13}$C NMR for **4d** (126 MHz, $CDCl_3$)



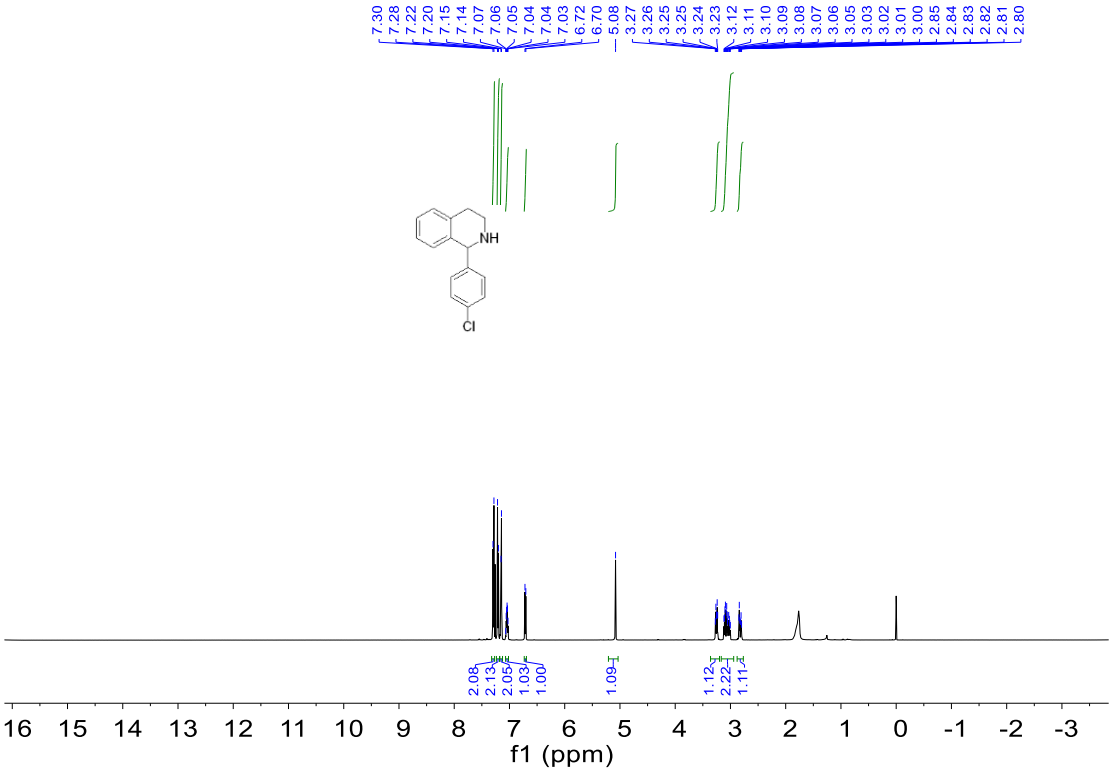
$^{1}$H NMR for **4e** (500 MHz, $CDCl_3$)



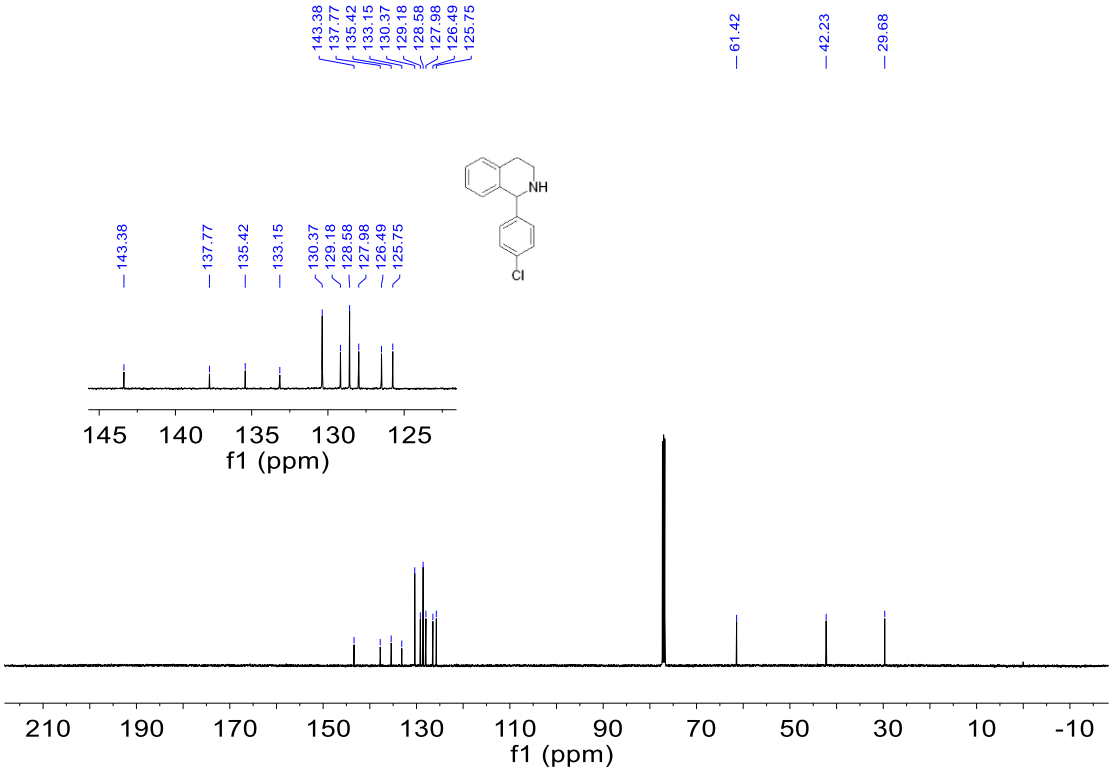

$^{13}$C NMR for **4e** (126 MHz, $CDCl_3$)



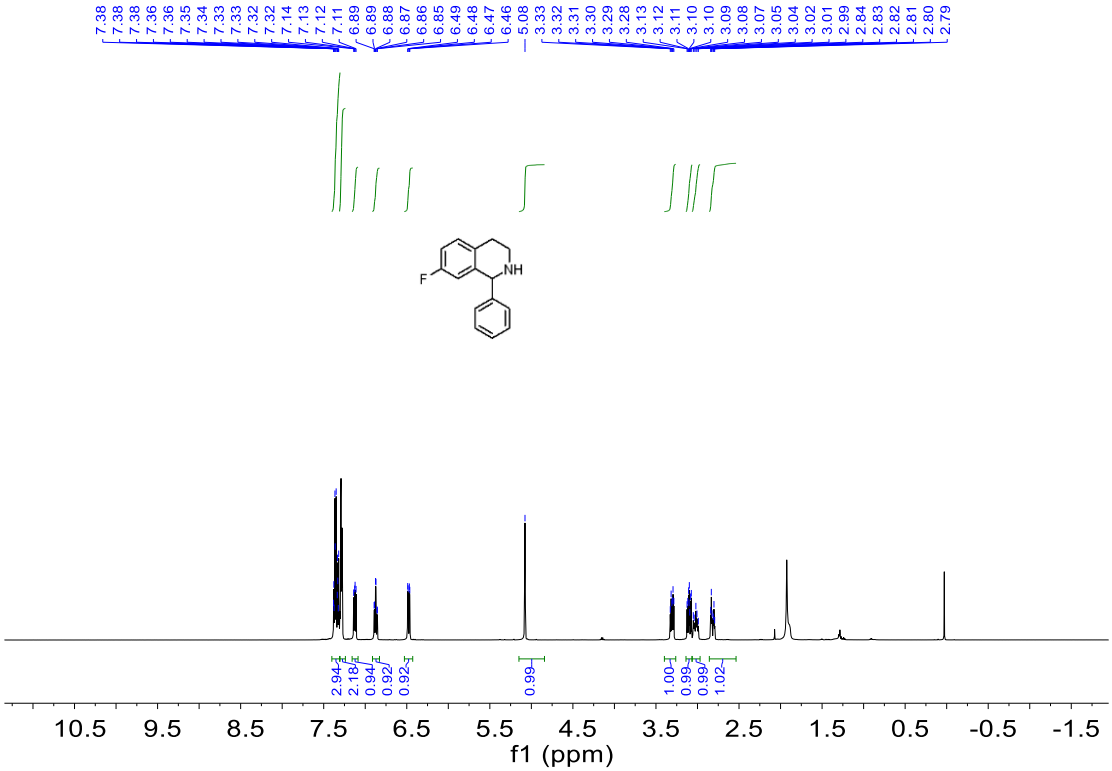
$^{1}$H NMR for **4f** (500 MHz, $CDCl_3$)



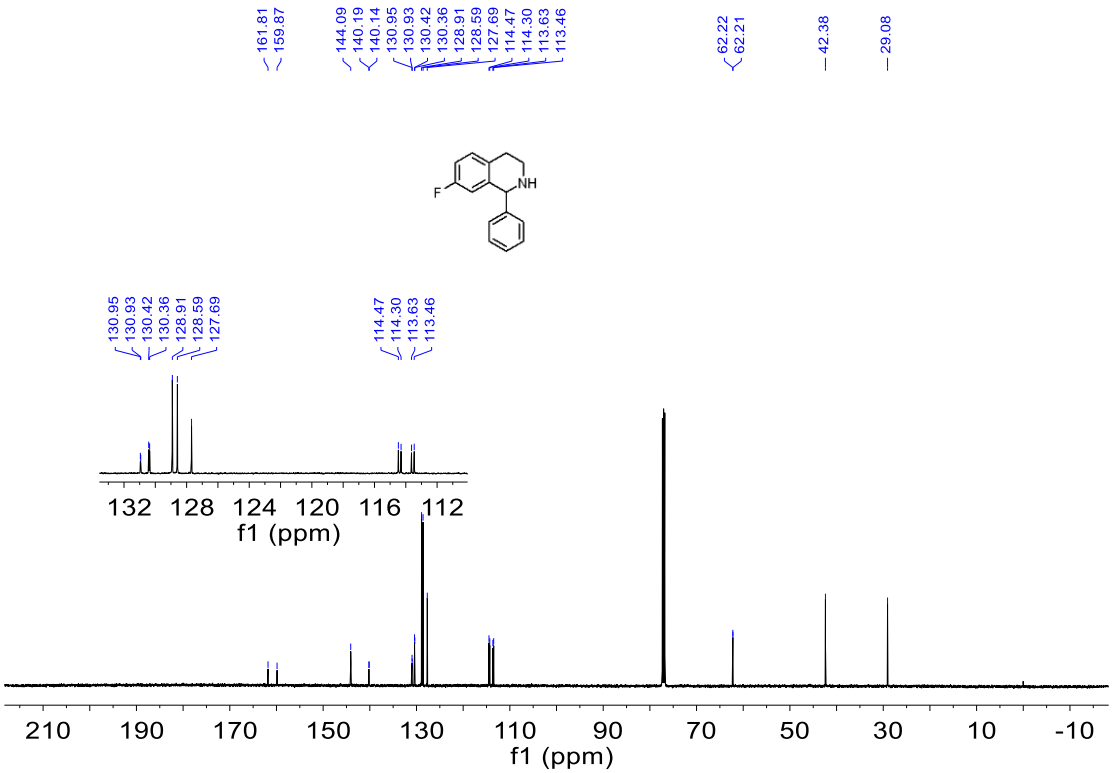

$^{13}$C NMR for **4f** (126 MHz, $CDCl_3$)



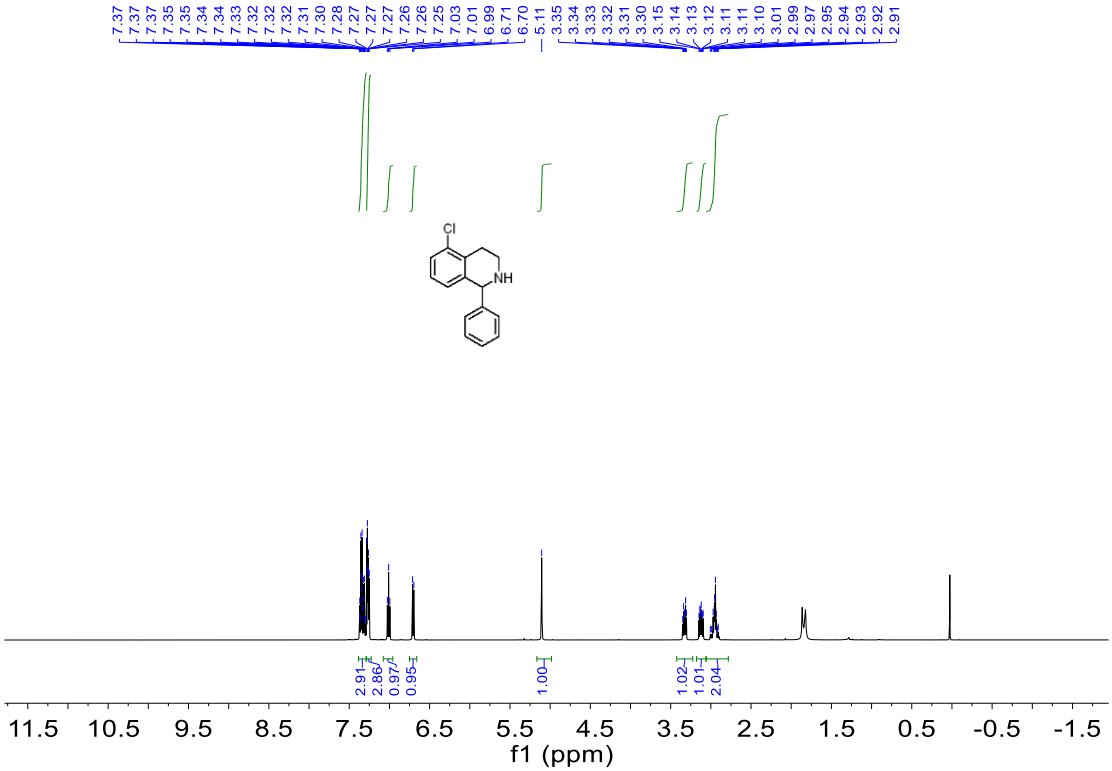
$^{1}$H NMR for **4g** (500 MHz, $CDCl_3$)



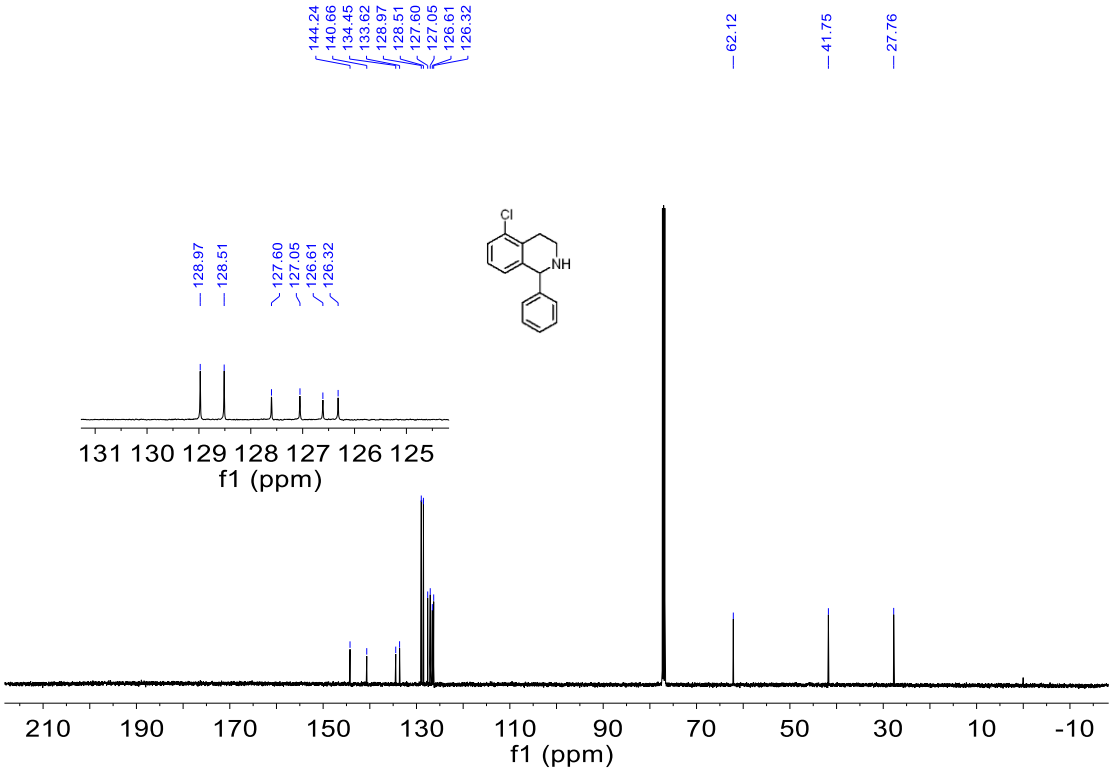

$^{13}$C NMR for **4g** (126 MHz, $CDCl_3$)



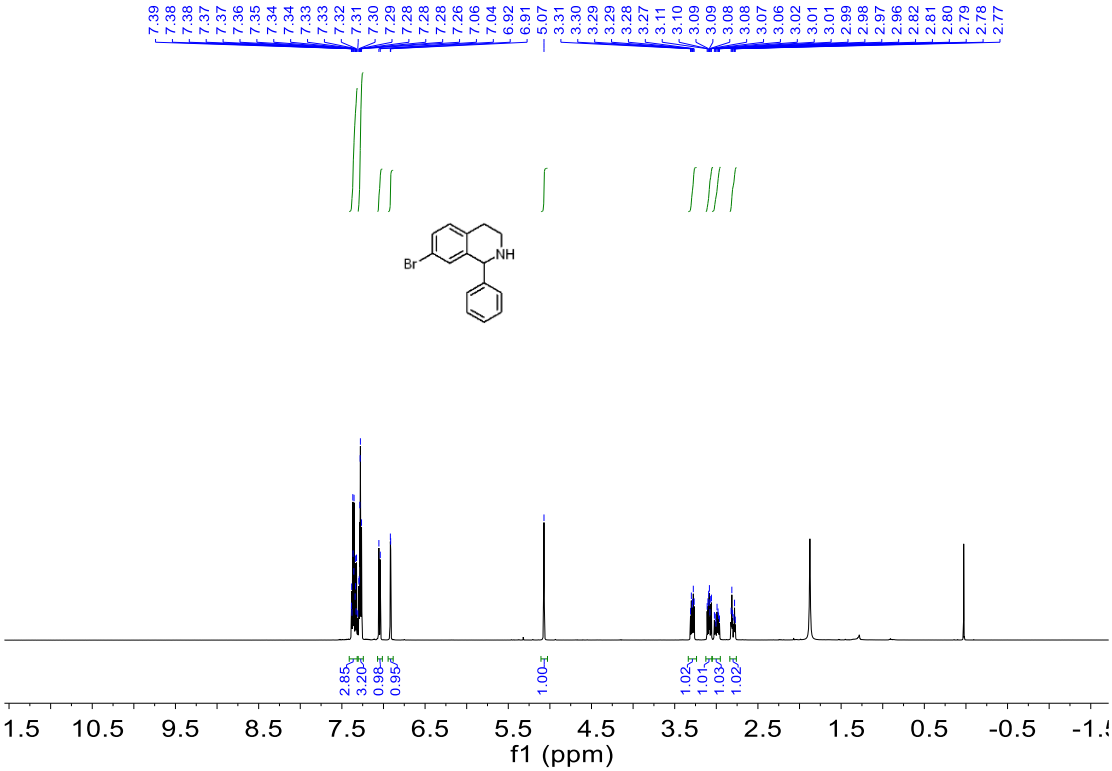
$^{1}$H NMR for **4h** (500 MHz, $CDCl_3$)



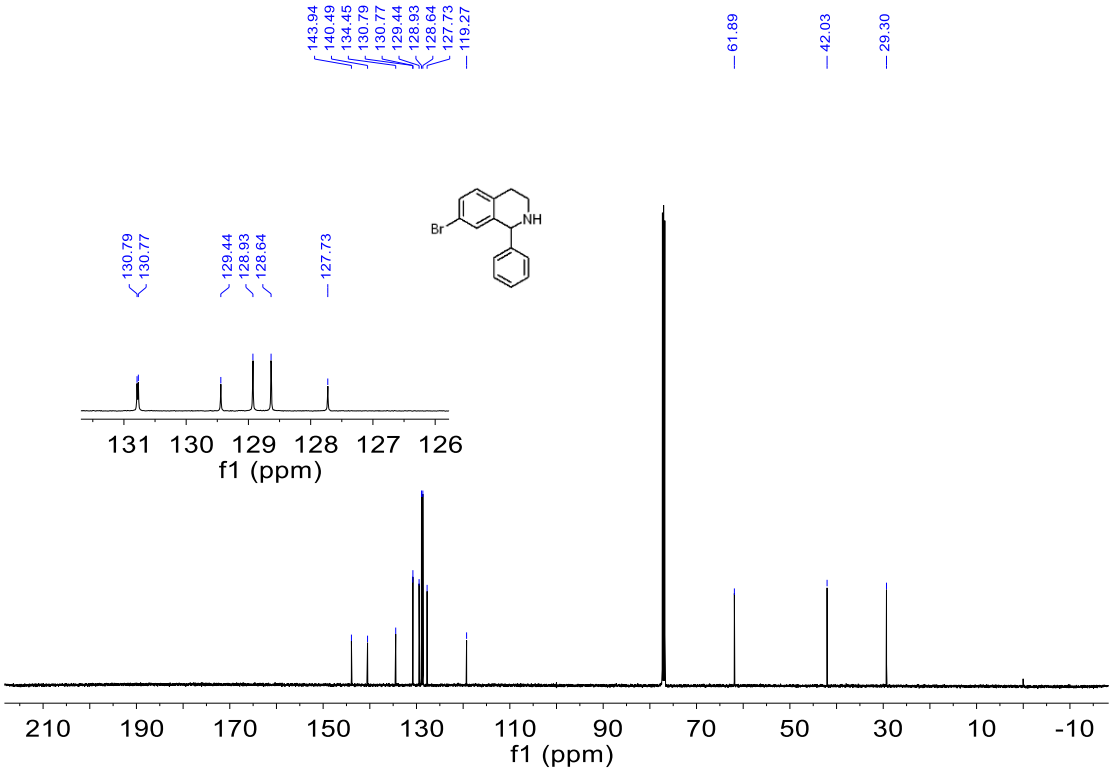

$^{13}$C NMR for **4h** (126 MHz, $CDCl_3$)



