Supporting Information

Cobalt-Catalyzed Cross-Dehydrogenative Coupling Reaction between Unactivated C(sp^2)–H and C(sp^3)–H Bonds

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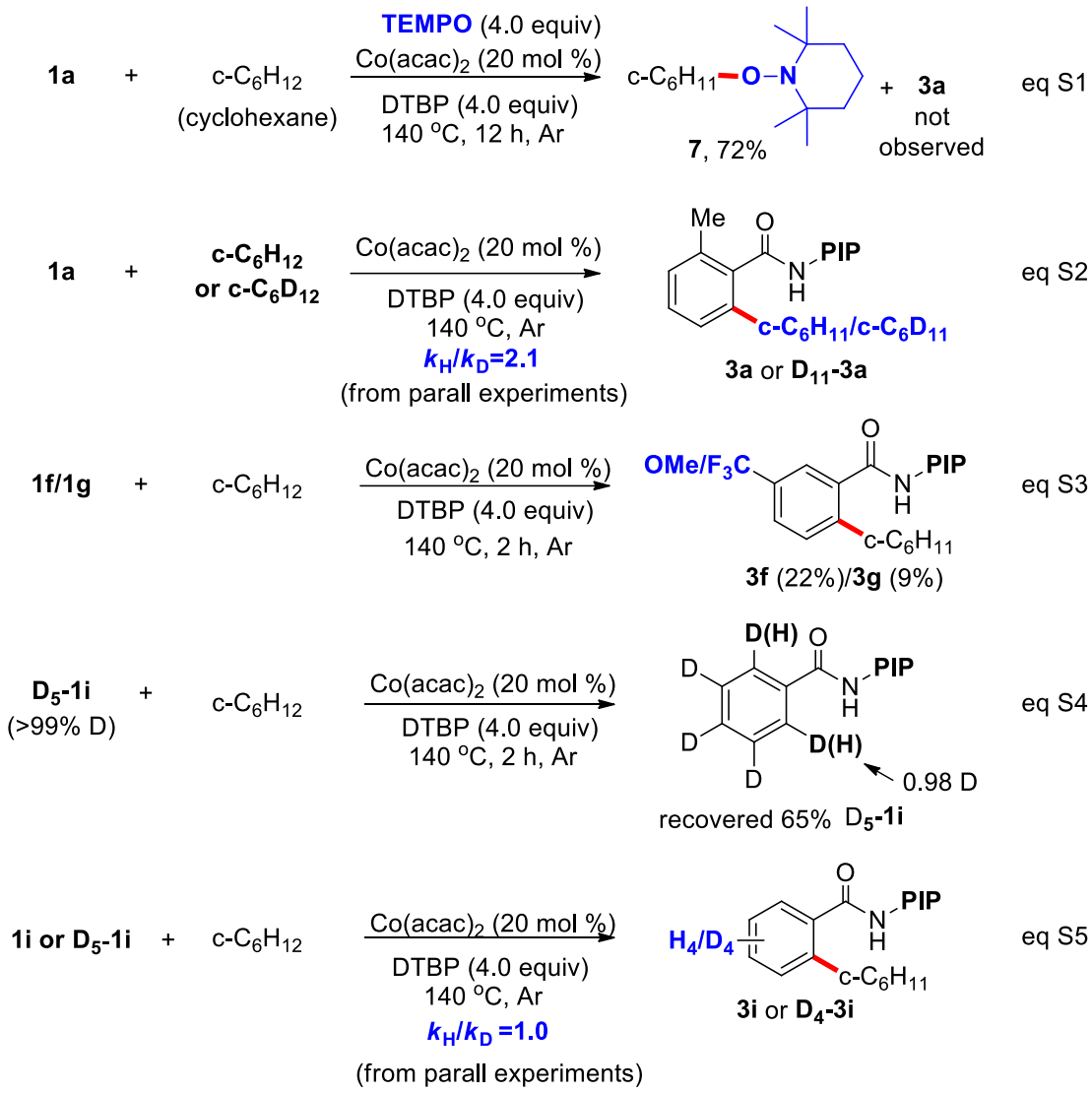
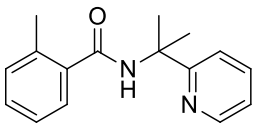
Scheme S1. Mechanistic studies



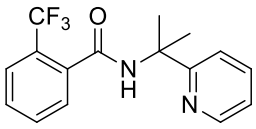
General Information

Unless otherwise noted, the reagents were purchased from commercial sources and were used directly without further purification. 2-(Pyridin-2-yl)isopropyl amine (PIP-NH_2) was synthesized according to the known method.[1] Thin layer chromatography (TLC) was measured on EMD preloaded plates (silica gel 60 F254) and was visualized under UV light (254 nm). Column chromatography was performed with silica gel (200-300 mesh). ^{1}H NMR and ^{13}C NMR was recorded on Bruker DPX 400 MHz spectrometer. Chemical shifts (δ) were reported in ppm referenced to tetramethylsilane (TMS) as internal standard. Abbreviations were used to describe signal couplings: s = singlet, d = doublet, t = triplet, q= quartet, m = multiplet, dd = doublet of doublet, td = triplet of doublet, ddd = doublet of doublet of doublet. Coupling constants (J) were reported in hertz (Hz). Infrared (IR) spectras were recorded on a ThermoFisher Nicolet iS5 spectrophotometer and reported as wave number (cm^{-1}). High resolution mass spectra were obtained on Agilent 6540 Series Q-TOF equipped with ESI.

Preparation of Starting Materials



1a



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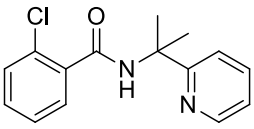

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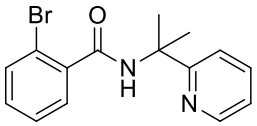

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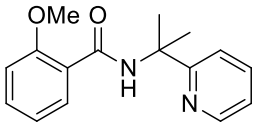

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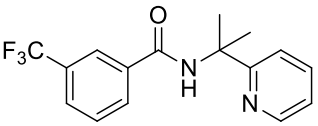

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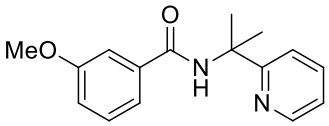

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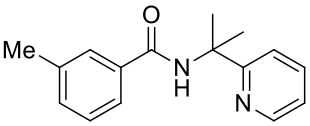

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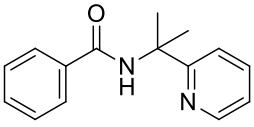

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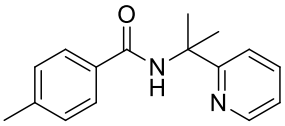

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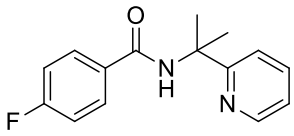

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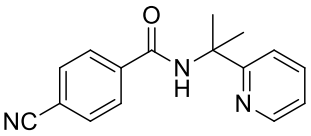

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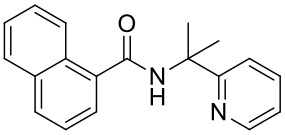

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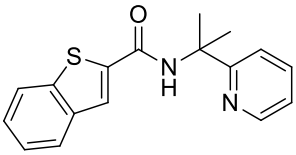
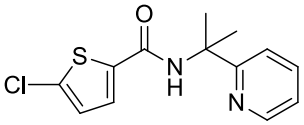


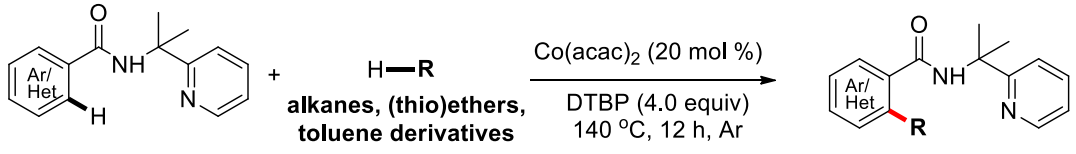
1n



1o

Compound **1a**,[2] **1b**,[2] **1c**,[3] **1d**,[5] **1e**,[4] **1f**,[2] **1g**,[2] **1h**,[2] **1i**,[2] **1j**,[2] **1k**,[5] **1l**,[2] **1m**,[3] **1n**,[5] **1o**[4] and D_5-**1i**[5] were known compounds and prepared according the literature procedure.

General Procedure for Cross-Dehydrogenative Coupling Reaction between Aromatic Carboxamides 1 and Alkyl Sources 2



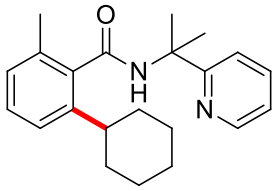
1 **2**

Reaction condition A: A 25 mL oven-dried Schlenk tube was charged with a stir bar,

amide **1** (0.2 mmol), $Co(acac)_2$ (0.04 mmol, 10.3 mg). After the tube was evacuated and filled with Ar, alkyl sources **2** (1.0 mL) and DTBP (0.8 mmol, 117.0 mg) were injected into the tube by syringe. The tube was then stirred vigorously at 140 °C for 12 h. The reaction mixture was then cooled to room temperature, diluted with EtOAc (2.0 mL), filtered through a celite pad, and concentrated under reduced pressure. The residue was purified by silica gel chromatography (CH_2Cl_2 or hexane/EtOAc) to give the desired product.

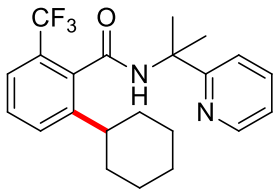
Reaction condition B: A 25 mL oven-dried Schlenk tube was charged with a stir bar, amide **1** (0.2 mmol), $Co(acac)_2$ (0.04 mmol, 10.3 mg). After the tube was evacuated and filled with Ar, alkyl sources **2** (4.0 mmol), DTBP (0.8 mmol, 117.0 mg) and benzene (1.0 mL) were injected into the tube by syringe. The tube was then stirred vigorously at 140 °C for 12 h. The reaction mixture was then cooled to room temperature, diluted with EtOAc (2.0 mL), filtered through a celite pad, and concentrated under reduced pressure. The residue was purified by silica gel chromatography (CH_2Cl_2 or hexane/EtOAc) to give the desired product.

2-Cyclohexyl-6-methyl-*N*-(2-(pyridin-2-yl)propan-2-yl)benzamide (3a)



The general procedure was followed with **1a** (50.9 mg, 0.20 mmol) and cyclohexane (1.0 mL). Purification by column chromatography (EtOAc/n-hexane 1:10) gave **3a** (52.4 mg, 78%) as a white solid (m.p. 115–116 ℃). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.43 (d, *J* = 4.2 Hz, 1H), 8.03 (s, 1H), 7.74 (t, *J* = 7.5 Hz, 1H), 7.47 (d, *J* = 8.0 Hz, 1H), 7.27–7.16 (m, 2H), 7.14 (d, *J* = 7.8 Hz, 1H), 7.03 (d, *J* = 7.4 Hz, 1H), 2.75 (t, *J* = 11.6 Hz, 1H), 2.37 (s, 3H), 1.93–1.89 (m, 8H), 1.81–1.64 (m, 3H), 1.47–1.39 (m, 2H), 1.33–1.19 (m, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 169.3, 164.3, 147.4, 144.2, 138.1, 137.2, 134.1, 128.4, 127.5, 123.5, 121.9, 119.5, 57.0, 41.2, 34.5, 27.4, 27.0, 26.2, 19.3. IR (neat) ν 3328, 2926, 2850, 1659, 1501, 1471, 1379, 1298, 889, 786, 750 cm^{-1}. HRMS (ESI, m/z): calcd. for $C_{22}H_{29}N_2O$ $(M+H)^+$: 337.2280, found: 337.2276.

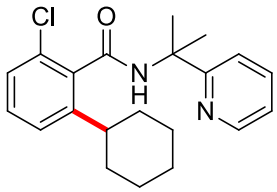
2-Cyclohexyl-*N*-(2-(pyridin-2-yl)propan-2-yl)-6-(trifluoromethyl)benzamide (3b)



The general procedure was followed with **1b** (61.7 mg, 0.20 mmol) and cyclohexane (1.0 mL). Purification by column chromatography (EtOAc/n-hexane 1:10) gave **3b** (66.5 mg, 85%) as a white solid (m.p. 135–136 °C). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.42 (d, *J* = 4.3 Hz, 1H), 8.25 (s, 1H), 7.75 (t, *J* = 7.3 Hz, 1H), 7.59–7.37 (m, 4H),

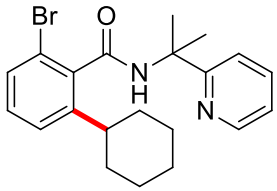
7.23–7.15 (m, 1H), 2.86 (t, *J* = 11.7 Hz, 1H), 1.98–1.87 (m, 8H), 1.84–1.75 (m, 2H), 1.73–1.66 (m, 1H), 1.50–1.37 (m, 2H), 1.34–1.21 (m, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 166.0, 164.1, 147.4, 146.4, 137.2, 135.7, 130.2, 128.7, 126.8 (q, *J* = 31.0 Hz), 124.1 (q, *J* = 274.3 Hz), 123.5 (q, *J* = 5.0 Hz), 121.9, 119.5, 57.3, 40.8, 35.0, 34.1, 27.1, 27.0, 26.8, 26.7, 26.0. IR (neat) ν 3322, 2928, 2853, 1667, 1506, 1473, 1318, 1127, 1100, 888, 787, 749 cm^{-1}. HRMS (ESI, m/z): calcd. for $C_{22}H_{26}F_3N_2O$ $(M+H)^+$: 391.1997, found: 391.1995.

2-Chloro-6-cyclohexyl-*N*-(2-(pyridin-2-yl)propan-2-yl)benzamide (3c)



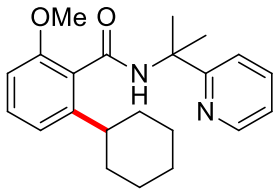
The general procedure was followed with **1c** (55.0 mg, 0.20 mmol) and cyclohexane (1.0 mL). Purification by column chromatography (EtOAc/n-hexane 1:10) gave **3c** (57.7 mg, 81%) as a white solid (m.p. 118–119 ℃). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.44 (d, *J* = 4.5 Hz, 1H), 8.11 (s, 1H), 7.74 (t, *J* = 7.6 Hz, 1H), 7.49 (d, *J* = 8.0 Hz, 1H), 7.33–7.13 (m, 4H), 2.77 (t, *J* = 11.7 Hz, 1H), 2.02–1.87 (m, 8H), 1.78 (d, *J* = 10.5 Hz, 2H), 1.70 (d, *J* = 8.7 Hz, 1H), 1.52–1.35 (m, 2H), 1.34–1.14 (m, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 166.1, 164.1, 147.5, 146.9, 137.2, 137.1, 130.5, 129.6, 126.8, 124.7, 121.9, 119.5, 57.3, 41.5, 34.5, 27.4, 26.9(2), 26.9, 26.1. IR (neat) ν 3320, 2926, 2851, 1664, 1503, 1472, 1299, 1116, 887, 786, 749 cm^{-1}. HRMS (ESI, m/z): calcd. for $C_{21}H_{26}ClN_2O$ $(M+H)^+$: 357.1734, found: 357.1732.

2-Bromo-6-cyclohexyl-*N*-(2-(pyridin-2-yl)propan-2-yl)benzamide (3d)



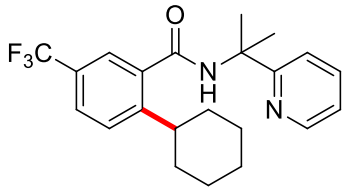
The general procedure was followed with **1d** (63.8 mg, 0.20 mmol) and cyclohexane (1.0 mL). Purification by column chromatography (EtOAc/n-hexane 1:10) gave **3d** (51.4 mg, 64%) as a white solid (m.p. 104–105 ℃). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.45 (d, *J* = 4.6 Hz, 1H), 8.09 (s, 1H), 7.74 (t, *J* = 7.6 Hz, 1H), 7.49 (d, *J* = 8.0 Hz, 1H), 7.39 (d, *J* = 7.8 Hz, 1H), 7.27–7.25 (m, 1H), 7.22–7.14 (m, 2H), 2.78 (t, *J* = 11.7 Hz, 1H), 2.01–1.88 (m, 8H), 1.78 (d, *J* = 9.7 Hz, 2H), 1.69 (d, *J* = 7.1 Hz, 1H), 1.50–1.34 (m, 2H), 1.28–1.19 (m, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 166.9, 164.1, 147.4, 147.0, 139.0, 137.2, 129.9, 129.8(9), 125.2, 122.0, 119.5, 119.5(3), 57.3, 41.7, 35.0, 34.2, 27.3, 26.9, 26.1. IR (neat) ν 3323, 2927, 2851, 1666, 1503, 1472, 1380, 1298, 886, 787, 749 cm^{-1}. HRMS (ESI, m/z): calcd. for $C_{21}H_{26}BrN_2O$ $(M+H)^+$: 401.1229, found: 401.1225.

2-Cyclohexyl-6-methoxy-*N*-(2-(pyridin-2-yl)propan-2-yl)benzamide (3e)



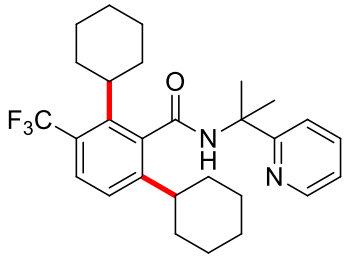
The general procedure was followed with **1e** (54.1 mg, 0.20 mmol) and cyclohexane (1.0 mL). Purification by column chromatography (EtOAc/CH_2Cl_2 1:20) gave **3e** (33.4 mg, 47%) as a white solid (m.p. 108–109 ℃). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.45 (d, *J* = 4.3 Hz, 1H), 7.80–7.64 (m, 2H), 7.54 (d, *J* = 8.0 Hz, 1H), 7.33–7.23 (m, 1H), 7.20–7.12 (m, 1H), 6.92 (d, *J* = 7.8 Hz, 1H), 6.75 (d, *J* = 8.2 Hz, 1H), 3.81 (s, 3H), 2.77 (t, *J* = 11.7 Hz, 1H), 1.92–1.89 (m, 8H), 1.77 (d, *J* = 11.6 Hz, 2H), 1.69 (d, *J* = 9.6 Hz, 1H), 1.47–1.38 (m, 2H), 1.35–1.19 (m, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 167.2, 164.5, 155.9, 147.6, 146.4, 137.0, 129.4, 127.6, 121.7, 119.6, 118.5, 108.4, 57.3, 55.9, 41.0, 34.4, 27.7, 26.9, 26.2. IR (neat) ν 3338, 2926, 2851, 1660, 1502, 1470, 1261, 1084, 889, 787, 750 cm^{-1}. HRMS (ESI, m/z): calcd. for $C_{22}H_{29}N_2O_2$ $(M+H)^+$: 353.2229, found: 353.2225.

2-Cyclohexyl-*N*-(2-(pyridin-2-yl)propan-2-yl)-5-(trifluoromethyl)benzamide (3f)



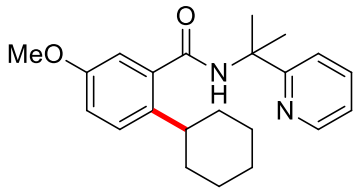
The general procedure was followed with **1f** (61.7 mg, 0.20 mmol) and cyclohexane (1.0 mL). Purification by column chromatography (EtOAc/n-hexane 1:10) gave **3f** (50.9 mg, 65%) as a white solid (m.p. 134–135 ℃). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.46 (d, *J* = 3.2 Hz, 1H), 8.22 (s, 1H), 7.76 (t, *J* = 7.2 Hz, 1H), 7.65 (s, 1H), 7.60 (d, *J* = 8.1 Hz, 1H), 7.46 (t, *J* = 7.9 Hz, 2H), 7.25–7.15 (m, 1H), 3.04 (t, *J* = 11.6 Hz, 1H), 1.95–1.91 (m, 8H), 1.80 (d, *J* = 10.7 Hz, 2H), 1.72 (d, *J* = 8.5 Hz, 1H), 1.49–1.31 (m, 2H), 1.38–1.20 (m, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 168.3, 164.0, 149.2, 147.5, 138.3, 137.3, 127.1, 127.9 (q, *J* = 32.7 Hz), 126.0 (q, *J* = 3.6 Hz), 124.0 (q, *J* = 272.0 Hz), 123.8 (q, *J* = 3.7 Hz), 122.1, 119.5, 57.2, 40.6, 34.3, 27.4, 26.8, 26.0. IR (neat) ν 3308, 2929, 2853, 1650, 1507, 1449, 1337, 1125, 833, 786, 747 cm^{-1}. HRMS (ESI, m/z): calcd. for $C_{22}H_{26}F_3N_2O$ $(M+H)^+$: 391.1997, found: 391.1995.

2,6-Dicyclohexyl-*N*-(2-(pyridin-2-yl)propan-2-yl)-3-(trifluoromethyl)benzamide (3f′)



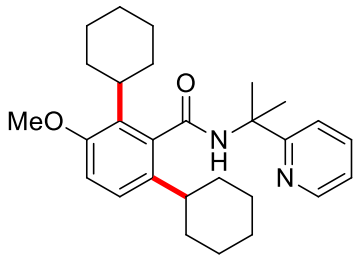
The general procedure was followed with **1f** (61.7 mg, 0.20 mmol) and cyclohexane (1.0 mL). Purification by column chromatography (EtOAc/n-hexane 1:10) gave **3f′** (17.4 mg, 18%) as a white solid (m.p. 60–61 ℃). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.42 (d, *J* = 4.4 Hz, 1H), 8.36 (s, 1H), 7.77 (td, *J* = 7.9, 1.8 Hz, 1H), 7.65 (d, *J* = 8.4 Hz, 1H), 7.49 (d, *J* = 8.1 Hz, 1H), 7.28 (d, *J* = 6.8 Hz, 1H), 7.22 (dd, *J* = 7.4, 4.9 Hz, 1H), 3.11 (t, *J* = 11.9 Hz, 1H), 2.84 (t, *J* = 11.5 Hz, 1H), 2.24–1.97 (m, 8H), 1.88–1.63 (m, 10H), 1.48–1.13 (m, 8H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 168.7, 163.9, 149.9, 147.4, 142.6, 138.9, 137.3, 126.5, 126.4, 125.0 (q, *J* = 273.9 Hz), 124.2, 122.0, 119.5, 57.4, 42.3, 40.6, 34.7, 34.3, 32.7, 32.1, 27.6, 27.5, 27.2, 26.9, 26.8, 26.6, 26.1, 26.0. IR (neat) ν 3326, 2926, 2852, 1661, 1499, 1448, 1312, 1118, 830, 785, 748 cm^{-1}. HRMS (ESI, m/z): calcd. for $C_{28}H_{36}F_3N_2O$ $(M+H)^+$: 473.2780, found: 473.2783.

2-Cyclohexyl-5-methoxy-*N*-(2-(pyridin-2-yl)propan-2-yl)benzamide (3g)



The general procedure was followed with **1g** (54.1 mg, 0.20 mmol) and cyclohexane (1.0 mL). Purification by column chromatography (EtOAc/n-hexane 1:10) gave **3g** (28.9 mg, 41%) as a white solid (m.p. 92–93 ℃). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.47 (ddd, *J* = 4.8, 1.7, 0.9 Hz, 1H), 8.06 (s, 1H), 7.79–7.70 (m, 1H), 7.48 (d, *J* = 8.1 Hz, 1H), 7.26 (d, *J* = 8.5 Hz, 1H), 7.20 (ddd, *J* = 7.4, 4.9, 1.0 Hz, 1H), 7.00–6.86 (m, 2H), 3.82 (s, 3H), 2.94 (tt, *J* = 11.8, 3.2 Hz, 1H), 1.96–1.87 (m, 8H), 1.79 (d, *J* = 12.0 Hz, 2H), 1.71 (d, *J* = 10.0 Hz, 1H), 1.48–1.40 (m, 2H), 1.36–1.24 (m, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 169.5, 164.3, 157.2, 147.6, 138.7, 137.2, 137.1, 127.6, 121.9, 119.4, 115.3, 112.0, 57.1, 55.4, 39.8, 34.8, 27.5, 27.0, 26.2. IR (neat) ν 3335, 2925, 2850, 1660, 1506, 1472, 1287, 1042, 996, 786, 748 cm^{-1}. HRMS (ESI, m/z): calcd. for $C_{22}H_{29}N_2O_2$ $(M+H)^+$: 353.2229, found: 353.2229.

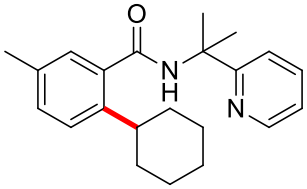
2,6-Dicyclohexyl-3-methoxy-*N*-(2-(pyridin-2-yl)propan-2-yl)benzamide (3g′)



The general procedure was followed with **1g** (54.1 mg, 0.20 mmol) and cyclohexane (1.0 mL). Purification by column chromatography (EtOAc/n-hexane 1:10) gave **3g′** (32.7 mg, 38%) as a white solid (m.p. 74–75 ℃). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.43 (dd, *J* = 4.8, 0.7 Hz, 1H), 8.00 (s, 1H), 7.75 (td, *J* = 7.9, 1.8 Hz, 1H), 7.49 (d, *J* = 8.1 Hz, 1H), 7.19 (ddd, *J* = 7.4, 4.9, 0.8 Hz, 1H), 7.13 (d, *J* = 8.6 Hz, 1H), 6.88 (d, *J* = 8.6 Hz, 1H), 3.82 (s, 3H), 2.79 (t, *J* = 11.8 Hz, 1H), 2.70 (tt, *J* = 11.6, 3.0 Hz, 1H), 2.21–

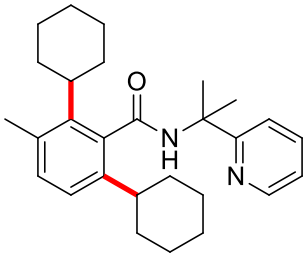
2.08 (m, 2H), 2.01–1.86 (m, 8H), 1.83–1.65 (m, 8H), 1.49–1.15 (m, 8H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 169.2, 164.4, 156.6, 147.5, 139.0, 137.0, 136. 5, 131.1, 124.4, 121.8, 119.4, 111.8, 57.0, 55.3, 42.4, 40.6, 35.4, 34.4, 30.6, 30.0, 27.4, 27.3, 27.2(5), 27.0, 26.2, 26.2. IR (neat) ν 3336, 2925, 2850, 1659, 1499, 1472, 1259, 1069, 996, 785, 747 cm^{-1}. HRMS (ESI, m/z): calcd. for $C_{28}H_{39}N_2O_2$ $(M+H)^+$: 435.3012, found: 435.3013.

2-Cyclohexyl-5-methyl-*N*-(2-(pyridin-2-yl)propan-2-yl)benzamide (3h)



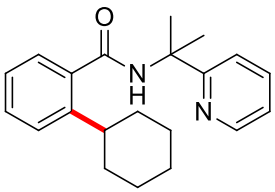
The general procedure was followed with **1h** (50.9 mg, 0.20 mmol) and cyclohexane (1.0 mL). Purification by column chromatography (EtOAc/n-hexane 1:10) gave **3h** (29.6 mg, 44%) as a white solid (m.p. 116–117 ℃). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.45 (d, *J* = 4.4 Hz, 1H), 7.96 (s, 1H), 7.73 (t, *J* = 7.7 Hz, 1H), 7.47 (d, *J* = 8.1 Hz, 1H), 7.23–7.14 (m, 4H), 2.99–2.85 (m, 1H), 2.33 (s, 3H), 1.93–1.89 (m, 8H), 1.77 (d, *J* = 11.8 Hz, 2H), 1.69 (d, *J* = 9.9 Hz, 1H), 1.46–1.37 (m, 2H), 1.34–1.20 (m, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 169.9, 164.4, 147.6, 142.1, 137.7, 137.1, 135.1, 130.1, 127.4, 126.4, 121.9, 119.5, 57.1, 40.1, 34.6, 27.5, 27.0, 26.2, 20.9. IR (neat) ν 3335, 2925, 2851, 1659, 1504, 1472, 1446, 1309, 893, 786, 748 cm^{-1}. HRMS (ESI, m/z): calcd. for $C_{22}H_{29}N_2O$ $(M+H)^+$: 337.2280, found: 337.2279.

2, 6-Dicyclohexyl-3-methyl-*N*-(2-(pyridin-2-yl)propan-2-yl)benzamide (3h′)



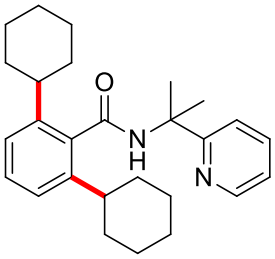
The general procedure was followed with **1h** (50.9 mg, 0.20 mmol) and cyclohexane (1.0 mL). Purification by column chromatography (EtOAc/n-hexane 1:10) gave **3h′** (27.8 mg, 33%) as a white solid (m.p. 155–156 ℃). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.38 (d, *J* = 3.7 Hz, 1H), 8.04 (s, 1H), 7.71 (t, *J* = 7.4 Hz, 1H), 7.46 (d, *J* = 8.0 Hz, 1H), 7.17–7.13 (m, 1H), 7.10–7.05 (s, 2H), 2.93 (t, *J* = 11.1 Hz, 1H), 2.71 (t, *J* = 9.9 Hz, 1H), 2.46 (s, 3H), 2.05–1.62 (m, 18H), 1.47–1.02 (m, 8H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 170.1, 164.4, 147.5, 142.0, 140.5, 138.9, 137.1, 133.9, 132.3, 123.7, 121.9, 119.5, 57.1, 43.9, 41.1, 35.1, 34.4, 31.1, 30.7, 27.6, 27.4, 27.3, 27.2, 27.0, 26.3, 26.2, 21.7. IR (neat) ν 3336, 2926, 2851, 1656, 1498, 1471, 1447, 1378, 817, 786, 753 cm^{-1}. HRMS (ESI, m/z): calcd. for $C_{28}H_{39}N_2O$ $(M+H)^+$: 419.3062, found: 419.3060.

2-Cyclohexyl-*N*-(2-(pyridin-2-yl)propan-2-yl)benzamide (3i)



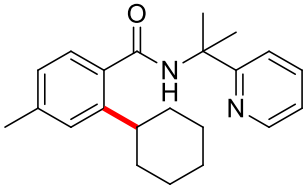
The general procedure was followed with **1i** (48.1 mg, 0.20 mmol) and cyclohexane (1.0 mL). Purification by column chromatography (EtOAc/n-hexane 1:10) gave **3i** (12.9 mg, 20%) as a white solid (m.p. 120–121 ℃). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.45 (d, *J* = 4.2 Hz, 1H), 8.02 (s, 1H), 7.74 (td, *J* = 7.9, 1.6 Hz, 1H), 7.47 (d, *J* = 8.1 Hz, 1H), 7.41 (d, *J* = 7.3 Hz, 1H), 7.38–7.32 (m, 2H), 7.23–7.16 (m, 2H), 3.01 (tt, *J* = 11.8, 3.1 Hz, 1H), 1.97–1.86 (m, 8H), 1.82–1.75 (m, 2H), 1.70 (d, *J* = 10.6 Hz, 1H), 1.50–1.38 (m, 2H), 1.37–1.20 (m, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 169.8, 164.4, 147.6, 145.2, 137.8, 137.1, 129.3, 126.8, 126.5, 125.5, 121.9, 119.5, 57.1, 40.4, 34.5, 27.5, 27.0, 26.2. IR (neat) ν 3333, 2925, 2851, 1660, 1502, 1472, 1446, 1306, 1126, 884, 786, 751 cm^{-1}. HRMS (ESI, m/z): calcd. for $C_{21}H_{27}N_2O$ $(M+H)^+$: 323.2123, found: 323.2122.

2, 6-Dicyclohexyl-*N*-(2-(pyridin-2-yl)propan-2-yl)benzamide (3i′)



The general procedure was followed with **1i** (48.1 mg, 0.20 mmol) and cyclohexane (1.0 mL). Purification by column chromatography (EtOAc/n-hexane 1:10) gave **3i′** (44.6 mg, 55%) as a white solid (m.p. 176–177 ℃). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.41 (d, *J* = 4.4 Hz, 1H), 8.02 (s, 1H), 7.73 (t, *J* = 7.6 Hz, 1H), 7.47 (d, *J* = 8.0 Hz, 1H), 7.30 (t, *J* = 7.7 Hz, 1H), 7.19–7.14 (m, 3H), 2.74 (t, *J* = 11.7 Hz, 2H), 2.01–1.86 (m, 10H), 1.80–1.74 (m, 4H), 1.69 (d, *J* = 4.8 Hz, 2H), 1.49–1.36 (m, 4H), 1.35–1.19 (m, 6H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 169.2, 164.3, 147.5, 144.1, 137.4, 137.1, 128.5, 123.6, 121.9, 119.5, 57.0, 41.3, 35.2, 34.2, 27.4, 27.2, 26.9, 26.2. IR (neat) ν 3301, 2923, 2850, 1636, 1516, 1473, 1447, 1296, 1124, 910, 785, 757 cm^{-1}. HRMS (ESI, m/z): calcd. for $C_{27}H_{37}N_2O$ $(M+H)^+$: 405.2906, found: 405.2902.

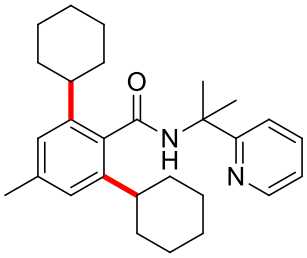
2-Cyclohexyl-4-methyl-*N*-(2-(pyridin-2-yl)propan-2-yl)benzamide (3j)



The general procedure was followed with **1j** (50.9 mg, 0.20 mmol) and cyclohexane (1.0 mL). Purification by column chromatography (EtOAc/n-hexane 1:10) gave **3j**

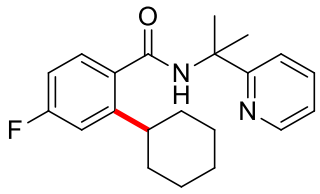
(16.8 mg, 25%) as a white solid (m.p. 123–124 ℃). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.45 (d, *J* = 4.3 Hz, 1H), 7.96 (s, 1H), 7.73 (t, *J* = 7.7 Hz, 1H), 7.47 (d, *J* = 8.0 Hz, 1H), 7.31 (d, *J* = 7.7 Hz, 1H), 7.21–7.16 (m, 1H), 7.13 (s, 1H), 7.01 (d, *J* = 7.7 Hz, 1H), 3.06–2.97 (m, 1H), 2.36 (s, 3H), 1.93–1.89 (m, 8H), 1.78 (d, *J* = 12.2 Hz, 2H), 1.70 (d, *J* = 10.7 Hz, 1H), 1.49–1.38 (m, 2H), 1.36–1.22 (m, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 169.9, 164.5, 147.5, 145.2, 139.1, 137.1, 135.1, 127.2, 126.9, 126.2, 121.8, 119.5, 57.0, 40.3, 34.5, 27.5, 27.0, 26.2, 21.5. IR (neat) ν 3336, 2925, 2851, 1659, 1507, 1472, 1447, 1305, 880, 786, 748 cm^{-1}. HRMS (ESI, m/z): calcd. for $C_{22}H_{29}N_2O$ $(M+H)^+$: 337.2280, found: 337.2280.

2, 6-Dicyclohexyl-4-methyl-*N*-(2-(pyridin-2-yl)propan-2-yl)benzamide (3j′)



The general procedure was followed with **1j** (50.9 mg, 0.20 mmol) and cyclohexane (1.0 mL). Purification by column chromatography (EtOAc/n-hexane 1:10) gave **3j′** (38.6 mg, 46%) as a white solid (m.p. 194–195 ℃). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.40 (d, *J* = 4.3 Hz, 1H), 7.94 (s, 1H), 7.72 (t, *J* = 7.6 Hz, 1H), 7.47 (d, *J* = 8.0 Hz, 1H), 7.21–7.12 (m, 1H), 6.95 (s, 2H), 2.72 (t, *J* = 11.7 Hz, 2H), 2.34 (s, 3H), 1.92–1.87 (m, 10H), 1.79–1.74 (m, 4H), 1.68 (d, *J* = 4.3 Hz, 2H), 1.52–1.36 (m, 4H), 1.34–1.19 (m, 6H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 169.4, 164.4, 147.5, 144.0, 137.9, 137.0, 134.8, 124.3, 121.8, 119.5, 57.0, 41.2, 35.1, 34.2, 27.4, 27.2, 26.9, 26.2, 21.7. IR (neat) ν 3335, 2925, 2851, 1657, 1501, 1471, 1447, 1379, 881, 786, 751 cm^{-1}. HRMS (ESI, m/z): calcd. For $C_{28}H_{39}N_2O$ $(M+H)^+$: 419.3062, found: 419.3061.

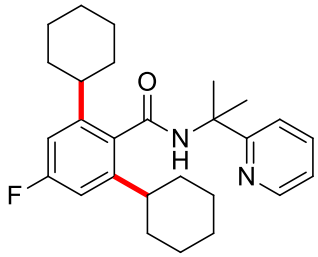
2-Cyclohexyl-4-fluoro-*N*-(2-(pyridin-2-yl)propan-2-yl)benzamide (3k)



The general procedure was followed with **1k** (51.7 mg, 0.20 mmol) and cyclohexane (1.0 mL). Purification by column chromatography (EtOAc/n-hexane 1:10) gave **3k** (23.1 mg, 34%) as a white solid (m.p. 126–127 ℃). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.46 (d, *J* = 4.3 Hz, 1H), 8.08 (s, 1H), 7.73 (td, *J* = 8.0, 1.4 Hz, 1H), 7.46 (d, *J* = 8.1 Hz, 1H), 7.39 (dd, *J* = 8.3, 6.1 Hz, 1H), 7.19 (dd, *J* = 6.8, 5.2 Hz, 1H), 7.01 (dd, *J* = 10.7, 2.3 Hz, 1H), 6.88 (td, *J* = 8.3, 2.4 Hz, 1H), 3.06 (t, *J* = 10.3 Hz, 1H), 1.97–1.86 (m, 8H), 1.79 (d, *J* = 11.0 Hz, 2H), 1.70 (d, *J* = 10.9 Hz, 1H), 1.43–1.19 (m, 5H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 168.9, 164.3, 163.4 (d, *J* = 247.3 Hz), 148.46 (d, *J* = 7.1 Hz), 147.6, 137.1, 133.9 (d, *J* = 3.0 Hz), 128.8 (d, *J* = 8.6 Hz), 121.9, 119.4, 113.4 (d,

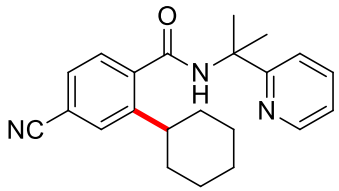
J = 21.6 Hz), 112.4 (d, *J* = 21.6 Hz), 57.1, δ 40.3 (d, *J* = 1.2 Hz), 34.4, 27.4, 26.8, 26.1. IR (neat) ν 3323, 2927, 2852, 1652, 1589, 1507, 1472, 1380, 1157, 880, 786, 748 cm^{-1}. HRMS (ESI, m/z): calcd. for $C_{21}H_{26}FN_2O$ $(M+H)^+$: 341.2029, found: 341.2028.

2, 6-Dicyclohexyl-4-fluoro-*N*-(2-(pyridin-2-yl)propan-2-yl)benzamide (3k′)



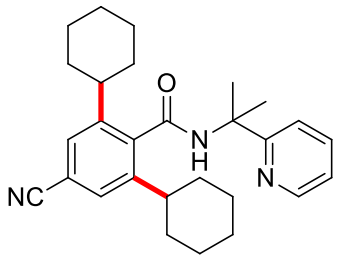
The general procedure was followed with **1k** (51.7 mg, 0.20 mmol) and cyclohexane (1.0 mL). Purification by column chromatography (EtOAc/n-hexane 1:10) gave **3k′** (34.2 mg, 40%) as a white solid (m.p. 183–184 ℃). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.42 (d, *J* = 4.3 Hz, 1H), 8.06 (s, 1H), 7.73 (t, *J* = 7.1 Hz, 1H), 7.46 (d, *J* = 8.0 Hz, 1H), 7.18 (dd, *J* = 6.8, 5.2 Hz, 1H), 6.82 (d, *J* = 10.2 Hz, 2H), 2.77 (t, *J* = 10.6 Hz, 2H), 1.92–1.88 (m, 10H), 1.81–1.64 (m, 6H), 1.43–1.19 (m, 10H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 168.6, 164.2, 163.1 (d, *J* = 244.8 Hz), 147.5, 146.9 (d, *J* = 7.2 Hz), 137.1, 133.4 (d, *J* = 2.7 Hz), 121.9, 119.4, 110.4 (d, *J* = 21.6 Hz), 57.0, 41.3 (d, *J* = 1.5 Hz), 35.0, 34.1, 27.3, 27.0, 26.8, 26.1. IR (neat) ν 3299, 2926, 2851, 1659, 1596, 1507, 1472, 1447, 1307, 857, 786, 749 cm^{-1}. HRMS (ESI, m/z): calcd. for $C_{27}H_{36}FN_2O$ $(M+H)^+$: 423.2812, found: 423.2812.

4-Cyano-2-cyclohexyl-*N*-(2-(pyridin-2-yl)propan-2-yl)benzamide (3l)



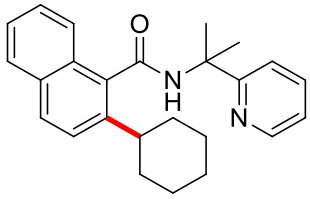
The general procedure was followed with **1l** (53.1 mg, 0.20 mmol) and cyclohexane (1.0 mL). Purification by column chromatography (EtOAc/n-hexane 1:5) gave **3l** (22.3 mg, 32%) as a white solid (m.p. 181–182 ℃). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.45 (d, *J* = 4.8 Hz, 1H), 8.29 (s, 1H), 7.77 (td, *J* = 7.8, 1.7 Hz, 1H), 7.62 (s, 1H), 7.54–7.44 (m, 3H), 7.22 (dd, *J* = 7.4, 4.9 Hz, 1H), 3.01 (tt, *J* = 11.7, 3.0 Hz, 1H), 1.98–1.87 (m, 8H), 1.83–1.80 (m, 2H), 1.74–1.65 (m, 1H), 1.47–1.36 (m, 2H), 1.33–1.25 (m, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 167.8, 163.8, 147.5, 146.5, 141.8, 137.4, 130.7, 129.4, 127.6, 122.1, 119.4, 118.8, 113.2, 57.2, 40.4, 34.3, 27.3, 26.7, 25.9. IR (neat) ν 3308, 2927, 2852, 2230, 1651, 1507, 1472, 1449, 1310, 880, 786, 749 cm^{-1}. HRMS (ESI, m/z): calcd. for $C_{22}H_{26}N_3O$ $(M+H)^+$: 348.2076, found: 348.2075.

4-Cyano-2,6-dicyclohexyl-*N*-(2-(pyridin-2-yl)propan-2-yl)benzamide (3l′)



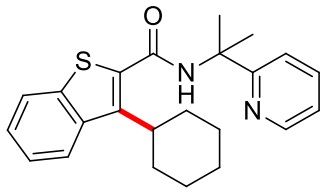
The general procedure was followed with **1l** (53.1 mg, 0.20 mmol) and cyclohexane (1.0 mL). Purification by column chromatography (EtOAc/n-hexane 1:5) gave **3l′** (35.2 mg, 41%) as a white solid (m.p. 152–153 °C). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.42 (d, *J* = 4.6 Hz, 1H), 8.25 (s, 1H), 7.76 (t, *J* = 7.7 Hz, 1H), 7.47 (d, *J* = 8.1 Hz, 1H), 7.43 (s, 2H), 7.21 (dd, *J* = 7.1, 5.2 Hz, 1H), 2.82–2.70 (m, 2H), 1.95–1.85 (m, 10H), 1.84–1.73 (m, 4H), 1.70 (d, *J* = 5.8 Hz, 2H), 1.46–1.17 (m, 10H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 167.3, 163.8, 147.5, 145.5, 141.3, 137.3, 127.7, 122.1, 119.4, 119.3, 112.5, 57.2, 41.2, 35.0, 34.0, 27.3, 26.9, 26.7, 25.9. IR (neat) ν 3321, 2928, 2852, 2229, 1661, 1506, 1448, 1381, 1302, 875, 787, 737 cm^{-1}. HRMS (ESI, m/z): calcd. for $C_{28}H_{36}N_3O$ $(M+H)^+$: 430.2858, found: 430.2855.

2-Cyclohexyl-*N*-(2-(pyridin-2-yl)propan-2-yl)-1-naphthamide (3m)



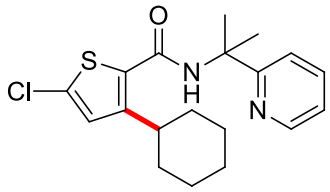
The general procedure was followed with **1m** (58.1 mg, 0.20 mmol) and cyclohexane (1.0 mL). Purification by column chromatography (EtOAc/n-hexane 1:10) gave **3m** (46.2 mg, 62%) as a white solid (m.p. 143–144 ℃). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.38 (d, *J* = 4.3 Hz, 1H), 8.21 (s, 1H), 7.96 (d, *J* = 8.1 Hz, 1H), 7.86–7.77 (m, 2H), 7.74 (t, *J* = 7.5 Hz, 1H), 7.53–7.39 (m, 4H), 7.20–7.13 (m, 1H), 2.98 (t, *J* = 11.9 Hz, 1H), 2.06 (s, 3H), 2.00 (s, 3H), 1.94 (d, *J* = 12.0 Hz, 2H), 1.86–1.70 (m, 3H), 1.57 (dd, *J* = 22.2, 10.9 Hz, 2H), 1.40–1.20 (m, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 168.9, 164.2, 147.5, 141.2, 137.2, 134.2, 131.9, 130.3, 128.7, 127.8, 126.6, 125.4, 125.3, 124.4, 121.9, 119.5, 57.3, 41.7, 34.6, 33.7, 27.7, 27.4, 27.0, 26.8, 26.2. IR (neat) ν 3327, 2926, 2851, 1659, 1498, 1472, 1447, 1379, 1288, 817, 786, 747 cm^{-1}. HRMS (ESI, m/z): calcd. for $C_{25}H_{29}N_2O$ $(M+H)^+$: 373.2280, found: 373.2276.

3-Cyclohexyl-*N*-(2-(pyridin-2-yl)propan-2-yl)benzo[*b*]thiophene-2-carboxamide (3n)



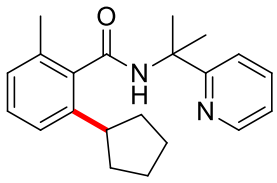
The general procedure was followed with **1n** (59.3 mg, 0.20 mmol) and cyclohexane (1.0 mL). Purification by column chromatography (EtOAc/n-hexane 1:10) gave **3n** (40.9 mg, 54%) as a white solid (m.p. 111–112 ℃). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.60 (s, 1H), 8.49 (d, *J* = 4.2 Hz, 1H), 8.10–8.03 (m, 1H), 7.86–7.79 (m, 1H), 7.75 (td, *J* = 8.0, 1.6 Hz, 1H), 7.46 (d, *J* = 8.1 Hz, 1H), 7.39–7.32 (m, 2H), 7.21 (dd, *J* = 6.7, 5.0 Hz, 1H), 3.57 (tt, *J* = 12.4, 3.4 Hz, 1H), 2.21–2.07 (m, 2H), 1.98–1.84 (m, 10H), 1.76 (d, *J* = 9.4 Hz, 1H), 1.46–1.32 (m, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 164.2, 163.5, 147.4, 141.8, 139.4, 139.1, 137.3, 133.3, 125.1, 124.7, 123.8, 122.8, 122.0, 119.5, 57.4, 39.5, 31.5, 27.5, 27.1, 26.2. IR (neat) ν 3318, 2927, 2852, 1656, 1496, 1471, 1449, 1291, 786, 734 cm^{-1}. HRMS (ESI, m/z): calcd. for $C_{23}H_{27}N_2OS$ $(M+H)^+$: 379.1844, found: 379.1841.

5-Chloro-3-cyclohexyl-*N*-(2-(pyridin-2-yl)propan-2-yl)thiophene-2-carboxamide (3o)



The general procedure was followed with **1o** (56.2 mg, 0.20 mmol) and cyclohexane (1.0 mL). Purification by column chromatography (EtOAc/n-hexane 1:10) gave **3o** (41.7 mg, 57%) as a white solid (m.p. 109–110 ℃). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.60 (s, 1H), 8.55–8.48 (m, 1H), 7.78 (td, *J* = 7.9, 1.8 Hz, 1H), 7.46 (d, *J* = 8.1 Hz, 1H), 7.25 (ddd, *J* = 7.4, 4.9, 0.8 Hz, 1H), 6.87 (s, 1H), 3.50–3.24 (m, 1H), 2.02–1.96 (m, 2H), 1.90–1.82 (m, 8H), 1.77–1.73 (m, 1H), 1.45–1.37 (m, 4H), 1.31–1.23 (m, 1H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 164.3, 161.3, 149.1, 147.4, 137.4, 132.4, 131.7, 127.1, 122.1, 119.5, 57.3, 38.5, 34.1, 27. 6, 26.6, 26.0. IR (neat) ν 3335, 2927, 2852, 1648, 1498, 1472, 1450, 1297, 997, 786, 748 cm^{-1}. HRMS (ESI, m/z): calcd. for $C_{19}H_{23}ClN_2OS$ $(M+H)^+$: 363.1298, found: 363.1295.

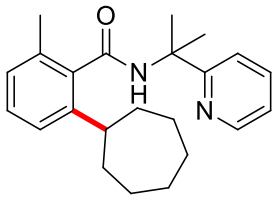
2-Cyclopentyl-6-methyl-*N*-(2-(pyridin-2-yl)propan-2-yl)benzamide (3p)



The general procedure was followed with **1a** (50.9 mg, 0.20 mmol) and cyclopentane (1.0 mL). Purification by column chromatography (EtOAc/n-hexane 1:10) gave **3p** (53.5 mg, 83%) as a white solid (m.p. 116–117 ℃). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.44 (d, *J* = 4.2 Hz, 1H), 7.99 (s, 1H), 7.73 (t, *J* = 7.5 Hz, 1H), 7.47 (d, *J* = 8.0 Hz, 1H), 7.25–7.15 (m, 3H), 7.02 (d, *J* = 7.2 Hz, 1H), 3.23–3.12 (m, 1H), 2.37 (s, 3H), 2.11–2.02 (m, 2H), 1.91 (s, 6H), 1.83–1.74 (m, 2H), 1.65–1.55 (m, 4H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 169.5, 164.3, 147.5, 143.1, 138.7, 137.1, 134.0, 128.5, 127.4, 123.3, 121.9, 119.5, 57.1, 42.5, 35.6, 27.4, 25.9, 19.3. IR (neat) ν 3331, 2953, 2867,

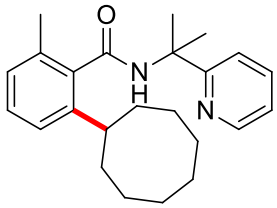
1660, 1501, 1471, 1447, 1379, 1298, 887, 786, 749 cm^{-1}. HRMS (ESI, m/z): calcd. for $C_{21}H_{27}N_2O$ $(M+H)^+$: 323.2123, found: 323.2123.

2-Cycloheptyl-6-methyl-*N*-(2-(pyridin-2-yl)propan-2-yl)benzamide (3q)



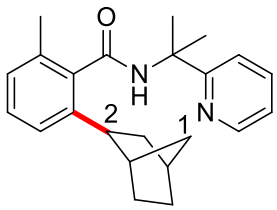
The general procedure was followed with **1a** (50.9 mg, 0.20 mmol) and cycloheptane (1.0 mL). Purification by column chromatography (EtOAc/n-hexane 1:10) gave **3q** (56.0 mg, 80%) as a white solid (m.p. 112–113 ℃). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.42 (d, *J* = 1.6 Hz, 1H), 8.03 (s, 1H), 7.73 (t, *J* = 7.5 Hz, 1H), 7.47 (d, *J* = 7.9 Hz, 1H), 7.23–7.16 (m, 2H), 7.12 (d, *J* = 7.6 Hz, 1H), 7.00 (d, *J* = 7.2 Hz, 1H), 2.90 (t, *J* = 9.9 Hz, 1H), 2.36 (s, 3H), 1.98–1.88 (m, 8H), 1.75–1.35 (m, 10H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 169.3, 164.3, 147.5, 146.3, 137.2, 137.1, 134.0, 128.5, 127.1, 123.6, 121.9, 119.5, 57.0, 42.9, 37.0, 27.8, 27. 6, 27.4, 19.3. IR (neat) ν 3331, 2924, 2853, 1659, 1501, 1471, 1446, 1379, 1298, 887, 786, 748 cm^{-1}. HRMS (ESI, m/z): calcd. for $C_{23}H_{31}N_2O$ $(M+H)^+$: 351.2436, found: 351.2437.

2-Cyclooctyl-6-methyl-*N*-(2-(pyridin-2-yl)propan-2-yl)benzamide (3r)



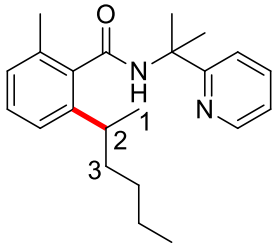
The general procedure was followed with **1a** (50.9 mg, 0.20 mmol) and cyclooctane (1.0 mL). Purification by column chromatography (EtOAc/n-hexane 1:10) gave **3r** (48.9 mg, 67%) as a white solid (m.p. 88–89 ℃). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.42 (d, *J* = 4.7 Hz, 1H), 8.11 (s, 1H), 7.73 (t, *J* = 7.2 Hz, 1H), 7.47 (d, *J* = 8.1 Hz, 1H), 7.24–7.16 (m, 2H), 7.10 (d, *J* = 7.8 Hz, 1H), 7.00 (d, *J* = 7.4 Hz, 1H), 3.02 (t, *J* = 9.8 Hz, 1H), 2.36 (s, 3H), 1.94 (s, 6H), 1.91–1.83 (m, 2H), 1.81–1.68 (m, 4H), 1.66–1.44 (m, 8H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 169.4, 164.3, 147.5, 147.2, 137.3, 137.1, 133.9, 128.5, 127.1, 124.1, 12.9, 119.5, 57.0, 40.5, 35.8, 27.4, 26.6, 26.5, 26.3, 19.4. IR (neat) ν 3333, 2921, 2852, 1659, 1500, 1471, 1445, 1379, 1298, 887, 786, 748 cm^{-1}. HRMS (ESI, m/z): calcd. for $C_{24}H_{33}N_2O$ $(M+H)^+$: 365.2593, found: 365.2593.

2-(Bicyclo[2.2.1]heptan-2-yl)-6-methyl-*N*-(2-(pyridin-2-yl)propan-2-yl)benzamide (3s)



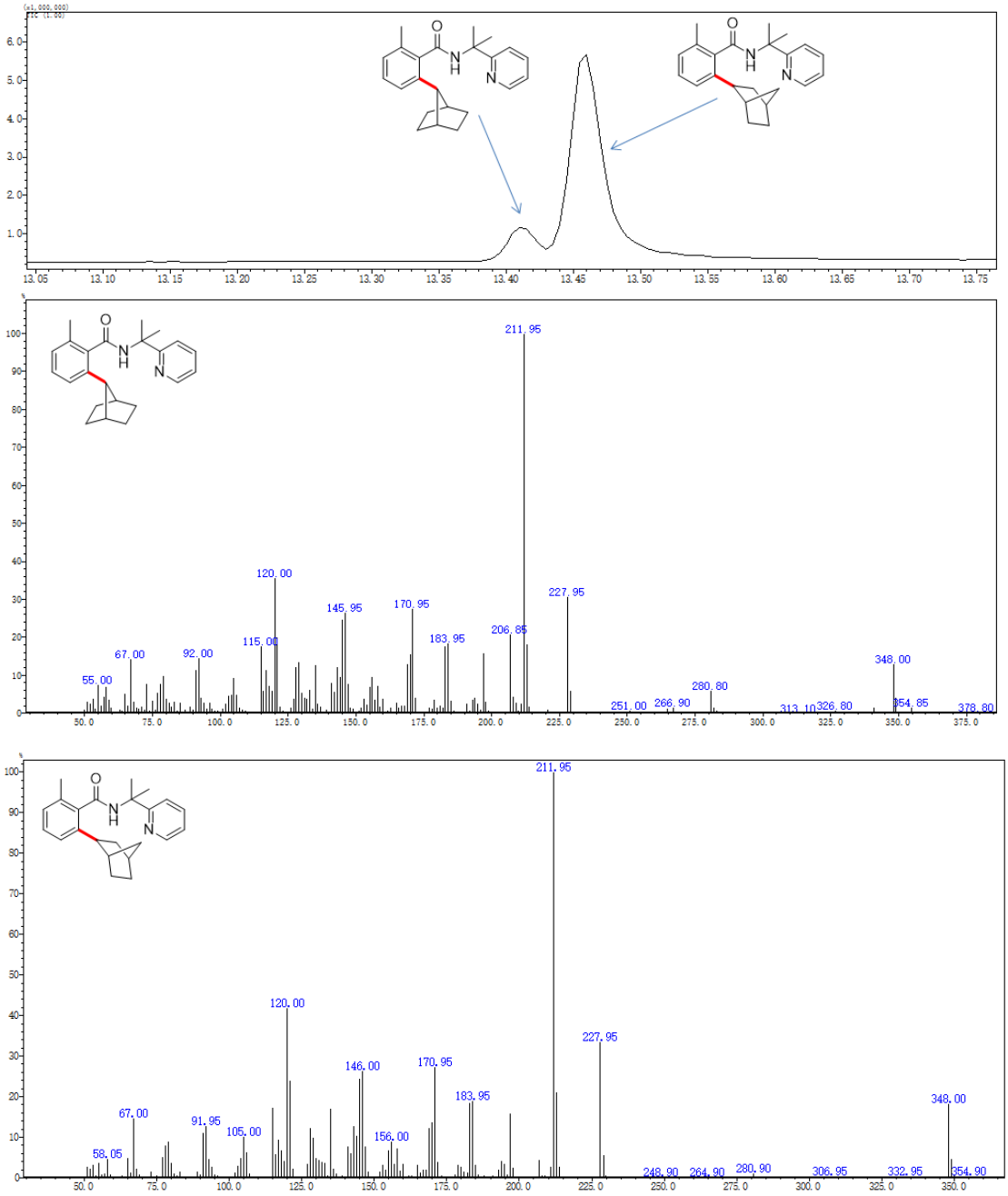
The general procedure was followed with **1a** (50.9 mg, 0.20 mmol) and norbornane (914.0 mg). Purification by column chromatography (EtOAc/n-hexane 1:10) gave **3s** (43.8 mg, 63%, a mixture, C(1):C(2)=1:6, determined by ^{1}H NMR) as a white solid (m.p. 100–101 ℃). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.43 (d, *J* = 4.6 Hz, 1H), 8.03 (s, 1H), 7.73 (t, *J* = 7.7 Hz, 1H), 7.47 (d, *J* = 8.1 Hz, 1H), 7.24–7.11 (m, 3H), 7.06–7.00 (m, 1H), 3.44 (dd, *J* = 6.5, 4.5 Hz, 0.14H), 3.00–2.92 (m, 0.86H), 2.42–2.25 (m, 5H), 1.93 (s, 6H), 1.79–1.60 (m, 3H), 1.53–1.43 (m, 2H), 1.30–1.13 (m, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 169.6, 164.3, 147.5, 143.9, 138.7, 137.1, 134.2, 128.2,127.6(4), 127.6, 127.3, 123.0, 121.9, 119.5, 57.0, 43.8, 43.7, 41.5, 40.1, 37.8, 36.8, 36.4, 30.8, 29.9, 28.7, 27.5, 27.3, 23.0, 19.3, 19.3. IR (neat) ν 3332, 2953, 2869, 1659, 1501, 1471, 1448, 1298, 1205, 887, 786, 750 cm^{-1}. HRMS (ESI, m/z): calcd. for $C_{23}H_{29}N_2O$ $(M+H)^+$: 349.2280, found: 349.2278.