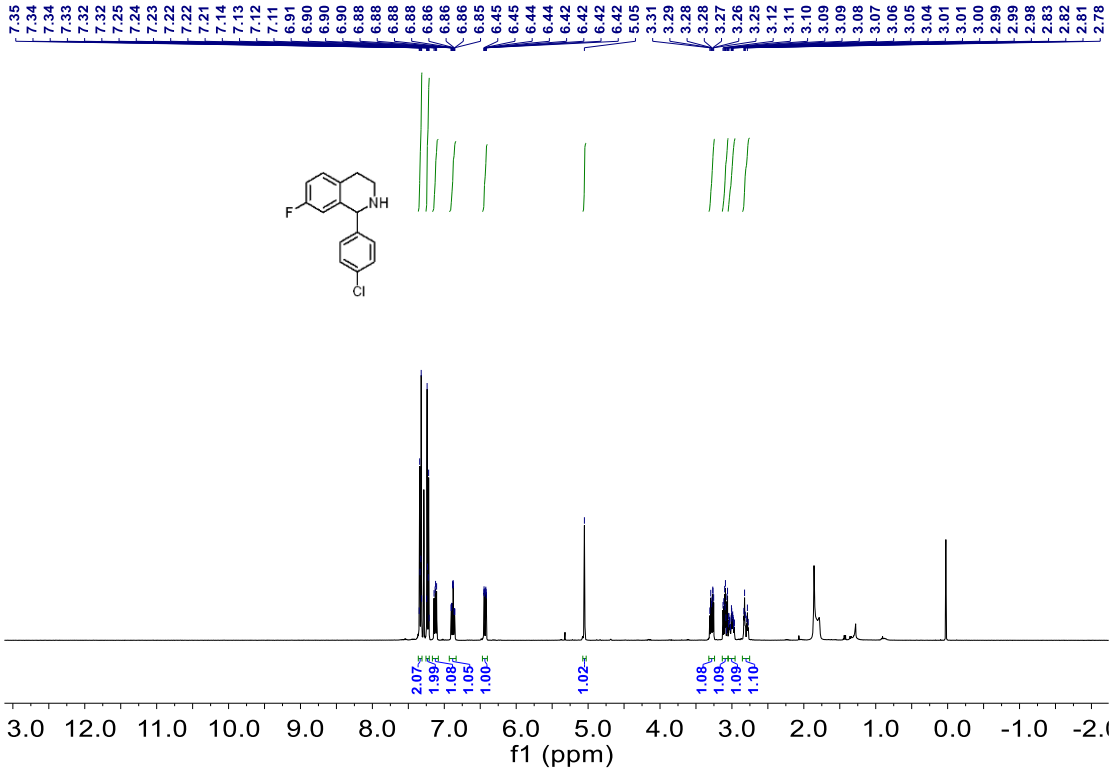
$^{1}$H NMR for **4i** (500 MHz, $CDCl_3$)



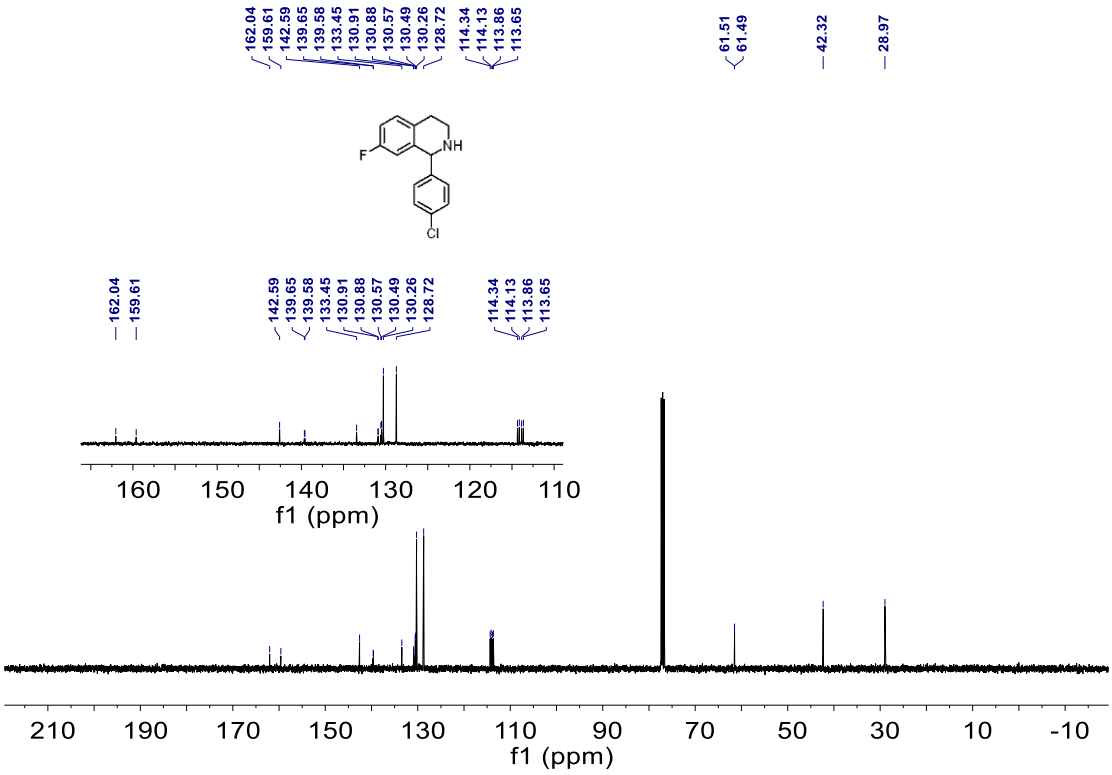

$^{13}$C NMR for **4i** (126 MHz, $CDCl_3$)



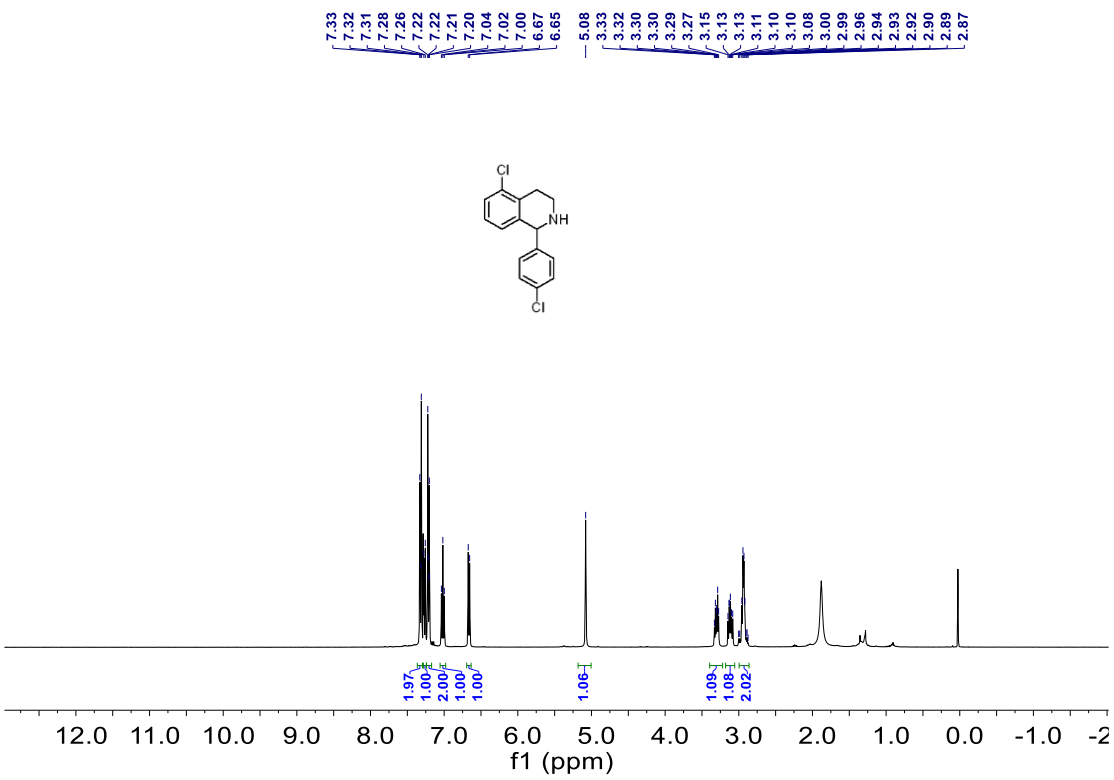
$^{1}$H NMR for **4j** (400 MHz, $CDCl_3$)



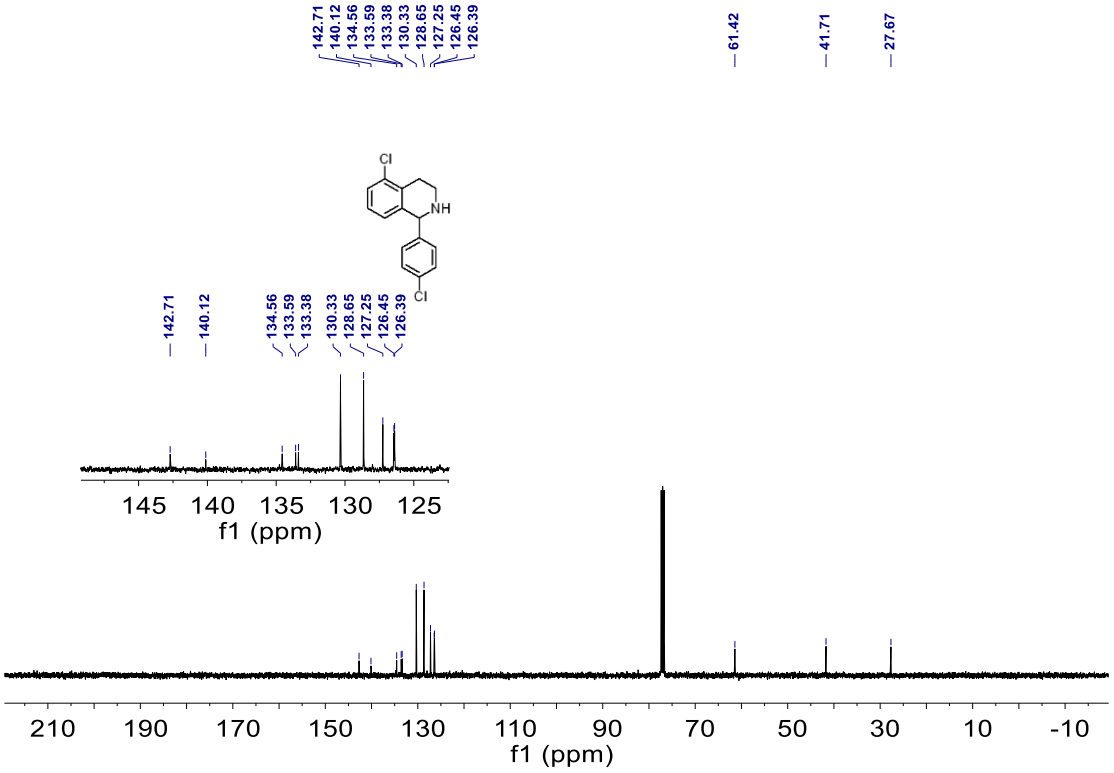

$^{13}$C NMR for **4j** (101 MHz, $CDCl_3$)



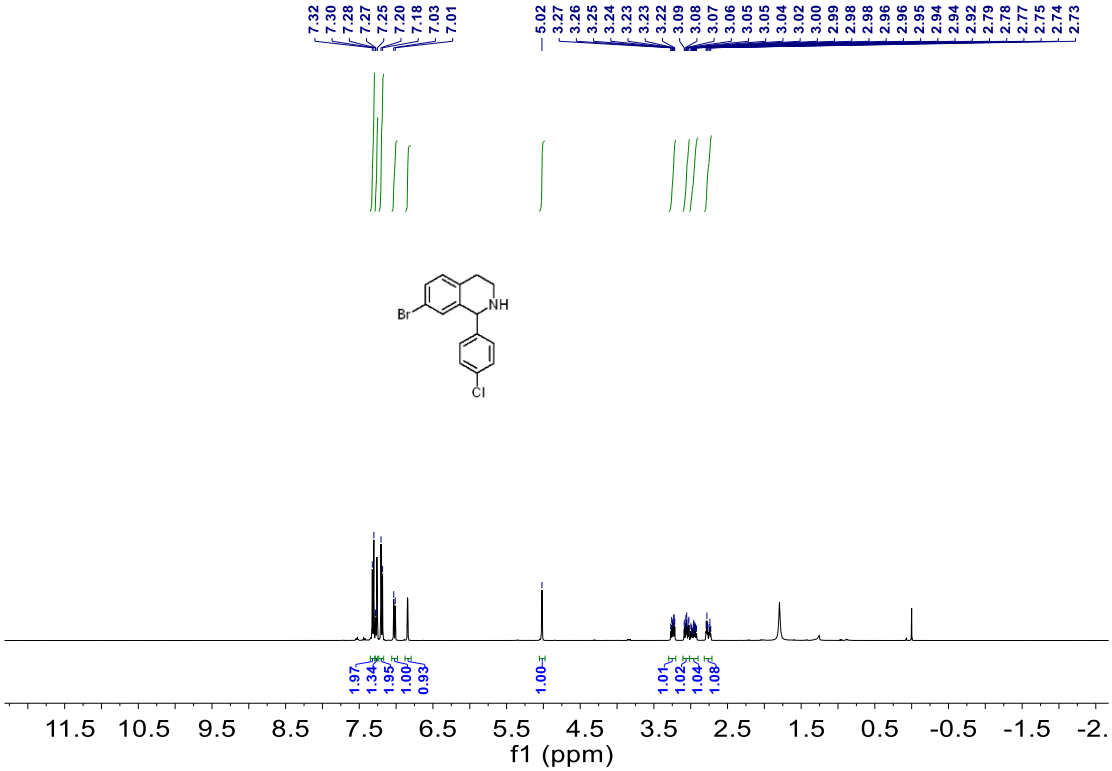
$^{1}$H NMR for **4k** (400 MHz, $CDCl_3$)



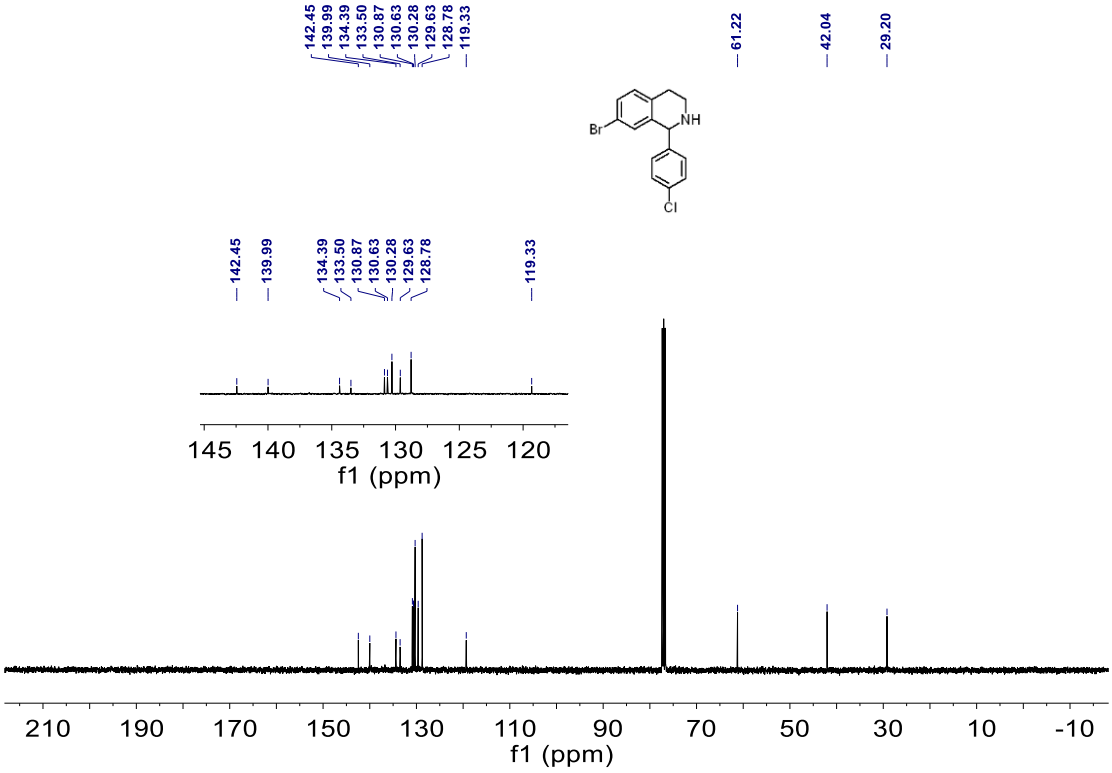

$^{13}$C NMR for **4k** (101 MHz, $CDCl_3$)



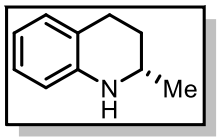
$^{1}$H NMR for **4l** (400 MHz, $CDCl_3$)




$^{13}$C NMR for **4l** (101 MHz, $CDCl_3$)



## 6. HPLC spectra

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Last changed    : 8/28/2017 7:39:16 PM by SYSTEM
Additional Info : Peak(s) manually integrated
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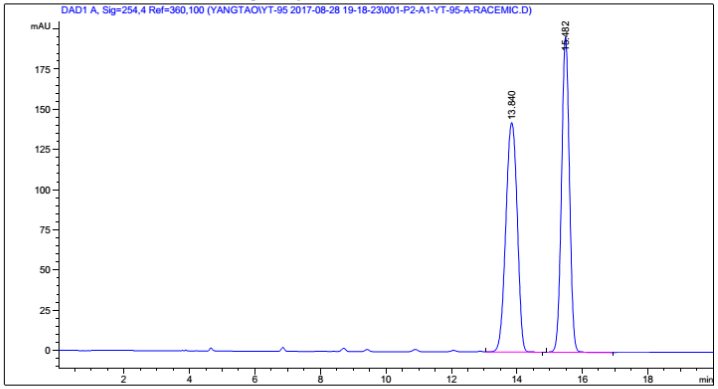


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Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: DAD1 A, Sig=254,4 Ref=360,100

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|-------|
   1  13.840 BB    0.3895 3446.49146  142.85660  51.1500
   2  15.482 BB    0.2617 3291.51367  196.20607  48.8500

Totals :                  6738.00513  339.06267
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Last changed    : 8/28/2017 7:20:18 PM by SYSTEM
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Additional Info : Peak(s) manually integrated
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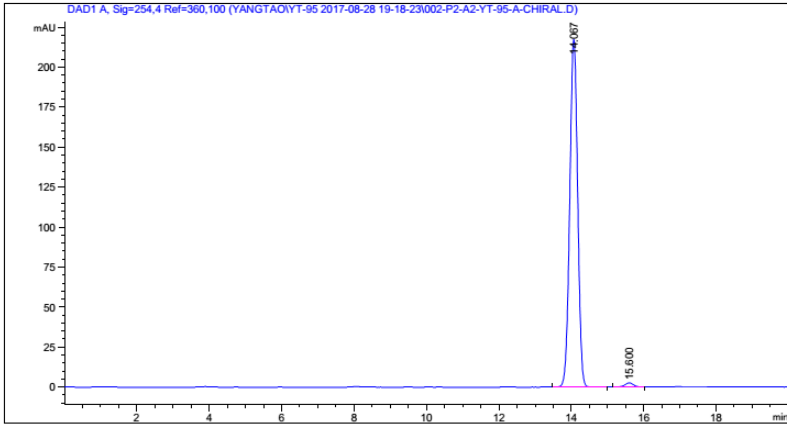


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                        Area Percent Report
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Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: DAD1 A, Sig=254,4 Ref=360,100

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|-------|
   1  14.067 BB    0.2366 3294.90479  217.66071  98.7278
   2  15.600 BB    0.2529   42.45958    2.59480   1.2722

Totals :                  3337.36437  220.25550
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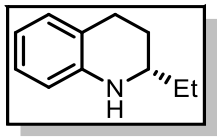