2-(Hexan-2-yl)-6-methyl-*N*-(2-(pyridin-2-yl)propan-2-yl)benzamide (3t)

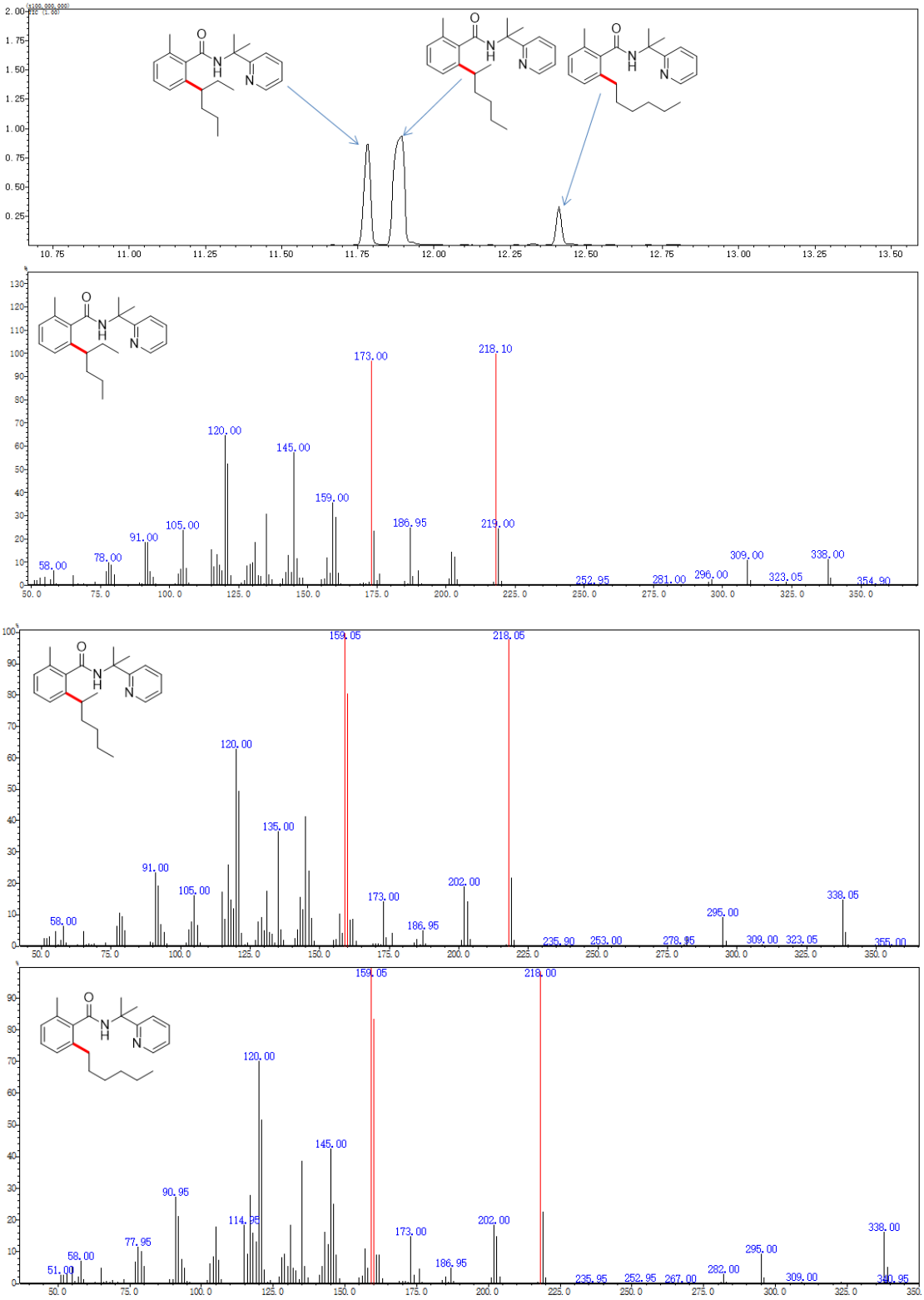


The general procedure was followed with **1a** (50.9 mg, 0.20 mmol) and *n*-hexane (1.0 mL). Purification by column chromatography (EtOAc/n-hexane 1:10) gave **3t** (56.8 mg, 84%, a mixture, C(1):C(2):C(3)=1:6:2, determined by ^{1}H NMR) as a colorless oil. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.44–8.37 (m, 1H), 8.15–8.02 (m, 1H), 7.73 (td, *J* = 8.1, 1.6 Hz, 1H), 7.46 (d, *J* = 8.1 Hz, 1H), 7.26–7.21 (m, 1H), 7.19–7.15 (m, 1H), 7.13 (d, *J* = 7.8 Hz, 0.69H), 7.08 (d, *J* = 7.7 Hz, 0.31H), 7.06–7.00 (m, 1H), 3.00–2.91 (m, 0.67H), 2.80–2.71 (m, 0.27H), 2.70–2.64 (m, 0.11H), 2.38 (s, 3H), 1.93 (s, 6H), 1.73–1.47 (m, 2.62H), 1.33–1.06 (m, 5.88H), 0.85–0.73 (m, 3.67H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 169.3, 169.2, 164.3, 147.4, 147.3(9), 144.4, 142.8, 139.4, 139.3, 138.5, 137.1, 134.3, 134.0, 133.9, 128.5, 128.4, 128.2, 127.5, 127.4, 127.3, 126.6, 123.2, 123.1, 121.9, 119.5, 119.4, 57.0(3), 57.0, 43.2, 39.2, 38.1, 36.0, 33.5, 32.0, 31.7, 30.2, 30.0, 29.5, 27.4, 27.3(8), 27.3, 23.0, 22.8, 22.5, 19.4, 19.3, 19.2, 14.4, 14.0, 12.3. IR (neat) ν 3334, 2927, 2857, 1660, 1500, 1471, 1447, 1379, 1297, 887, 787, 749 cm^{-1}. HRMS (ESI, m/z): calcd. for $C_{22}H_{31}N_2O$ $(M+H)^+$: 339.2436, found: 339.2438.

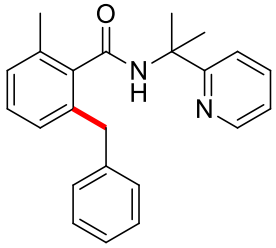
GC-MS spectrum of 3s



GC-MS spectrum of 3t

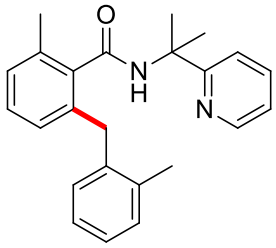


2-Benzyl-6-methyl-*N*-(2-(pyridin-2-yl)propan-2-yl)benzamide (4a)



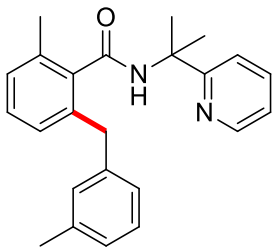
The general procedure was followed with **1a** (50.9 mg, 0.20 mmol) and toluene (1.0 mL). Purification by column chromatography (EtOAc/n-hexane 1:10) gave **4a** (54.6 mg, 79%) as a white solid (m.p. 123–124 ℃). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.39 (d, *J* = 4.1 Hz, 1H), 7.94 (s, 1H), 7.74–7.66 (m, 1H), 7.40 (d, *J* = 8.1 Hz, 1H), 7.25–7.10 (m, 7H), 7.07 (d, *J* = 7.5 Hz, 1H), 6.95 (d, *J* = 7.6 Hz, 1H), 4.08 (s, 2H), 2.40 (s, 3H), 1.84 (s, 6H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 169.0, 164.2, 147.5, 141.0, 138.7, 137.1(2), 137.1, 134.6, 129.1, 128.4, 128.3(7), 128.1, 127.5, 125.9, 121.9, 119.4, 57.1, 38.7, 27.3, 19.4. IR (neat) ν 3325, 2975, 2924, 1659, 1501, 1471, 1380, 1299, 1204, 885, 786, 700 cm^{-1}. HRMS (ESI, m/z): calcd. for $C_{23}H_{25}N_2O$ $(M+H)^+$: 345.1967, found: 345.1965.

2-Methyl-6-(2-methylbenzyl)-*N*-(2-(pyridin-2-yl)propan-2-yl)benzamide (4b)



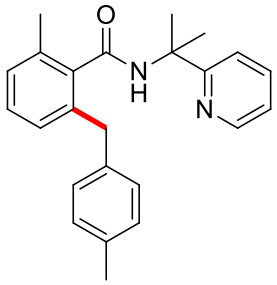
The general procedure was followed with **1a** (50.9 mg, 0.20 mmol) and *o*-xylene (1.0 mL). Purification by column chromatography (EtOAc/n-hexane 1:10) gave **4b** (53.7 mg, 75%) as a white solid (m.p. 111–112 ℃). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.40 (d, *J* = 5.6 Hz, 1H), 7.91 (s, 1H), 7.69 (td, *J* = 8.0, 1.8 Hz, 1H), 7.38 (d, *J* = 8.1 Hz, 1H), 7.17–7.06 (m, 6H), 7.01 (dd, *J* = 8.1, 4.7 Hz, 1H), 6.75 (d, *J* = 7.6 Hz, 1H), 4.06 (s, 2H), 2.41 (s, 3H), 2.23 (s, 3H), 1.81 (s, 6H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 169.0, 164.2, 147.5, 138.8(3), 138.8, 137.1, 136.7, 136.5, 134.5, 130.1, 129.7, 128.5, 128.0, 126.6, 126.3, 126.0, 121.9, 119.4, 57.0, 36.2, 27.3, 19.7, 19.3. IR (neat) ν 3326, 2974, 2925, 1658, 1471, 1380, 1299, 1204, 886, 787, 741 cm^{-1}. HRMS (ESI, m/z): calcd. for $C_{24}H_{27}N_2O$ $(M+H)^+$: 359.2123, found: 359.2122.

2-Methyl-6-(3-methylbenzyl)-*N*-(2-(pyridin-2-yl)propan-2-yl)benzamide (4c)



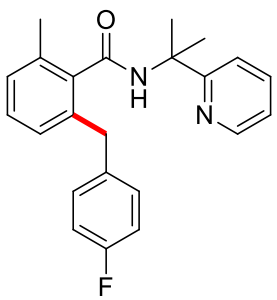
The general procedure was followed with **1a** (50.9 mg, 0.20 mmol) and *m*-xylene (1.0 mL). Purification by column chromatography (EtOAc/n-hexane 1:10) gave **4c** (47.5 mg, 66%) as a white solid (m.p. 105–106 ℃). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.41 (d, *J* = 4.7 Hz, 1H), 7.99 (s, 1H), 7.71 (t, *J* = 7.7 Hz, 1H), 7.41 (d, *J* = 8.1 Hz, 1H), 7.21–7.08 (m, 4H), 7.05–6.92 (m, 4H), 4.06 (s, 2H), 2.42 (s, 3H), 2.25 (s, 3H), 1.87 (s, 6H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 169.0, 164.2, 147.5, 140.9, 138.7, 137.9, 137.2, 137.1, 134.6, 129.8, 128.4, 128.3, 128.0, 127.5, 126.7, 126.1, 121.9, 119.4, 57.1, 38.6, 27.3, 21.4, 19.4. IR (neat) ν 3328, 2975, 2923, 1659, 1502, 1471, 1300, 1205, 887, 773, 749 cm^{-1}. HRMS (ESI, m/z): calcd. for $C_{24}H_{27}N_2O$ $(M+H)^+$: 359.2123, found: 359.2121.

2-Methyl-6-(4-methylbenzyl)-*N*-(2-(pyridin-2-yl)propan-2-yl)benzamide (4d)



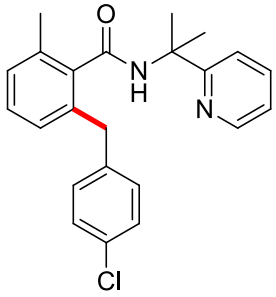
The general procedure was followed with **1a** (50.9 mg, 0.20 mmol) and *p*-xylene (1.0 mL). Purification by column chromatography (EtOAc/n-hexane 1:10) gave **4d** (45.1 mg, 63%) as a white solid (m.p. 97–98 ℃). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.39 (d, *J* = 4.4 Hz, 1H), 7.91 (s, 1H), 7.69 (td, *J* = 8.0, 1.4 Hz, 1H), 7.40 (d, *J* = 8.1 Hz, 1H), 7.16 (dd, *J* = 9.8, 5.3 Hz, 2H), 7.11–7.00 (m, 5H), 6.94 (d, *J* = 7.6 Hz, 1H), 4.03 (s, 2H), 2.39 (s, 3H), 2.25 (s, 3H), 1.85 (s, 6H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 169.0, 164.2, 147.5, 138.6, 137.9, 137.4, 137.0, 135.3, 134.5, 129.0, 128.9, 128.4, 128.0, 127.4, 121.8, 119.4, 57.1, 38.2, 27.3, 21.0, 19.3. IR (neat) ν 3326, 2975, 2923, 1659, 1501, 1471, 1300, 1204, 885, 787, 749 cm^{-1}. HRMS (ESI, m/z): calcd. for $C_{24}H_{27}N_2O$ $(M+H)^+$: 359.2123, found: 359.2123.

2-(4-Fluorobenzyl)-6-methyl-*N*-(2-(pyridin-2-yl)propan-2-yl)benzamide (4e)



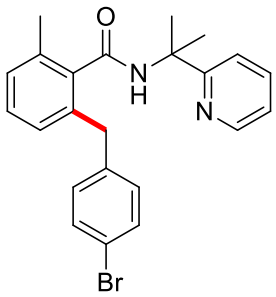
The general procedure was followed with **1a** (50.9 mg, 0.20 mmol) and *p*-fluorotoluene (1.0 mL). Purification by column chromatography (EtOAc/n-hexane 1:10) gave **4e** (51.4 mg, 71%) as a white solid (m.p. 143–144 ℃). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.37 (d, *J* = 4.1 Hz, 1H), 7.98 (s, 1H), 7.70 (td, *J* = 8.0, 1.8 Hz, 1H), 7.39 (d, *J* = 8.1 Hz, 1H), 7.20–7.11 (m, 4H), 7.07 (d, *J* = 7.5 Hz, 1H), 6.94 (d, *J* = 7.6 Hz, 1H), 6.91–6.84 (m, 2H), 4.02 (s, 2H), 2.39 (s, 3H), 1.85 (s, 6H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 168.9, 164.0, 161.3 (d, *J* = 243.6 Hz), 147.4, 138.7, 137.1, 137.0, 136.7 (d, *J* = 3.1 Hz), 134.7, 130.4 (d, *J* = 7.8 Hz), 128.5, 128.2, 127.4, 121.9, 119.4, 115.1 (d, *J* = 21.1 Hz), 57.0, 37.9, 27.3, 19.4. IR (neat) ν 3304, 2987, 2923, 1643, 1530, 1506, 1473, 1307, 1224, 1158, 804, 770 cm^{-1}. HRMS (ESI, m/z): calcd. for $C_{23}H_{24}FN_2O$ $(M+H)^+$: 363.1873, found: 363.1870.

2-(4-Chlorobenzyl)-6-methyl-*N*-(2-(pyridin-2-yl)propan-2-yl)benzamide (4f)



The general procedure was followed with **1a** (50.9 mg, 0.20 mmol) and *p*-chlorotoluene (506.3 mg, 4.0 mmol). Purification by column chromatography (EtOAc/CH_2Cl_2 1:20) gave **4f** (48.5 mg, 64%) as a white solid (m.p. 121–122 ℃). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.36 (d, *J* = 4.2 Hz, 1H), 8.00 (s, 1H), 7.70 (td, *J* = 7.9, 1.7 Hz, 1H), 7.39 (d, *J* = 8.1 Hz, 1H), 7.21–7.07 (m, 7H), 6.94 (d, *J* = 7.6 Hz, 1H), 4.02 (s, 2H), 2.40 (s, 3H), 1.85 (s, 6H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 168.9, 164.0, 147.4, 139.5, 138.7, 137.1, 136.5, 134.8, 131.7, 130.3, 128.5, 128.4, 128.3, 127.5, 121.9, 119.3, 57.0, 38.1, 27.3, 19.4. IR (neat) ν 3324, 2975, 2925, 1656, 1492, 1471, 1301, 1091, 885, 786, 749 cm^{-1}. HRMS (ESI, m/z): calcd. for $C_{23}H_{24}ClN_2O$ $(M+H)^+$: 379.1577, found: 379.1575.

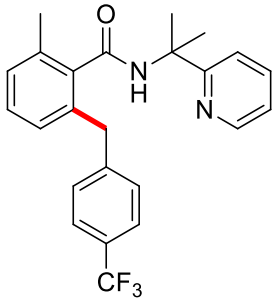
2-(4-Bromobenzyl)-6-methyl-*N*-(2-(pyridin-2-yl)propan-2-yl)benzamide (4g)



The general procedure was followed with **1a** (50.9 mg, 0.20 mmol) and *p*-bromotoluene (684.1 mg, 4.0 mmol). Purification by column chromatography (EtOAc/CH_2Cl_2 1:20) gave **4g** (48.3 mg, 57%) as a white solid (m.p. 105–106 ℃). ^{1}H

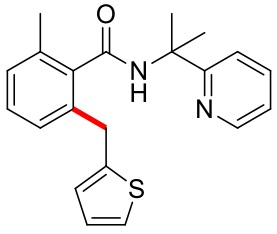
NMR (400 MHz, $CDCl_3$) δ 8.36 (d, *J* = 4.2 Hz, 1H), 8.00 (s, 1H), 7.70 (td, *J* = 7.9, 1.7 Hz, 1H), 7.39 (d, *J* = 8.1 Hz, 1H), 7.30 (d, *J* = 8.4 Hz, 2H), 7.21–7.15 (m, 2H), 7.10–7.05 (m, 3H), 6.94 (d, *J* = 7.6 Hz, 1H), 4.01 (s, 2H), 2.40 (s, 3H), 1.85 (s, 6H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 168.8, 164.0, 147. 5, 140.1, 138.7, 137.1, 136.4, 134.8, 131.4, 130.7, 128.5, 128.3, 127.5, 121.9, 119.8, 119.3, 57.0, 38.1, 27.3, 19.4. IR (neat) ν 3324, 2975, 2925, 1658, 1503, 1471, 1301, 1070, 1011, 885, 786 cm^{-1}. HRMS (ESI, m/z): calcd. for $C_{23}H_{24}BrN_2O$ $(M+H)^+$: 423.1072, found: 423.1070.

2-Methyl-*N*-(2-(pyridin-2-yl)propan-2-yl)-6-(4-(trifluoromethyl)benzyl)benzamide (4h)



The general procedure was followed with **1a** (50.9 mg, 0.20 mmol) and 4-Methylbenzotrifluoride (1.0 mL). Purification by column chromatography (EtOAc/n-hexane 1:10) gave **4h** (49.7 mg, 60%) as a white solid (m.p. 149–150 ℃). ^1H NMR (400 MHz, $CDCl_3$) δ 8.34 (d, *J* = 2.5 Hz, 1H), 8.04 (s, 1H), 7.69 (t, *J* = 7.7 Hz, 1H), 7.44 (d, *J* = 7.8 Hz, 2H), 7.38 (d, *J* = 8.0 Hz, 1H), 7.30 (d, *J* = 7.7 Hz, 2H), 7.21 (t, *J* = 7.5 Hz, 1H), 7.17–7.09 (m, 2H), 6.96 (d, *J* = 7.5 Hz, 1H), 4.12 (s, 2H), 2.41 (s, 3H), 1.84 (s, 6H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 168.8, 163.9, 147.4, 145.2 (q, *J* = 1.3 Hz), 138.8, 137.2, 136.0, 134.9, 129.2, 128.6, 128.5, 128.2 (q, *J* = 32.3 Hz), 127.6, 125.2 (q, *J* = 3.8 Hz), 124.3 (q, *J* = 271.9 Hz), 122.0, 119.3, 57.0, 38.6, 27.3, 19.4. IR (neat) ν 3312, 2977, 2926, 1656, 1503, 1472, 1326, 1162, 1123, 1067, 885, 787, 747 cm^{-1}. HRMS (ESI, m/z): calcd. for $C_{24}H_{24}F_3N_2O$ $(M+H)^+$: 413.1841, found: 413.1837.

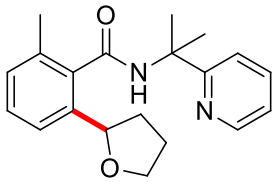
2-Methyl-*N*-(2-(pyridin-2-yl)propan-2-yl)-6-(thiophen-2-ylmethyl)benzamide (4i)



The general procedure was followed with **1a** (50.9 mg, 0.20 mmol) and 2-methylthiophene (1.0 mL). Purification by column chromatography (EtOAc/n-hexane 1:10) gave **4i** (43.4 mg, 62%) as a white solid (m.p. 109–110 ℃). ^1H NMR (400 MHz, $CDCl_3$) δ 8.39 (d, *J* = 4.1 Hz, 1H), 7.91 (s, 1H), 7.70 (t, *J* = 7.2 Hz, 1H), 7.41 (d, *J* = 8.0 Hz, 1H), 7.24–7.13 (m, 2H), 7.11–7.04 (m, 3H), 6.86–6.82 (m, 1H), 6.79–6.75 (m, 1H), 4.23 (s, 2H), 2.39 (s, 3H), 1.86 (s, 6H). ^{13}C NMR (101

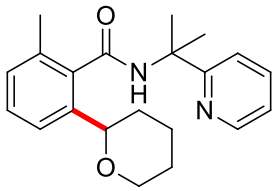
MHz, $CDCl_3$) δ 168.7, 164.1, 147.5, 144.0, 138.2, 137.1, 136.5, 134.8, 128.6, 128.5, 127.2, 126.8, 125.4, 123.8, 121.9, 119.4, 57.1, 33.1, 27.3, 19.4. IR (neat) ν 3320, 2974, 2924, 1657, 1503, 1472, 1299, 1203, 884, 787, 696 cm^{-1}. HRMS (ESI, m/z): calcd. for $C_{21}H_{23}N_2OS$ $(M+H)^+$: 351.1531, found: 351.1529.

2-Methyl-*N*-(2-(pyridin-2-yl)propan-2-yl)-6-(tetrahydrofuran-2-yl)benzamide (5a)



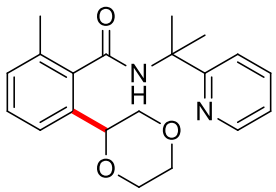
The general procedure was followed with **1a** (50.9 mg, 0.20 mmol) and THF (288.4 mg, 4.0 mmol) in benzene (1.0 mL). Purification by column chromatography (EtOAc/n-hexane 1:5) gave **5a** (45.4 mg, 70%) as as a white solid (m.p. 75–76 ℃). ^1H NMR (400 MHz, $CDCl_3$) δ 8.43 (d, *J* = 4.5 Hz, 1H), 8.08 (s, 1H), 7.72 (t, *J* = 7.7 Hz, 1H), 7.45 (d, *J* = 8.1 Hz, 1H), 7.36 (d, *J* = 7.8 Hz, 1H), 7.27 (t, *J* = 7.6 Hz, 1H), 7.20–7.15 (m, 1H), 7.11 (d, *J* = 7.4 Hz, 1H), 5.08 (t, *J* = 7.2 Hz, 1H), 4.11 (dd, *J* = 14.3, 7.2 Hz, 1H), 3.89 (dd, *J* = 14.4, 7.3 Hz, 1H), 2.44–2.28 (m, 4H), 2.07–1.86 (m, 8H), 1.84–1.74 (m, 1H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 168.7, 164.1, 147.6, 140.5, 137.1, 136.7, 134.1, 128.9, 128.7, 122.6, 121.9, 119.4, 78.3, 68.9, 57.1, 35.3, 27.4, 27.3, 26.3, 19.2. IR (neat) ν 3323, 2975, 2927, 1659, 1503, 1472, 1299, 1065, 887, 787, 749 cm^{-1}. HRMS (ESI, m/z): calcd. for $C_{20}H_{25}N_2O_2$ $(M+H)^+$: 325.1916, found: 325.1914.

2-Methyl-*N*-(2-(pyridin-2-yl)propan-2-yl)-6-(tetrahydro-2*H*-pyran-2-yl)benzamide (5b)



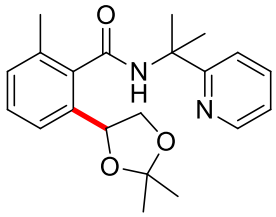
The general procedure was followed with **1a** (50.9 mg, 0.20 mmol) and tetrahydro-2*H*-pyran (344.5 mg, 4.0 mmol) in benzene (1.0 mL). Purification by column chromatography (EtOAc/n-hexane 1:5) gave **5b** (48.7 mg, 72%) as a colorless oil. ^1H NMR (400 MHz, $CDCl_3$) δ 8.45 (d, *J* = 4.0 Hz, 1H), 8.04 (s, 1H), 7.72 (t, *J* = 7.7 Hz, 1H), 7.47 (d, *J* = 8.0 Hz, 1H), 7.38 (d, *J* = 7.8 Hz, 1H), 7.27 (t, *J* = 7.5 Hz, 1H), 7.21–7.15 (m, 1H), 7.11 (d, *J* = 7.5 Hz, 1H), 4.53 (d, *J* = 10.4 Hz, 1H), 4.05 (d, *J* = 11.1 Hz, 1H), 3.55 (t, *J* = 11.5 Hz, 1H), 2.38 (s, 3H), 1.93–1.87 (m, 8H), 1.73–1.48 (m, 4H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 168.6, 164.2, 147.7, 139.5, 137.0, 136.9, 134.2, 129.2, 128.7, 123.3, 121.9, 119.4, 77.7, 69.2, 57.1, 33.7, 27.5, 27.4, 25.9, 24.1, 19.3. IR (neat) ν 3325, 2933, 2853, 1659, 1503, 1298, 1203, 1085, 1045, 887, 788 cm^{-1}. HRMS (ESI, m/z): calcd. for $C_{21}H_{27}N_2O_2$ $(M+H)^+$: 339.2073, found: 339.2072.

2-(1,4-Dioxan-2-yl)-6-methyl-*N*-(2-(pyridin-2-yl)propan-2-yl)benzamide (5c)



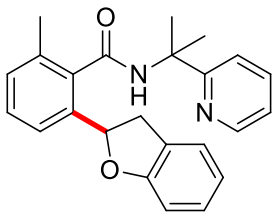
The general procedure was followed with **1a** (50.9 mg, 0.20 mmol) and 1,4-dioxane (1.0 mL). Purification by column chromatography (EtOAc/n-hexane 1:5) gave **5c** (53.4 mg, 78%) as a white solid (m.p. 133–134 ℃). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.44 (d, *J* = 4.5 Hz, 1H), 8.12 (s, 1H), 7.74 (t, *J* = 7.2 Hz, 1H), 7.46 (d, *J* = 8.0 Hz, 1H), 7.40 (d, *J* = 7.8 Hz, 1H), 7.30 (t, *J* = 7.7 Hz, 1H), 7.21–7.14 (m, 2H), 4.82 (dd, *J* = 10.0, 2.5 Hz, 1H), 4.02 (dd, *J* = 11.5, 2.5 Hz, 1H), 3.92–3.79 (m, 2H), 3.77–3.66 (m, 2H), 3.54–3.37 (m, 1H), 2.38 (s, 3H), 1.94 (s, 3H), 1.93 (s, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 168.2, 164.0, 147.5, 137.5, 137.2, 134.9, 134.3, 129.9, 128.7, 124.0, 122.0, 119.4, 75.8, 72.5, 67.2, 66.3, 57.2, 27.5, 27.3, 19.2. IR (neat) ν 3320, 2922, 2852, 1655, 1504, 1471, 1300, 913, 879, 786 cm^{-1}. HRMS (ESI, m/z): calcd. for $C_{20}H_{25}N_2O_3$ $(M+H)^+$: 341.1865, found: 341.1864.

2-(2,2-Dimethyl-1,3-dioxolan-4-yl)-6-methyl-*N*-(2-(pyridin-2-yl)propan-2-yl)benzamide (5d)



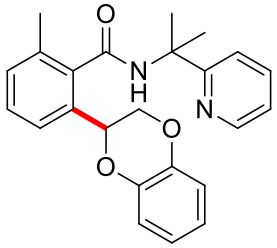
The general procedure was followed with **1a** (50.9 mg, 0.20 mmol) and 2,2-dimethyl-1,3-dioxolane (408.5 mg, 4.0 mmol) in benzene (1.0 mL). Purification by column chromatography (EtOAc/n-hexane 1:5) gave **5d** (53.3 mg, 75%) as a colorless oil. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.44 (d, *J* = 4.7 Hz, 1H), 8.06 (s, 1H), 7.73 (t, *J* = 7.7 Hz, 1H), 7.48 (d, *J* = 7.8 Hz, 1H), 7.45 (d, *J* = 8.1 Hz, 1H), 7.31 (t, *J* = 7.7 Hz, 1H), 7.19 (dd, *J* = 7.2, 5.0 Hz, 1H), 7.15 (d, *J* = 7.6 Hz, 1H), 5.30–5.25 (m, 1H), 4.36 (dd, *J* = 8.1, 6.5 Hz, 1H), 3.66 (t, *J* = 8.1 Hz, 1H), 2.39 (s, 3H), 1.91 (s, 6H), 1.56 (s, 3H), 1.43 (s, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 168.3, 164.0, 147.6, 137.2, 136.5, 134.0, 129.6, 128.9, 122.8, 122.0, 119.4, 109.3, 75.3, 72.2, 57.1, 27.5, 27.3, 26.4, 25.8, 19.2. IR (neat) ν 3321, 2983, 2931, 1659, 1503, 1472, 1380, 1157, 864, 787 cm^{-1}. HRMS (ESI, m/z): calcd. for $C_{21}H_{27}N_2O_3$ $(M+H)^+$: 355.2022, found: 355.2019.

2-(2,3-Dihydrobenzofuran-2-yl)-6-methyl-*N*-(2-(pyridin-2-yl)propan-2-yl)benzamide (5e)



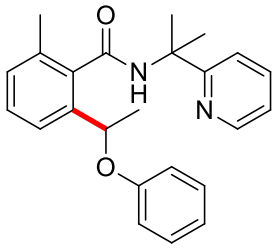
The general procedure was followed with **1a** (50.9 mg, 0.20 mmol) and 2,3-Dihydrobenzofuran (480.6 mg, 4.0 mmol) in benzene (1.0 mL). Purification by column chromatography (EtOAc/n-hexane 1:5) gave **5e** (45.4 mg, 61%) as a white solid (m.p. 114–115 ℃). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.43 (d, *J* = 4.3 Hz, 1H), 8.19 (s, 1H), 7.71 (t, *J* = 7.1 Hz, 1H), 7.43 (d, *J* = 8.0 Hz, 1H), 7.38 (d, *J* = 7.8 Hz, 1H), 7.25 (dd, *J* = 12.8, 4.7 Hz, 1H), 7.19–7.09 (m, 4H), 6.84 (t, *J* = 7.6 Hz, 2H), 5.97 (t, *J* = 8.9 Hz, 1H), 3.62 (dd, *J* = 15.9, 9.5 Hz, 1H), 3.19 (dd, *J* = 15.9, 8.3 Hz, 1H), 2.42 (s, 3H), 1.90 (s, 3H), 1.89 (s, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 168.3, 164.0, 159.7, 147.6, 139.1, 137.2, 136.6, 134.4, 129.7, 129.0, 128.0, 126.8, 125.0, 122.7, 122.0, 120.7, 119. 5, 109.2, 81.7, 57.2, 39.2, 27.5, 27.3, 19.3. IR (neat) ν 3316, 2975, 2926, 1658, 1595, 1504, 1479, 1302, 1232, 878, 787, 750 cm^{-1}. HRMS (ESI, m/z): calcd. for $C_{24}H_{25}N_2O_2$ $(M+H)^+$: 373.1916, found: 373.1912.

2-(2,3-Dihydrobenzo[*b*][1,4]dioxin-2-yl)-6-methyl-*N*-(2-(pyridin-2-yl)propan-2-yl)benzamide (5f)



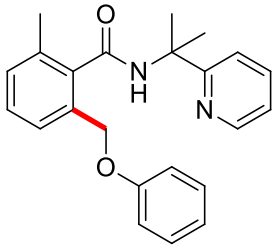
The general procedure was followed with **1a** (50.9 mg, 0.20 mmol) and 1,4-Benzodioxan (544.6 mg, 4.0 mmol) in benzene (1.0 mL). Purification by column chromatography (EtOAc/n-hexane 1:5) gave **5f** (45.2 mg, 58%) as a white solid (m.p. 84–85 ℃). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.39 (d, *J* = 4.2 Hz, 1H), 8.14 (s, 1H), 7.69 (t, *J* = 7.3 Hz, 1H), 7.44–7.31 (m, 3H), 7.23 (d, *J* = 7.5 Hz, 1H), 7.19–7.13 (m, 1H), 6.96–6.80 (m, 4H), 5.33 (d, *J* = 7.4 Hz, 1H), 4.55 (dd, *J* = 11.2, 1.6 Hz, 1H), 3.97 (dd, *J* = 10.9, 9.3 Hz, 1H), 2.43 (s, 3H), 1.89 (s, 3H), 1.86 (s, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 167.9, 163.9, 147.6, 144.0, 143.2, 137.6, 137.2, 134.5, 133.3, 130.6, 129.0, 124.1, 122.0, 121.4, 121.3, 119.4, 117.4, 117.2, 72.9, 69.4, 57.3, 27.7, 27.1, 19.2. IR (neat) ν 3310, 2976, 2924, 1655, 1592, 1494, 1264, 1070, 786, 748 cm^{-1}. HRMS (ESI, m/z): calcd. for $C_{24}H_{25}N_2O_3$ $(M+H)^+$: 389.1865, found: 389.1864.

2-Methyl-6-(1-phenoxyethyl)-*N*-(2-(pyridin-2-yl)propan-2-yl)benzamide (5g)



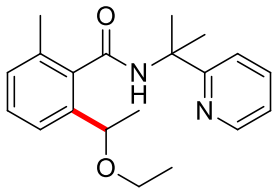
The general procedure was followed with **1a** (50.9 mg, 0.20 mmol) and ethoxybenzene (488.7 mg, 4.0 mmol) in benzene (1.0 mL). Purification by column chromatography (EtOAc/CH_2Cl_2 1:20) gave **5g** (57.6 mg, 77%) as a white solid (m.p. 110–111 ℃). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.45 (d, *J* = 4.7 Hz, 1H), 8.34 (s, 1H), 7.75 (td, *J* = 7.9, 1.7 Hz, 1H), 7.46 (d, *J* = 8.1 Hz, 1H), 7.38 (d, *J* = 7.8 Hz, 1H), 7.25–7.18 (m, 2H), 7.15–7.09 (m, 3H), 6.95 (d, *J* = 8.0 Hz, 2H), 6.81 (t, *J* = 7.3 Hz, 1H), 5.57 (q, *J* = 6.3 Hz, 1H), 2.40 (s, 3H), 1.94 (s, 6H), 1.66 (d, *J* = 6.4 Hz, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 168.4, 164.0, 157.7, 147.5, 140.1, 137.3, 136.5, 133.9, 129.3, 129.2, 129.1, 122.7, 122.1, 120.4, 119.5, 115.7, 72.6, 57.1, 27.4, 27.3, 24.7, 19.2. IR (neat) ν 3324, 2976, 2928, 1656, 1597, 1497, 1236, 887, 788, 752 cm^{-1}. HRMS (ESI, m/z): calcd. for $C_{24}H_{27}N_2O_2$ $(M+H)^+$: 375.2073, found: 375.2070.

2-Methyl-6-(phenoxymethyl)-*N*-(2-(pyridin-2-yl)propan-2-yl)benzamide (5h)



The general procedure was followed with **1a** (50.9 mg, 0.20 mmol) and anisole (1.0 mL). Purification by column chromatography (EtOAc/CH_2Cl_2 1:20) gave **5h** (48.4 mg, 67%) as a white solid (m.p. 105–106 ℃). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.42 (d, *J* = 4.3 Hz, 1H), 8.03 (s, 1H), 7.61 (td, *J* = 8.0, 1.3 Hz, 1H), 7.37–7.31 (m, 2H), 7.27 (t, *J* = 7.6 Hz, 1H), 7.20–7.11 (m, 4H), 6.89–6.85 (m, 3H), 5.08 (s, 2H), 2.40 (s, 3H), 1.76 (s, 6H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 168.1, 164.1, 158.6, 147.6, 138.0, 137.0, 135.0, 133.2, 130.2, 129.3, 128.8, 126.4, 121.9, 120.8, 119.4, 114.7, 67.7, 57.2, 27.4, 19.3. IR (neat) ν 3317, 2925, 1655, 1598, 1497, 1301, 1238, 886, 786, 752 cm^{-1}. HRMS (ESI, m/z): calcd. for $C_{23}H_{25}N_2O_2$ $(M+H)^+$: 361.1916, found: 361.1914.

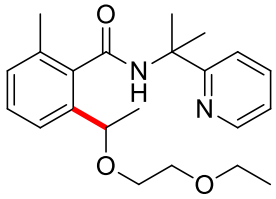
2-(1-Ethoxyethyl)-6-methyl-*N*-(2-(pyridin-2-yl)propan-2-yl)benzamide (5i)



The general procedure was followed with **1a** (50.9 mg, 0.20 mmol) and diethyl ether

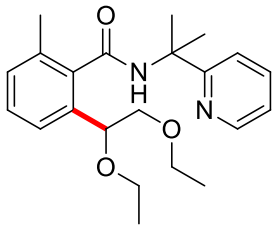
(296.5 mg, 4.0 mmol) in benzene (1.0 mL). Purification by column chromatography (EtOAc/n-hexane 1:5) gave **5i** (43.1 mg, 66%) as a colorless oil. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.41 (d, *J* = 4.4 Hz, 1H), 8.18 (s, 1H), 7.75 (t, *J* = 7.6 Hz, 1H), 7.46 (d, *J* = 8.0 Hz, 1H), 7.39 (d, *J* = 7.8 Hz, 1H), 7.31 (t, *J* = 7.6 Hz, 1H), 7.22–7.17 (m, 1H), 7.12 (d, *J* = 7.4 Hz, 1H), 4.67 (q, *J* = 6.3 Hz, 1H), 3.35 (q, *J* = 6.8 Hz, 2H), 2.39 (s, 3H), 1.92 (s, 6H), 1.46 (d, *J* = 6.4 Hz, 3H), 1.13 (t, *J* = 7.0 Hz, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 168.5, 164.1, 147.4, 141.1, 137.6, 137.2, 133.9, 129.0, 128.9, 123.0, 122.0, 119.5, 74.3, 64.0, 57.1, 27.4, 24.6, 19.1, 15.4. IR (neat) ν 3326, 2974, 2928, 1659, 1502, 1472, 1299, 1106, 887, 788, 750 cm^{-1}. HRMS (ESI, m/z): calcd. for $C_{20}H_{27}N_2O_2$ $(M+H)^+$: 327.2073, found: 327.2069.

2-(1-(2-Ethoxyethoxy)ethyl)-6-methyl-*N*-(2-(pyridin-2-yl)propan-2-yl)benzamide (5j)



The general procedure was followed with **1a** (50.9 mg, 0.20 mmol) and 1,2-diethoxyethane (1.0 mL). Purification by column chromatography (EtOAc/n-hexane 1:5) gave **5j** (26.7 mg, 36%) as a colorless oil. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.41 (d, *J* = 4.2 Hz, 1H), 8.15 (s, 1H), 7.74 (td, *J* = 7.9, 1.7 Hz, 1H), 7.46 (d, *J* = 8.1 Hz, 1H), 7.40 (d, *J* = 7.8 Hz, 1H), 7.30 (t, *J* = 7.7 Hz, 1H), 7.18 (dd, *J* = 7.0, 5.3 Hz, 1H), 7.12 (d, *J* = 7.4 Hz, 1H), 4.70 (q, *J* = 6.4 Hz, 1H), 3.54–3.38 (m, 6H), 2.38 (s, 3H), 1.92 (s, 3H), 1.91 (s, 3H), 1.48 (d, *J* = 6.4 Hz, 3H), 1.16 (t, *J* = 7.0 Hz, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 168.5, 164.1, 147.5, 140.7, 137.6, 137.2, 133.9, 129.0, 128.9, 123.2, 122.0, 119.4, 74.9, 69.8, 68.0, 66.4, 57.1, 27.4, 27.4, 24.6, 19.1, 15.1. IR (neat) ν 3326, 2974, 2928, 1660, 1502, 1472, 1299, 1105, 887, 789, 750 cm^{-1}. HRMS (ESI, m/z): calcd. for $C_{22}H_{31}N_2O_3$ $(M+H)^+$: 371.2335, found: 371.2334.

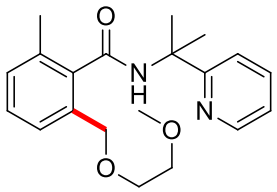
2-(1,2-Diethoxyethyl)-6-methyl-*N*-(2-(pyridin-2-yl)propan-2-yl)benzamide (5j′)



The general procedure was followed with **1a** (50.9 mg, 0.20 mmol) and 1,2-diethoxyethane (1.0 mL). Purification by column chromatography (EtOAc/n-hexane 1:5) gave **5j′** (31.1 mg, 42%) as a colorless oil. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.44 (d, *J* = 4.3 Hz, 1H), 8.07 (s, 1H), 7.73 (td, *J* = 7.9, 1.7 Hz, 1H), 7.48 (d, *J* = 8.1 Hz, 1H), 7.36 (d, *J* = 7.7 Hz, 1H), 7.29 (d, *J* = 7.6 Hz, 1H), 7.18 (dd, *J* = 7.0, 5.3 Hz, 1H), 7.14 (d, *J* = 7.4 Hz, 1H), 4.81 (dd, *J* = 7.6, 4.3 Hz, 1H), 3.70 (dd, *J* =

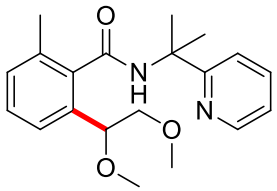
10.1, 7.9 Hz, 1H), 3.53 (dd, *J* = 10.4, 4.3 Hz, 1H), 3.49–3.36 (m, 4H), 2.38 (s, 3H), 1.91 (s, 3H), 1.90 (s, 3H), 1.14 (t, *J* = 7.0 Hz, 3H), 1.07 (t, *J* = 7.0 Hz, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 168.3, 164.3, 147.6, 138.3, 137.0, 136.8, 134.3, 129.5, 128.6, 123.9, 121.9, 119.5, 75.1, 66.5, 64.4, 57.2, 27.5, 19.2, 15.3, 15.0. IR (neat) ν 3326, 2974, 2926, 1660, 1503, 1471, 1110, 887, 788, 750 cm^{-1}. HRMS (ESI, m/z): calcd. for $C_{22}H_{31}N_2O_3$ $(M+H)^+$: 371.2335, found: 371.2333.

2-((2-Methoxyethoxy)methyl)-6-methyl-*N*-(2-(pyridin-2-yl)propan-2-yl)benzamide (5k)



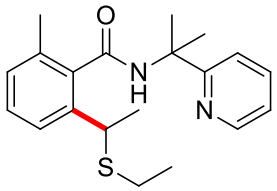
The general procedure was followed with **1a** (50.9 mg, 0.20 mmol) and 1,2-dimethoxyethane (360.5 mg, 4.0 mmol) in benzene (1.0 mL). Purification by column chromatography (EtOAc/n-hexane 1:5) gave **5k** (24.0 mg, 35%) as a colorless oil. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.46 (d, *J* = 4.2 Hz, 1H), 8.03 (s, 1H), 7.73 (t, *J* = 7.6 Hz, 1H), 7.49 (d, *J* = 8.0 Hz, 1H), 7.32–7.23 (m, 2H), 7.20–7.14 (m, 2H), 4.63 (s, 2H), 3.73–3.57 (m, 2H), 3.57–3.43 (m, 2H), 3.31 (s, 3H), 2.38 (s, 3H), 1.90 (s, 6H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 168.4, 164.3, 147.7, 137.9, 137.0, 134.9, 134.4, 129.8, 128.6, 126.4, 121.9, 119.5, 71.9, 70.8, 69.3, 58.9, 57.2, 27.5, 19.3. IR (neat) ν 3325, 2923, 1659, 1504, 1472, 1472, 1300, 1094, 886, 787, 749 cm^{-1}. HRMS (ESI, m/z): calcd. for $C_{20}H_{27}N_2O_3$ $(M+H)^+$: 343.2022, found: 343.2018.

2-(1,2-Dimethoxyethyl)-6-methyl-*N*-(2-(pyridin-2-yl)propan-2-yl)benzamide (5k′)



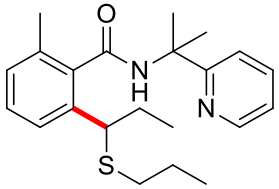
The general procedure was followed with **1a** (50.9 mg, 0.20 mmol) and 1,2-dimethoxyethane (360.5 mg, 4.0 mmol) in benzene (1.0 mL). Purification by column chromatography (EtOAc/n-hexane 1:5) gave **5k′** (31.5 mg, 46%) as a colorless oil. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.43 (d, *J* = 4.3 Hz, 1H), 8.18 (s, 1H), 7.74 (td, *J* = 7.9, 1.8 Hz, 1H), 7.47 (d, *J* = 8.1 Hz, 1H), 7.36–7.28 (m, 2H), 7.23–7.13 (m, 2H), 4.72 (dd, *J* = 8.0, 3.7 Hz, 1H), 3.64 (dd, *J* = 10.1, 8.3 Hz, 1H), 3.51 (dd, *J* = 10.3, 3.7 Hz, 1H), 3.30 (s, 3H), 3.26 (s, 3H), 2.39 (s, 3H), 1.92 (s, 3H), 1.91 (s, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 168.2, 164.2, 147.5, 138.5, 137.1, 135.6, 134.4, 129.8, 128.7, 123.9, 122.0, 119.5, 79.3, 77.1, 59.0, 57.2, 57.0, 27.4(4), 27.4, 19.2. IR (neat) ν 3324, 2925, 1660, 1504, 1472, 1300, 1103, 887, 788, 750 cm^{-1}. HRMS (ESI, m/z): calcd. for $C_{20}H_{27}N_2O_3$ $(M+H)^+$: 343.2022, found: 343.2019.

2-(1-(Ethylthio)ethyl)-6-methyl-N-(2-(pyridin-2-yl)propan-2-yl)benzamide (6a)



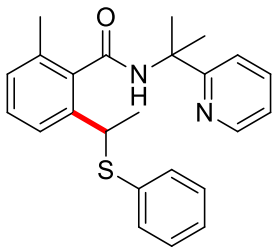
The general procedure was followed with **1a** (50.9 mg, 0.20 mmol) and diethyl sulfide (1.0 mL). Purification by column chromatography (EtOAc/hexane 1:10) gave **6a** (57.2 mg, 84%) as a colorless oil. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.42 (d, *J* = 4.4 Hz, 1H), 8.14 (s, 1H), 7.73 (td, *J* = 8.0, 1.5 Hz, 1H), 7.51 (d, *J* = 7.8 Hz, 1H), 7.46 (d, *J* = 8.1 Hz, 1H), 7.28 (t, *J* = 7.7 Hz, 1H), 7.18 (dd, *J* = 6.9, 5.1 Hz, 1H), 7.07 (d, *J* = 7.4 Hz, 1H), 4.29 (q, *J* = 6.9 Hz, 1H), 2.54–2.25 (m, 5H), 1.92 (s, 3H), 1.92 (s, 3H), 1.55 (d, *J* = 7.0 Hz, 3H), 1.11 (t, *J* = 7.4 Hz, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 168.6, 164.1, 147.5, 141.1, 137.8, 137.2, 134.0, 128.9, 128.5, 124.5, 122.0, 119.5, 57.2, 40.6, 27. 5, 27.4, 25.6, 23. 7, 19.3, 14.6. IR (neat) ν 3326, 2970, 2867, 1660, 1501, 1471, 1447, 1379, 1296, 996, 886, 787, 749 cm^{-1}. HRMS (ESI, m/z): calcd. for $C_{20}H_{27}N_2OS$ $(M+H)^+$: 343.1844, found: 343.1840.

2-Methyl-6-(1-(propylthio)propyl)-*N*-(2-(pyridin-2-yl)propan-2-yl)benzamide (6b)



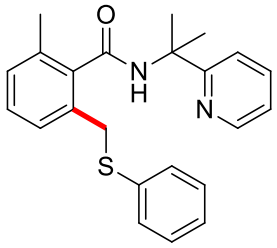
The general procedure was followed with **1a** (50.9 mg, 0.20 mmol) and propyl sulfide (1.0 mL). Purification by column chromatography (EtOAc/hexane 1:10) gave **6b** (60.5 mg, 82%) as a colorless oil. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.47–8.39 (m, 1H), 8.11 (s, 1H), 7.75 (td, *J* = 8.0, 1.8 Hz, 1H), 7.49–7.44 (m, 2H), 7.28 (t, *J* = 7.7 Hz, 1H), 7.19 (ddd, *J* = 7.4, 4.9, 0.9 Hz, 1H), 7.08 (d, *J* = 7.4 Hz, 1H), 4.03 (t, *J* = 7.3 Hz, 1H), 2.50–2.42 (m, 1H), 2.39 (s, 3H), 2.35–2.22 (m, 1H), 1.94 (s, 3H), 1.93 (s, 3H), 1.88 (dd, *J* = 14.7, 7.4 Hz, 2H), 1.55–1.33 (m, 2H), 0.93 (t, *J* = 7.4 Hz, 3H), 0.85 (t, *J* = 7.2 Hz, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 168.6, 164.1, 147. 5, 140.2, 138.5, 137.1, 133.8, 128.7, 128.4, 124.8, 122.0, 119.5, 57.1, 47. 9, 33.4, 30. 7, 27.5, 27.3, 22.9, 19.3, 13.5, 12.4. IR (neat) ν 3334, 2963, 2871, 1660, 1500, 1471, 1432, 1379, 1295, 996, 886, 787, 748 cm^{-1}. HRMS (ESI, m/z): calcd. for $C_{22}H_{31}N_2OS$ $(M+H)^+$: 371.2157, found: 371.2143.

2-Methyl-6-(1-(phenylthio)ethyl)-*N*-(2-(pyridin-2-yl)propan-2-yl)benzamide (6c)



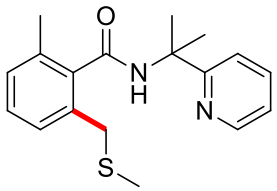
The general procedure was followed with **1a** (50.9 mg, 0.20 mmol) and ethyl phenyl sulfide (4.0 mmol, 552.9 mg) in benzene (1.0 mL). Purification by column chromatography (EtOAc/hexane 1:10) gave **6c** (55.8 mg, 71%) as a viscous oil. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.47 (d, *J* = 4.3 Hz, 1H), 7.91 (s, 1H), 7.74 (td, *J* = 7.9, 1.8 Hz, 1H), 7.49–7.45 (m, 2H), 7.36–7.31 (m, 2H), 7.27 (t, *J* = 7.7 Hz,1H), 7.23–7.18 (m, 1H), 7.16–7.07 (m, 4H), 4.73 (q, *J* = 6.9 Hz, 1H), 2.39 (s, 3H), 1.90 (s, 3H), 1.89 (s, 3H), 1.64 (d, *J* = 6.9 Hz, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 168.5, 164.1, 147.6, 139.8, 137. 6, 137.1, 135. 6, 134.3, 131.6, 129.0, 128.8, 128.6, 126.7, 124.4, 121.9, 119.4, 57.2, 44.3, 27.6, 27.2, 23.5, 19.4. IR (neat) ν 3325, 2925, 1658, 1506, 1472, 1379, 1296, 886, 787, 746, 691 cm^{-1}. HRMS (ESI, m/z): calcd. for $C_{24}H_{27}N_2OS$ $(M+H)^+$: 391.1844, found: 391.1847.

2-Methyl-6-((phenylthio)methyl)-*N*-(2-(pyridin-2-yl)propan-2-yl)benzamide (6d)



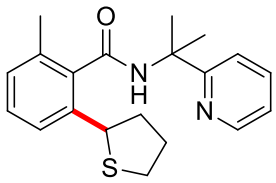
The general procedure was followed with **1a** (50.9 mg, 0.20 mmol) and thioanisole (1.0 mL). Purification by column chromatography (EtOAc/CH_2Cl_2 1:20) gave **6d** (41.4 mg, 55%) as a white solid (m.p. 102–103 ℃). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.46 (dd, *J* = 4.8, 0.7 Hz, 1H), 7.97 (s, 1H), 7.67 (td, *J* = 7.9, 1.8 Hz, 1H), 7.44 (d, *J* = 8.1 Hz, 1H), 7.30–7.26 (m, 2H), 7.23–7.09 (m, 7H), 4.24 (s, 2H), 2.39 (s, 3H), 1.86 (s, 6H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 168.3, 164.2, 147.7, 138.3, 137.0, 136.7, 135.0, 133.4, 129.4, 129.3, 128.8, 128.5, 127.2, 126.2, 121.9, 119.4, 57.3, 36.4, 27.5, 19.4. IR (neat) ν 3324, 2921, 2850, 1655, 1504, 1472, 1438, 1301, 787, 742, 690 cm^{-1}. HRMS (ESI, m/z): calcd. for $C_{23}H_{25}N_2OS$ $(M+H)^+$: 377.1688, found: 377.1686.

2-Methyl-6-((methylthio)methyl)-*N*-(2-(pyridin-2-yl)propan-2-yl)benzamide (6e)



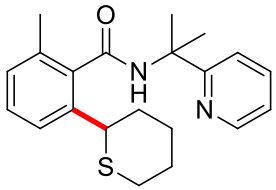
The general procedure was followed with **1a** (50.9 mg, 0.20 mmol) and dimethyl sulfide (4.0 mmol, 284.5 mg) in benzene (1.0 mL). Purification by column chromatography (EtOAc/hexane 1:10) gave a mixture **1a+6e** (67% determine by ^{1}H NMR) as a colorless oil. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.49–8.46 (m, 1H), 8.00 (s, 1H), 7.73–7.69 (m, 1H), 7.51–7.46 (m, 1H), 7.24–7.22 (m, 2H), 7.19–7.16 (m, 1H), 7.11 (dd, *J* = 6.1, 2.4 Hz, 1H), 3.81 (s, 2H), 2.40 (s, 3H), 2.08 (s, 3H), 1.93 (s, 6H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 168.4, 164.2, 147.7, 138.3, 137.0, 135.0, 134.7, 129.0, 128.4, 127.1, 121.9, 119.5, 57.3, 35.6, 27.5, 19.4, 15.5. IR (neat) ν 3325, 2922, 2855, 1660, 1506, 1472, 1431, 1304, 995, 787, 748 cm^{-1}. HRMS (ESI, m/z): calcd. for $C_{18}H_{23}N_2OS$ $(M+H)^+$: 315.1531, found: 315.1528.

2-Methyl-*N*-(2-(pyridin-2-yl)propan-2-yl)-6-(tetrahydrothiophen-2-yl)benzamide (6f)



The general procedure was followed with **1a** (50.9 mg, 0.20 mmol) and tetrahydrothiophene (1.0 mL). Purification by column chromatography (EtOAc/CH_2Cl_2 1:20) gave **6f** (50.4 mg, 74%) as a white solid (m.p. 139–140 ℃). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.45 (d, *J* = 4.3 Hz, 1H), 8.02 (s, 1H), 7.73 (td, *J* = 7.9, 1.8 Hz, 1H), 7.57 (d, *J* = 7.9 Hz, 1H), 7.47 (d, *J* = 8.1 Hz, 1H), 7.28–7.24 (m, 1H), 7.18 (ddd, *J* = 7.4, 4.9, 0.8 Hz, 1H), 7.07 (d, *J* = 7.5 Hz, 1H), 4.74 (t, *J* = 7.2 Hz, 1H), 3.19–3.09 (m, 1H), 3.00–2.93 (m, 1H), 2.47–2.40 (m, 1H), 2.37 (s, 3H), 2.29–2.19 (m, 1H), 1.96–1.86 (m, 8H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 168.8, 164.1, 147.6, 139.8, 138.3, 137.1, 134.0, 128.7, 128.6, 124.9, 121.9, 119.5, 57.2, 49.2, 41.1, 33.7, 31.3, 27.6, 27.3, 19.2. IR (neat) ν 3320, 2927, 2858, 1656, 1502, 1471, 1380, 1297, 887, 787, 749 cm^{-1}. HRMS (ESI, m/z): calcd. for $C_{20}H_{25}N_2OS$ $(M+H)^+$: 341.1688, found: 341.1684.

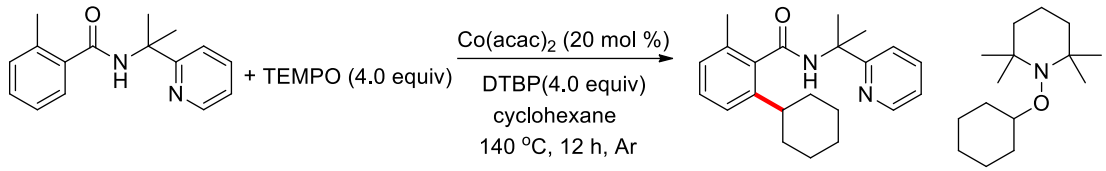
2-Methyl-*N*-(2-(pyridin-2-yl)propan-2-yl)-6-(tetrahydro-2H-thiopyran-2-yl)benz amide (6g)



The general procedure was followed with **1a** (50.9 mg, 0.20 mmol) and thiane (4.0 mmol, 408.8 mg) in benzene (1.0 mL). Purification by column chromatography (EtOAc/hexane 1:10) gave **6g** (56.2 mg, 79%) as a white solid (m.p. 94–95 ℃). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.51 (d, *J* = 4.2 Hz, 1H), 7.86 (s, 1H), 7.74 (td, *J* = 7.9, 1.8 Hz, 1H), 7.53 (d, *J* = 8.1 Hz, 1H), 7.35 (d, *J* = 7.8 Hz, 1H), 7.26 (t, *J* = 7.7 Hz, 1H), 7.19 (ddd, *J* = 7.4, 4.9, 0.9 Hz, 1H), 7.10 (d, *J* = 7.5 Hz, 1H), 4.15 (dd, *J* = 11.3, 2.2

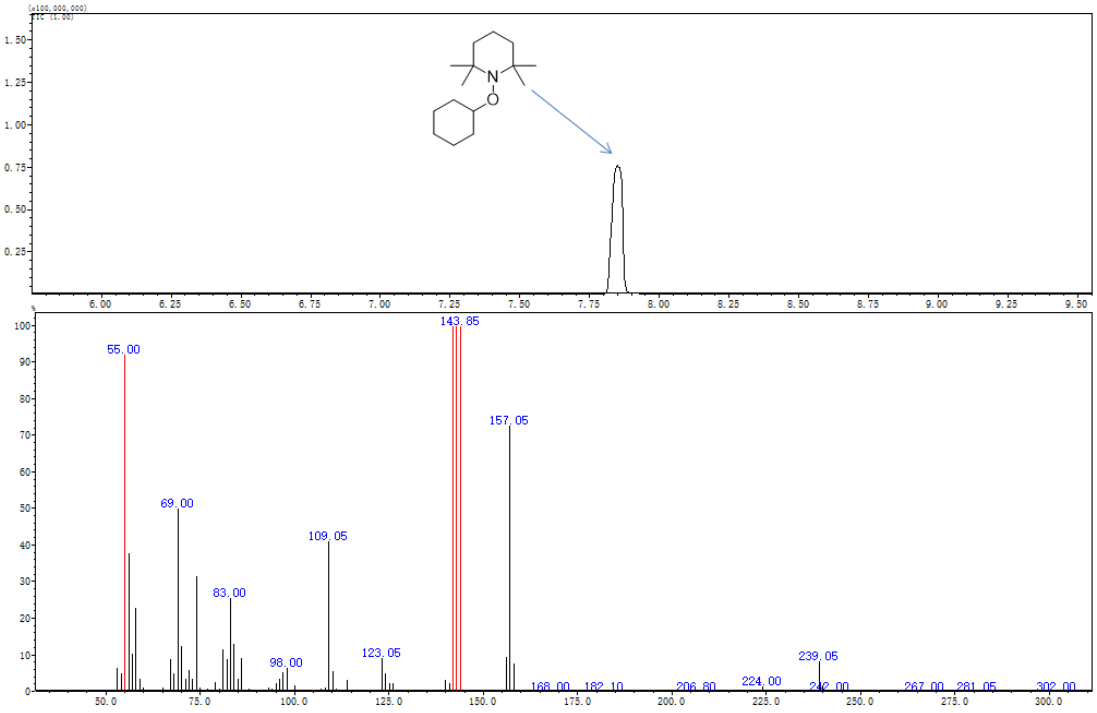
Hz, 1H), 2.89 (t, *J* = 12.0 Hz, 1H), 2.64 (d, *J* = 13.4 Hz, 1H), 2.38 (s, 3H), 2.17 (dd, *J* = 13.0, 2.8 Hz, 1H), 2.07–1.88 (m, 9H), 1.76–1.63 (m, 1H), 1.53–1.38 (m, 1H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 168.4, 164.3, 147.9, 139.1, 137.4, 136.8, 134.8, 129.1, 128.8, 124.6, 121.8, 119.5, 57.3, 44.3, 31.1, 27.9, 27.3, 27.2, 26.8, 19.4. IR (neat) ν 3325, 2926, 2850, 1660, 1506, 1472, 1379, 1296, 886, 786, 748 cm^{-1}. HRMS (ESI, m/z): calcd. for $C_{21}H_{27}N_2OS$ $(M+H)^+$: 355.1844, found: 355.1848.