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Injection Date  : 8/28/2017 8:00:53 PM             Inj :   1
                                               Inj Volume : 1.000 µl
Acq. Method     : d:\Chem32\1\Data\YANGTAO\YT-95 2017-08-28 19-18-23\YT-OJ-H-95-5-0.8-25MIN.M
Last changed    : 8/28/2017 7:20:18 PM by SYSTEM
Analysis Method : d:\Chem32\1\Data\YANGTAO\YT-95 2017-08-28 19-18-23\YT-OJ-H-95-5-0.8-25MIN.M
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Last changed    : 8/28/2017 7:39:16 PM by SYSTEM
Additional Info : Peak(s) manually integrated
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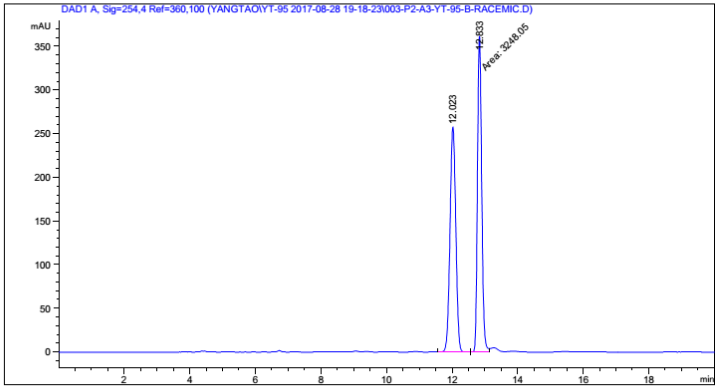


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Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: DAD1 A, Sig=254,4 Ref=360,100

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1  12.023 BB    0.1911 3162.80713  257.87521  49.3352
   2  12.833 MF    0.1497 3248.04736  361.58081  50.6648

Totals :                  6410.85449  619.45602
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Injection Date  : 8/28/2017 8:21:43 PM             Inj :   1
                                               Inj Volume : 1.000 µl
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Last changed    : 8/28/2017 7:20:18 PM by SYSTEM
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Last changed    : 8/28/2017 7:39:16 PM by SYSTEM
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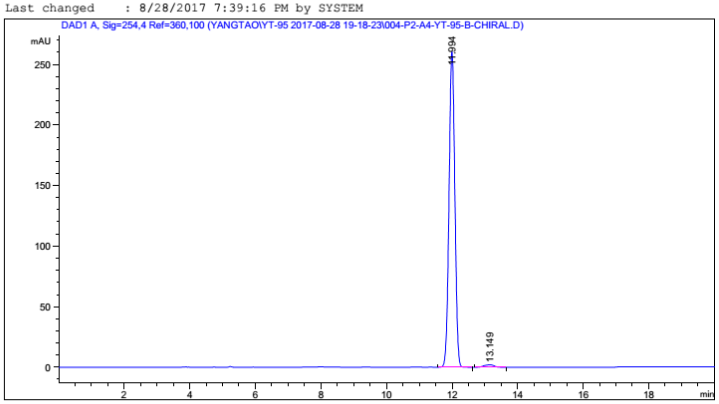


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                      Area Percent Report
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Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: DAD1 A, Sig=254,4 Ref=360,100

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1  11.994 BB    0.1915 3206.67578  260.70264  98.6392
   2  13.149 BB    0.3056   44.23962    2.17210   1.3608

Totals :                  3250.91540  262.87473
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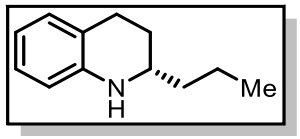


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Acq. Operator   : SYSTEM                        Seq. Line :   5
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Injection Date  : 8/28/2017 8:42:31 PM             Inj :   1
                                               Inj Volume : 1.000 µl
Acq. Method     : d:\Chem32\1\Data\YANGTAO\YT-95 2017-08-28 19-18-23\YT-OJ-H-95-5-0.8-25MIN.M
Last changed    : 8/28/2017 7:20:18 PM by SYSTEM
Analysis Method : d:\Chem32\1\Data\YANGTAO\YT-95 2017-08-28 19-18-23\YT-OJ-H-95-5-0.8-25MIN.M
                  (Sequence Method)
Last changed    : 8/28/2017 7:39:16 PM by SYSTEM
Additional Info : Peak(s) manually integrated
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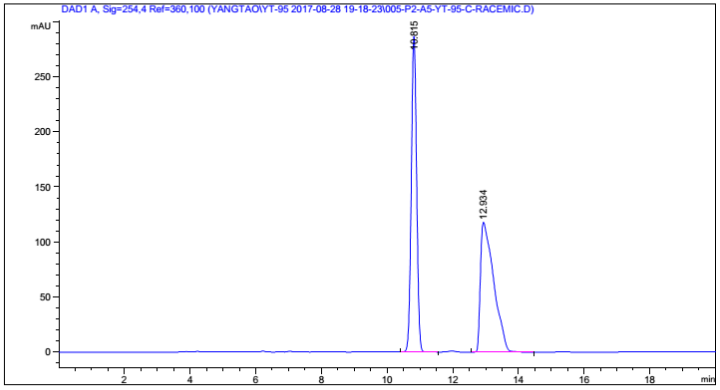


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Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: DAD1 A, Sig=254,4 Ref=360,100

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1  10.815 BB    0.1753 3230.56714  286.95975  49.4417
   2  12.934 BB    0.3785 3303.53076  118.05826  50.5583

Totals :                  6534.09790  405.01801
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```
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Acq. Instrument : 1260-DAD                      Location :   P2-A-06
Injection Date  : 8/28/2017 9:30:16 PM             Inj :   1
                                               Inj Volume : 1.000 µl
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                  .M
Last changed    : 8/28/2017 9:31:36 PM by SYSTEM
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Analysis Method : d:\Chem32\1\Data\YANGTAO\YT-95-2 2017-08-28 21-28-40\YT-OJ-H-95-5-0.8-25MIN
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Additional Info : Peak(s) manually integrated
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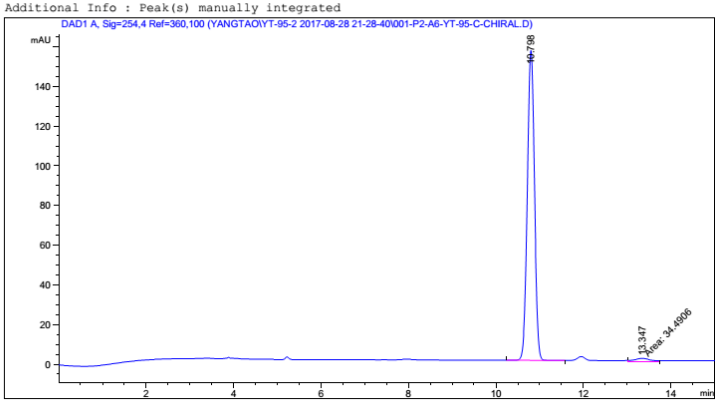


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Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: DAD1 A, Sig=254,4 Ref=360,100

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1  10.798 BB    0.1755 1760.91272  156.17355  98.0790
   2  13.347 MM    0.3893   34.49057    1.47654   1.9210

Totals :                  1795.40329  157.65010
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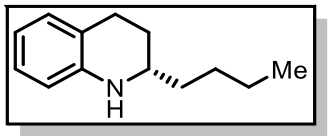


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                                              Inj Volume : 1.000 µl
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                  .M
Last changed    : 8/28/2017 9:31:36 PM by SYSTEM
Analysis Method : d:\Chem32\1\Data\YANGTAO\YT-95-2 2017-08-28 21-28-40\YT-OJ-H-95-5-0.8-25MIN
                  .M (Sequence Method)
Last changed    : 8/28/2017 9:45:19 PM by SYSTEM
Additional Info : Peak(s) manually integrated
```
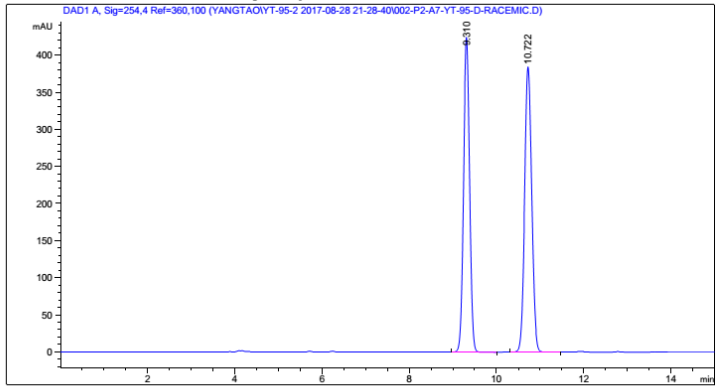
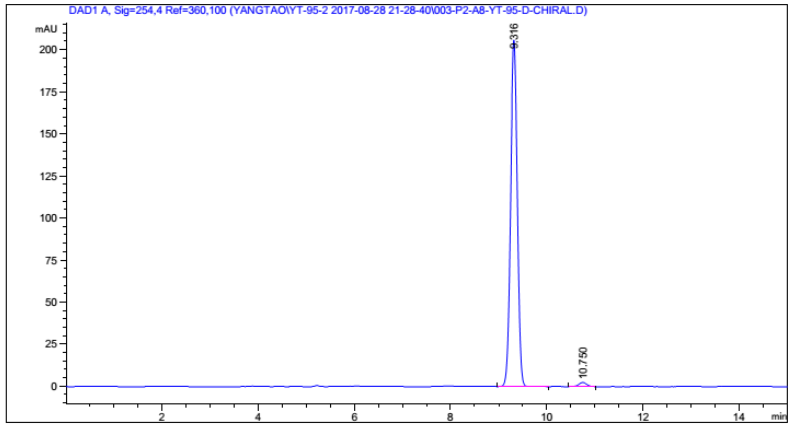



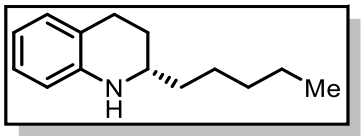

```
=====================================================================
                        Area Percent Report
=====================================================================

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


Signal 1: DAD1 A, Sig=254,4 Ref=360,100

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1   9.310 BB    0.1507 4099.13672  424.23398  48.5858
   2  10.722 BB    0.1757 4337.75781  384.38669  51.4142

Totals :                  8436.89453  808.62067
```



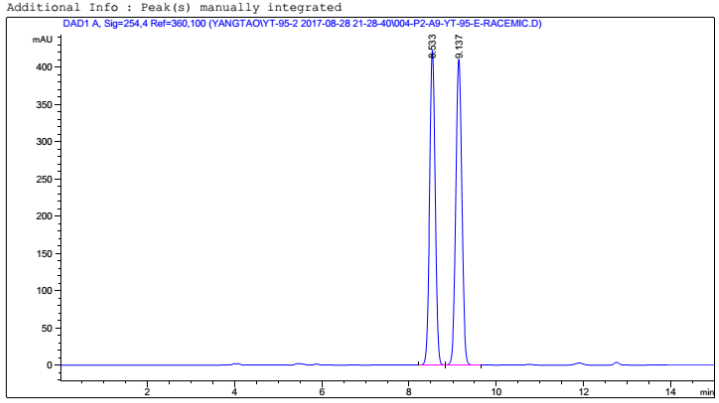
```
Acq. Operator   : SYSTEM                       Seq. Line :   3
Acq. Instrument : 1260-DAD                     Location :   P2-A-08
Injection Date  : 8/28/2017 10:01:56 PM            Inj :   1
                                              Inj Volume : 1.000 µl
Acq. Method     : d:\Chem32\1\Data\YANGTAO\YT-95-2 2017-08-28 21-28-40\YT-OJ-H-95-5-0.8-25MIN
                  .M
Last changed    : 8/28/2017 9:31:36 PM by SYSTEM
Analysis Method : d:\Chem32\1\Data\YANGTAO\YT-95-2 2017-08-28 21-28-40\YT-OJ-H-95-5-0.8-25MIN
                  .M (Sequence Method)
Last changed    : 8/28/2017 9:45:19 PM by SYSTEM
```




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

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


Signal 1: DAD1 A, Sig=254,4 Ref=360,100

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1   9.316 BB    0.1510 1998.36145  206.25394  98.6379
   2  10.750 BB    0.1750   27.59562    2.45815   1.3621

Totals :                  2025.95707  208.71209
```

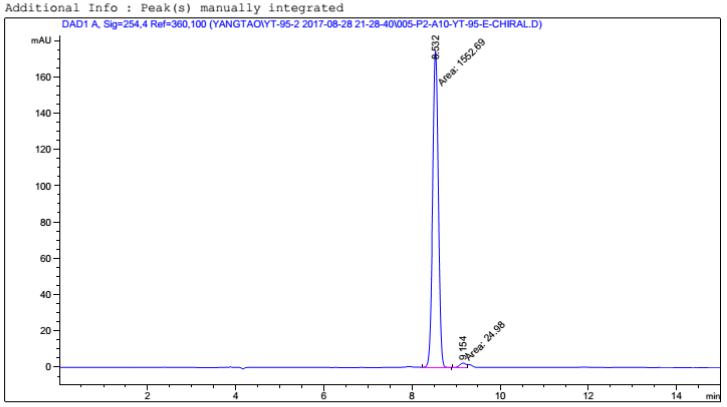



```
Acq. Operator   : SYSTEM                       Seq. Line :   4
Acq. Instrument : 1260-DAD                     Location :   P2-A-09
Injection Date  : 8/28/2017 10:17:45 PM            Inj :   1
                                              Inj Volume : 1.000 µl
Acq. Method     : d:\Chem32\1\Data\YANGTAO\YT-95-2 2017-08-28 21-28-40\YT-OJ-H-95-5-0.8-25MIN
                  .M
Last changed    : 8/28/2017 9:31:36 PM by SYSTEM
Analysis Method : d:\Chem32\1\Data\YANGTAO\YT-95-2 2017-08-28 21-28-40\YT-OJ-H-95-5-0.8-25MIN
                  .M (Sequence Method)
Last changed    : 8/28/2017 9:45:19 PM by SYSTEM
Additional Info : Peak(s) manually integrated
```

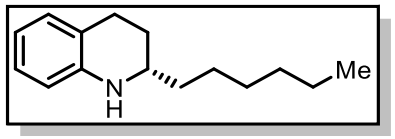



```
=====================================================================
                      Area Percent Report
=====================================================================

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


Signal 1: DAD1 A, Sig=254,4 Ref=360,100

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1   8.533 BB    0.1371 3732.47144  422.28940  48.6869
   2   9.137 BB    0.1496 3933.79907  411.10553  51.3131

Totals :                  7666.27051  833.39493
```

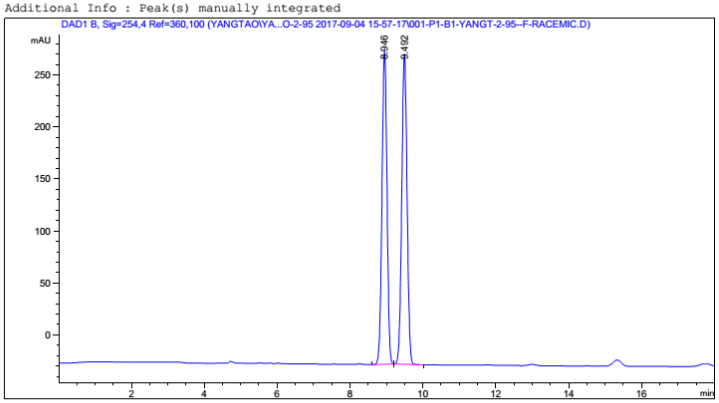
```
Acq. Operator   : SYSTEM                       Seq. Line :   5
Acq. Instrument : 1260-DAD                     Location :   P2-A-10
Injection Date  : 8/28/2017 10:33:35 PM            Inj :   1
                                              Inj Volume : 1.000 µl
Acq. Method     : d:\Chem32\1\Data\YANGTAO\YT-95-2 2017-08-28 21-28-40\YT-OJ-H-95-5-0.8-25MIN
                  .M
Last changed    : 8/28/2017 9:31:36 PM by SYSTEM
Analysis Method : d:\Chem32\1\Data\YANGTAO\YT-95-2 2017-08-28 21-28-40\YT-OJ-H-95-5-0.8-25MIN
                  .M (Sequence Method)
Last changed    : 8/28/2017 9:45:19 PM by SYSTEM
Additional Info : Peak(s) manually integrated
```




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

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


Signal 1: DAD1 A, Sig=254,4 Ref=360,100

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1   8.532 MM    0.1482 1552.69312  174.59900  98.4167
   2   9.154 MF    0.1747   24.98001    2.38271   1.5833

Totals :                  1577.67313  176.98171
```

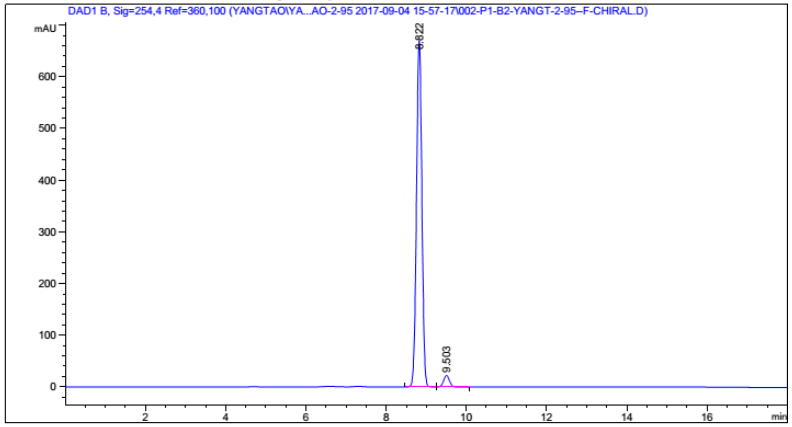



```
Acq. Operator   : SYSTEM                        Seq. Line :   1
Acq. Instrument : 1260-DAD                      Location :   P1-B-01
Injection Date  : 9/4/2017 3:59:59 PM              Inj :   1
                                               Inj Volume : 1.000 µl
Method          : d:\Chem32\1\Data\YANGTAO\YANGTAO-2-95 2017-09-04 15-57-17\YTANT-OJ-H-95-5-
                  08-18MIN.M (Sequence Method)
Last changed    : 7/26/2017 8:52:36 PM by SYSTEM
Additional Info : Peak(s) manually integrated
```

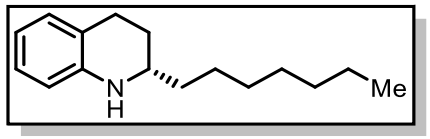



```
=====================================================================
                        Area Percent Report
=====================================================================

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


Signal 1: DAD1 B, Sig=254,4 Ref=360,100

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1   8.946 BB    0.1494 2878.97217  301.56345  48.8704
   2   9.492 BB    0.1576 3012.06372  298.70081  51.1296

Totals :                  5891.03589  600.26425
```

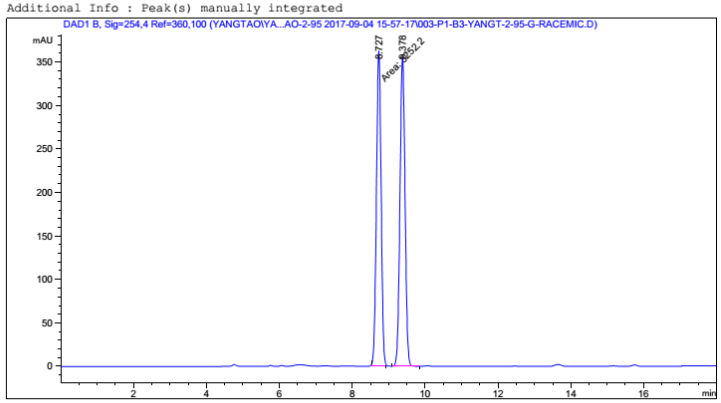
```
Acq. Operator   : SYSTEM                        Seq. Line :   2
Acq. Instrument : 1260-DAD                      Location :   P1-B-02
Injection Date  : 9/4/2017 4:18:50 PM              Inj :   1
                                               Inj Volume : 1.000 µl
Method          : d:\Chem32\1\Data\YANGTAO\YANGTAO-2-95 2017-09-04 15-57-17\YTANT-OJ-H-95-5-
                  08-18MIN.M (Sequence Method)
Last changed    : 7/26/2017 8:52:36 PM by SYSTEM
Additional Info : Peak(s) manually integrated
```




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

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


Signal 1: DAD1 B, Sig=254,4 Ref=360,100

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1   8.822 BB    0.1446 6252.17090  671.92316  96.4884
   2   9.503 BB    0.1591  227.54153   22.28694   3.5116

Totals :                  6479.71243  694.21010

=====================================================================
```