Radical Trapping Experiment

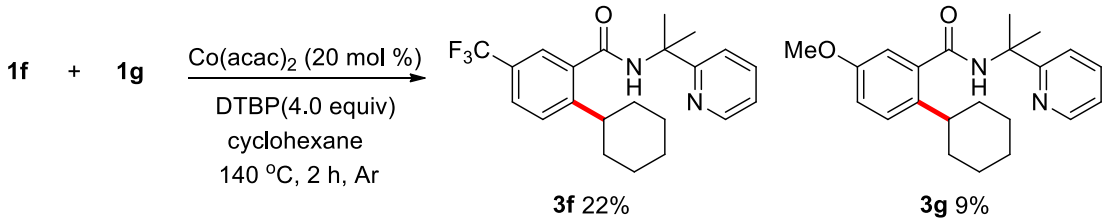


1a **3a**, 0% **7**, 72%

A 25 mL oven-dried Schlenk tube was charged with a stir bar, amide **1a** (0.2 mmol, 50.9 mg), $Co(acac)_2$ (0.04 mmol, 10.2 mg) and TEMPO (0.8 mmol, 125.1 mg). After the tube was evacuated and filled with Ar, cyclohexane (1.0 mL) and DTBP (0.8 mmol, 117.0 mg) were injected into the tube by syringe. The tube was then stirred vigorously at 140 ˚C for 12 h. The reaction mixture was then cooled to room temperature, diluted with EtOAc (2.0 mL), filtered through a celite pad, analyzed by GC-MS, and concentrated under reduced pressure. The residue was purified by flash column chromatography (EtOAc/hexane 1:100, v/v) to afford compound **7** as a colorless oil. ^{1}H NMR (400 MHz, $CDCl_3$) δ 3.65–3.51 (m, 1H), 2.13–2.02 (m, 2H), 1.80–1.70 (t, *J* = 8.1 Hz, 2H), 1.57–1.44 (m, 6H), 1.27–1.08 (m, 18H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 81.7, 59.6, 40.3, 34.5, 32.9, 26.0, 25.1, 20.3, 17.3.[6]



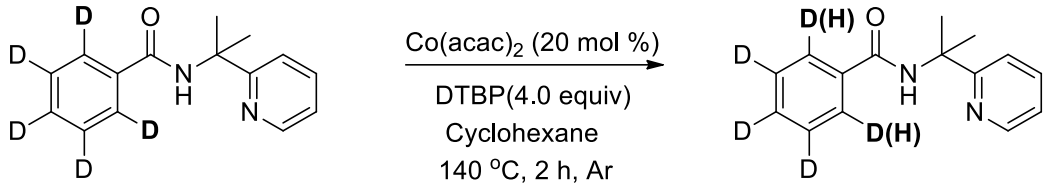
Intermolecular Competition Experiment



3f 22% **3g** 9%

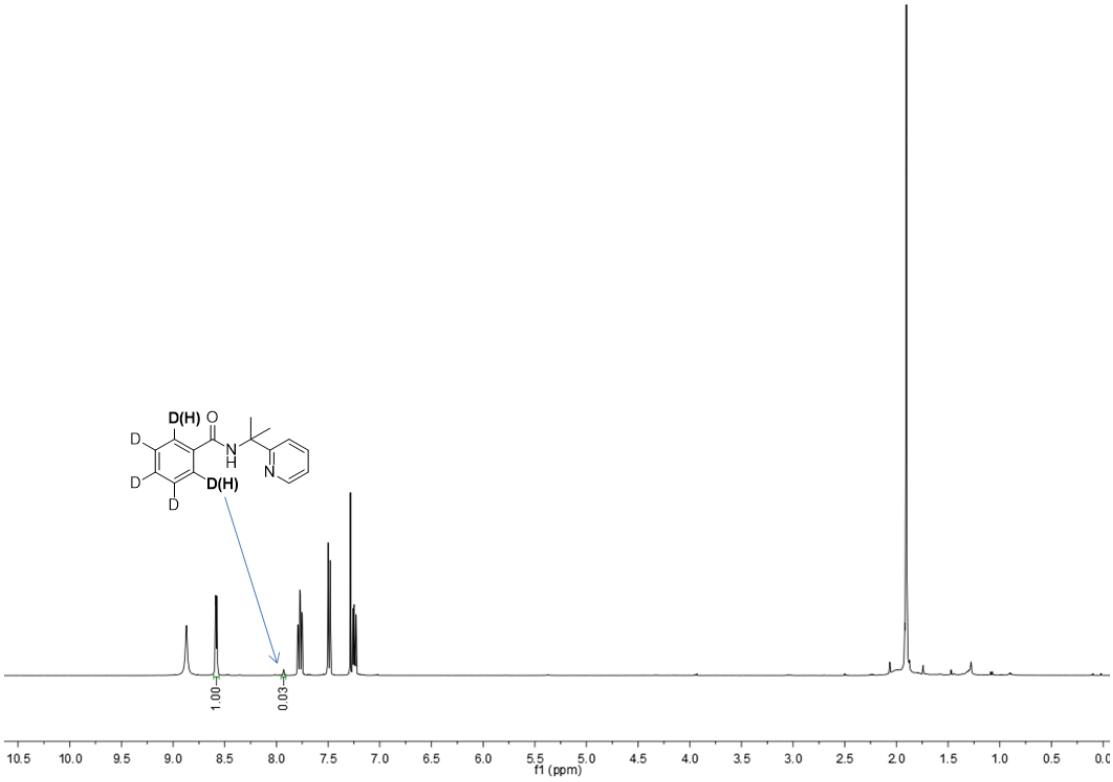
A 25 mL oven-dried Schlenk tube was charged with a stir bar, benzamide **1f** (61.7 mg, 0.2 mmol), benzamide **1g** (54.1 mg, 0.2 mmol) and $Co(acac)_2$ (0.04 mmol, 10.3 mg). After the tube was evacuated and filled with Ar, cyclohexane (1.0 mL) and DTBP (0.8 mmol, 117.0 mg) were injected into the tube by syringe. The tube was then stirred vigorously at 140 °C for 2 h. The reaction mixture was then cooled to room temperature, diluted with EtOAc (2.0 mL), filtered through a celite pad, and concentrated under reduced pressure. The residue was analyzed by ^1H NMR in $CDCl_3$ using CH_2Br_2 as internal standard.

H/D scrambling experiment



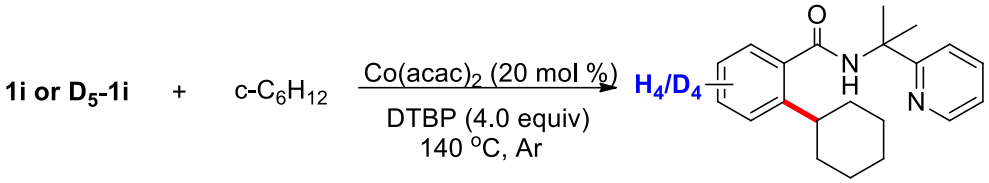
D5-**1i** (>99% D) recovered 65% (98% D)

A 25 mL oven-dried Schlenk tube was charged with a stir bar, D_5-**1i** (49.1 mg, 0.2 mmol) and $Co(acac)_2$ (0.04 mmol, 10.3 mg). After the tube was evacuated and filled with Ar, cyclohexane (1.0 mL) and DTBP (0.8 mmol, 117.0 mg) were injected into the tube by syringe. The tube was then stirred vigorously at 140 °C for 2 h. The reaction mixture was then cooled to room temperature, diluted with EtOAc (2.0 mL), filtered through a celite pad, and concentrated under reduced pressure. The residue was purified by silica gel chromatography (gradient eluent of 20% EtOAc in CH_2Cl_2, v/v) .



KIE Experiment

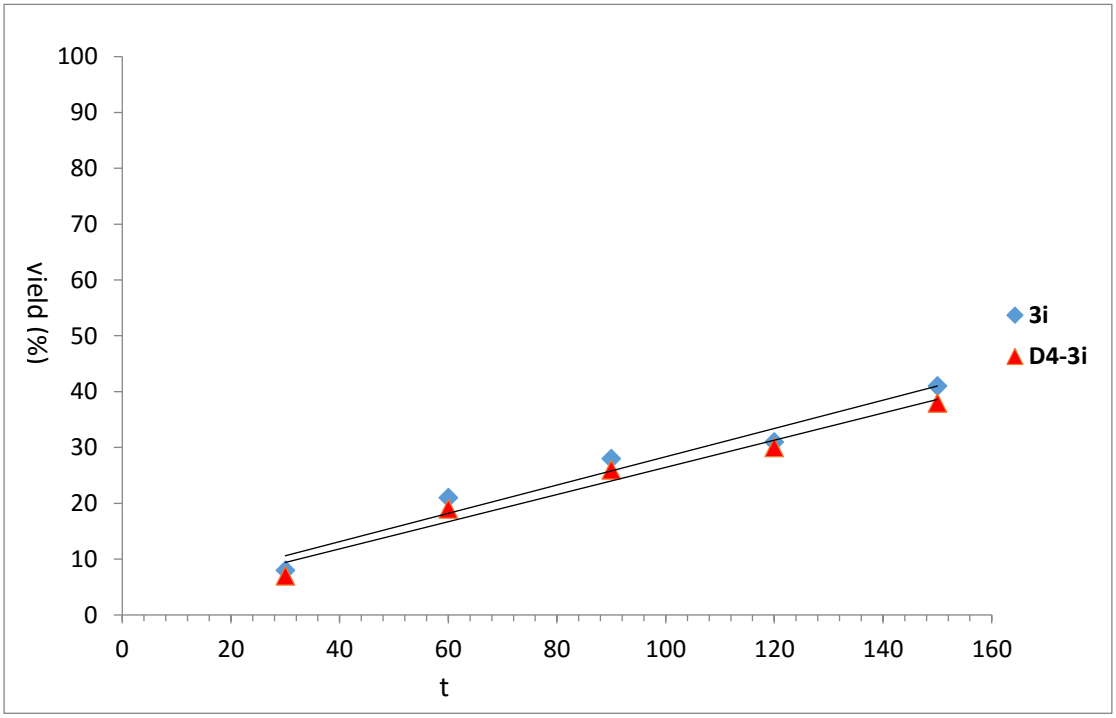
Parallel KIE Experiments



3i or **D_4-3i**

A 25 mL oven-dried Schlenk tube was charged with a stir bar, **1i** (48.1 mg, 0.2 mmol) or D_5-**1i** (49.1 mg, 0.2 mmol) and $Co(acac)_2$ (0.04 mmol, 10.3 mg). After the tube was evacuated and filled with Ar, cyclohexane (1.0 mL) and DTBP (0.8 mmol, 117.0 mg) were injected into the tube by syringe. The tube was then stirred vigorously at 140 °C for the indicated time. The reaction was stopped by rapid cooling, diluted with EtOAc (2.0 mL), filtered through a celite pad, and concentrated under reduced pressure. The residue was analyzed by ^1H NMR in $CDCl_3$ using CH_2Br_2 as internal standard.

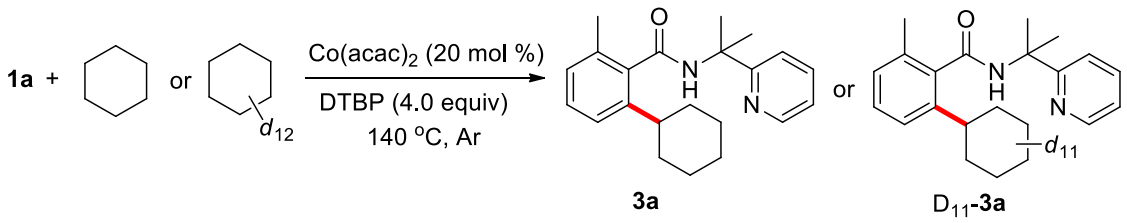
Time (min)	30	60	90	120	150
Yield **3i** (%)	8	21	28	31	41
Yield D_4-**3i** (%)	7	19	26	30	38



Equation for **3i:** $y = 0.2533x + 3$ $R^2 = 0.9582$

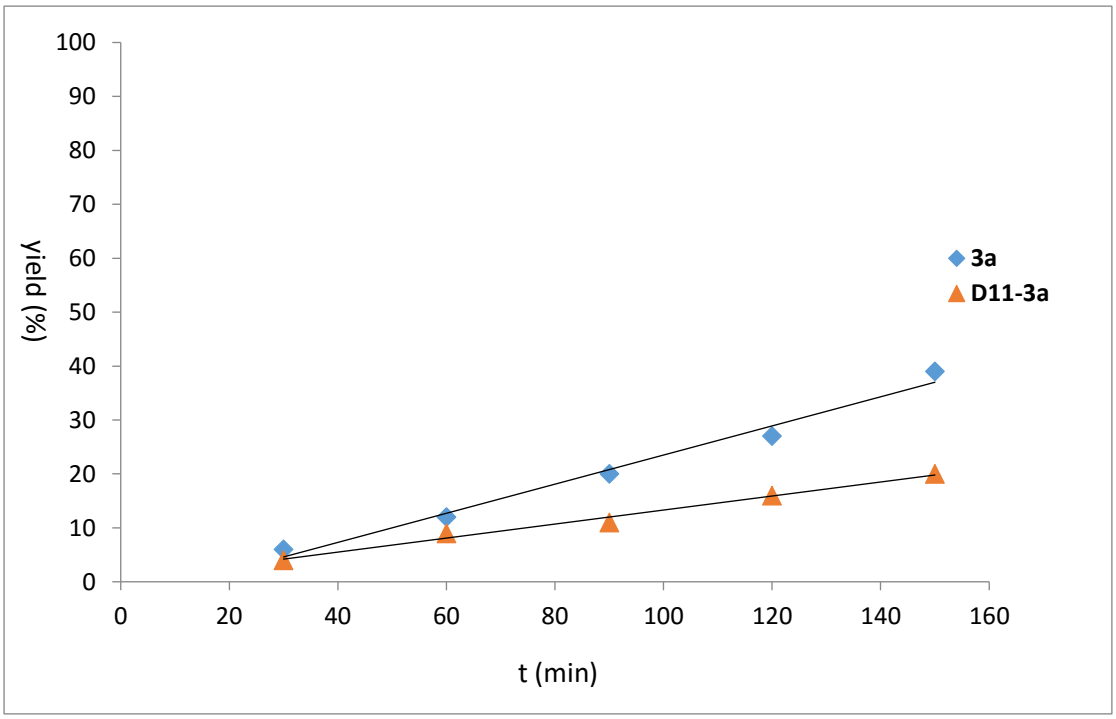
Equation for D_4-**3i:** $y = 0.2433x + 2.1$ $R^2 = 0.9689$

$k_H/k_D = 0.2533/0.2433 \approx 1.0$



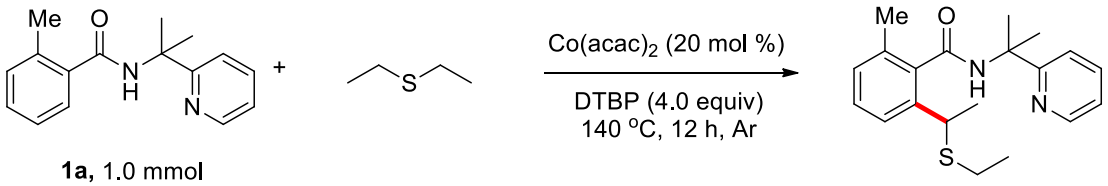
A 25 mL oven-dried Schlenk tube was charged with a stir bar, **1a** (0.2 mmol, 50.9 mg) and Co(acac)$_2$ (0.04 mmol, 10.3 mg). After the tube was evacuated and filled with Ar, cyclohexane (1.0 mL) or cyclohexane-d_{12} (1.0 mL) and DTBP (0.8 mmol, 117.0 mg) were injected into the tube by syringe. The tube was then stirred vigorously at 140 °C for the indicated time. The reaction was stopped by rapid cooling, diluted with EtOAc (2.0 mL), filtered through a celite pad, and concentrated under reduced pressure. The residue was analyzed by ^{1}H NMR in $CDCl_3$ using CH_2Br_2 as internal standard.

Time (min)	30	60	90	120	150
Yield **3a** (%)	6	12	20	27	39
Yield D$_{11}$-**3a** (%)	4	9	11	16	20



Equation for **3a:** $y = 0.27x - 3.5$ $R^2 = 0.984$
Equation for D$_{11}$-**3a:** $y = 0.13x + 0.3$ $R^2 = 0.9877$
$k_H/k_D = 0.27/0.13 \approx 2.1$

Synthesis of 6a in 1.0 mmol scale



1a, 1.0 mmol

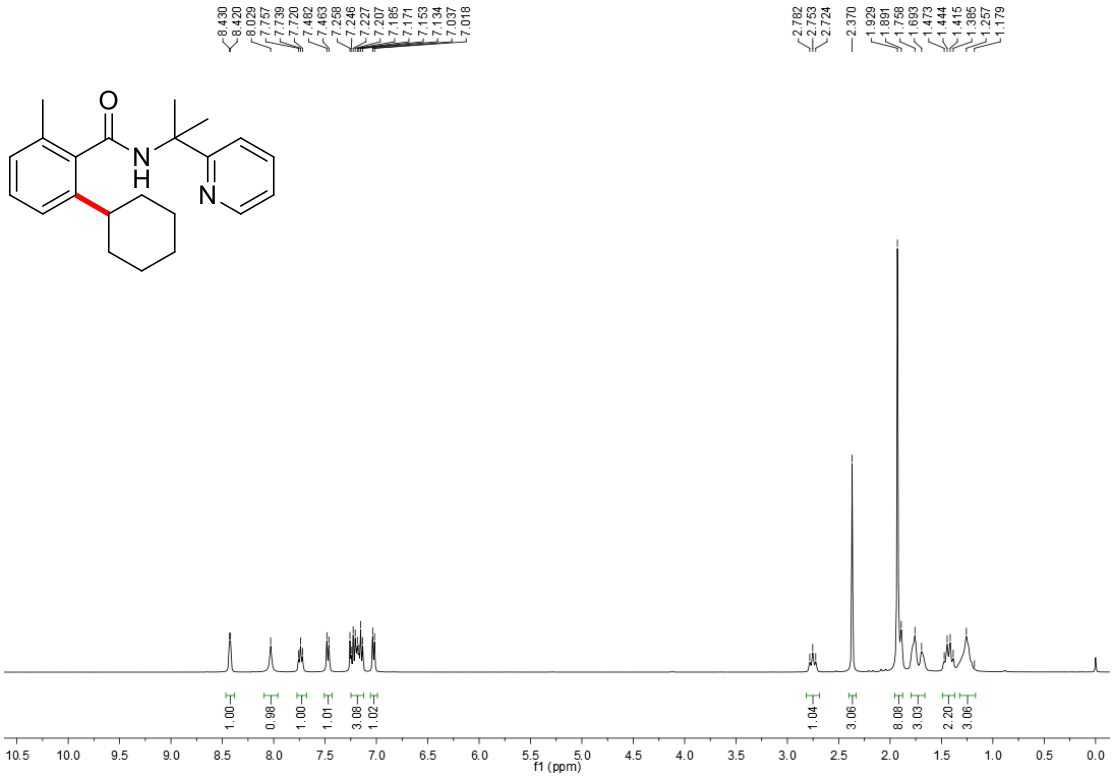
A 50 mL oven-dried Schlenk tube was charged with a stir bar, amide **1a** (1.0 mmol, 254.3 mg), $Co(acac)_2$ (0.2 mmol, 51.5 mg). After the tube was evacuated and filled with Ar, diethyl sulfide (5.0 mL) and DTBP (4.0 mmol, 584.9 mg) were injected into the tube by syringe. The tube was then stirred vigorously at 140 °C for 12 h. The reaction mixture was then cooled to room temperature, diluted with EtOAc (10.0 mL), filtered through a celite pad, and concentrated under reduced pressure. Purification by column chromatography (EtOAc/hexane 1:10) gave **6a** (255.1 mg, 74%) as a colorless oil.

References

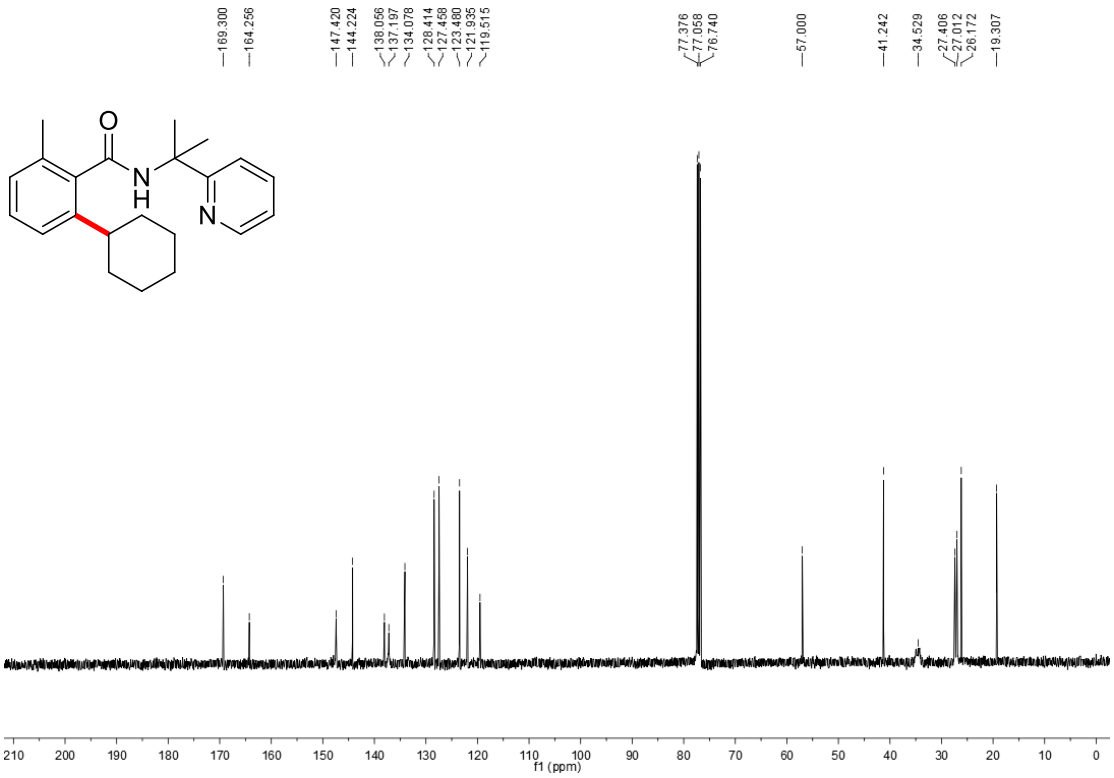
(1) Zhang, Q.; Chen, K.; Rao, W.-H.; Zhang, Y.; Chen, F.-J.; Shi, B.-F. *Angew. Chem., Int. Ed*. **2013**, *52*, 13588.
(2) Li, X.; Liu, Y.-H.; Gu, W.-J.; Li, B.; Chen, F.-J.; Shi, B.-F. *Org. Lett.* **2014**, *16*, 3904.
(3) Liu, Y.-J.; Liu, Y.-H.; Yin, X.-S.; Gu, W.-J.; Shi, B.-F. *Chem. - Eur. J.* **2015**, *21*, 205.
(4) Li, B.; Liu, B.; Shi, B.-F. *Chem. Commun.* **2015**, *51*, 5093.
(5) Chen, F.-J.; Liao, G.; Li, X.; Wu, J.; Shi, B.-F. *Org. Lett.* **2014**, *16*, 5644.
(6) Cadot, C. P.; Dalko, I.; Cossy, J.; Ollivier, C.; Chuard, R; Renaud, P. *J. Org. Chem.* **2002**, *67*, 7193.

^{1}H and ^{13}C NMR Spectra

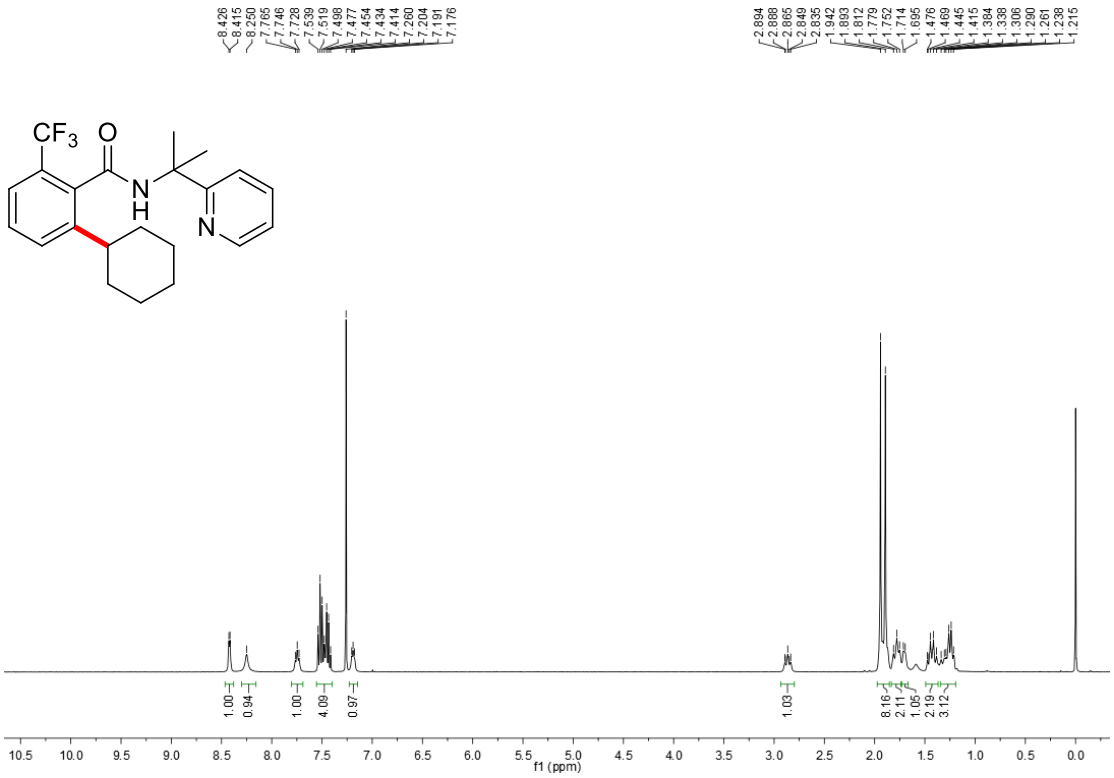
Compound 3a



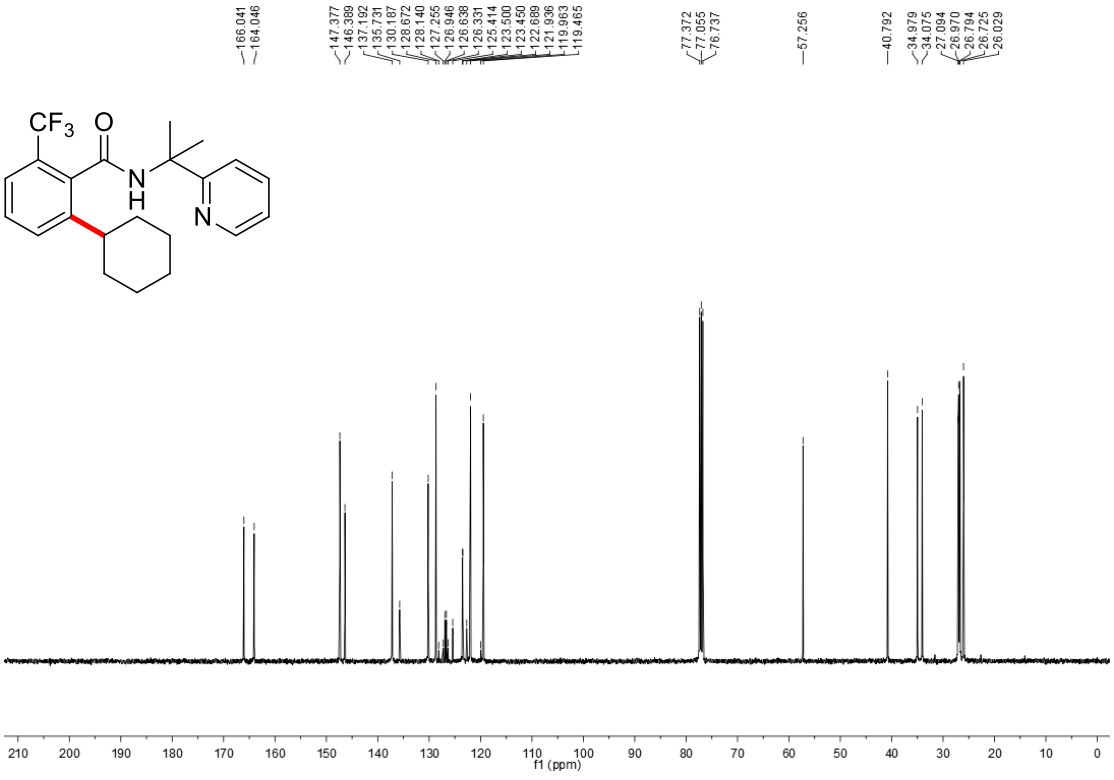
Compound 3a



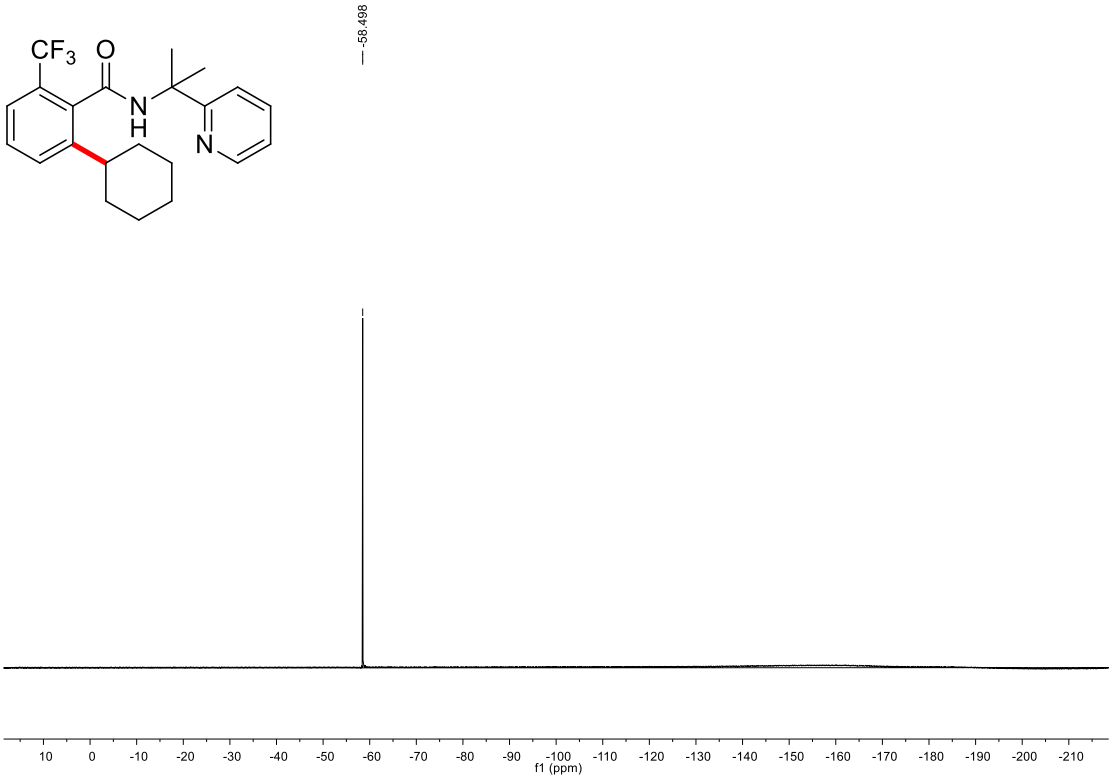
Compound 3b



Compound 3b



Compound 3b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H
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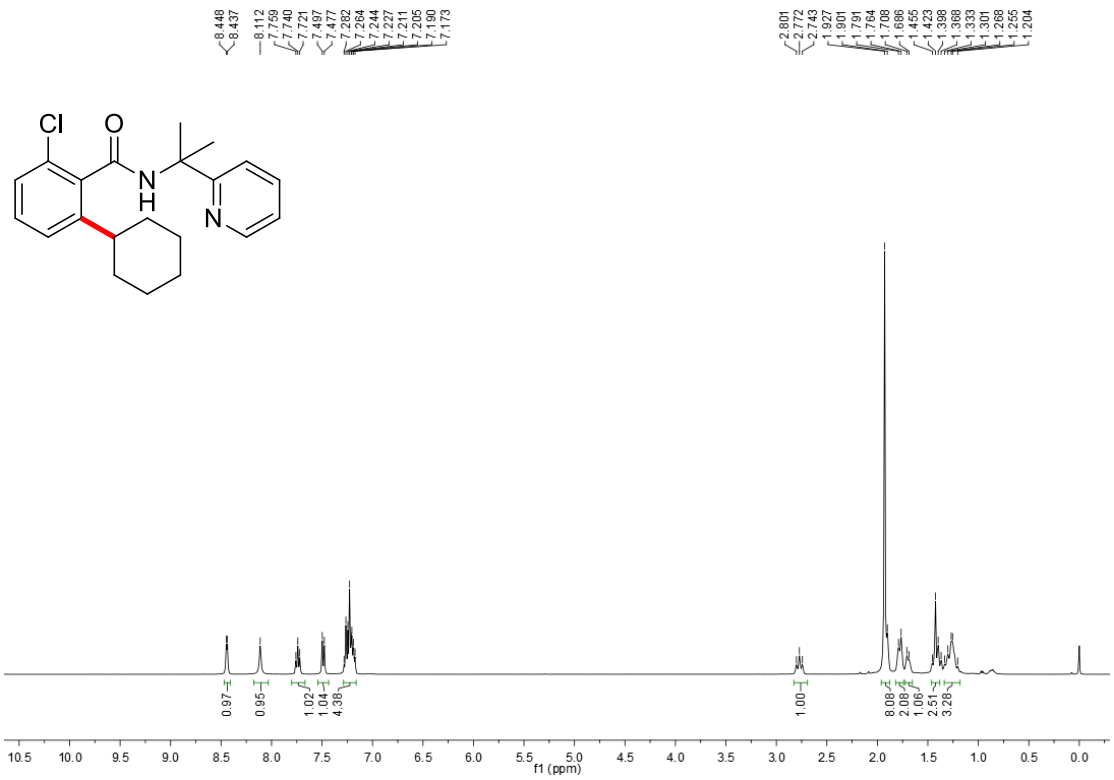
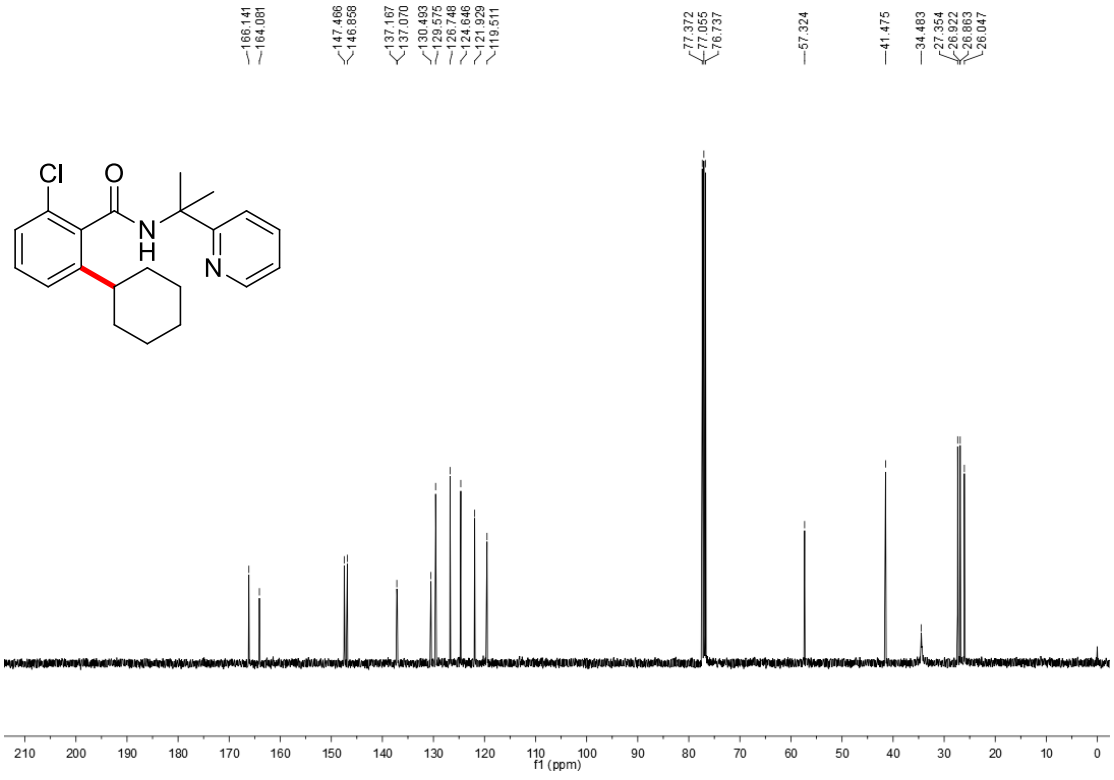
f1 (ppm)

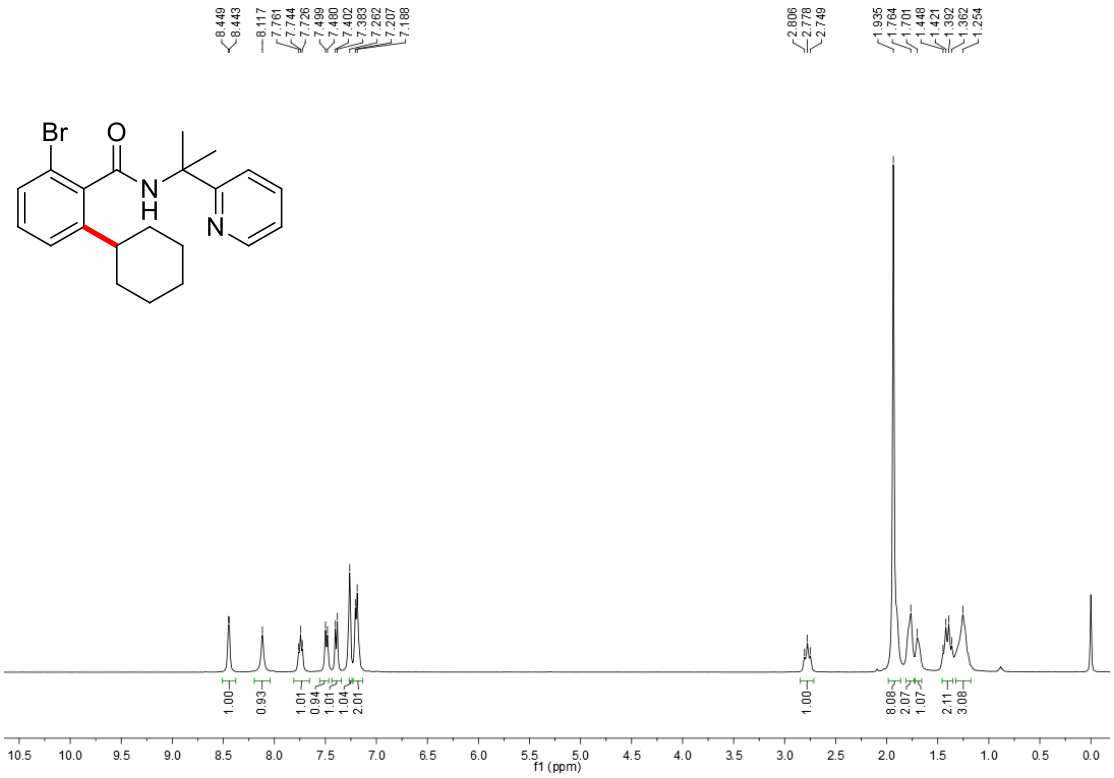
Compound 3c



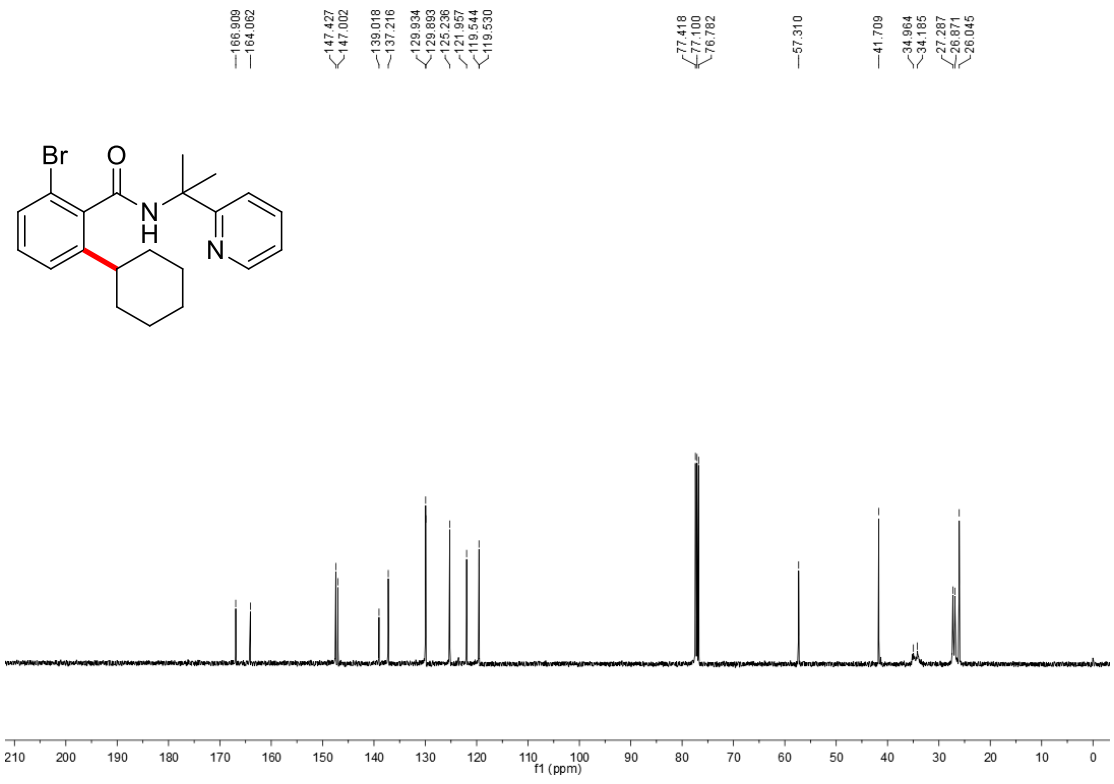
Compound 3c



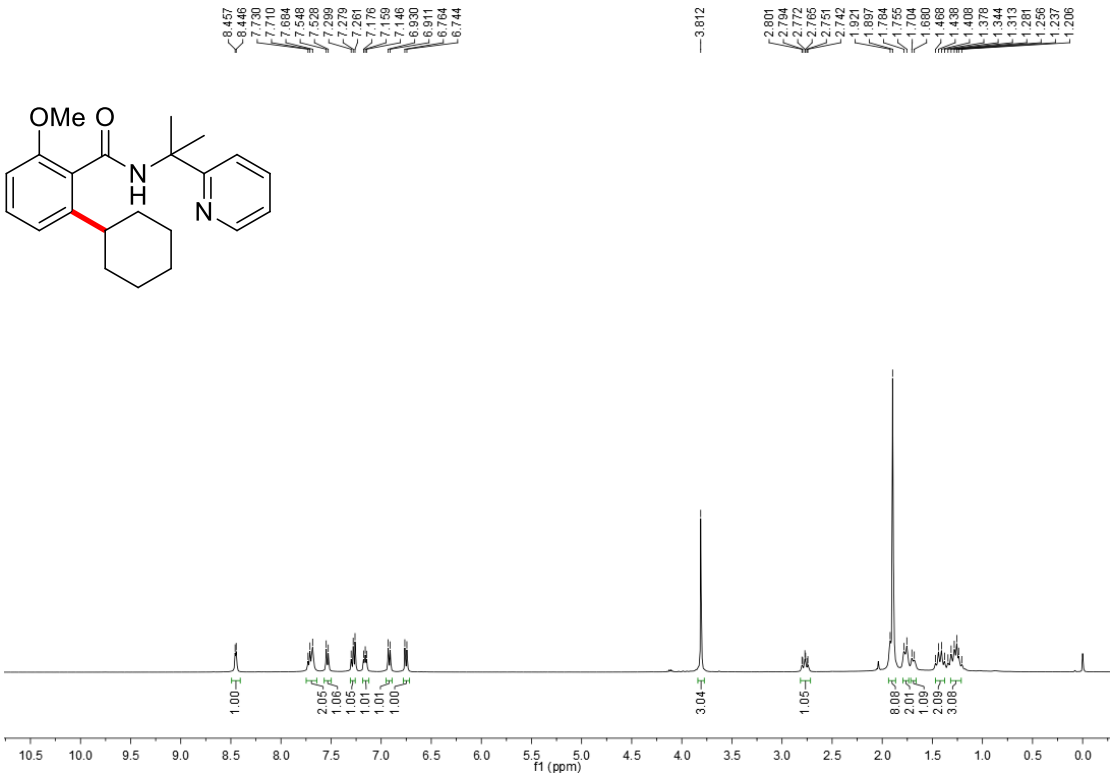
Compound 3d



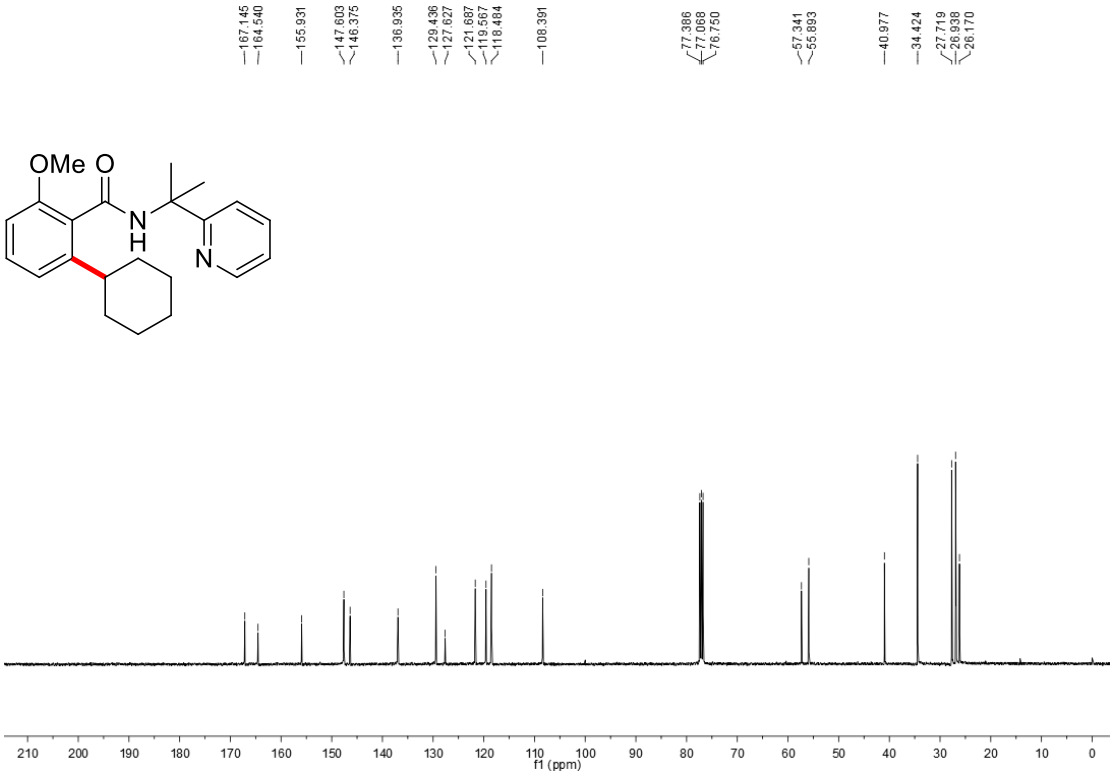
Compound 3d



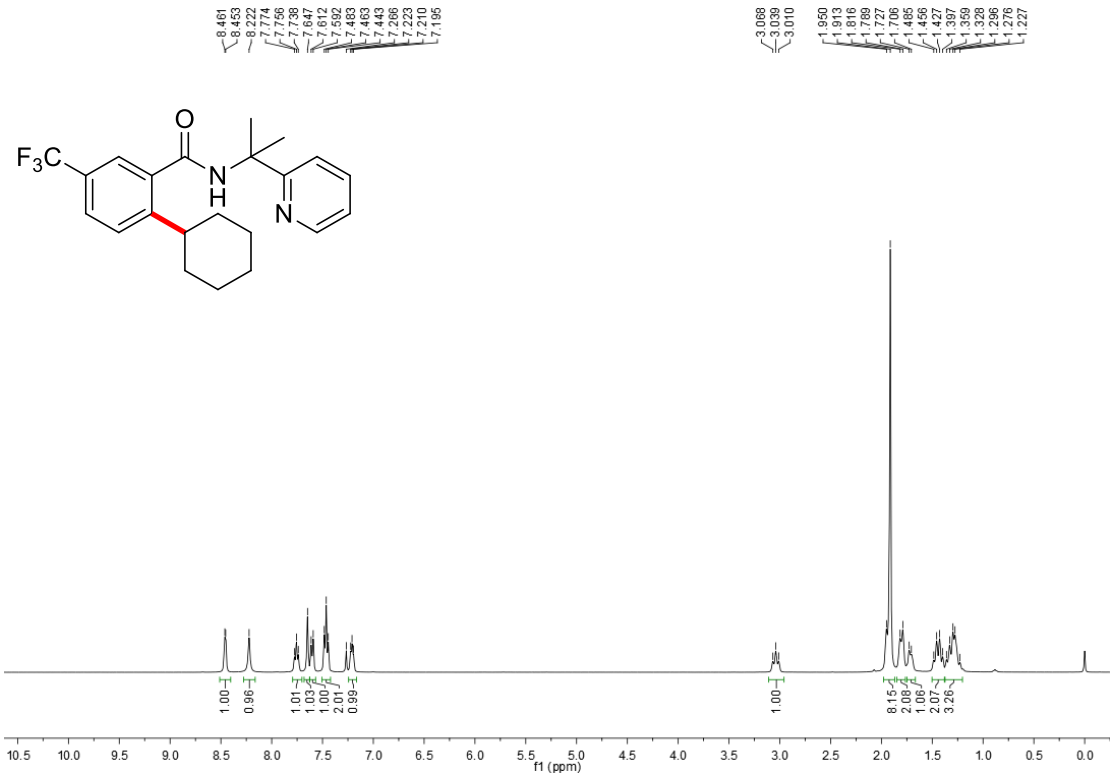
Compound 3e



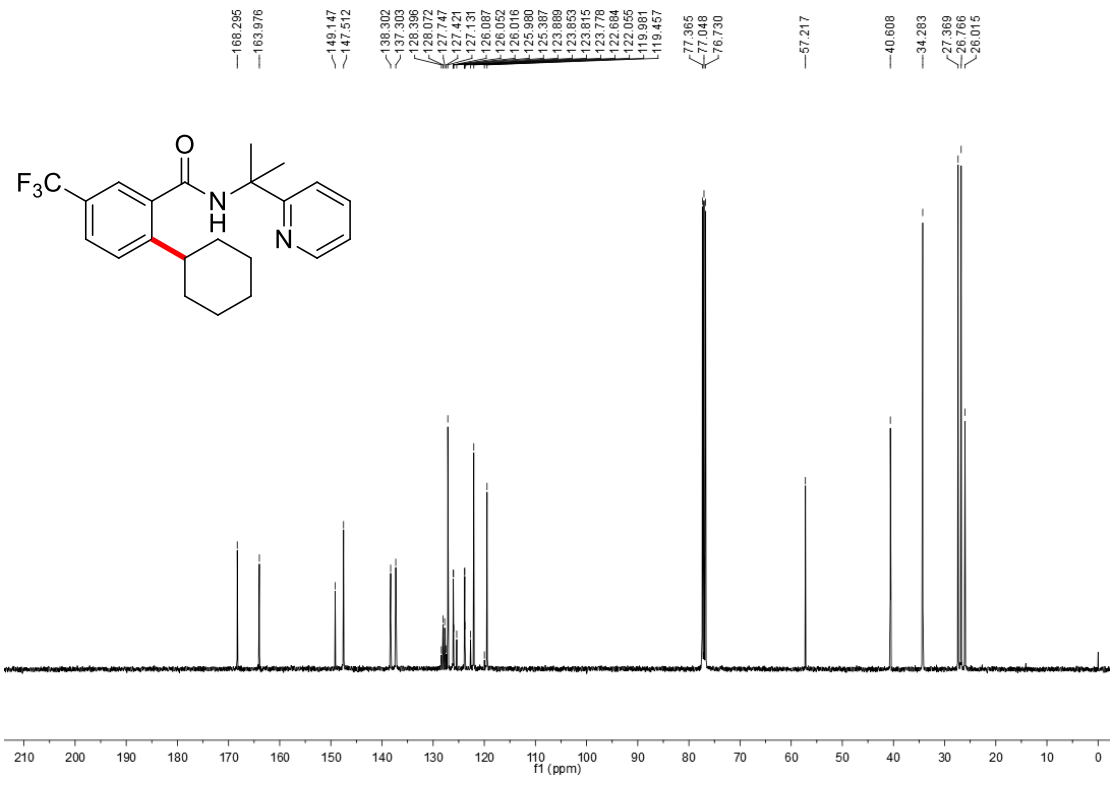
Compound 3e



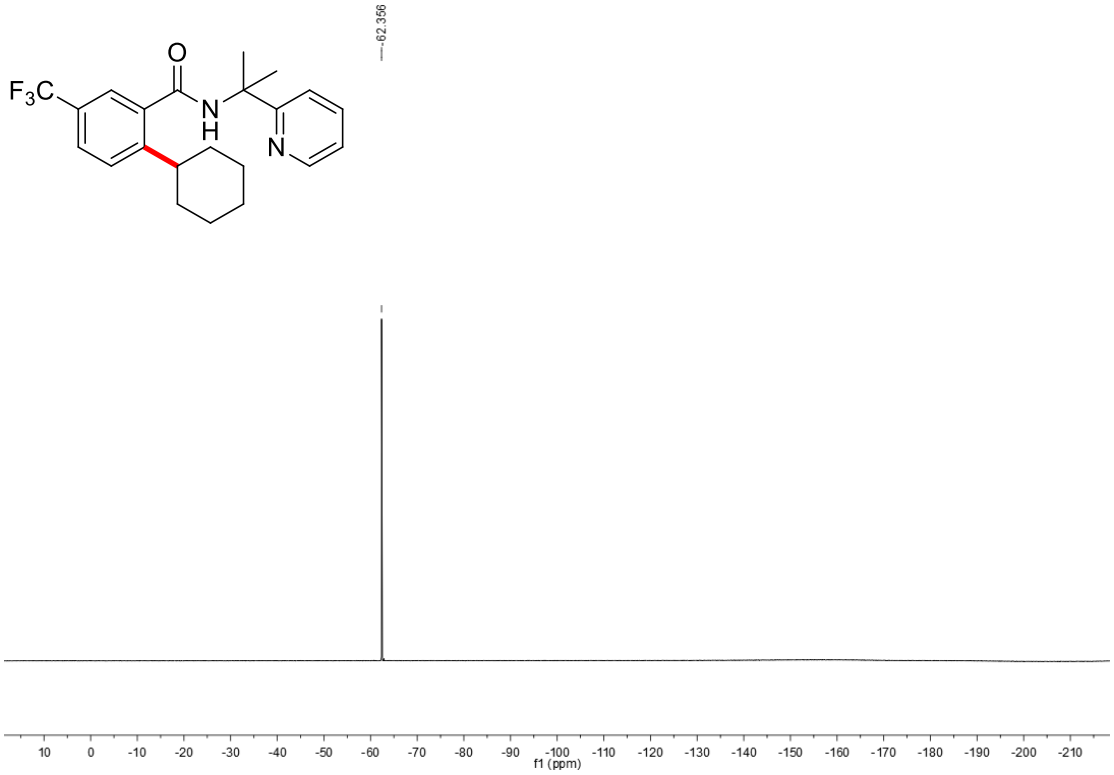
Compound 3f



Compound 3f



Compound 3f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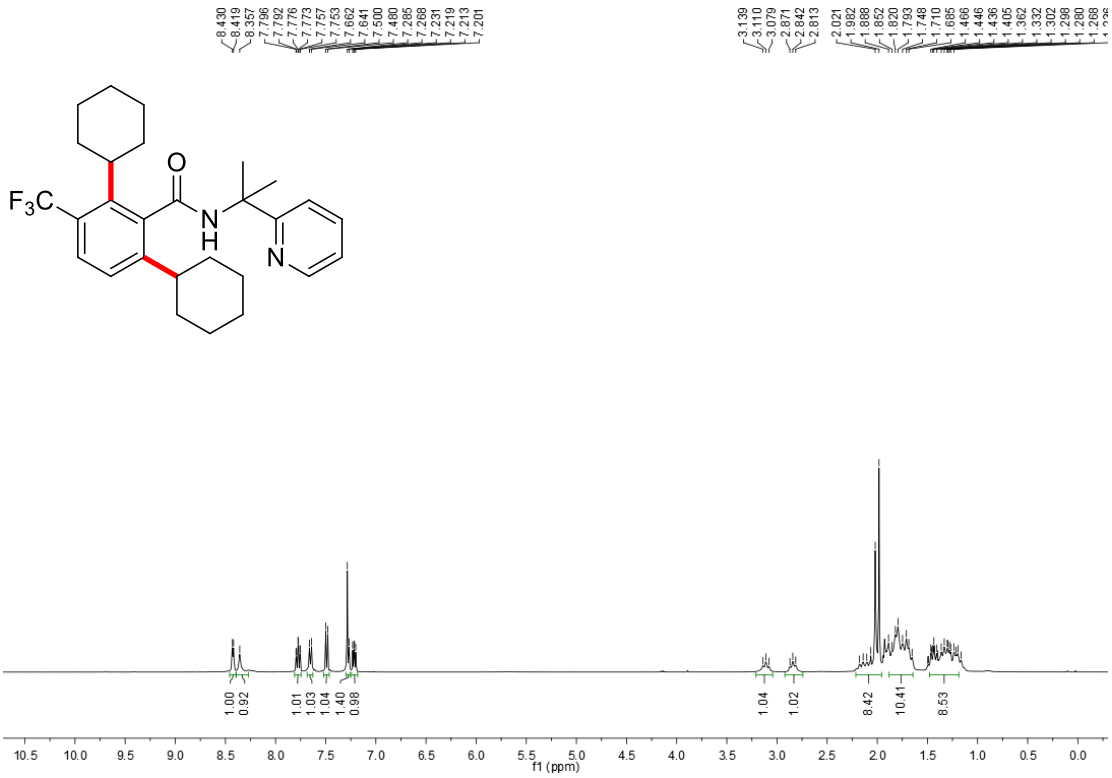
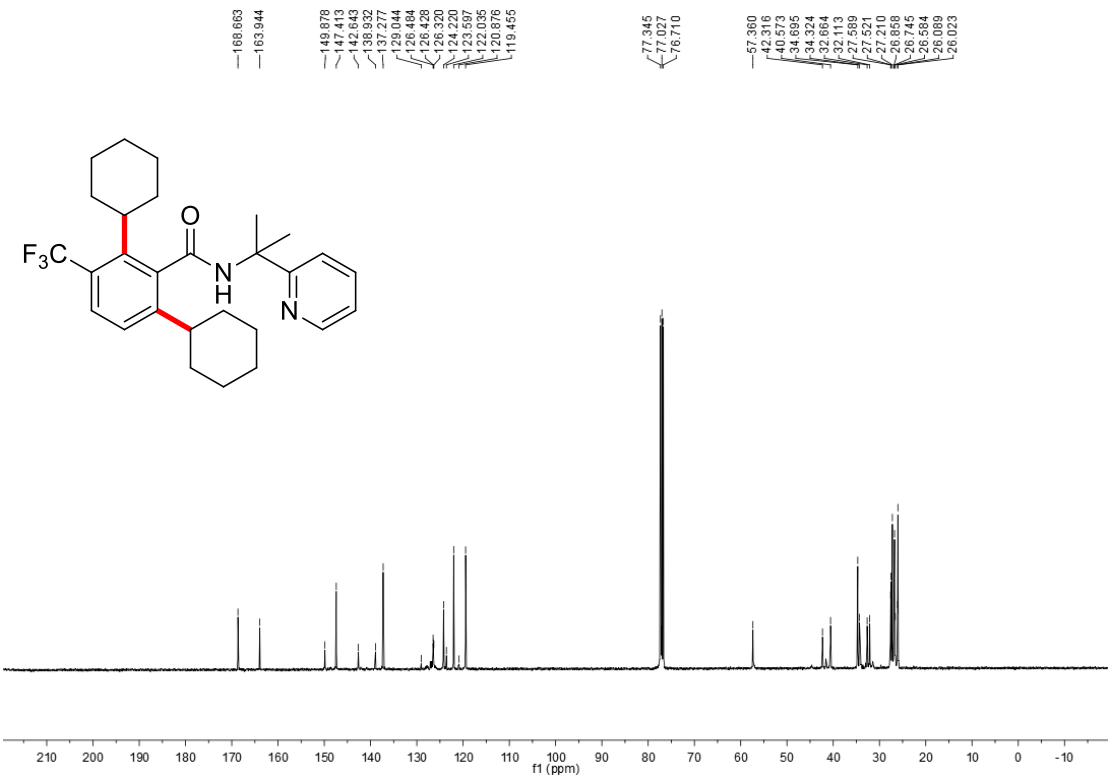
f1 (ppm)