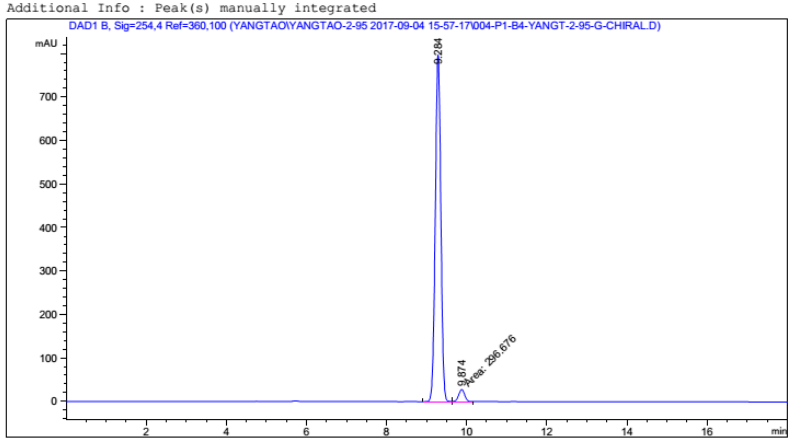



```
Acq. Operator   : SYSTEM                      Seq. Line :   3
Acq. Instrument : 1260-DAD                    Location :   P1-B-03
Injection Date  : 9/4/2017 4:37:41 PM             Inj :   1
                                            Inj Volume : 1.000 µl
Method          : d:\Chem32\1\Data\YANGTAO\YANGTAO-2-95 2017-09-04 15-57-17\YTANT-OJ-H-95-5-
                  08-18MIN.M (Sequence Method)
Last changed    : 7/26/2017 8:52:36 PM by SYSTEM
Additional Info : Peak(s) manually integrated
```

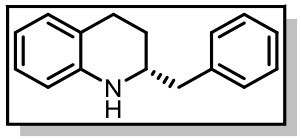



```
================================================================================
                            Area Percent Report
================================================================================

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


Signal 1: DAD1 B, Sig=254,4 Ref=360,100

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1   8.727 FM    0.1494 3252.19727  362.90979  48.5648
   2   9.378 BB    0.1511 3444.41992  355.45142  51.4352

Totals :                  6696.61719  718.36121
```

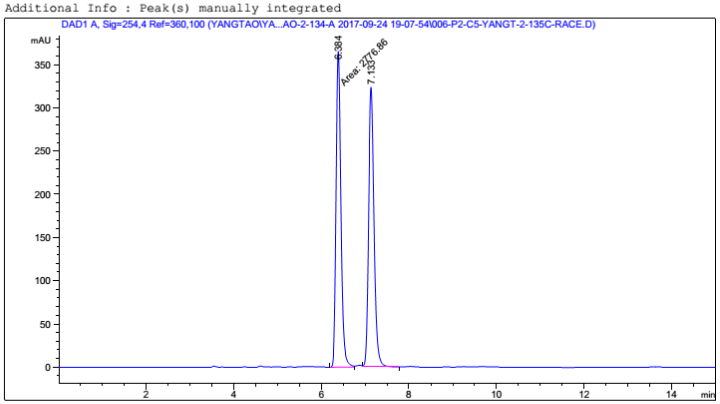
```
Acq. Operator   : SYSTEM                      Seq. Line :   4
Acq. Instrument : 1260-DAD                    Location :   P1-B-04
Injection Date  : 9/4/2017 4:56:32 PM             Inj :   1
                                            Inj Volume : 1.000 µl
Method          : d:\Chem32\1\Data\YANGTAO\YANGTAO-2-95 2017-09-04 15-57-17\YTANT-OJ-H-95-5-
                  08-18MIN.M (Sequence Method)
Last changed    : 7/26/2017 8:52:36 PM by SYSTEM
Additional Info : Peak(s) manually integrated
```




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

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


Signal 1: DAD1 B, Sig=254,4 Ref=360,100

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1   9.284 BV    0.1502 7673.83252  797.75934  96.2778
   2   9.874 MF    0.1758  296.67639   28.11973   3.7222

Totals :                  7970.50891  825.87907
```

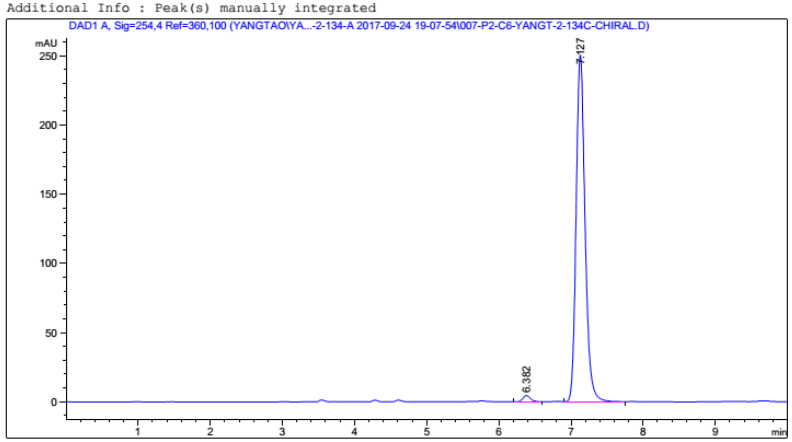


```
Acq. Operator   : SYSTEM                        Seq. Line :   6
Acq. Instrument : 1260-DAD                       Location :   P2-C-05
Injection Date  : 9/24/2017 8:27:54 PM               Inj :   1
                                               Inj Volume : 1.000 µl
Acq. Method     : d:\Chem32\1\Data\YANGTAO\YANGTAO-2-134-A 2017-09-24 19-07-54\YT-OD-H-85-15-
                  0.8-15MIN.M
Last changed    : 9/24/2017 7:08:18 PM by SYSTEM
Analysis Method : d:\Chem32\1\Data\YANGTAO\YANGTAO-2-134-A 2017-09-24 19-07-54\YT-OD-H-85-15-
                  0.8-15MIN.M (Sequence Method)
Last changed    : 9/24/2017 8:53:46 PM by SYSTEM
Additional Info : Peak(s) manually integrated
```

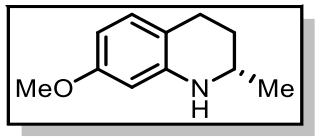



```
================================================================================
                            Area Percent Report
================================================================================

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


Signal 1: DAD1 A, Sig=254,4 Ref=360,100

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1   6.384 MF    0.1265 2776.85693  365.74756  49.8015
   2   7.133 VB    0.1328 2798.99072  324.06723  50.1985

Totals :                  5575.84766  689.81479
```

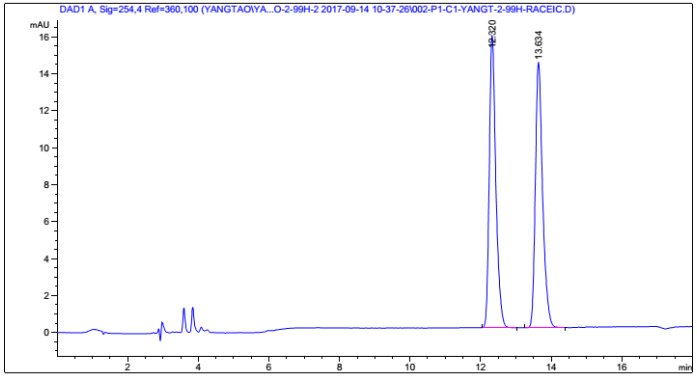
```
Acq. Operator   : SYSTEM                        Seq. Line :   7
Acq. Instrument : 1260-DAD                       Location :   P2-C-06
Injection Date  : 9/24/2017 8:43:44 PM               Inj :   1
                                               Inj Volume : 1.000 µl
Acq. Method     : d:\Chem32\1\Data\YANGTAO\YANGTAO-2-134-A 2017-09-24 19-07-54\YT-OD-H-85-15-
                  0.8-15MIN.M
Last changed    : 9/24/2017 8:51:34 PM by SYSTEM
                  (modified after loading)
Analysis Method : d:\Chem32\1\Data\YANGTAO\YANGTAO-2-134-A 2017-09-24 19-07-54\YT-OD-H-85-15-
                  0.8-15MIN.M (Sequence Method)
Last changed    : 9/24/2017 8:53:46 PM by SYSTEM
Additional Info : Peak(s) manually integrated
```




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

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


Signal 1: DAD1 A, Sig=254,4 Ref=360,100

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1   6.382 BB    0.1129   32.03716    4.40497   1.4682
   2   7.127 BB    0.1321 2150.08350  250.67177  98.5318

Totals :                  2182.12066  255.07674
```

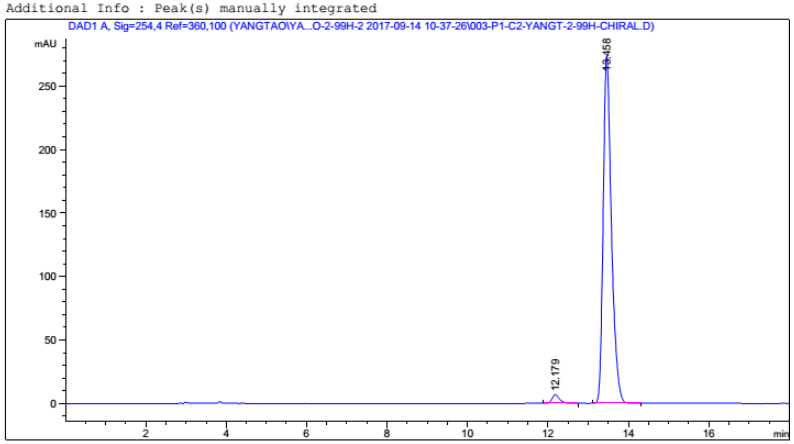



```
Acq. Operator   : SYSTEM                      Seq. Line :   2
Acq. Instrument : 1260-DAD                    Location :   P1-C-01
Injection Date  : 9/14/2017 11:11:13 AM           Inj :   2
                                            Inj Volume : 1.000 µl
Acq. Method     : d:\Chem32\1\Data\YANGTAO\YANGTAO-2-99H-2 2017-09-14 10-37-26\YT-AD-3-95-0.5
                  -30MIN.M
Last changed    : 9/14/2017 11:25:08 AM by SYSTEM
                  (modified after loading)
Analysis Method : d:\Chem32\1\Data\YANGTAO\YANGTAO-2-99H-2 2017-09-14 10-37-26\YT-AD-3-95-0.5
                  -30MIN.M (Sequence Method)
Last changed    : 9/14/2017 11:29:16 AM by SYSTEM
Additional Info : Peak(s) manually integrated
```

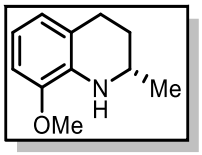



```
=====================================================================
                        Area Percent Report
=====================================================================

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


Signal 1: DAD1 A, Sig=254,4 Ref=360,100

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|-------|
   1  12.320 BB    0.1948  204.40359   15.81196  49.9192
   2  13.634 BB    0.2146  205.06554   14.36457  50.0808

Totals :                   409.46913   30.17653
```

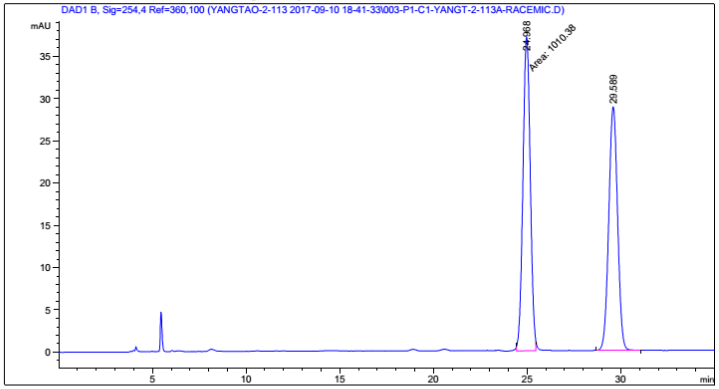
```
Acq. Operator   : SYSTEM                      Seq. Line :   3
Acq. Instrument : 1260-DAD                    Location :   P1-C-02
Injection Date  : 9/14/2017 11:30:04 AM           Inj :   1
                                            Inj Volume : 1.000 µl
Acq. Method     : d:\Chem32\1\Data\YANGTAO\YANGTAO-2-99H-2 2017-09-14 10-37-26\YT-AD-3-95-0.5
                  -30MIN.M
Last changed    : 9/14/2017 11:25:08 AM by SYSTEM
Analysis Method : d:\Chem32\1\Data\YANGTAO\YANGTAO-2-99H-2 2017-09-14 10-37-26\YT-AD-3-95-0.5
                  -30MIN.M (Sequence Method)
Last changed    : 9/14/2017 11:29:16 AM by SYSTEM
Additional Info : Peak(s) manually integrated
```




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

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


Signal 1: DAD1 A, Sig=254,4 Ref=360,100

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|-------|
   1  12.179 BB    0.1933   87.89921    6.86728   2.2018
   2  13.458 BB    0.2144 3904.32129  273.75671  97.7982

Totals :                  3992.22050  280.62399
```




Acq. Operator : SYSTEM Seq. Line : 3
Acq. Instrument : 1260-DAD Location : P1-C-01
Injection Date : 9/10/2017 19:51:52 Inj : 1
Inj Volume : 1.000 µl
Acq. Method : d:\Chem32\1\Data\YANGTAO-2-113 2017-09-10 18-41-33\YTANT-OJ-H-95-5-08-18MIN .M
Last changed : 9/10/2017 19:19:05 by SYSTEM
Analysis Method : d:\Chem32\1\Data\YANGTAO-2-113 2017-09-10 18-41-33\YTANT-OJ-H-95-5-08-18MIN .M (Sequence Method)
Last changed : 9/10/2017 19:51:03 by SYSTEM
Additional Info : Peak(s) manually integrated



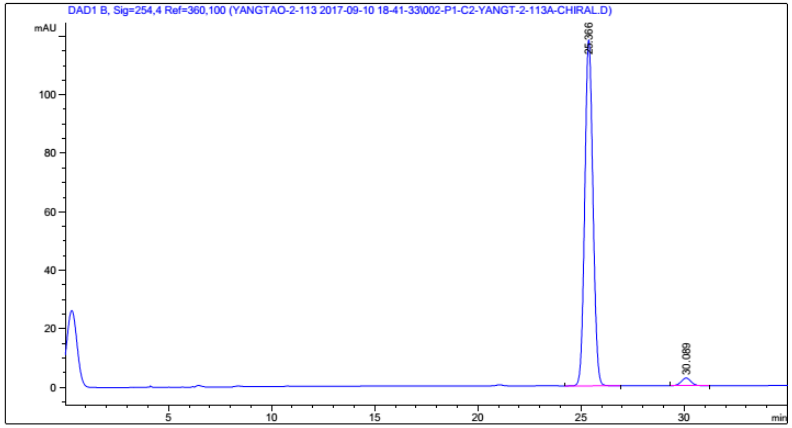

Area Percent Report

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

Signal 1: DAD1 B, Sig=254,4 Ref=360,100

| Peak # | RetTime [min] | Type | Width [min] | Area [mAU*s] | Height [mAU] | Area % |
|---|---|---|---|---|---|---|
| 1 | 24.968 | MF | 0.4532 | 1010.37897 | 37.15995 | 51.7472 |
| 2 | 29.589 | BB | 0.5132 | 942.15002 | 28.83801 | 48.2528 |
| Totals : | | | | 1952.52899 | 65.99796 | |

Acq. Operator : SYSTEM Seq. Line : 2
Acq. Instrument : 1260-DAD Location : P1-C-02
Injection Date : 9/10/2017 7:16:00 PM Inj : 1
Inj Volume : 1.000 µl
Acq. Method : d:\Chem32\1\Data\YANGTAO-2-113 2017-09-10 18-41-33\YTANT-OJ-H-95-5-08-18MIN .M
Last changed : 9/10/2017 7:19:05 PM by SYSTEM (modified after loading)
Analysis Method : d:\Chem32\1\Data\YANGTAO-2-113 2017-09-10 18-41-33\YTANT-OJ-H-95-5-08-18MIN .M (Sequence Method)
Last changed : 9/10/2017 7:51:03 PM by SYSTEM
Additional Info : Peak(s) manually integrated

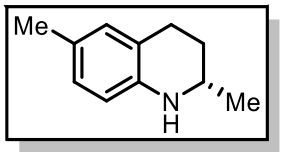



Area Percent Report

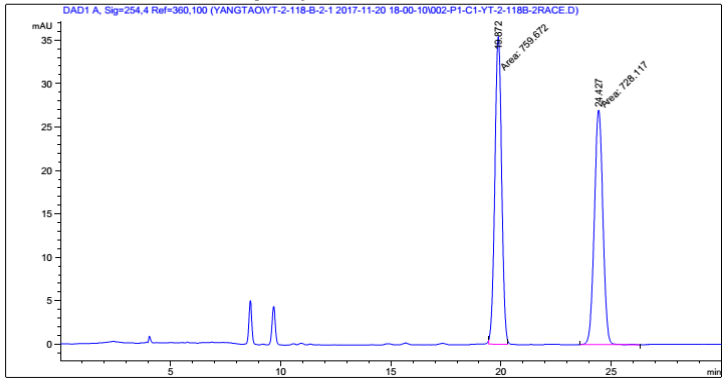
Sorted By : Signal
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: DAD1 B, Sig=254,4 Ref=360,100

| Peak # | RetTime [min] | Type | Width [min] | Area [mAU*s] | Height [mAU] | Area % |
|---|---|---|---|---|---|---|
| 1 | 25.366 | BB | 0.4300 | 3265.82690 | 118.31031 | 97.4480 |
| 2 | 30.089 | BB | 0.4753 | 85.52647 | 2.58967 | 2.5520 |
| Totals : | | | | 3351.35337 | 120.89998 | |

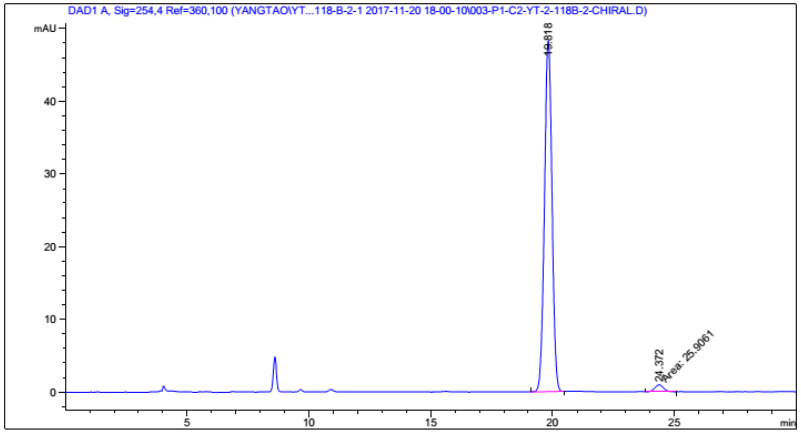



```
Acq. Operator   : SYSTEM                          Seq. Line :   2
Acq. Instrument : 1260-DAD                         Location :   P1-C-01
Injection Date  : 11/20/2017 18:41:53                 Inj :   2
                                                  Inj Volume : 1.000 µl
Acq. Method     : d:\Chem32\1\Data\YANGTAO\YT-2-118-B-2-1 2017-11-20 18-00-10\YT-OJ-H-95-5-0.
                  8-25MIN.M
Last changed    : 11/20/2017 19:09:05 by SYSTEM
                  (modified after loading)
Analysis Method : d:\Chem32\1\Data\YANGTAO\YT-2-118-B-2-1 2017-11-20 18-00-10\YT-OJ-H-95-5-0.
                  8-25MIN.M (Sequence Method)
Last changed    : 11/20/2017 19:11:56 by SYSTEM
Additional Info : Peak(s) manually integrated
```

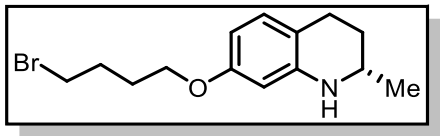



```
=====================================================================
                        Area Percent Report
=====================================================================

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


Signal 1: DAD1 A, Sig=254,4 Ref=360,100

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1  19.872 FM    0.3572  759.67212   35.44522  51.0605
   2  24.427 MM    0.4493  728.11670   27.00854  48.9395

Totals :                  1487.78882   62.45376
```

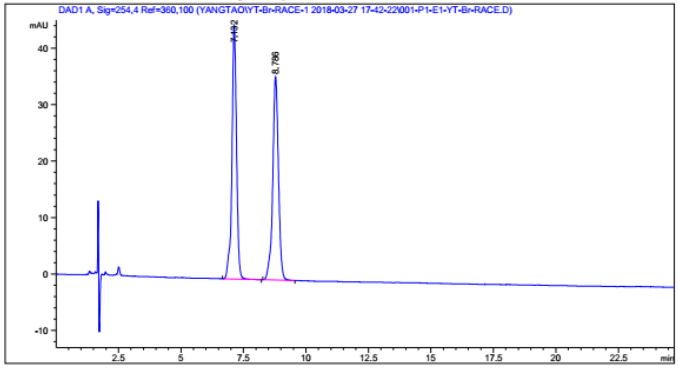
```
Acq. Operator   : SYSTEM                          Seq. Line :   3
Acq. Instrument : 1260-DAD                         Location :   P1-C-02
Injection Date  : 11/20/2017 19:12:44                 Inj :   1
                                                  Inj Volume : 1.000 µl
Acq. Method     : d:\Chem32\1\Data\YANGTAO\YT-2-118-B-2-1 2017-11-20 18-00-10\YT-OJ-H-95-5-0.
                  8-25MIN.M
Last changed    : 11/20/2017 19:09:05 by SYSTEM
Analysis Method : d:\Chem32\1\Data\YANGTAO\YT-2-118-B-2-1 2017-11-20 18-00-10\YT-OJ-H-95-5-0.
                  8-25MIN.M (Sequence Method)
Last changed    : 11/20/2017 19:11:56 by SYSTEM
Additional Info : Peak(s) manually integrated
```




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

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


Signal 1: DAD1 A, Sig=254,4 Ref=360,100

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1  19.818 BB    0.3346 1037.04272   48.27863  97.5628
   2  24.372 MM    0.4406   25.90606 9.79966e-1   2.4372

Totals :                  1062.94878   49.25860
```

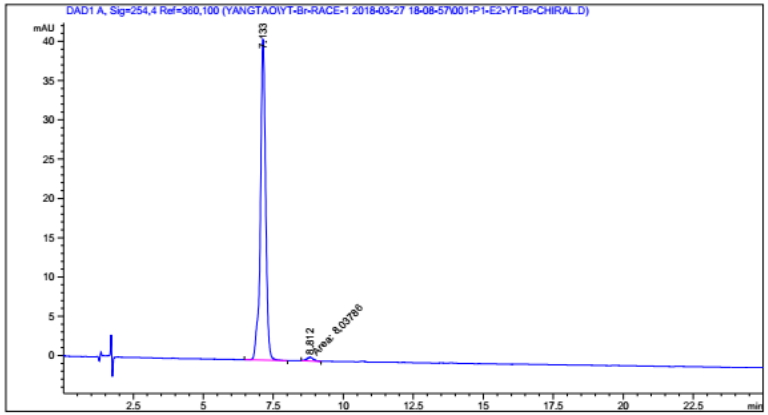



```
Acq. Operator   : SYSTEM                          Seq. Line :   1
Acq. Instrument : 1290-DAD                        Location :   P1-E-01
Injection Date  : 3/27/2018 5:43:17 PM               Inj :   1
                                                  Inj Volume : 0.500 µl
Acq. Method     : d:\Chem32\1\Data\YANGTAO\YT-Br-RACE-1 2018-03-27 17-42-22\YT-OJ-3-65-35-0.5
                  -15MIN.M
Last changed    : 3/27/2018 5:51:15 PM by SYSTEM
                  (modified after loading)
Analysis Method : d:\Chem32\1\Data\YANGTAO\YT-Br-RACE-1 2018-03-27 17-42-22\YT-OJ-3-65-35-0.5
                  -15MIN.M (Sequence Method)
Last changed    : 3/27/2018 6:10:18 PM by SYSTEM
                  (modified after loading)
Additional Info : Peak(s) manually integrated
```

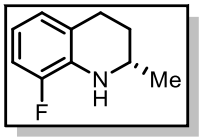



```
                          Area Percent Report

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


Signal 1: DAD1 A, Sig=254,4 Ref=360,100

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1   7.132 BB    0.1929  574.88129   45.04755  50.1178
   2   8.786 BB    0.2393  572.17871   36.01836  49.8822

Totals :                   1147.06000   81.06591
```

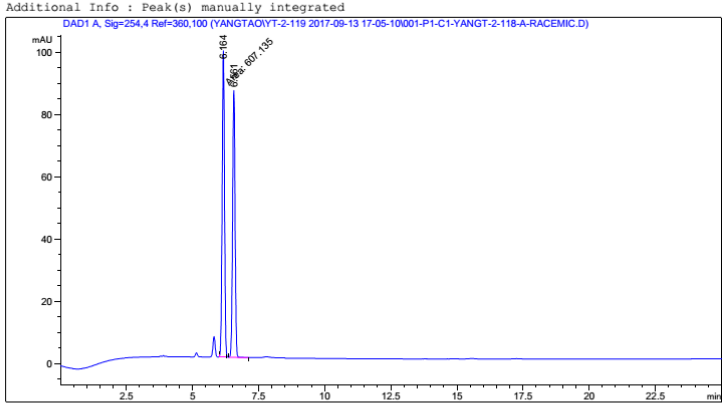
```
Acq. Operator   : SYSTEM                          Seq. Line :   1
Acq. Instrument : 1290-DAD                        Location :   P1-E-02
Injection Date  : 3/27/2018 6:09:53 PM               Inj :   1
                                                  Inj Volume : 0.500 µl
Acq. Method     : d:\Chem32\1\Data\YANGTAO\YT-Br-RACE-1 2018-03-27 18-08-57\YT-OJ-3-65-35-0.5
                  -15MIN.M
Last changed    : 3/27/2018 6:23:25 PM by SYSTEM
                  (modified after loading)
Analysis Method : d:\Chem32\1\Data\YANGTAO\YT-Br-RACE-1 2018-03-27 18-08-57\YT-OJ-3-65-35-0.5
                  -15MIN.M (Sequence Method)
Last changed    : 3/27/2018 6:34:56 PM by SYSTEM
Additional Info : Peak(s) manually integrated
```




```
                          Area Percent Report

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


Signal 1: DAD1 A, Sig=254,4 Ref=360,100

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1   7.133 BB    0.1953  529.53003   40.82240  98.5048
   2   8.812 MM    0.2776    8.03786 4.82632e-1   1.4952

Totals :                   537.56789   41.30503
```

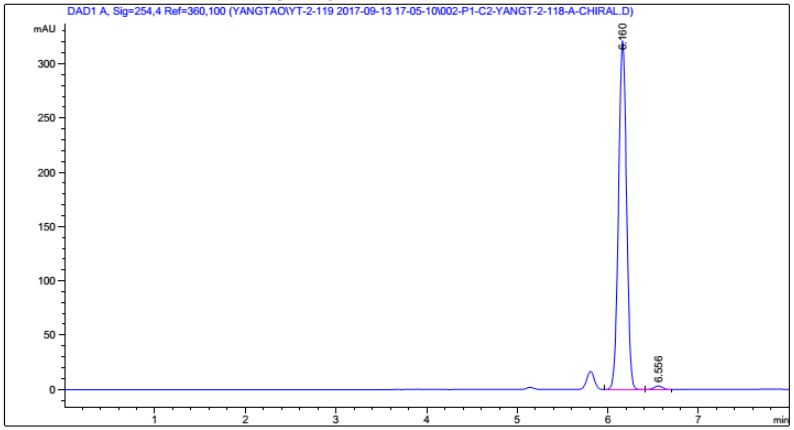



```
Acq. Operator   : SYSTEM                          Seq. Line :   1
Acq. Instrument : 1260-DAD                         Location :   P1-C-01
Injection Date  : 9/13/2017 5:06:49 PM                 Inj :   1
                                                 Inj Volume : 1.000 µl
Acq. Method     : d:\Chem32\1\Data\YANGTAO\YT-2-119 2017-09-13 17-05-10\YT-OJ-H-95-5-0.8-
                  25MIN.M
Last changed    : 8/28/2017 7:13:33 PM by SYSTEM
Analysis Method : d:\Chem32\1\Data\YANGTAO\YT-2-119 2017-09-13 17-05-10\YT-OJ-H-95-5-0.8-
                  25MIN.M (Sequence Method)
Last changed    : 9/13/2017 7:05:19 PM by SYSTEM
Additional Info : Peak(s) manually integrated
```

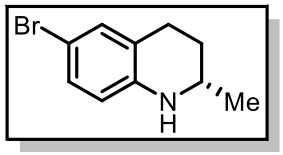



```
=====================================================================
                        Area Percent Report
=====================================================================

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


Signal 1: DAD1 A, Sig=254,4 Ref=360,100

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|---------|---------|--------|
   1   6.164 MF    0.1026  607.13483   98.67295  52.1005
   2   6.561 BB    0.1020  558.17920   85.66538  47.8995

Totals :                  1165.31403  184.33833
```

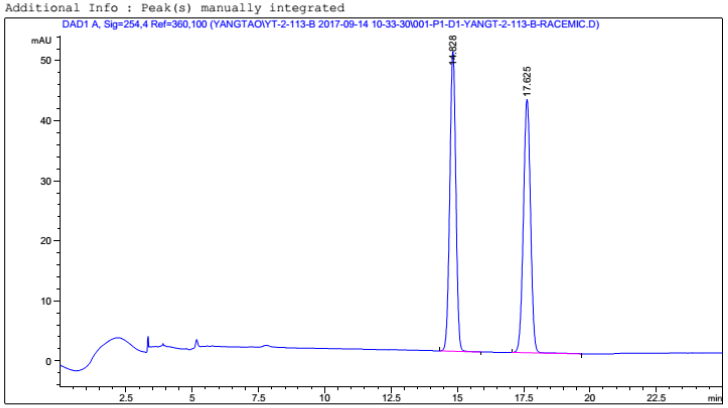
```
Acq. Operator   : SYSTEM                          Seq. Line :   2
Acq. Instrument : 1260-DAD                         Location :   P1-C-02
Injection Date  : 9/13/2017 5:32:41 PM                 Inj :   1
                                                 Inj Volume : 1.000 µl
Acq. Method     : d:\Chem32\1\Data\YANGTAO\YT-2-119 2017-09-13 17-05-10\YT-OJ-H-95-5-0.8-
                  25MIN.M
Last changed    : 9/13/2017 5:39:54 PM by SYSTEM
                  (modified after loading)
Analysis Method : d:\Chem32\1\Data\YANGTAO\YT-2-119 2017-09-13 17-05-10\YT-OJ-H-95-5-0.8-
                  25MIN.M (Sequence Method)
Last changed    : 9/13/2017 7:05:19 PM by SYSTEM
Additional Info : Peak(s) manually integrated
```




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

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


Signal 1: DAD1 A, Sig=254,4 Ref=360,100

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|---------|---------|--------|
   1   6.160 BB    0.0954 1966.84399  321.26532  98.9761
   2   6.556 BB    0.1006   20.34607    3.18360   1.0239

Totals :                  1987.19006  324.44892
```




Acq. Operator : SYSTEM Seq. Line : 1
Acq. Instrument : 1260-DAD Location : P1-D-01
Injection Date : 9/14/2017 10:35:08 AM Inj : 1
Inj Volume : 1.000 µl
Acq. Method : d:\Chem32\1\Data\YANGTAO\YT-2-113-B 2017-09-14 10-33-30\YT-OJ-H-95-5-0.8-25MIN.M
Last changed : 9/13/2017 8:49:12 PM by SYSTEM
Analysis Method : d:\Chem32\1\Data\YANGTAO\YT-2-113-B 2017-09-14 10-33-30\YT-OJ-H-95-5-0.8-25MIN.M (Sequence Method)
Last changed : 9/14/2017 12:09:54 PM by SYSTEM
Additional Info : Peak(s) manually integrated



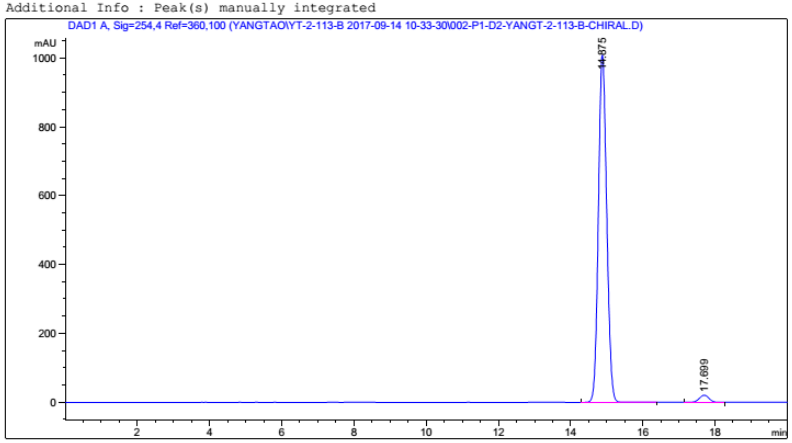

Area Percent Report

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

Signal 1: DAD1 A, Sig=254,4 Ref=360,100

| Peak # | RetTime [min] | Type | Width [min] | Area [mAU*s] | Height [mAU] | Area % |
|---|---|---|---|---|---|---|
| 1 | 14.828 | BB | 0.2473 | 792.65631 | 49.91691 | 50.0719 |
| 2 | 17.625 | BB | 0.2905 | 790.37854 | 42.20811 | 49.9281 |
| Totals : | | | | 1583.03485 | 92.12502 | |

Acq. Operator : SYSTEM Seq. Line : 2
Acq. Instrument : 1260-DAD Location : P1-D-02
Injection Date : 9/14/2017 11:00:59 AM Inj : 1
Inj Volume : 1.000 µl
Acq. Method : d:\Chem32\1\Data\YANGTAO\YT-2-113-B 2017-09-14 10-33-30\YT-OJ-H-95-5-0.8-25MIN.M
Last changed : 9/14/2017 11:19:27 AM by SYSTEM (modified after loading)
Analysis Method : d:\Chem32\1\Data\YANGTAO\YT-2-113-B 2017-09-14 10-33-30\YT-OJ-H-95-5-0.8-25MIN.M (Sequence Method)
Last changed : 9/14/2017 12:09:54 PM by SYSTEM
Additional Info : Peak(s) manually integrated

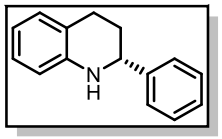



Area Percent Report

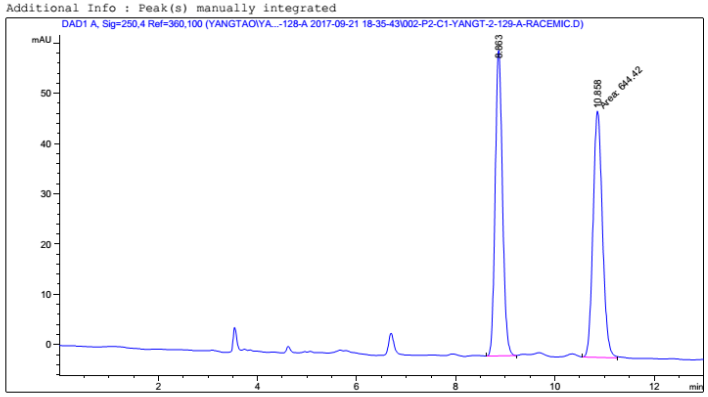
Sorted By : Signal
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: DAD1 A, Sig=254,4 Ref=360,100

| Peak # | RetTime [min] | Type | Width [min] | Area [mAU*s] | Height [mAU] | Area % |
|---|---|---|---|---|---|---|
| 1 | 14.875 | BB | 0.2485 | 1.61275e4 | 1008.64667 | 97.6569 |
| 2 | 17.699 | BB | 0.2878 | 386.94376 | 20.91897 | 2.3431 |
| Totals : | | | | 1.65144e4 | 1029.56564 | |

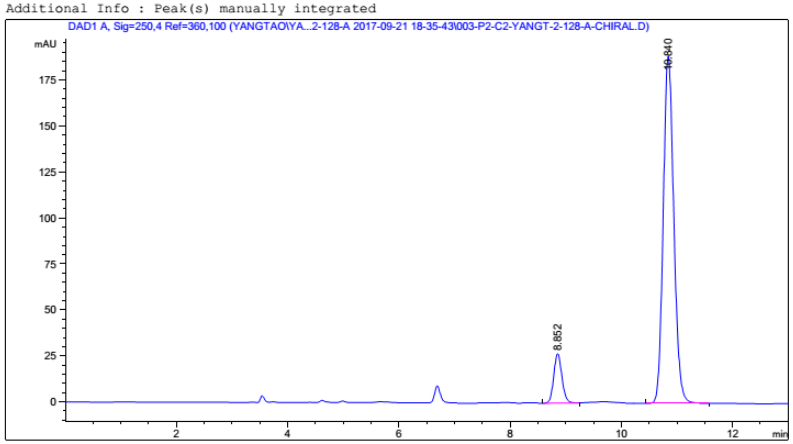


```
Acq. Operator   : SYSTEM                        Seq. Line :   2
Acq. Instrument : 1260-DAD                       Location :   P2-C-01
Injection Date  : 9/21/2017 6:54:19 PM               Inj :   2
                                               Inj Volume : 1.000 µl
Acq. Method     : d:\Chem32\1\Data\YANGTAO\YANGTAO-2-128-A 2017-09-21 18-35-43\YT-OD-H-85-15-
                  0.8-15MIN.M
Last changed    : 9/21/2017 7:05:32 PM by SYSTEM
                  (modified after loading)
Analysis Method : d:\Chem32\1\Data\YANGTAO\YANGTAO-2-128-A 2017-09-21 18-35-43\YT-OD-H-85-15-
                  0.8-15MIN.M (Sequence Method)
Last changed    : 9/21/2017 9:32:50 PM by SYSTEM
Additional Info : Peak(s) manually integrated
```

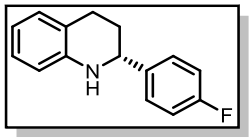



```
=====================================================================
                        Area Percent Report
=====================================================================

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


Signal 1: DAD1 A, Sig=250,4 Ref=360,100

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1   8.863 BB    0.1571  620.60883   60.81099  49.0589
   2  10.858 MF    0.2192  644.41962   49.00108  50.9411

Totals :                  1265.02844  109.81207
```

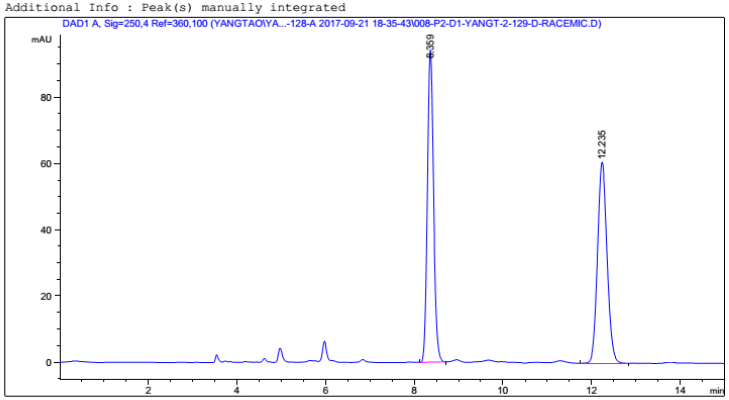
```
Acq. Operator   : SYSTEM                        Seq. Line :   3
Acq. Instrument : 1260-DAD                       Location :   P2-C-02
Injection Date  : 9/21/2017 7:08:09 PM               Inj :   1
                                               Inj Volume : 1.000 µl
Acq. Method     : d:\Chem32\1\Data\YANGTAO\YANGTAO-2-128-A 2017-09-21 18-35-43\YT-OD-H-85-15-
                  0.8-15MIN.M
Last changed    : 9/21/2017 7:19:50 PM by SYSTEM
                  (modified after loading)
Analysis Method : d:\Chem32\1\Data\YANGTAO\YANGTAO-2-128-A 2017-09-21 18-35-43\YT-OD-H-85-15-
                  0.8-15MIN.M (Sequence Method)
Last changed    : 9/21/2017 9:32:50 PM by SYSTEM
Additional Info : Peak(s) manually integrated
```




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

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


Signal 1: DAD1 A, Sig=250,4 Ref=360,100

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1   8.852 BB    0.1574  274.36084   26.80852   9.9398
   2  10.840 BB    0.2036 2485.86548  188.87050  90.0602

Totals :                  2760.22632  215.67901
```

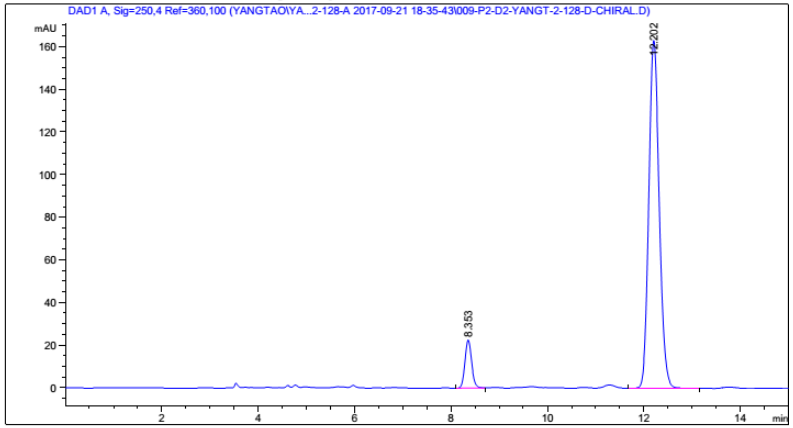



```
Acq. Operator   : SYSTEM                          Seq. Line :   8
Acq. Instrument : 1260-DAD                         Location :   P2-D-01
Injection Date  : 9/21/2017 8:23:18 PM                Inj :   1
                                                  Inj Volume : 1.000 µl
Acq. Method     : d:\Chem32\1\Data\YANGTAO\YANGTAO-2-128-A 2017-09-21 18-35-43\YT-OD-H-85-15-
                  0.8-15MIN.M
Last changed    : 9/21/2017 8:36:09 PM by SYSTEM
                  (modified after loading)
Analysis Method : d:\Chem32\1\Data\YANGTAO\YANGTAO-2-128-A 2017-09-21 18-35-43\YT-OD-H-85-15-
                  0.8-15MIN.M (Sequence Method)
Last changed    : 9/21/2017 9:32:50 PM by SYSTEM
Additional Info : Peak(s) manually integrated
```

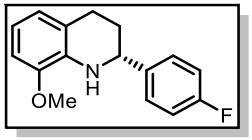



```
=====================================================================
                        Area Percent Report
=====================================================================

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


Signal 1: DAD1 A, Sig=250,4 Ref=360,100

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1   8.359 BB    0.1479  904.66748   94.35817  49.9232
   2  12.235 BB    0.2323  907.45160   60.73674  50.0768

Totals :                  1812.11908  155.09491
```