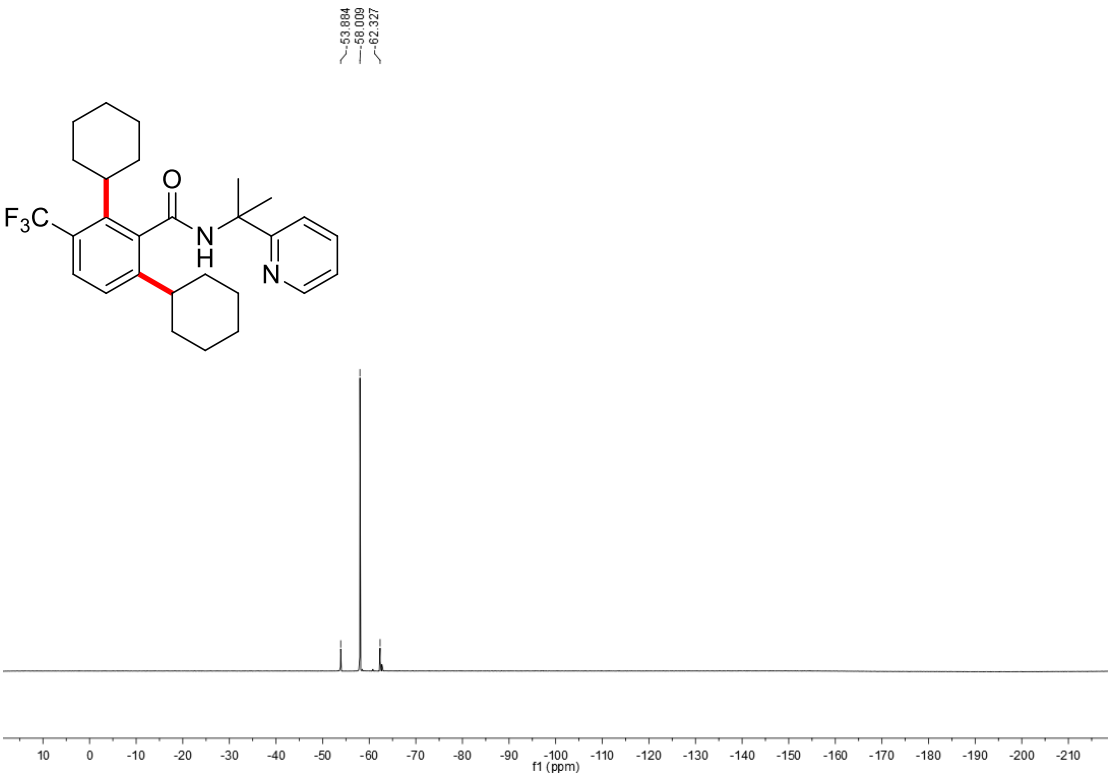
Compound 3f′



Compound 3f′



Compound 3f′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H
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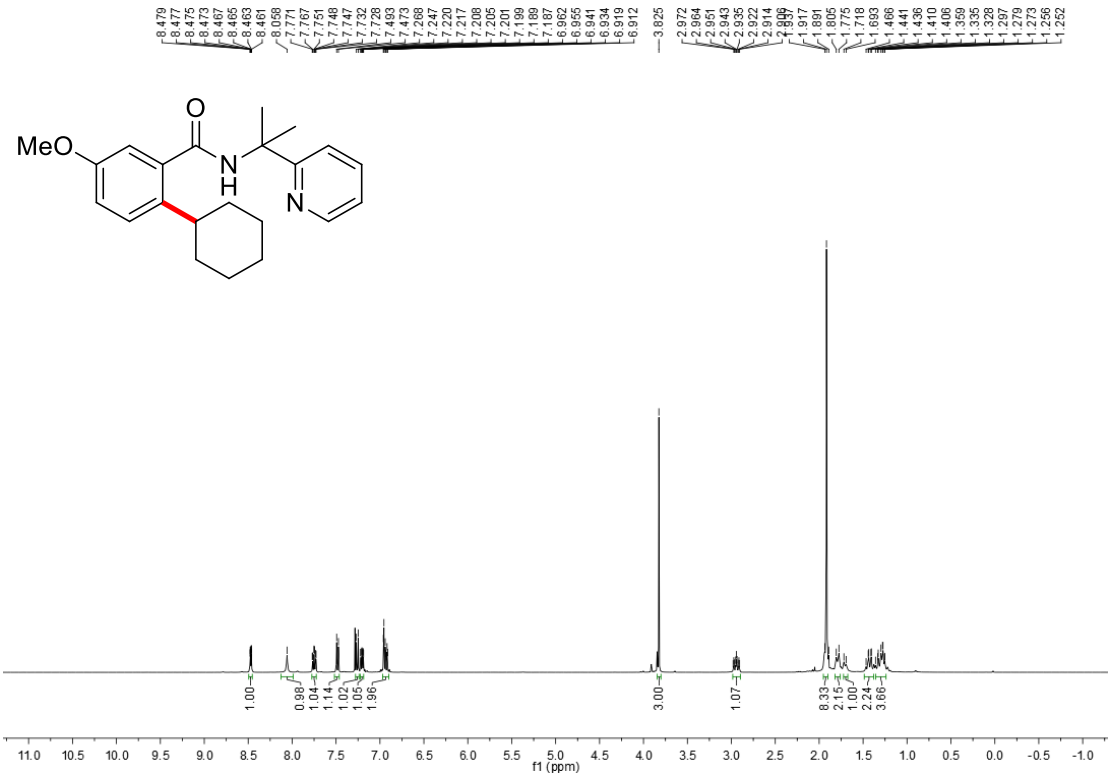
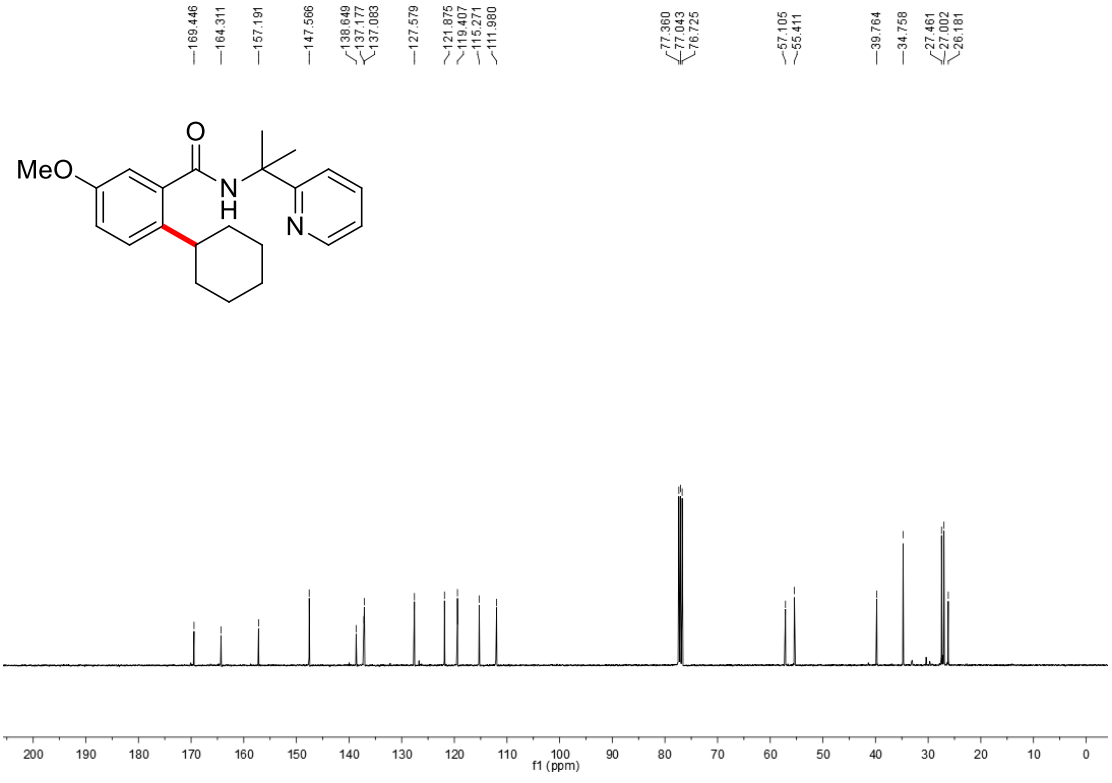
-180
-190
-200
-210
f1 (ppm)

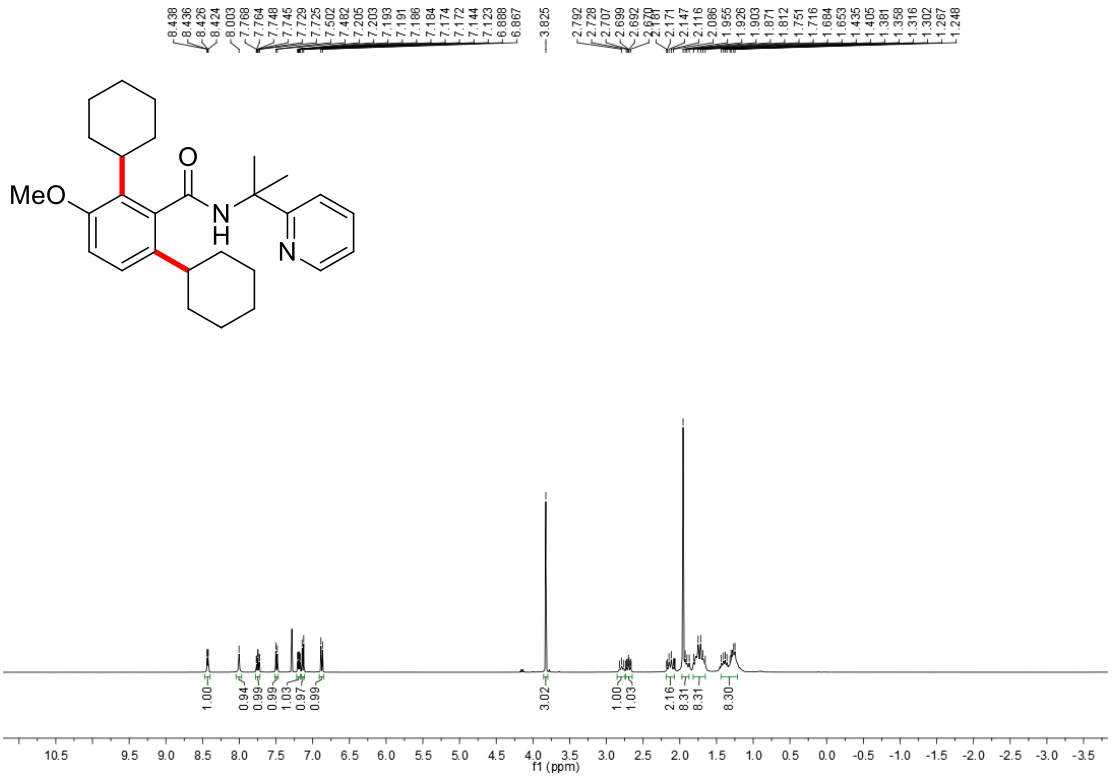
Compound 3g



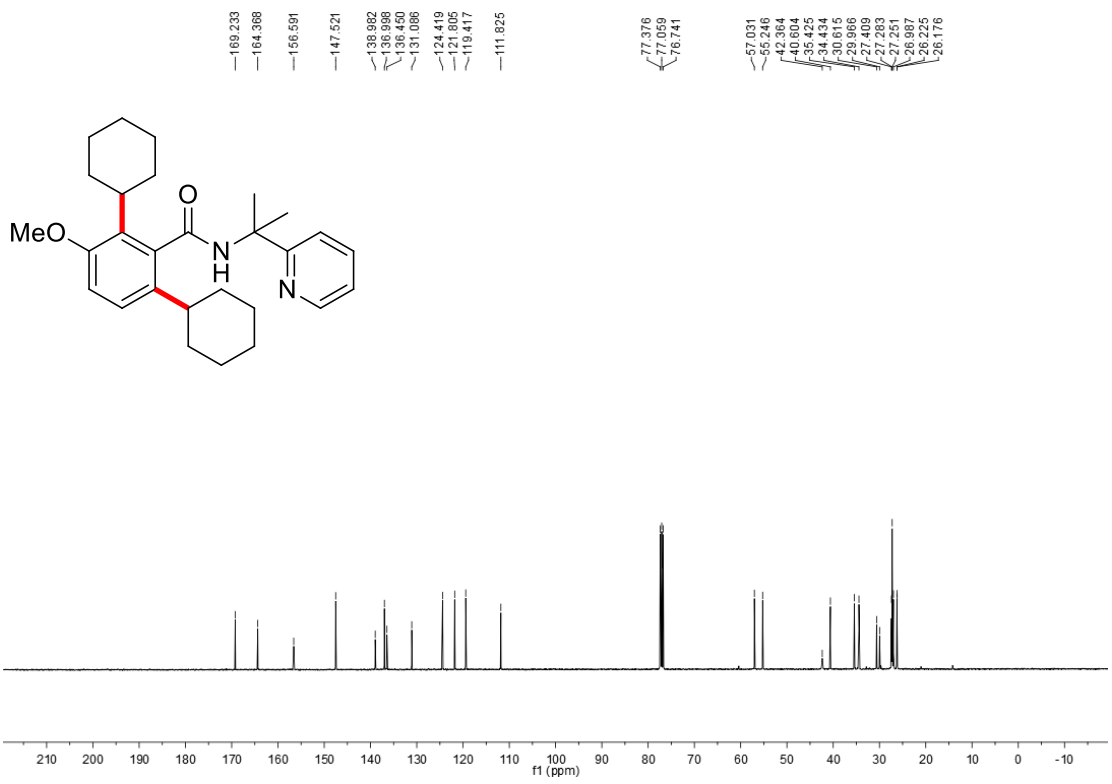
Compound 3g



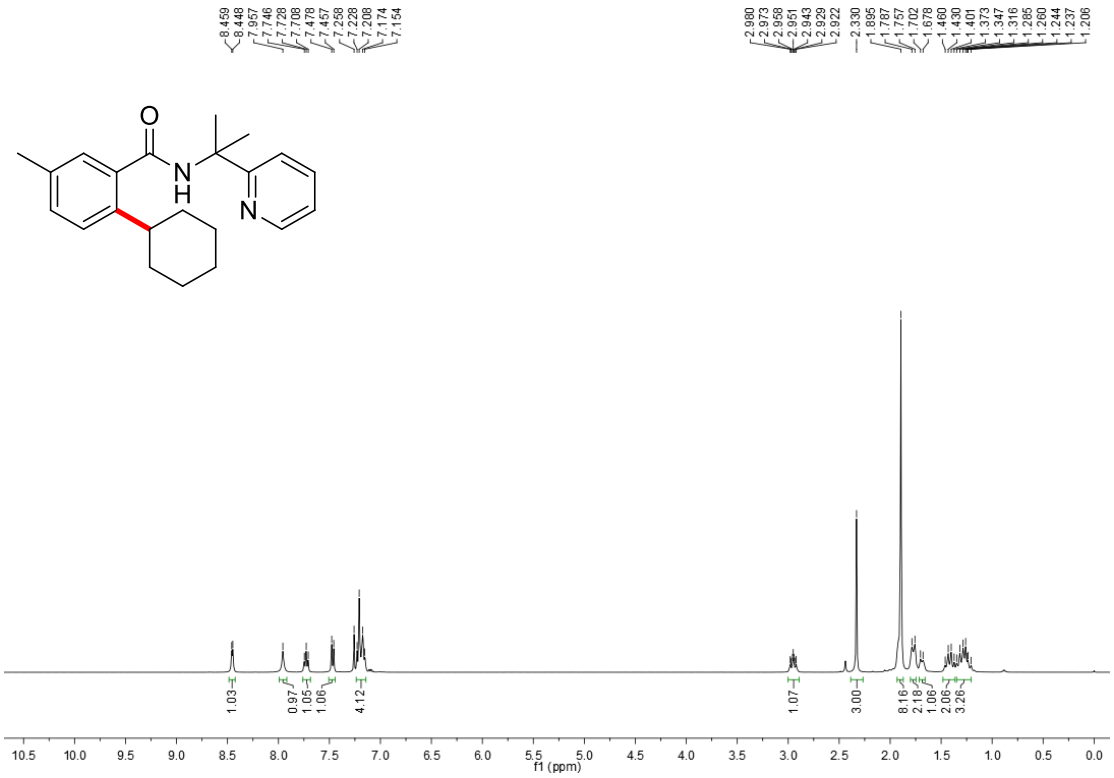
Compound 3g′



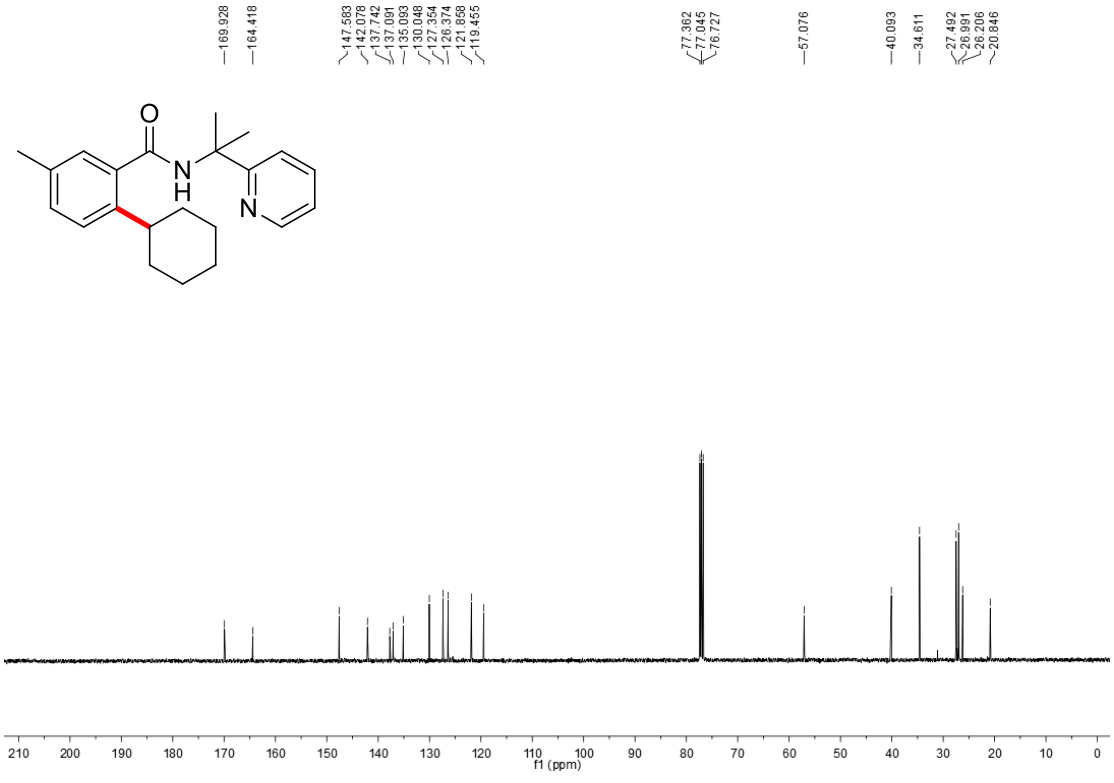
Compound 3g′



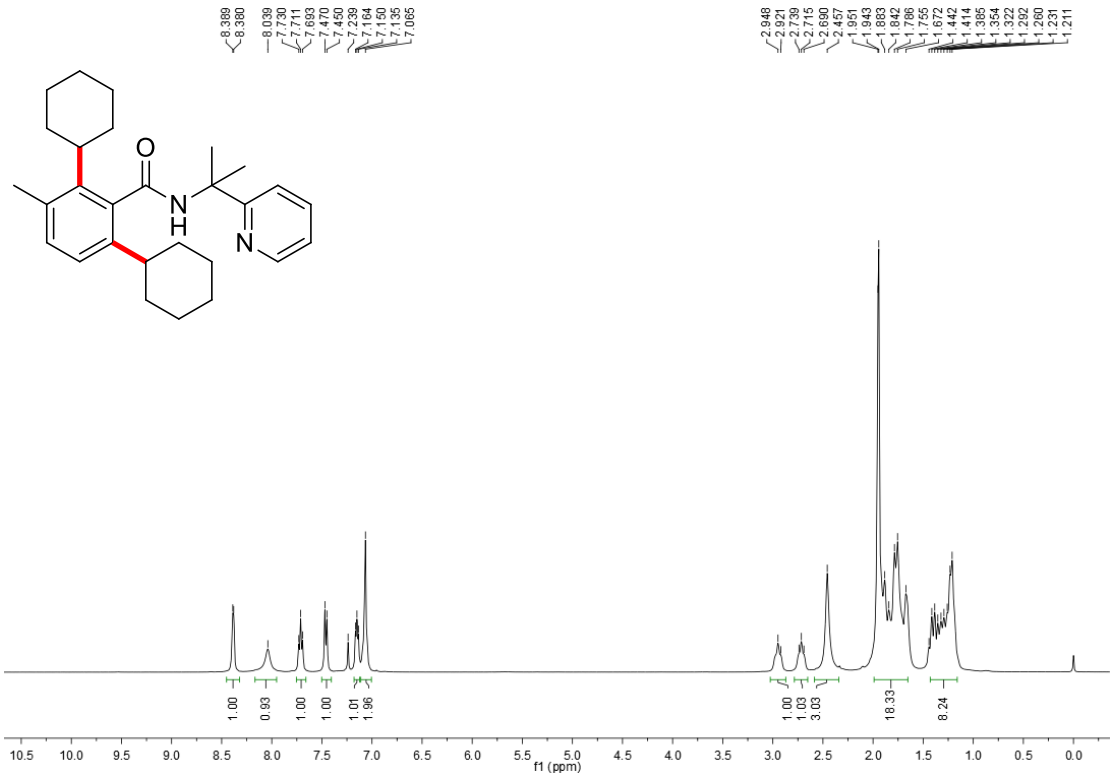
Compound 3h



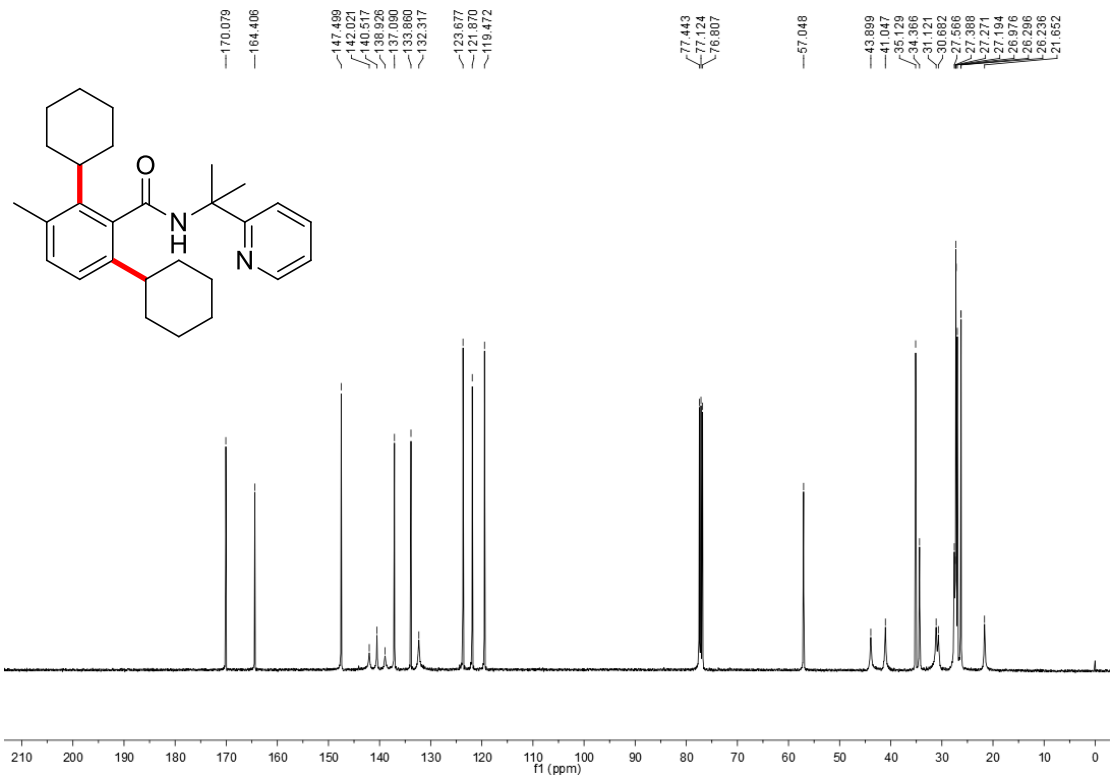
Compound 3h



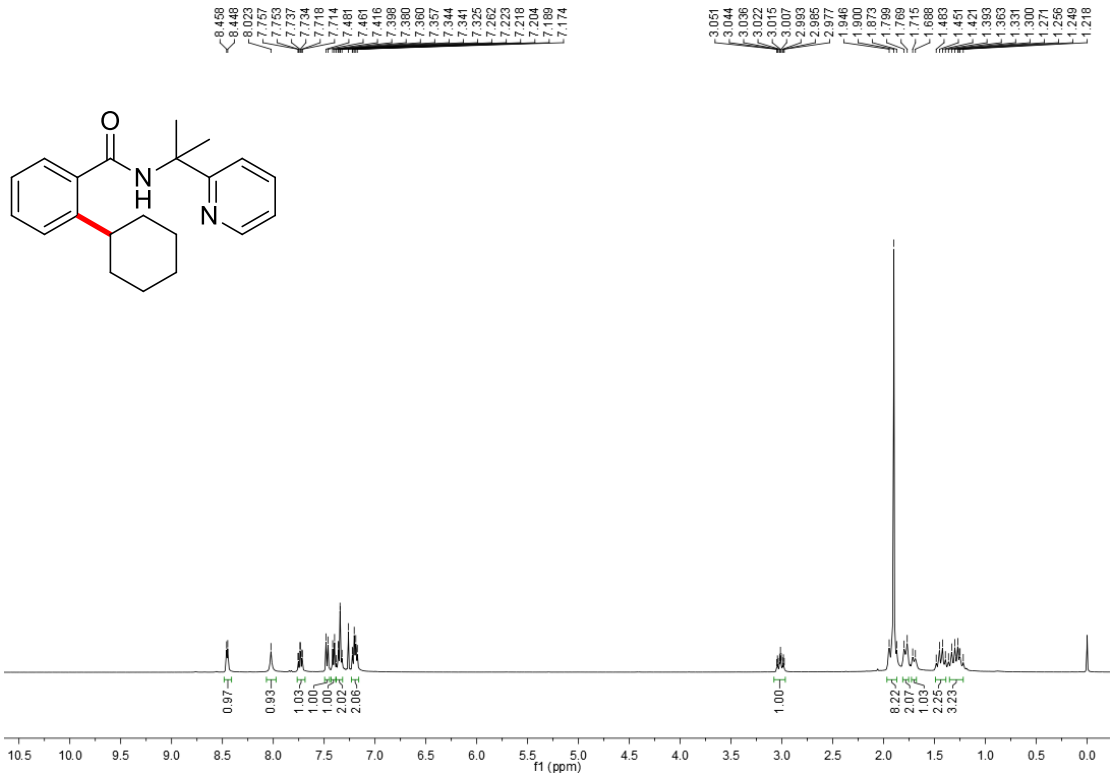
Compound 3h′



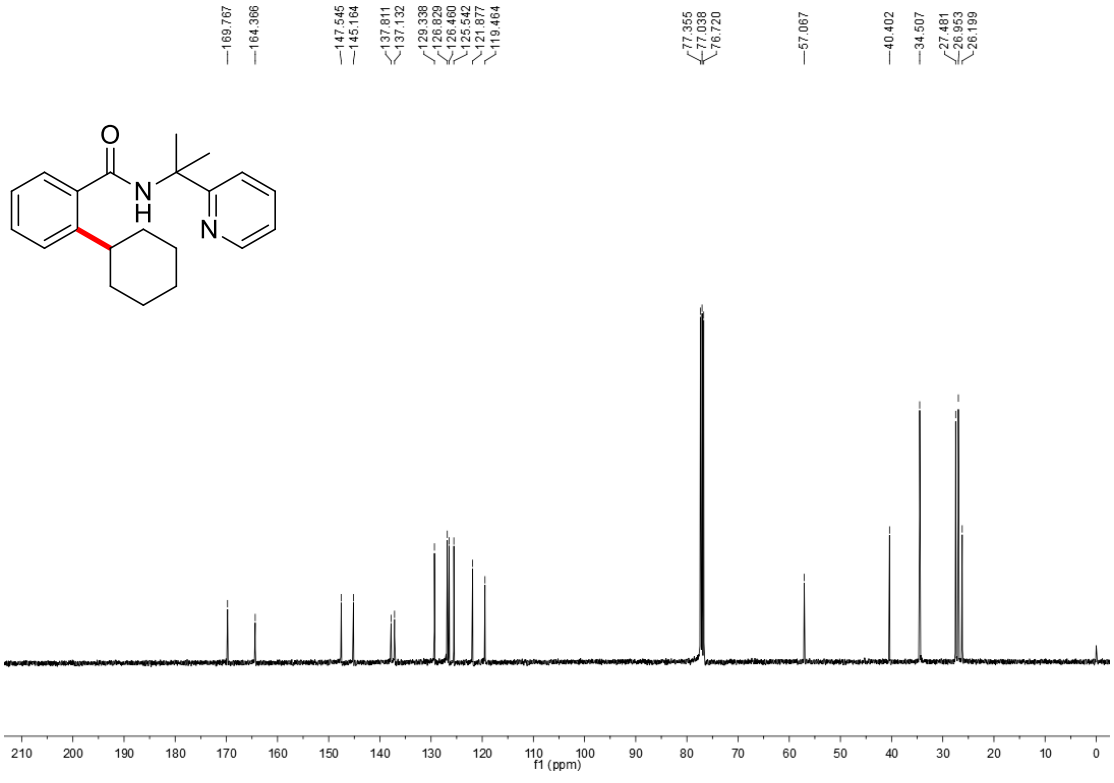
Compound 3h′



Compound 3i



Compound 3i



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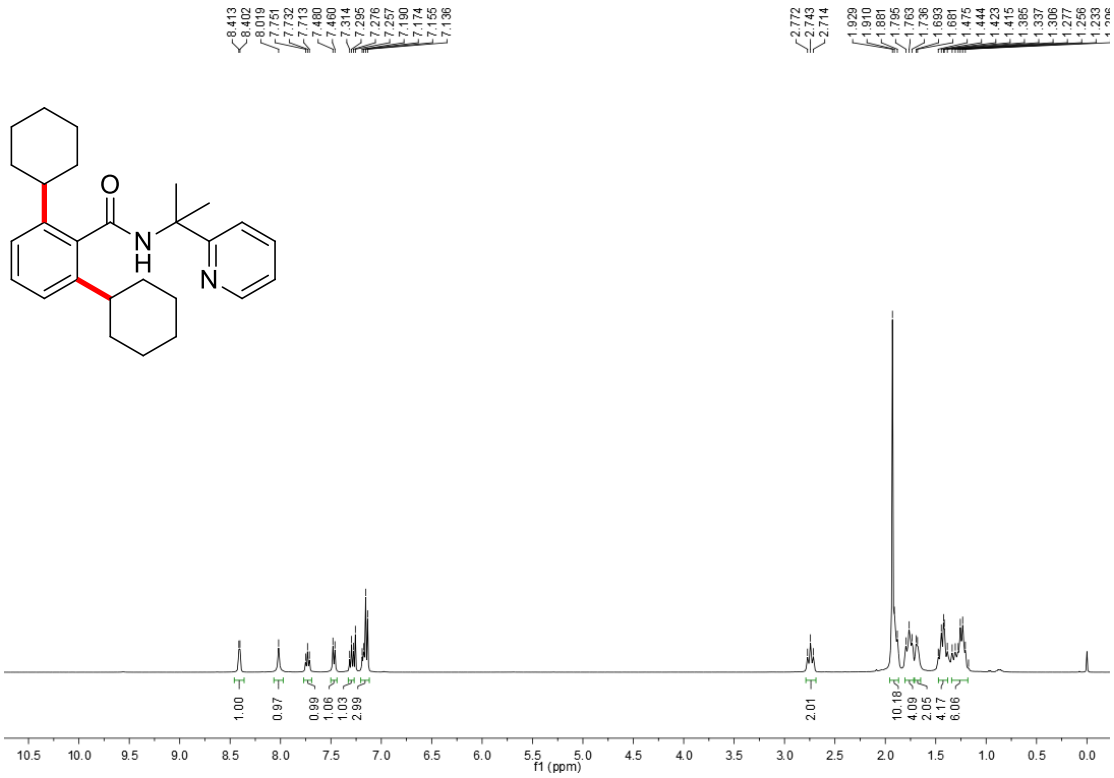