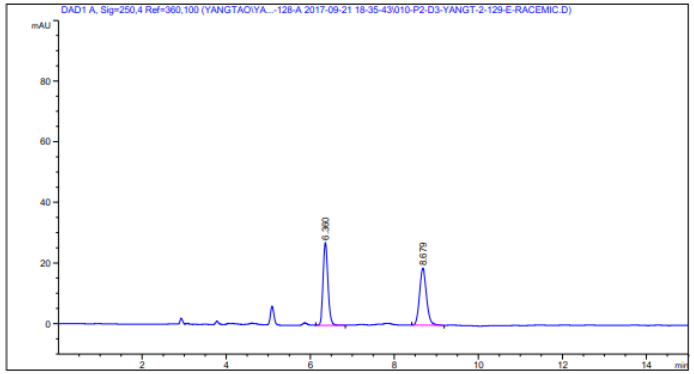
```
Acq. Operator   : SYSTEM                          Seq. Line :   9
Acq. Instrument : 1260-DAD                         Location :   P2-D-02
Injection Date  : 9/21/2017 8:39:08 PM                Inj :   1
                                                  Inj Volume : 1.000 µl
Acq. Method     : d:\Chem32\1\Data\YANGTAO\YANGTAO-2-128-A 2017-09-21 18-35-43\YT-OD-H-85-15-
                  0.8-15MIN.M
Last changed    : 9/21/2017 8:36:09 PM by SYSTEM
Analysis Method : d:\Chem32\1\Data\YANGTAO\YANGTAO-2-128-A 2017-09-21 18-35-43\YT-OD-H-85-15-
                  0.8-15MIN.M (Sequence Method)
Last changed    : 9/21/2017 9:32:50 PM by SYSTEM
Additional Info : Peak(s) manually integrated
```




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

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


Signal 1: DAD1 A, Sig=250,4 Ref=360,100

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1   8.353 BB    0.1477  214.95056   22.44785   8.0959
   2  12.202 BB    0.2326 2440.10107  163.06314  91.9041

Totals :                  2655.05164  185.51099
```

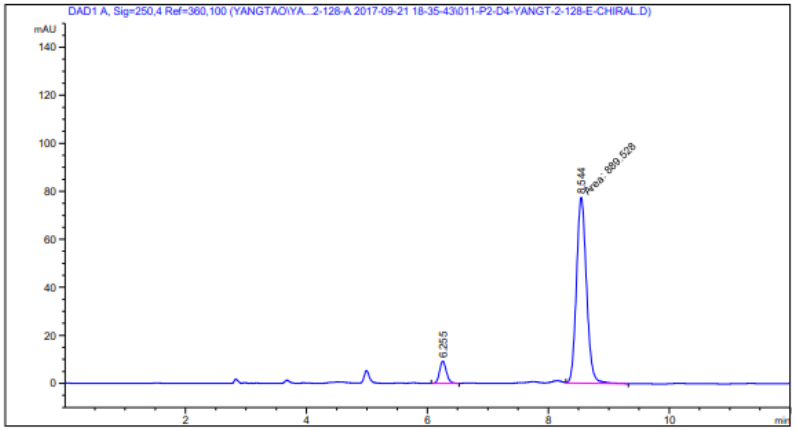



```
                0.8-15MIN.M
Last changed    : 9/21/2017 20:55:23 by SYSTEM
                  (modified after loading)
Analysis Method : d:\Chem32\1\Data\YANGTAO\YANGTAO-2-128-A 2017-09-21 18-35-43\YT-OD-H-85-15-
                  0.8-15MIN.M (Sequence Method)
Last changed    : 3/27/2018 12:36:29 by SYSTEM
                  (modified after loading)
Additional Info : Peak(s) manually integrated
```

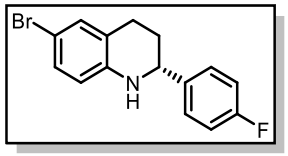



```
=====================================================================
                      Area Percent Report
=====================================================================

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


Signal 1: DAD1 A, Sig=250,4 Ref=360,100

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1   6.360 BB    0.1223  215.52820   27.23316  49.8492
   2   8.679 BB    0.1764  216.83179   18.81563  50.1508

Totals :                   432.35999   46.04879
```

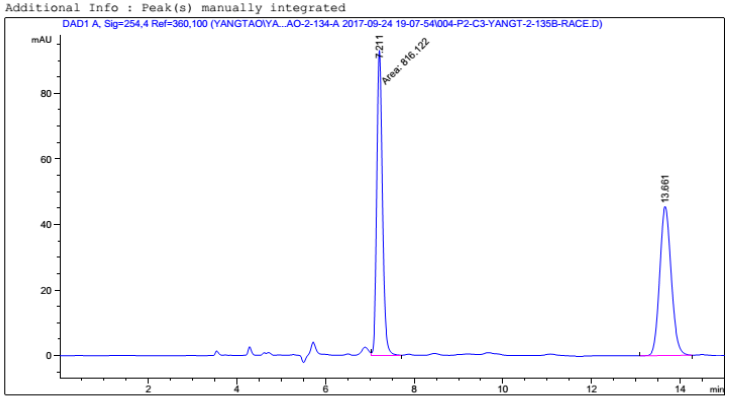
```
                                                  Inj Volume : 1.000 µl
Acq. Method     : d:\Chem32\1\Data\YANGTAO\YANGTAO-2-128-A 2017-09-21 18-35-43\YT-OD-H-85-15-
                  0.8-15MIN.M
Last changed    : 9/21/2017 21:28:42 by SYSTEM
                  (modified after loading)
Analysis Method : d:\Chem32\1\Data\YANGTAO\YANGTAO-2-128-A 2017-09-21 18-35-43\YT-OD-H-85-15-
                  0.8-15MIN.M (Sequence Method)
Last changed    : 3/27/2018 12:38:05 by SYSTEM
                  (modified after loading)
Additional Info : Peak(s) manually integrated
```




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

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


Signal 1: DAD1 A, Sig=250,4 Ref=360,100

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1   6.255 BB    0.1211   72.06497   9.22822   7.4943
   2   8.544 FM    0.1915  889.52808  77.41685  92.5057

Totals :                   961.59305  86.64508
```




Acq. Operator : SYSTEM Seq. Line : 4
Acq. Instrument : 1260-DAD Location : P2-C-03
Injection Date : 9/24/2017 7:56:16 PM Inj : 1
Inj Volume : 1.000 µl
Acq. Method : d:\Chem32\1\Data\YANGTAO\YANGTAO-2-134-A 2017-09-24 19-07-54\YT-OD-H-85-15-0.8-15MIN.M
Last changed : 9/24/2017 7:08:18 PM by SYSTEM
Analysis Method : d:\Chem32\1\Data\YANGTAO\YANGTAO-2-134-A 2017-09-24 19-07-54\YT-OD-H-85-15-0.8-15MIN.M (Sequence Method)
Last changed : 9/24/2017 8:53:46 PM by SYSTEM
Additional Info : Peak(s) manually integrated




Area Percent Report

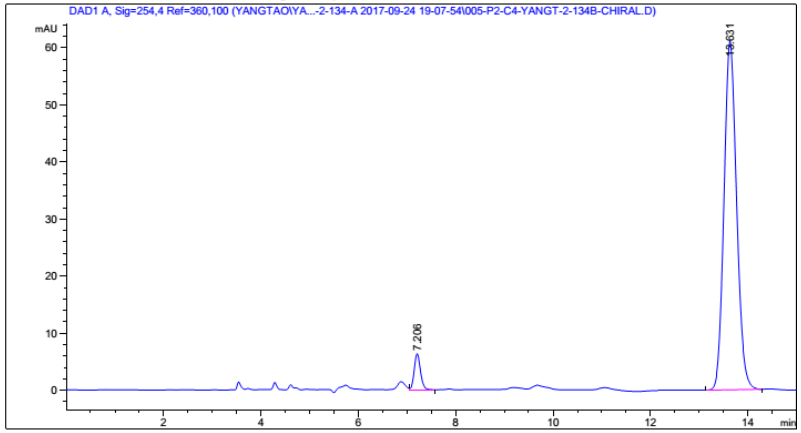
Sorted By : Signal
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: DAD1 A, Sig=254,4 Ref=360,100

| Peak # | RetTime [min] | Type | Width [min] | Area [mAU*s] | Height [mAU] | Area % |
|---|---|---|---|---|---|---|
| 1 | 7.211 | FM | 0.1463 | 816.12207 | 92.98768 | 49.9278 |
| 2 | 13.661 | BB | 0.2782 | 818.48236 | 45.43610 | 50.0722 |

Totals : 1634.60443 138.42378

Acq. Operator : SYSTEM Seq. Line : 5
Acq. Instrument : 1260-DAD Location : P2-C-04
Injection Date : 9/24/2017 8:12:05 PM Inj : 1
Inj Volume : 1.000 µl
Acq. Method : d:\Chem32\1\Data\YANGTAO\YANGTAO-2-134-A 2017-09-24 19-07-54\YT-OD-H-85-15-0.8-15MIN.M
Last changed : 9/24/2017 7:08:18 PM by SYSTEM
Analysis Method : d:\Chem32\1\Data\YANGTAO\YANGTAO-2-134-A 2017-09-24 19-07-54\YT-OD-H-85-15-0.8-15MIN.M (Sequence Method)
Last changed : 9/24/2017 8:53:46 PM by SYSTEM
Additional Info : Peak(s) manually integrated



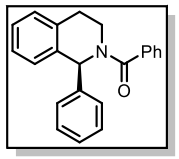

Area Percent Report

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

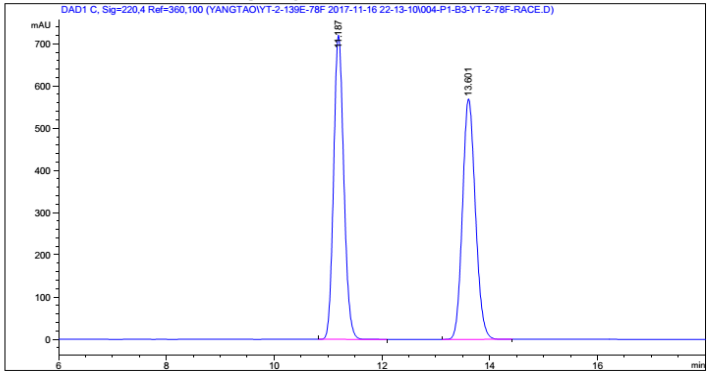
Signal 1: DAD1 A, Sig=254,4 Ref=360,100

| Peak # | RetTime [min] | Type | Width [min] | Area [mAU*s] | Height [mAU] | Area % |
|---|---|---|---|---|---|---|
| 1 | 7.206 | VB | 0.1345 | 55.48911 | 6.31725 | 4.7976 |
| 2 | 13.631 | BB | 0.2781 | 1101.10950 | 61.15631 | 95.2024 |

Totals : 1156.59861 67.47356




Acq. Operator : SYSTEM Seq. Line : 4
Acq. Instrument : 1260-DAD Location : P1-B-03
Injection Date : 11/16/2017 11:16:41 PM Inj : 1
Inj Volume : 1.000 µl
Different Inj Volume from Sample Entry! Actual Inj Volume : 2.000 µl
Acq. Method : d:\Chem32\1\Data\YANGTAO\YT-2-139E-78F 2017-11-16 22-13-10\YANGT-AD-3-70-30 -0.8-20MIN .M
Last changed : 11/16/2017 10:17:00 PM by SYSTEM
Analysis Method : d:\Chem32\1\Data\YANGTAO\YT-2-139E-78F 2017-11-16 22-13-10\YANGT-AD-3-70-30 -0.8-20MIN .M (Sequence Method)
Last changed : 11/17/2017 8:49:11 AM by SYSTEM (modified after loading)
Additional Info : Peak(s) manually integrated



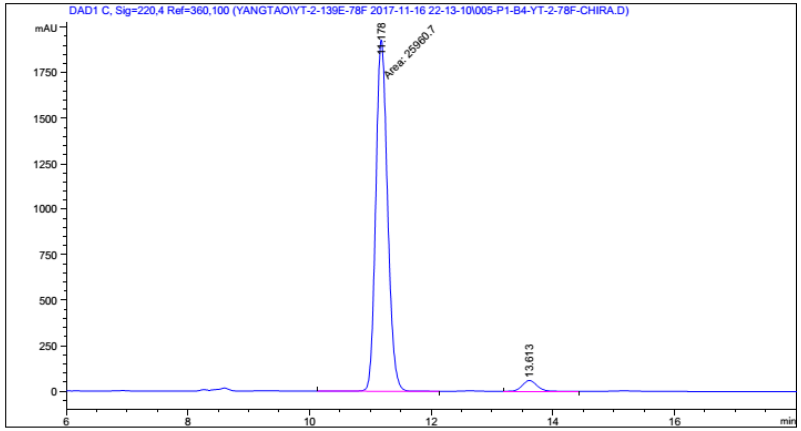

Area Percent Report

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

Signal 1: DAD1 C, Sig=220,4 Ref=360,100

| Peak # | RetTime [min] | Type | Width [min] | Area [mAU*s] | Height [mAU] | Area % |
|---|---|---|---|---|---|---|
| 1 | 11.187 | BB | 0.2035 | 9485.32715 | 721.06110 | 49.9784 |
| 2 | 13.601 | BB | 0.2583 | 9493.51855 | 569.94550 | 50.0216 |
| Totals : | | | | 1.89788e4 | 1291.00659 | |

Acq. Operator : SYSTEM Seq. Line : 5
Acq. Instrument : 1260-DAD Location : P1-B-04
Injection Date : 11/16/2017 11:37:33 PM Inj : 1
Inj Volume : 1.000 µl
Different Inj Volume from Sample Entry! Actual Inj Volume : 2.000 µl
Acq. Method : d:\Chem32\1\Data\YANGTAO\YT-2-139E-78F 2017-11-16 22-13-10\YANGT-AD-3-70-30 -0.8-20MIN .M
Last changed : 11/16/2017 10:17:00 PM by SYSTEM
Analysis Method : d:\Chem32\1\Data\YANGTAO\YT-2-139E-78F 2017-11-16 22-13-10\YANGT-AD-3-70-30 -0.8-20MIN .M (Sequence Method)
Last changed : 11/17/2017 8:49:11 AM by SYSTEM (modified after loading)
Additional Info : Peak(s) manually integrated

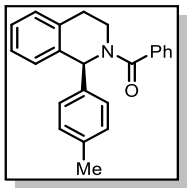



Area Percent Report

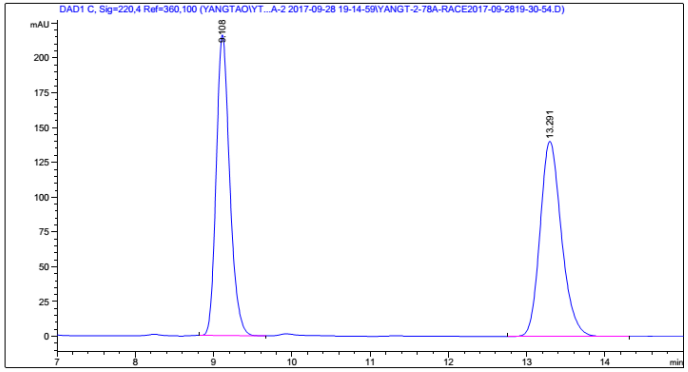
Sorted By : Signal
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: DAD1 C, Sig=220,4 Ref=360,100

| Peak # | RetTime [min] | Type | Width [min] | Area [mAU*s] | Height [mAU] | Area % |
|---|---|---|---|---|---|---|
| 1 | 11.178 | MM | 0.2241 | 2.59607e4 | 1930.35767 | 96.3325 |
| 2 | 13.613 | BB | 0.2581 | 988.35065 | 59.39674 | 3.6675 |
| Totals : | | | | 2.69490e4 | 1989.75441 | |

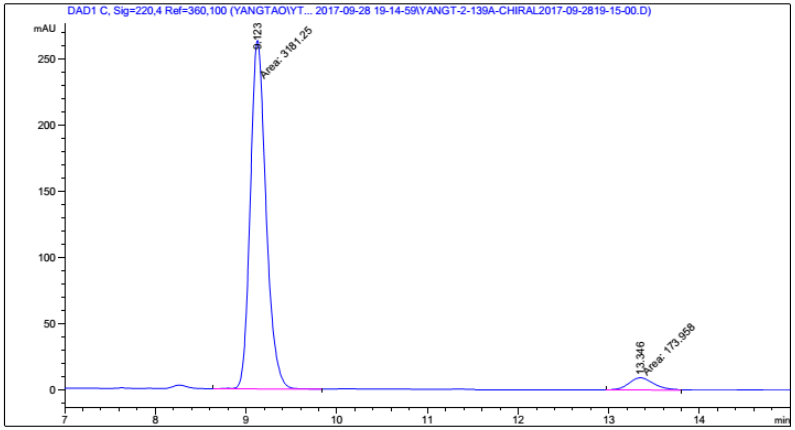



```
Acq. Operator   : SYSTEM                        Seq. Line :   2
Acq. Instrument : 1260-DAD                      Location :   P1-D-02
Injection Date  : 9/28/2017 7:31:43 PM              Inj :   1
                                               Inj Volume : 1.000 µl
Acq. Method     : d:\Chem32\1\Data\YANGTAO\YT-2-139-A-2 2017-09-28 19-14-59\YANGT-AD-3-70-30-
                  1-20MIN .M
Last changed    : 9/28/2017 7:14:44 PM by SYSTEM
Analysis Method : d:\Chem32\1\Data\YANGTAO\YT-2-139-A-2 2017-09-28 19-14-59\YANGT-AD-3-70-30-
                  1-20MIN .M (Sequence Method)
Last changed    : 9/29/2017 11:26:51 AM by SYSTEM
Additional Info : Peak(s) manually integrated
```

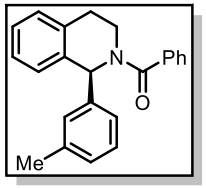



```
=====================================================================
                        Area Percent Report
=====================================================================

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


Signal 1: DAD1 C, Sig=220,4 Ref=360,100

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|-------|
   1   9.108 BB    0.1836 2586.17188  216.16197  49.3855
   2  13.291 BB    0.2905 2650.53052  140.23384  50.6145

Totals :                  5236.70239  356.39581
```

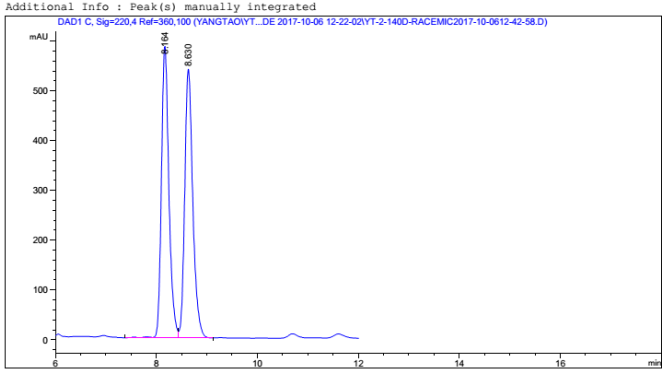
```
Acq. Operator   : SYSTEM                        Seq. Line :   1
Acq. Instrument : 1260-DAD                      Location :   P1-D-01
Injection Date  : 9/28/2017 7:15:50 PM              Inj :   1
                                               Inj Volume : 1.000 µl
Acq. Method     : d:\Chem32\1\Data\YANGTAO\YT-2-139-A-2 2017-09-28 19-14-59\YANGT-AD-3-70-30-
                  1-20MIN .M
Last changed    : 9/28/2017 7:14:44 PM by SYSTEM
Analysis Method : d:\Chem32\1\Data\YANGTAO\YT-2-139-A-2 2017-09-28 19-14-59\YANGT-AD-3-70-30-
                  1-20MIN .M (Sequence Method)
Last changed    : 9/29/2017 11:26:51 AM by SYSTEM
Additional Info : Peak(s) manually integrated
```




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

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


Signal 1: DAD1 C, Sig=220,4 Ref=360,100

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|-------|
   1   9.123 MM    0.2010 3181.25317  263.76883  94.8153
   2  13.346 MF    0.3155  173.95770    9.18956   5.1847

Totals :                  3355.21088  272.95839
```

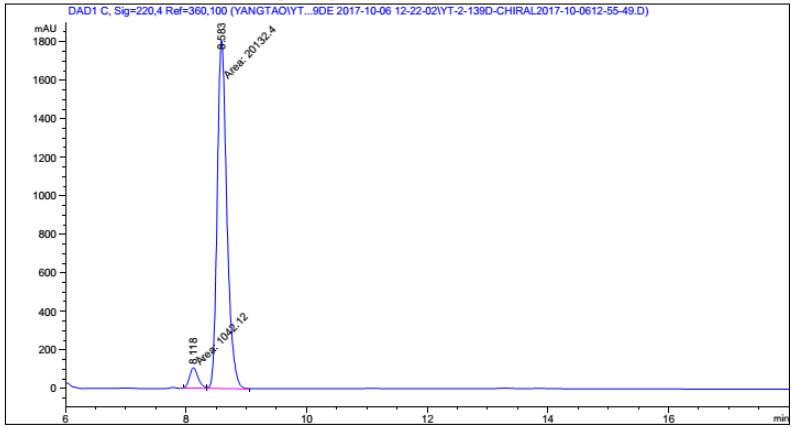



```
Acq. Operator   : SYSTEM                       Seq. Line :   2
Acq. Instrument : 1260-DAD                     Location :   P2-D-01
Injection Date  : 10/6/2017 12:43:46 PM            Inj :   2
                                              Inj Volume : 1.000 µl
Acq. Method     : d:\Chem32\1\Data\YANGTAO\YT-2-139DE 2017-10-06 12-22-02\YANGT-AD-3-70-30-1-
                  20MIN .M
Last changed    : 10/6/2017 12:54:04 PM by SYSTEM
                  (modified after loading)
Analysis Method : d:\Chem32\1\Data\YANGTAO\YT-2-139DE 2017-10-06 12-22-02\YANGT-AD-3-70-30-1-
                  20MIN .M (Sequence Method)
Last changed    : 11/17/2017 9:00:38 AM by SYSTEM
                  (modified after loading)
Additional Info : Peak(s) manually integrated
```

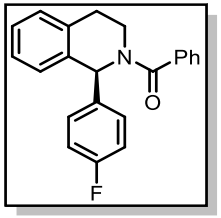



```
==================================================================
                      Area Percent Report
==================================================================

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


Signal 1: DAD1 C, Sig=220,4 Ref=360,100

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1   8.164 VV R  0.1558 6033.15088  585.95300  50.1538
   2   8.630 VB    0.1695 5996.15527  540.27246  49.8462

Totals :                  1.20293e4  1126.22546
```

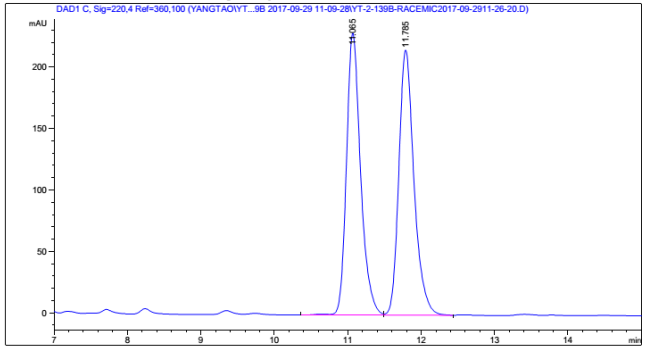
```
Acq. Operator   : SYSTEM                       Seq. Line :   3
Acq. Instrument : 1260-DAD                     Location :   P2-D-02
Injection Date  : 10/6/2017 12:56:35 PM            Inj :   1
                                              Inj Volume : 1.000 µl
Acq. Method     : d:\Chem32\1\Data\YANGTAO\YT-2-139DE 2017-10-06 12-22-02\YANGT-AD-3-70-30-1-
                  20MIN .M
Last changed    : 10/6/2017 12:57:53 PM by SYSTEM
                  (modified after loading)
Analysis Method : d:\Chem32\1\Data\YANGTAO\YT-2-139DE 2017-10-06 12-22-02\YANGT-AD-3-70-30-1-
                  20MIN .M (Sequence Method)
Last changed    : 11/16/2017 9:44:21 PM by SYSTEM
                  (modified after loading)
Additional Info : Peak(s) manually integrated
```




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

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


Signal 1: DAD1 C, Sig=220,4 Ref=360,100

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1   8.118 MF    0.1644 1042.11768  105.62257   4.9216
   2   8.583 FM    0.1855 2.01324e4  1809.22046  95.0784

Totals :                  2.11745e4  1914.84303
```

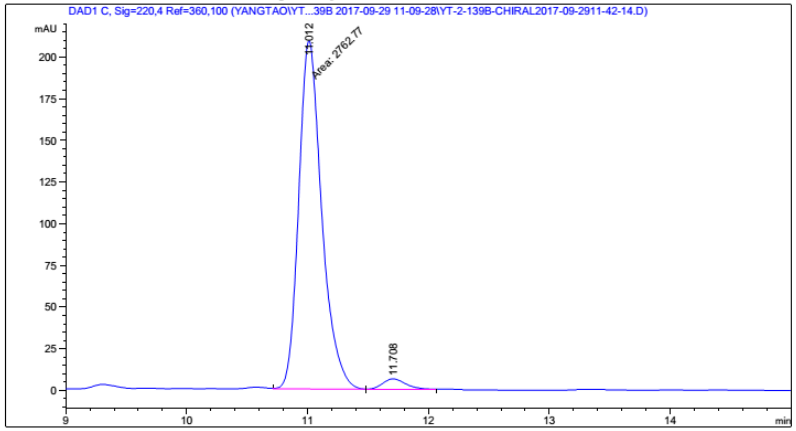



```
Acq. Operator   : SYSTEM                          Seq. Line :   2
Acq. Instrument : 1260-DAD                         Location :   P1-E-03
Injection Date  : 9/29/2017 11:27:09 AM                Inj :   2
                                                 Inj Volume : 1.000 µl
Acq. Method     : d:\Chem32\1\Data\YANGTAO\YT-2-139B 2017-09-29 11-09-28\YANGT-AD-3-70-30-1-
                  20MIN .M
Last changed    : 9/29/2017 11:21:31 AM by SYSTEM
Analysis Method : d:\Chem32\1\Data\YANGTAO\YT-2-139B 2017-09-29 11-09-28\YANGT-AD-3-70-30-1-
                  20MIN .M (Sequence Method)
Last changed    : 11/17/2017 8:58:51 AM by SYSTEM
                  (modified after loading)
Additional Info : Peak(s) manually integrated
```

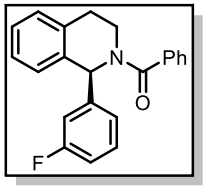



```
=====================================================================
                        Area Percent Report
=====================================================================

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


Signal 1: DAD1 C, Sig=220,4 Ref=360,100

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1  11.065 BV    0.2019 3065.04346  229.40308  49.7931
   2  11.785 VB    0.2172 3090.51929  215.60413  50.2069

Totals :                  6155.56274  445.00720
```

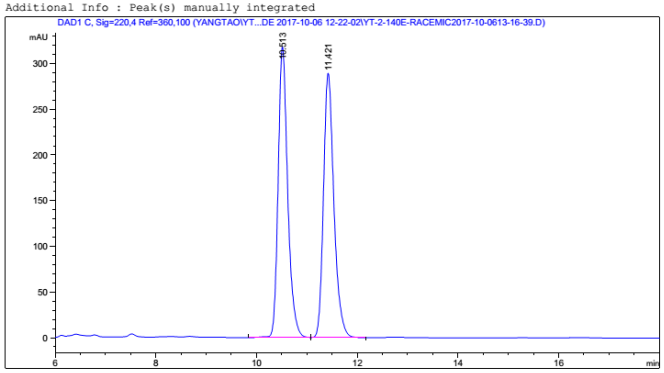
```
Acq. Operator   : SYSTEM                          Seq. Line :   3
Acq. Instrument : 1260-DAD                         Location :   P1-E-04
Injection Date  : 9/29/2017 11:43:04 AM                Inj :   1
                                                 Inj Volume : 1.000 µl
Acq. Method     : d:\Chem32\1\Data\YANGTAO\YT-2-139B 2017-09-29 11-09-28\YANGT-AD-3-70-30-1-
                  20MIN .M
Last changed    : 9/29/2017 11:21:31 AM by SYSTEM
Analysis Method : d:\Chem32\1\Data\YANGTAO\YT-2-139B 2017-09-29 11-09-28\YANGT-AD-3-70-30-1-
                  20MIN .M (Sequence Method)
Last changed    : 11/16/2017 9:37:21 PM by SYSTEM
                  (modified after loading)
Additional Info : Peak(s) manually integrated
```




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

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


Signal 1: DAD1 C, Sig=220,4 Ref=360,100

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1  11.012 FM    0.2203 2762.76733  209.01520  97.1775
   2  11.708 BB    0.1997   80.24355    6.17052   2.8225

Totals :                  2843.01088  215.18571
```

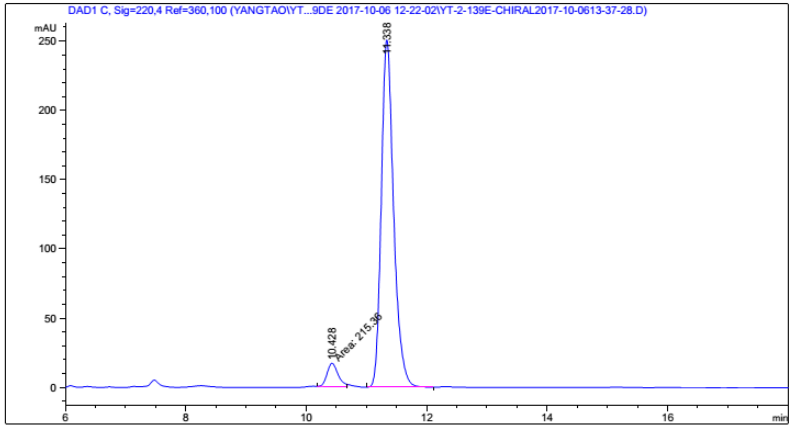



```
Acq. Operator   : SYSTEM                        Seq. Line :   4
Acq. Instrument : 1260-DAD                      Location :   P2-D-03
Injection Date  : 10/6/2017 1:17:25 PM              Inj :   1
                                               Inj Volume : 1.000 µl
Acq. Method     : d:\Chem32\1\Data\YANGTAO\YT-2-139DE 2017-10-06 12-22-02\YANGT-AD-3-70-30-1-
                  20MIN .M
Last changed    : 10/6/2017 12:57:53 PM by SYSTEM
Analysis Method : d:\Chem32\1\Data\YANGTAO\YT-2-139DE 2017-10-06 12-22-02\YANGT-AD-3-70-30-1-
                  20MIN .M (Sequence Method)
Last changed    : 11/17/2017 9:01:40 AM by SYSTEM
                  (modified after loading)
Additional Info : Peak(s) manually integrated
```

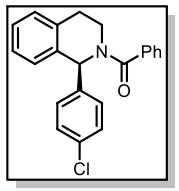



```
=====================================================================
                        Area Percent Report
=====================================================================

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


Signal 1: DAD1 C, Sig=220,4 Ref=360,100

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1  10.513 BB    0.1999 4189.77051  317.62515  50.2077
   2  11.421 BB    0.2198 4155.10596  288.89899  49.7923

Totals :                  8344.87646  606.52414
```

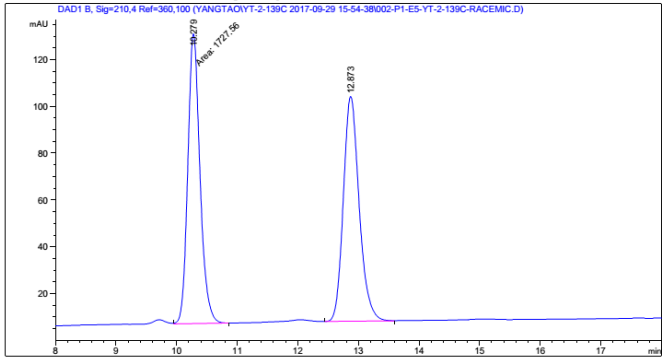
```
Acq. Operator   : SYSTEM                        Seq. Line :   5
Acq. Instrument : 1260-DAD                      Location :   P2-D-04
Injection Date  : 10/6/2017 1:38:13 PM              Inj :   1
                                               Inj Volume : 1.000 µl
Acq. Method     : d:\Chem32\1\Data\YANGTAO\YT-2-139DE 2017-10-06 12-22-02\YANGT-AD-3-70-30-1-
                  20MIN .M
Last changed    : 10/6/2017 12:57:53 PM by SYSTEM
Analysis Method : d:\Chem32\1\Data\YANGTAO\YT-2-139DE 2017-10-06 12-22-02\YANGT-AD-3-70-30-1-
                  20MIN .M (Sequence Method)
Last changed    : 11/17/2017 9:01:40 AM by SYSTEM
                  (modified after loading)
Additional Info : Peak(s) manually integrated
```




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

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


Signal 1: DAD1 C, Sig=220,4 Ref=360,100

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1  10.428 MF    0.2130  215.36006   16.84976   5.6893
   2  11.338 BB    0.2161 3569.96777  250.79404  94.3107

Totals :                  3785.32784  267.64379
```

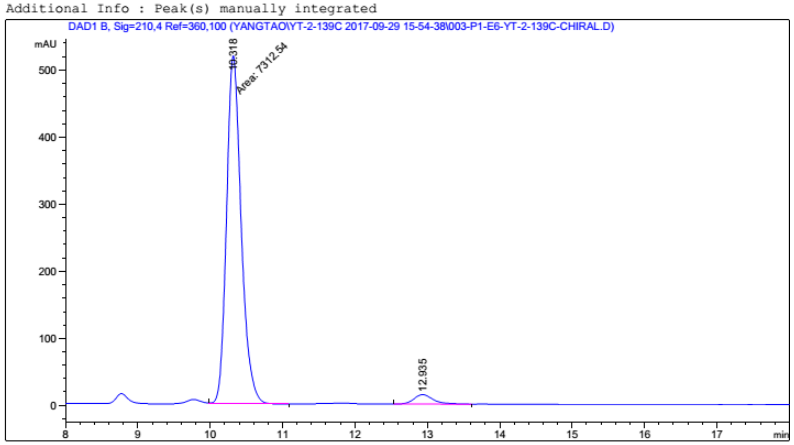



```
Acq. Operator   : SYSTEM                       Seq. Line :   2
Acq. Instrument : 1260-DAD                     Location :   P1-E-05
Injection Date  : 9/29/2017 4:16:25 PM             Inj :   2
                                             Inj Volume : 1.000 µl
Acq. Method     : d:\Chem32\1\Data\YANGTAO\YT-2-139C 2017-09-29 15-54-38\YANGT-AD-3-70-30-0.8
                  -20MIN .M
Last changed    : 7/26/2017 6:41:33 PM by SYSTEM
Analysis Method : d:\Chem32\1\Data\YANGTAO\YT-2-139C 2017-09-29 15-54-38\YANGT-AD-3-70-30-0.8
                  -20MIN .M (Sequence Method)
Last changed    : 11/16/2017 9:38:41 PM by SYSTEM
                  (modified after loading)
Additional Info : Peak(s) manually integrated
```

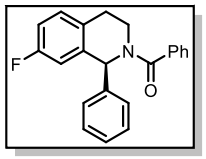



```
=====================================================================
                        Area Percent Report
=====================================================================

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


Signal 1: DAD1 B, Sig=210,4 Ref=360,100

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1  10.279 FM    0.2326 1727.56128  123.81106  49.8100
   2  12.873 BB    0.2774 1740.74023   96.05965  50.1900

Totals :                  3468.30151  219.87071
```

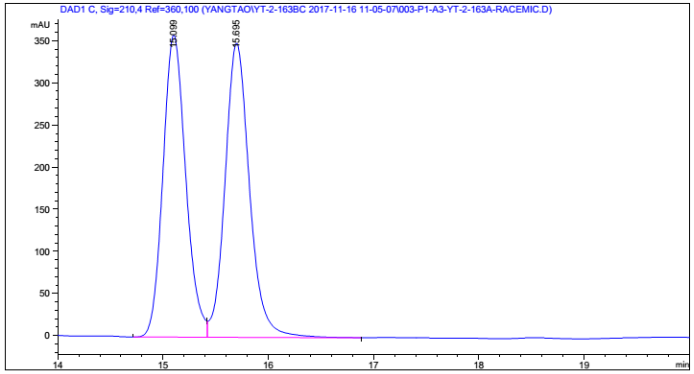
```
Acq. Operator   : SYSTEM                       Seq. Line :   3
Acq. Instrument : 1260-DAD                     Location :   P1-E-06
Injection Date  : 9/29/2017 4:37:18 PM             Inj :   1
                                             Inj Volume : 1.000 µl
Acq. Method     : d:\Chem32\1\Data\YANGTAO\YT-2-139C 2017-09-29 15-54-38\YANGT-AD-3-70-30-0.8
                  -20MIN .M
Last changed    : 7/26/2017 6:41:33 PM by SYSTEM
Analysis Method : d:\Chem32\1\Data\YANGTAO\YT-2-139C 2017-09-29 15-54-38\YANGT-AD-3-70-30-0.8
                  -20MIN .M (Sequence Method)
Last changed    : 11/16/2017 9:40:15 PM by SYSTEM
                  (modified after loading)
Additional Info : Peak(s) manually integrated
```




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

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


Signal 1: DAD1 B, Sig=210,4 Ref=360,100

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1  10.318 FM    0.2348 7312.54346  519.11328  96.6200
   2  12.935 BB    0.2808  255.80731   14.02400   3.3800

Totals :                  7568.35077  533.13728
```




Acq. Operator : SYSTEM Seq. Line : 3
Acq. Instrument : 1260-DAD Location : P1-A-03
Injection Date : 11/16/2017 11:44:42 AM Inj : 1
Inj Volume : 1.000 µl
Acq. Method : d:\Chem32\1\Data\YANGTAO\YT-2-163BC 2017-11-16 11-05-07\YT-AD3-80-20-1 mL-30Min.M
Last changed : 11/16/2017 11:58:32 AM by SYSTEM
(modified after loading)
Analysis Method : d:\Chem32\1\Data\YANGTAO\YT-2-163BC 2017-11-16 11-05-07\YT-AD3-80-20-1 mL-30Min.M (Sequence Method)
Last changed : 11/17/2017 9:13:16 AM by SYSTEM
(modified after loading)
Additional Info : Peak(s) manually integrated



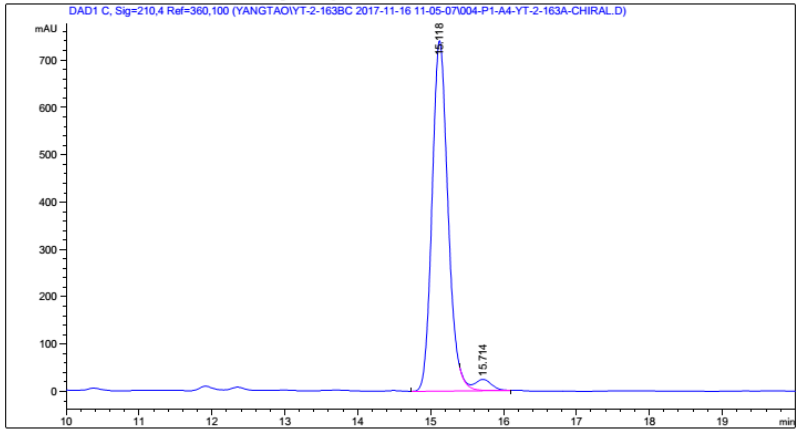

Area Percent Report

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

Signal 1: DAD1 C, Sig=210,4 Ref=360,100

| Peak # | RetTime [min] | Type | Width [min] | Area [mAU*s] | Height [mAU] | Area % |
|---|---|---|---|---|---|---|
| 1 | 15.099 | BV | 0.2337 | 5399.95752 | 358.65195 | 48.9272 |
| 2 | 15.695 | VB | 0.2483 | 5636.76904 | 349.21808 | 51.0728 |
| Totals : | | | | 1.10367e4 | 707.87003 | |

Acq. Operator : SYSTEM Seq. Line : 4
Acq. Instrument : 1260-DAD Location : P1-A-04
Injection Date : 11/16/2017 12:15:34 PM Inj : 1
Inj Volume : 1.000 µl
Acq. Method : d:\Chem32\1\Data\YANGTAO\YT-2-163BC 2017-11-16 11-05-07\YT-AD3-80-20-1 mL-30Min.M
Last changed : 11/16/2017 11:58:32 AM by SYSTEM
Analysis Method : d:\Chem32\1\Data\YANGTAO\YT-2-163BC 2017-11-16 11-05-07\YT-AD3-80-20-1 mL-30Min.M (Sequence Method)
Last changed : 11/17/2017 9:14:05 AM by SYSTEM
(modified after loading)
Additional Info : Peak(s) manually integrated

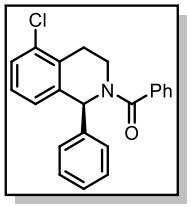



Area Percent Report

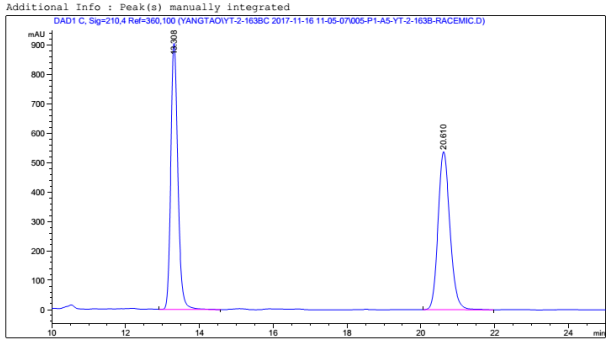
Sorted By : Signal
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: DAD1 C, Sig=210,4 Ref=360,100

| Peak # | RetTime [min] | Type | Width [min] | Area [mAU*s] | Height [mAU] | Area % |
|---|---|---|---|---|---|---|
| 1 | 15.118 | BV R | 0.2336 | 1.12653e4 | 740.16235 | 96.8749 |
| 2 | 15.714 | VB E | 0.2379 | 363.41055 | 23.04964 | 3.1251 |
| Totals : | | | | 1.16287e4 | 763.21199 | |




Acq. Operator : SYSTEM Seq. Line : 5
Acq. Instrument : 1260-DAD Location : P1-A-05
Injection Date : 11/16/2017 12:46:24 PM Inj : 1
Inj Volume : 1.000 µl
Acq. Method : d:\Chem32\1\Data\YANGTAO\YT-2-163BC 2017-11-16 11-05-07\YT-AD3-80-20-1 mL-30Min.M
Last changed : 11/16/2017 11:58:32 AM by SYSTEM
Analysis Method : d:\Chem32\1\Data\YANGTAO\YT-2-163BC 2017-11-16 11-05-07\YT-AD3-80-20-1 mL-30Min.M (Sequence Method)
Last changed : 11/17/2017 9:16:54 AM by SYSTEM
(modified after loading)
Additional Info : Peak(s) manually integrated



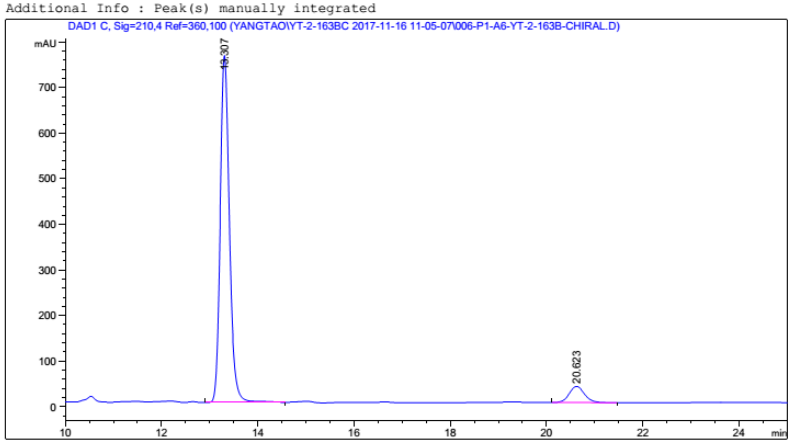

Area Percent Report

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

Signal 1: DAD1 C, Sig=210,4 Ref=360,100

| Peak # | RetTime [min] | Type | Width [min] | Area [mAU*s] | Height [mAU] | Area % |
|---|---|---|---|---|---|---|
| 1 | 13.308 | BB | 0.2026 | 1.19905e4 | 904.56006 | 50.0625 |
| 2 | 20.610 | BB | 0.3421 | 1.19606e4 | 536.40411 | 49.9375 |
| Totals : | | | | 2.39512e4 | 1440.96417 | |

Acq. Operator : SYSTEM Seq. Line : 6
Acq. Instrument : 1260-DAD Location : P1-A-06
Injection Date : 11/16/2017 1:17:16 PM Inj : 1
Inj Volume : 1.000 µl
Acq. Method : d:\Chem32\1\Data\YANGTAO\YT-2-163BC 2017-11-16 11-05-07\YT-AD3-80-20-1 mL-30Min.M
Last changed : 11/16/2017 11:58:32 AM by SYSTEM
Analysis Method : d:\Chem32\1\Data\YANGTAO\YT-2-163BC 2017-11-16 11-05-07\YT-AD3-80-20-1 mL-30Min.M (Sequence Method)
Last changed : 11/17/2017 9:17:13 AM by SYSTEM
(modified after loading)
Additional Info : Peak(s) manually integrated

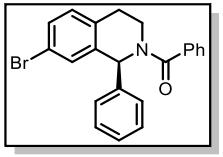



Area Percent Report

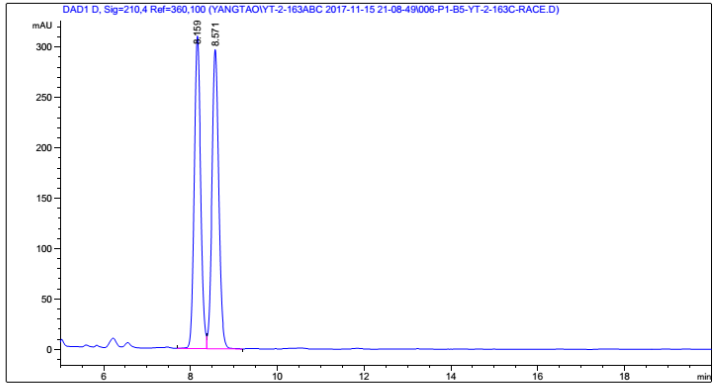
Sorted By : Signal
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: DAD1 C, Sig=210,4 Ref=360,100

| Peak # | RetTime [min] | Type | Width [min] | Area [mAU*s] | Height [mAU] | Area % |
|---|---|---|---|---|---|---|
| 1 | 13.307 | BB | 0.2024 | 1.00749e4 | 761.04272 | 92.8565 |
| 2 | 20.623 | BB | 0.3380 | 775.06598 | 35.31589 | 7.1435 |
| Totals : | | | | 1.08499e4 | 796.35862 | |

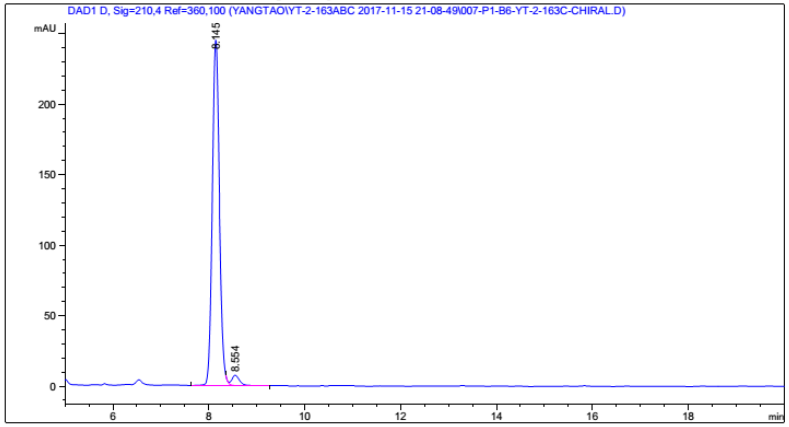



```
Acq. Operator   : SYSTEM                          Seq. Line :   6
Acq. Instrument : 1260-DAD                         Location :   P1-B-05
Injection Date  : 11/15/2017 11:18:57 PM              Inj :   1
                                                  Inj Volume : 1.000 µl
Acq. Method     : d:\Chem32\1\Data\YANGTAO\YT-2-163ABC 2017-11-15 21-08-49\YANGT-AD-3-70-30-1
                  -20MIN .M
Last changed    : 11/15/2017 9:10:13 PM by SYSTEM
Analysis Method : d:\Chem32\1\Data\YANGTAO\YT-2-163ABC 2017-11-15 21-08-49\YANGT-AD-3-70-30-1
                  -20MIN .M (Sequence Method)
Last changed    : 11/17/2017 9:10:17 AM by SYSTEM
                  (modified after loading)
Additional Info : Peak(s) manually integrated
```

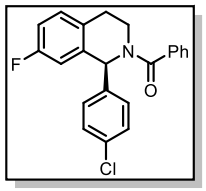



```
=====================================================================
                      Area Percent Report
=====================================================================

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


Signal 1: DAD1 D, Sig=210,4 Ref=360,100

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1   8.159 BV    0.1599 3188.79980  310.25836  49.7955
   2   8.571 VB    0.1663 3214.99609  296.99475  50.2045

Totals :                  6403.79590  607.25311
```

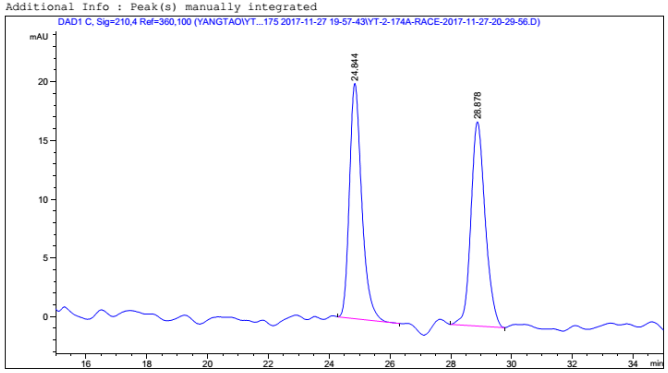
```
Acq. Operator   : SYSTEM                          Seq. Line :   7
Acq. Instrument : 1260-DAD                         Location :   P1-B-06
Injection Date  : 11/15/2017 11:44:47 PM              Inj :   1
                                                  Inj Volume : 1.000 µl
Acq. Method     : d:\Chem32\1\Data\YANGTAO\YT-2-163ABC 2017-11-15 21-08-49\YANGT-AD-3-70-30-1
                  -20MIN .M
Last changed    : 11/15/2017 9:10:13 PM by SYSTEM
Analysis Method : d:\Chem32\1\Data\YANGTAO\YT-2-163ABC 2017-11-15 21-08-49\YANGT-AD-3-70-30-1
                  -20MIN .M (Sequence Method)
Last changed    : 11/17/2017 9:11:49 AM by SYSTEM
                  (modified after loading)
Additional Info : Peak(s) manually integrated
```




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

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


Signal 1: DAD1 D, Sig=210,4 Ref=360,100

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1   8.145 BV R  0.1601 2523.97754  245.21860  96.7612
   2   8.554 VB E  0.1767   84.48272    7.31955   3.2388

Totals :                  2608.46026  252.53815
```

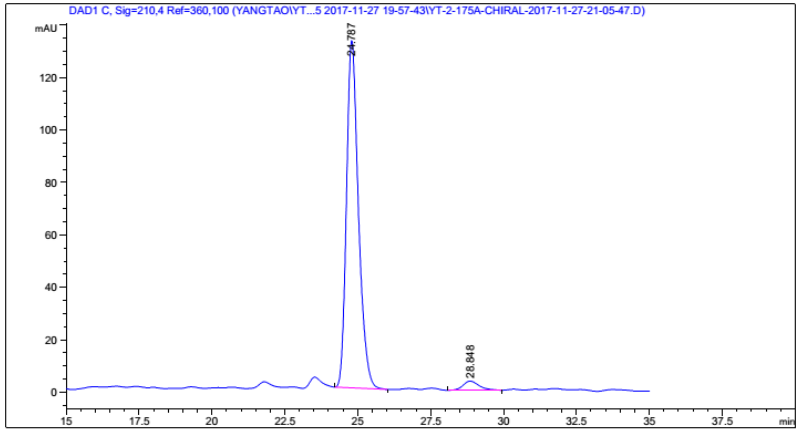



```
Acq. Operator   : SYSTEM                        Seq. Line :   2
Acq. Instrument : 1260-DAD                      Location :   P1-C-01
Injection Date  : 11/27/2017 20:30:44              Inj :   2
                                               Inj Volume : 1.000 µl
Acq. Method     : d:\Chem32\1\Data\YANGTAO\YT-2-175 2017-11-27 19-57-43\YANGT-AD-3-80-20-0.5-
                  30MIN .M
Last changed    : 11/27/2017 20:30:45 by SYSTEM
                  (modified after loading)
Analysis Method : d:\Chem32\1\Data\YANGTAO\YT-2-175 2017-11-27 19-57-43\YANGT-AD-3-80-20-0.5-
                  30MIN .M (Sequence Method)
Last changed    : 12/9/2017 17:58:41 by SYSTEM
                  (modified after loading)
Additional Info : Peak(s) manually integrated
```

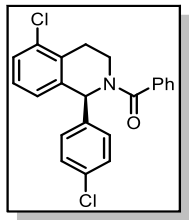



```
=====================================================================
                        Area Percent Report
=====================================================================

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


Signal 1: DAD1 C, Sig=210,4 Ref=360,100

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1  24.844 BB    0.4249  565.01740   20.04240  49.7930
   2  28.878 BB    0.4983  569.71576   17.38541  50.2070

Totals :                  1134.73315   37.42781
```

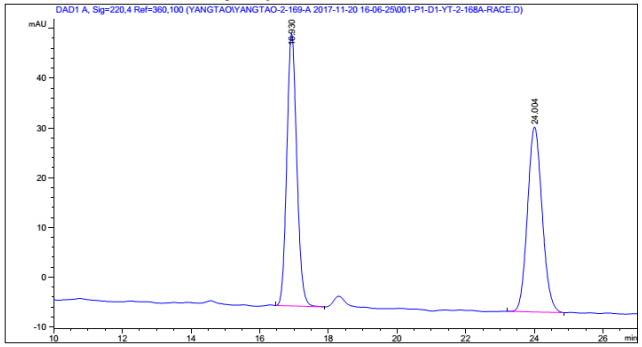
```
Acq. Operator   : SYSTEM                        Seq. Line :   3
Acq. Instrument : 1260-DAD                      Location :   P1-C-02
Injection Date  : 11/27/2017 21:06:34              Inj :   1
                                               Inj Volume : 1.000 µl
Acq. Method     : d:\Chem32\1\Data\YANGTAO\YT-2-175 2017-11-27 19-57-43\YANGT-AD-3-80-20-0.5-
                  30MIN .M
Last changed    : 11/27/2017 20:30:45 by SYSTEM
Analysis Method : d:\Chem32\1\Data\YANGTAO\YT-2-175 2017-11-27 19-57-43\YANGT-AD-3-80-20-0.5-
                  30MIN .M (Sequence Method)
Last changed    : 12/9/2017 17:51:28 by SYSTEM
Additional Info : Peak(s) manually integrated
```




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

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


Signal 1: DAD1 C, Sig=210,4 Ref=360,100

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1  24.787 BB    0.4297 3767.78003  132.51323  96.4970
   2  28.848 BB    0.5366  136.77548    3.52586   3.5030

Totals :                  3904.55551  136.03909
```




Acq. Operator : SYSTEM Seq. Line : 1
Acq. Instrument : 1260-DAD Location : P1-D-01
Injection Date : 11/20/2017 16:07:16 Inj : 1
Inj Volume : 1.000 µl
Acq. Method : d:\Chem32\1\Data\YANGTAO\YANGTAO-2-169-A 2017-11-20 16-06-25\YT-AD3-80-20-1 mL-30Min.M
Last changed : 11/20/2017 16:33:19 by SYSTEM (modified after loading)
Analysis Method : d:\Chem32\1\Data\YANGTAO\YANGTAO-2-169-A 2017-11-20 16-06-25\YT-AD3-80-20-1 mL-30Min.M (Sequence Method)
Last changed : 12/9/2017 17:44:30 by SYSTEM (modified after loading)
Additional Info : Peak(s) manually integrated



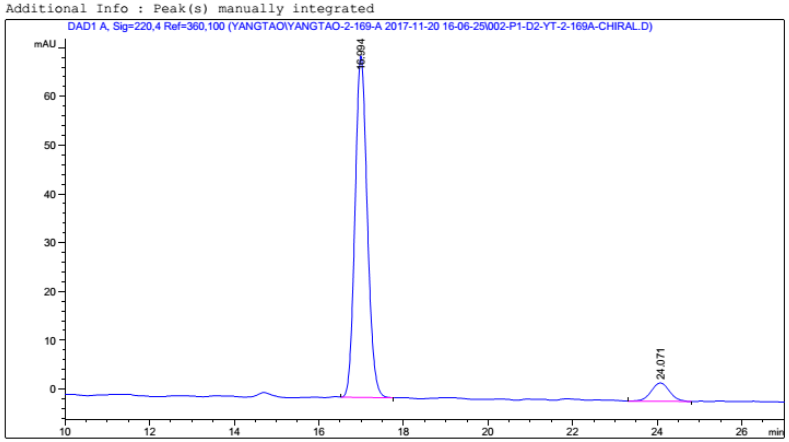

Area Percent Report

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

Signal 1: DAD1 A, Sig=220,4 Ref=360,100

| Peak # | RetTime [min] | Type | Width [min] | Area [mAU*s] | Height [mAU] | Area % |
|---|---|---|---|---|---|---|
| 1 | 16.930 | BB | 0.3131 | 1103.62183 | 54.75880 | 50.0677 |
| 2 | 24.004 | BB | 0.4574 | 1100.63843 | 37.17498 | 49.9323 |
| Totals : | | | | 2204.26025 | 91.93378 | |

Acq. Operator : SYSTEM Seq. Line : 2
Acq. Instrument : 1260-DAD Location : P1-D-02
Injection Date : 11/20/2017 16:36:08 Inj : 1
Inj Volume : 1.000 µl
Acq. Method : d:\Chem32\1\Data\YANGTAO\YANGTAO-2-169-A 2017-11-20 16-06-25\YT-AD3-80-20-1 mL-30Min.M
Last changed : 11/20/2017 16:33:19 by SYSTEM
Analysis Method : d:\Chem32\1\Data\YANGTAO\YANGTAO-2-169-A 2017-11-20 16-06-25\YT-AD3-80-20-1 mL-30Min.M (Sequence Method)
Last changed : 12/9/2017 17:45:15 by SYSTEM (modified after loading)
Additional Info : Peak(s) manually integrated

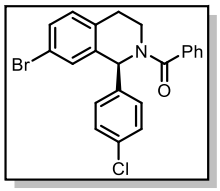



Area Percent Report

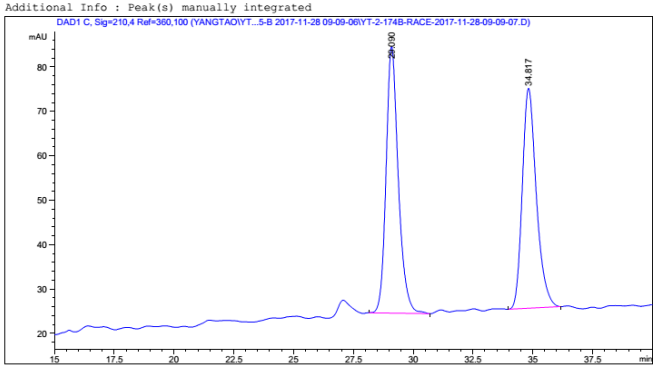
Sorted By : Signal
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: DAD1 A, Sig=220,4 Ref=360,100

| Peak # | RetTime [min] | Type | Width [min] | Area [mAU*s] | Height [mAU] | Area % |
|---|---|---|---|---|---|---|
| 1 | 16.994 | BB | 0.3106 | 1408.07959 | 70.02197 | 92.4680 |
| 2 | 24.071 | BB | 0.4522 | 114.69593 | 3.77794 | 7.5320 |
| Totals : | | | | 1522.77552 | 73.79990 | |

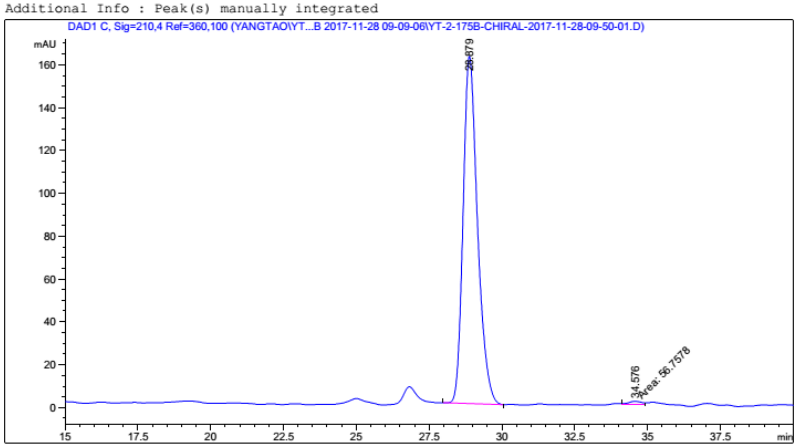



```
Acq. Operator   : SYSTEM                        Seq. Line :   1
Acq. Instrument : 1260-DAD                     Location :   P1-C-03
Injection Date  : 11/28/2017 09:09:57              Inj :   1
                                              Inj Volume : 1.000 µl
Acq. Method     : d:\Chem32\1\Data\YANGTAO\YT-2-175-B 2017-11-28 09-09-06\YANGT-AD-3-80-20-0.
                  5-30MIN .M
Last changed    : 11/28/2017 09:10:06 by SYSTEM
                  (modified after loading)
Analysis Method : d:\Chem32\1\Data\YANGTAO\YT-2-175-B 2017-11-28 09-09-06\YANGT-AD-3-80-20-0.
                  5-30MIN .M (Sequence Method)
Last changed    : 12/9/2017 17:55:16 by SYSTEM
                  (modified after loading)
Additional Info : Peak(s) manually integrated
```




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

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


Signal 1: DAD1 C, Sig=210,4 Ref=360,100

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1  29.090 BB    0.5348 2136.65381   60.09645  51.3572
   2  34.817 BB    0.6205 2023.72437   49.55000  48.6428

Totals :                  4160.37817  109.64645
```

```
Acq. Operator   : SYSTEM                        Seq. Line :   2
Acq. Instrument : 1260-DAD                     Location :   P1-C-04
Injection Date  : 11/28/2017 09:50:49              Inj :   1
                                              Inj Volume : 1.000 µl
Acq. Method     : d:\Chem32\1\Data\YANGTAO\YT-2-175-B 2017-11-28 09-09-06\YANGT-AD-3-80-20-0.
                  5-30MIN .M
Last changed    : 11/28/2017 09:10:06 by SYSTEM
Analysis Method : d:\Chem32\1\Data\YANGTAO\YT-2-175-B 2017-11-28 09-09-06\YANGT-AD-3-80-20-0.
                  5-30MIN .M (Sequence Method)
Last changed    : 12/9/2017 17:55:34 by SYSTEM
                  (modified after loading)
Additional Info : Peak(s) manually integrated
```




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

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


Signal 1: DAD1 C, Sig=210,4 Ref=360,100

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1  28.879 BB    0.5211 5574.14453  162.12366  98.9920
   2  34.576 FM    0.5711   56.75779    1.65625   1.0080

Totals :                  5630.90232  163.77991
```