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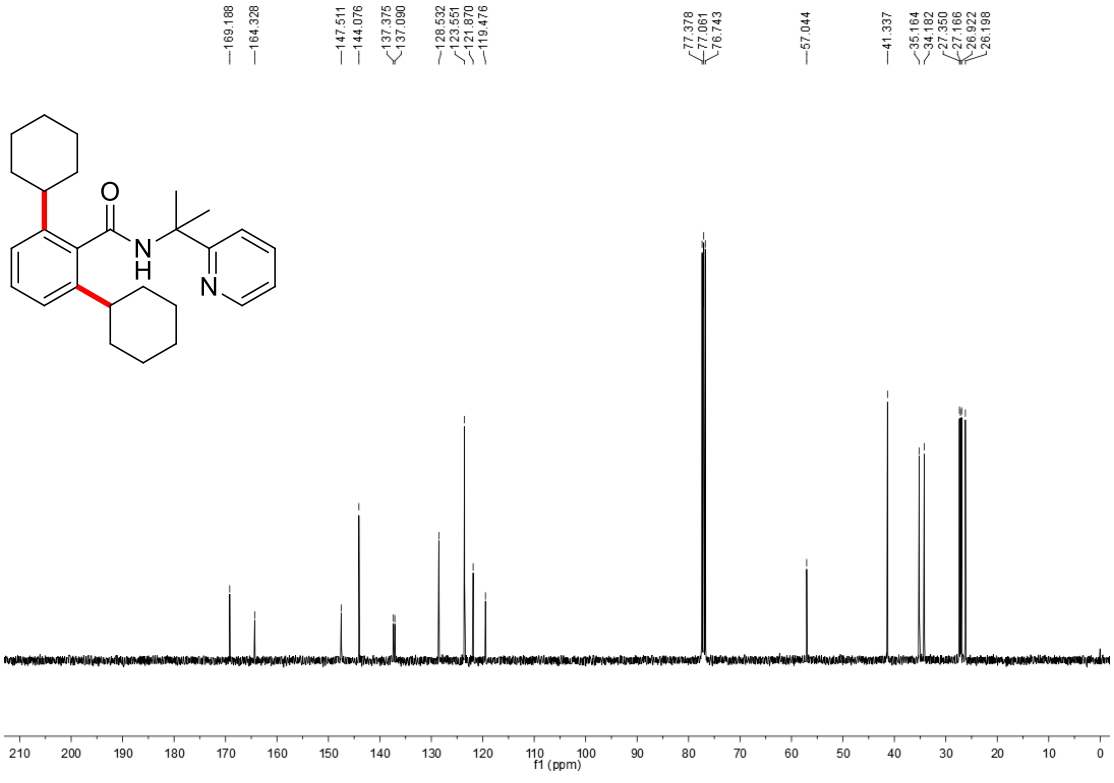

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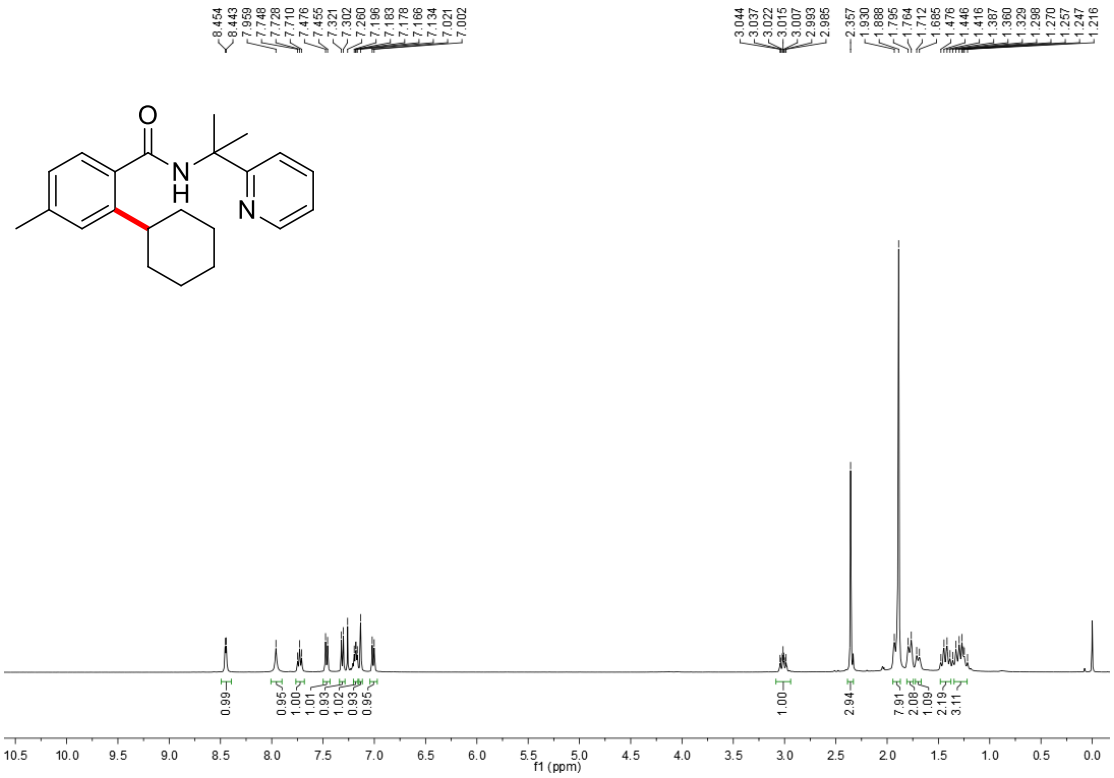
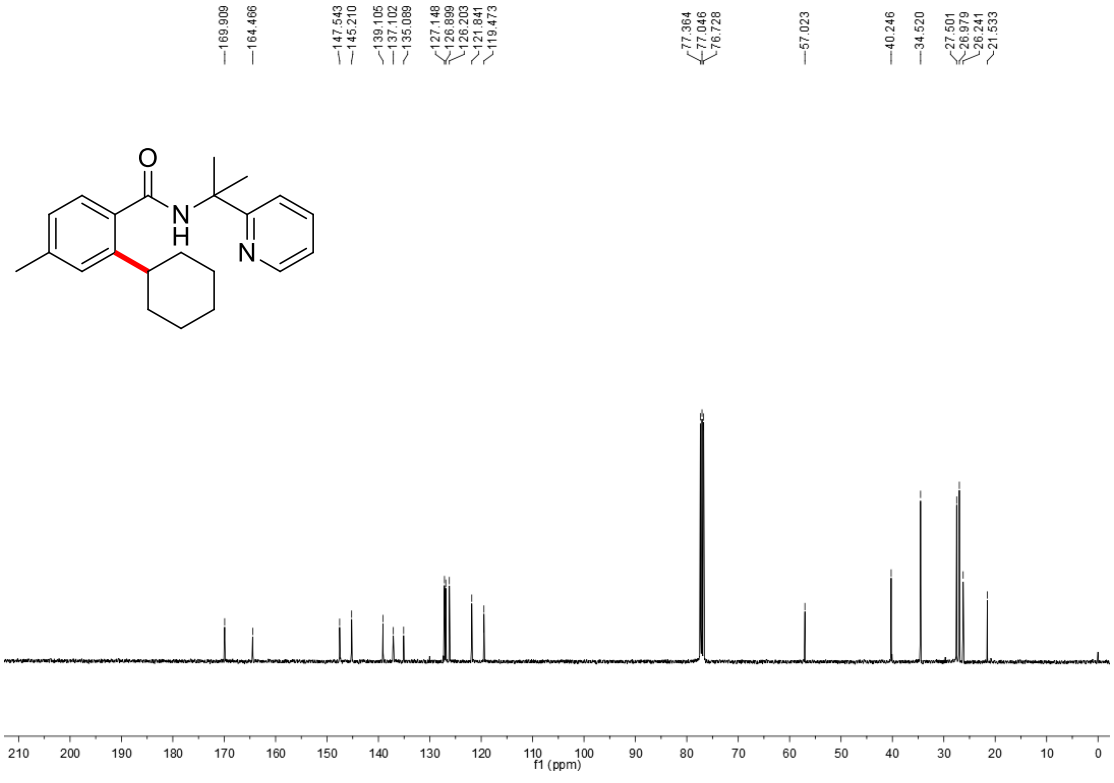


Compound 3j



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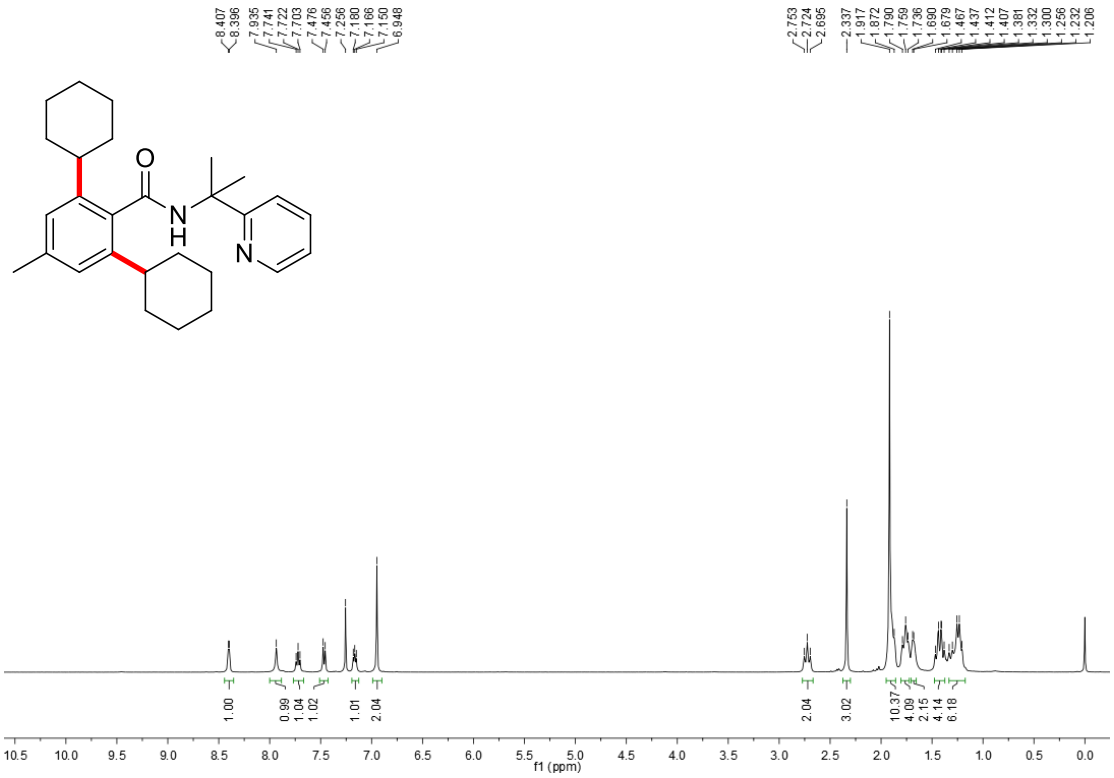

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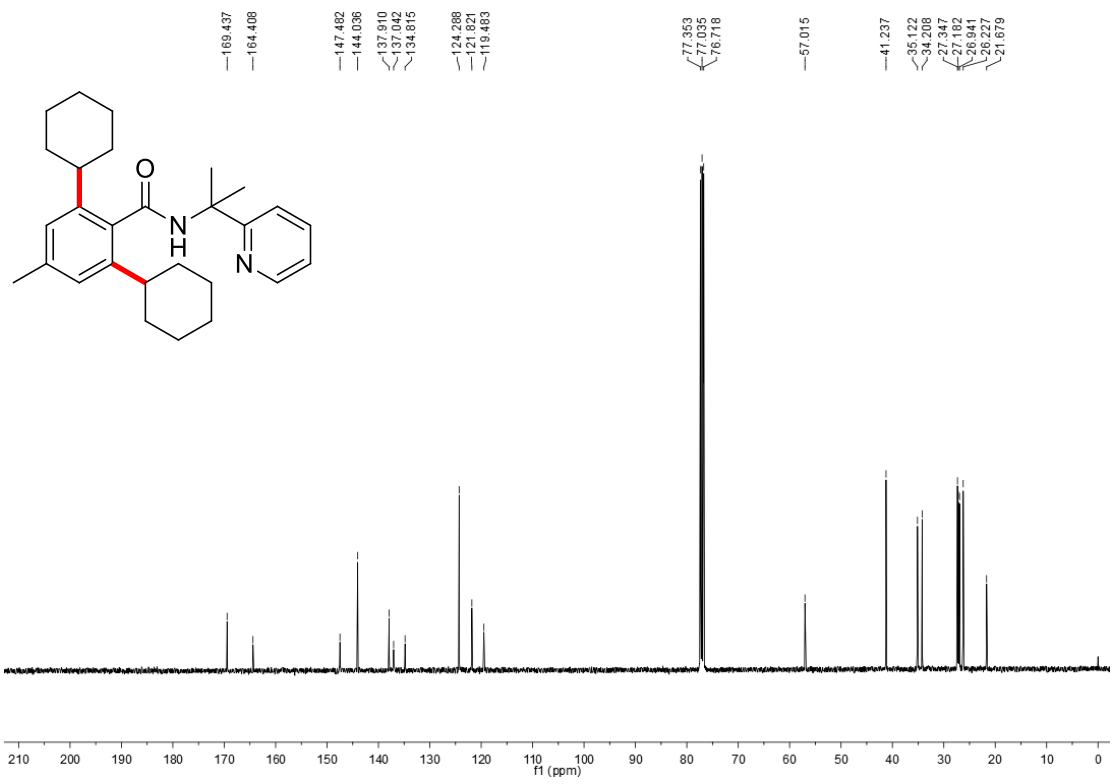
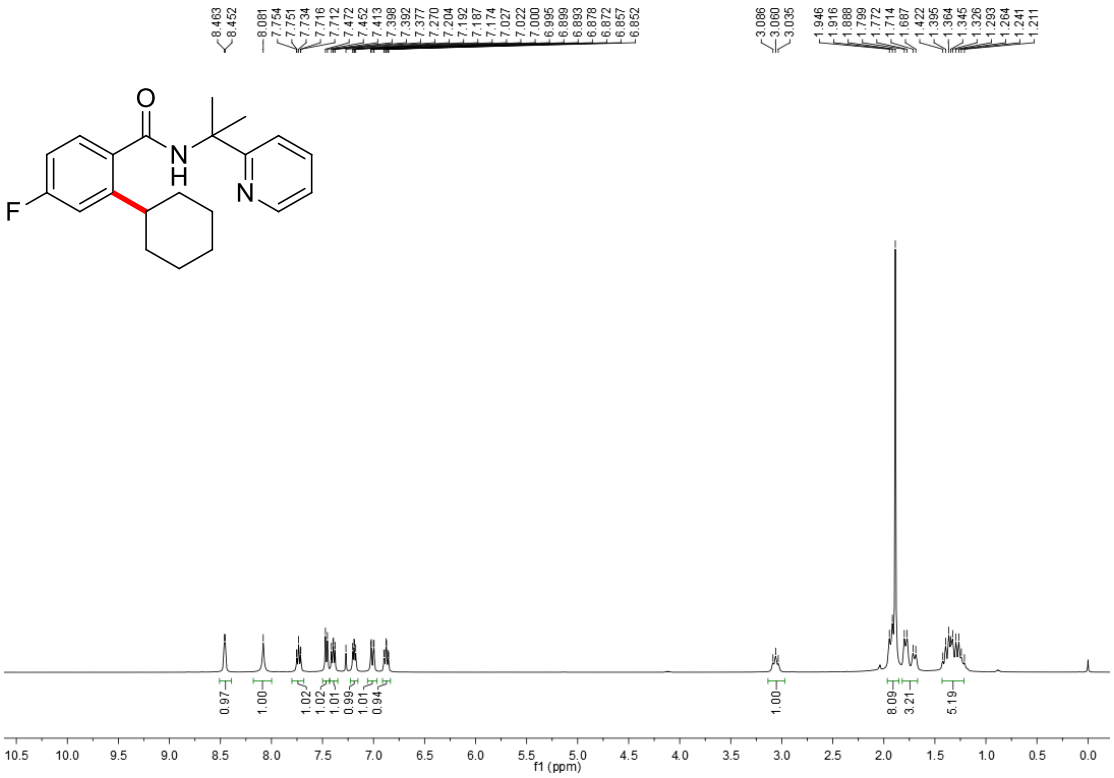
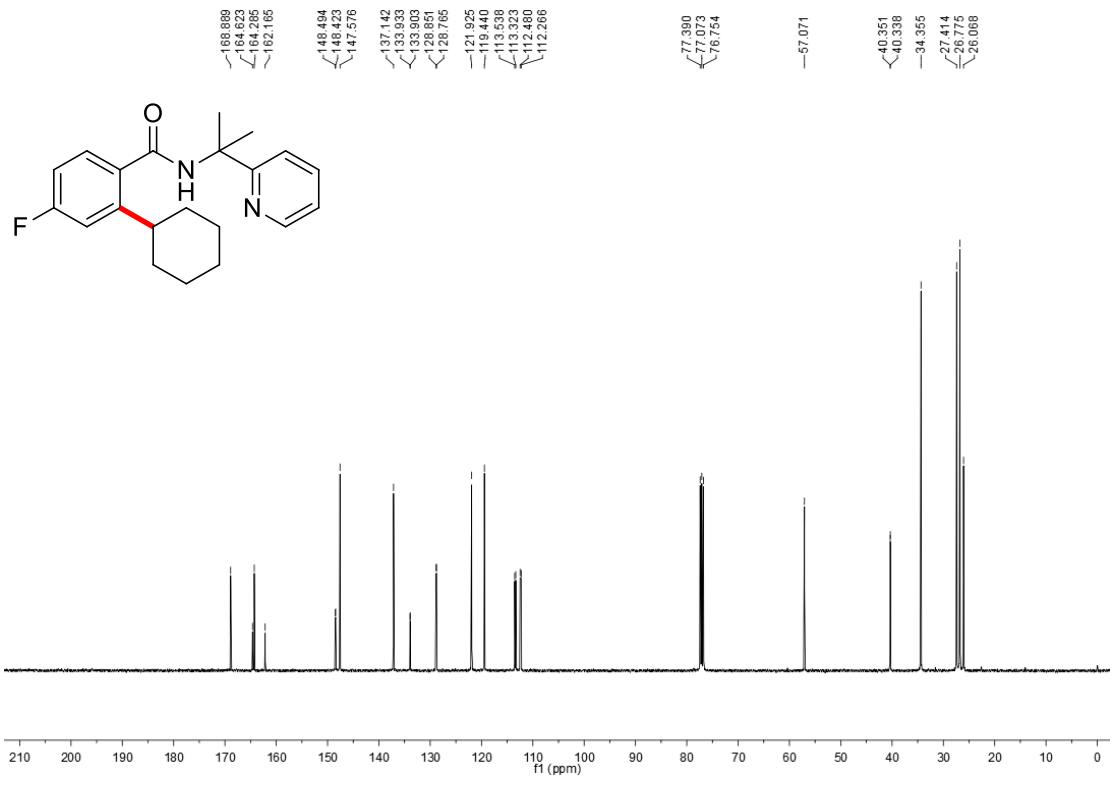


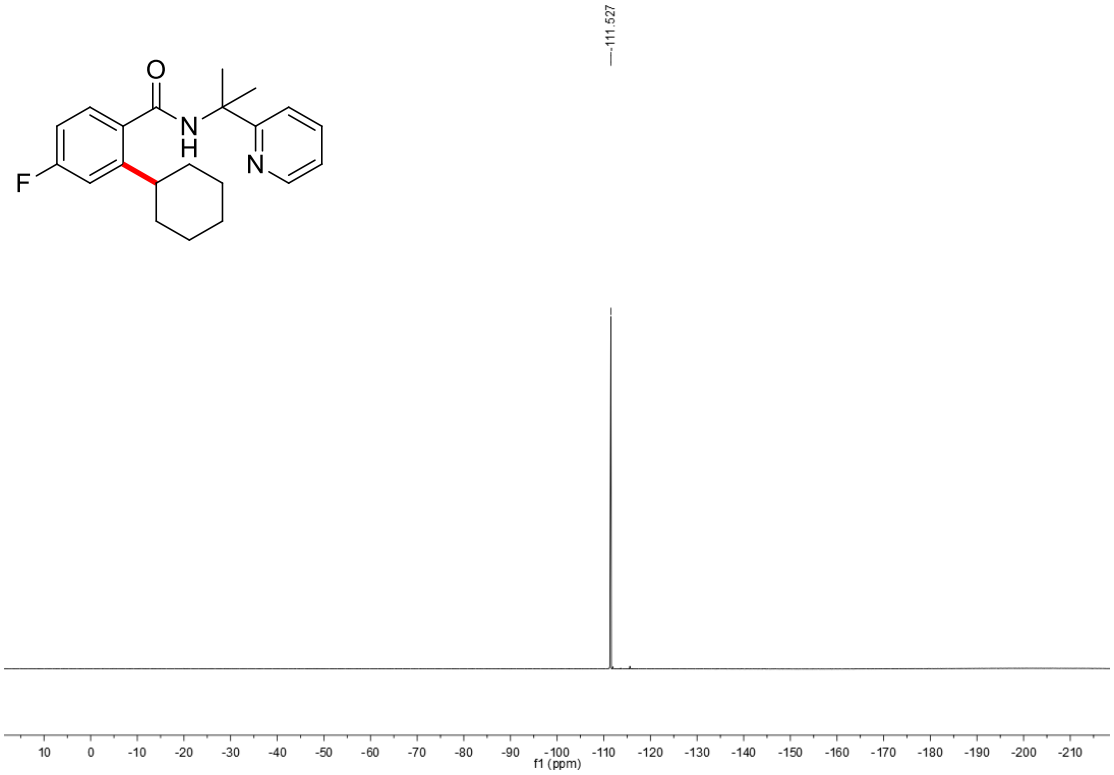
Compound 3k



Compound 3k



Compound 3k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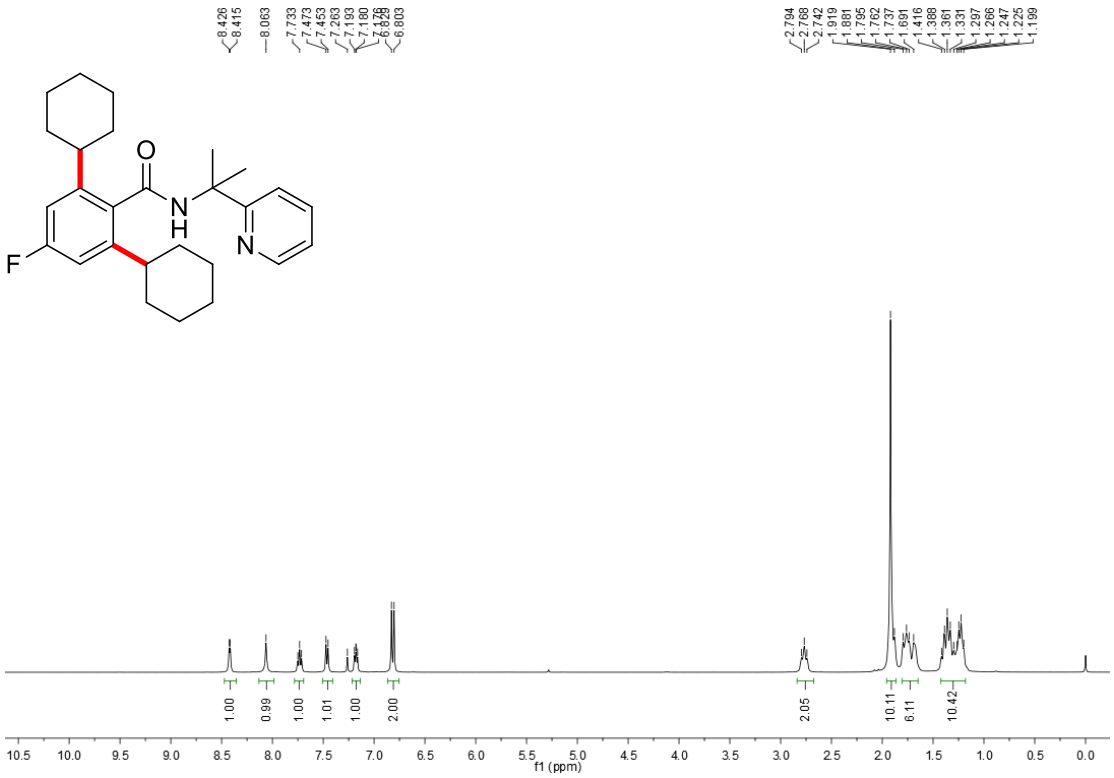
-180
-190
-200
-210
f1 (ppm)

Compound 3k′



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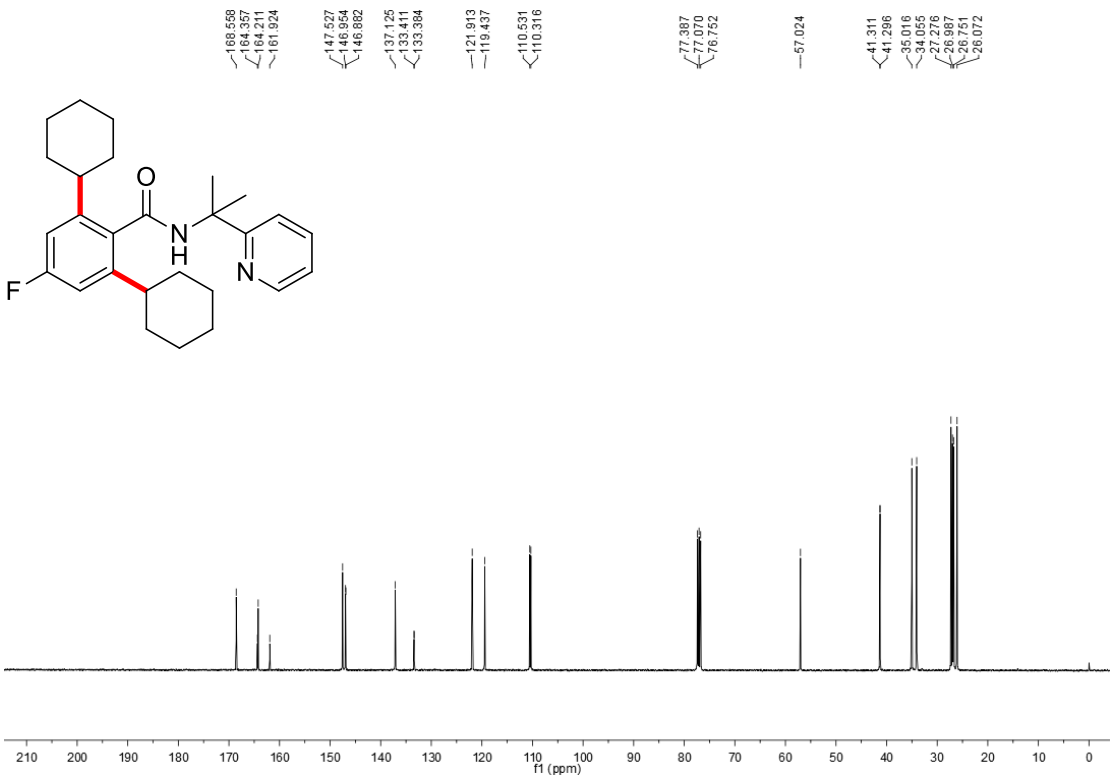
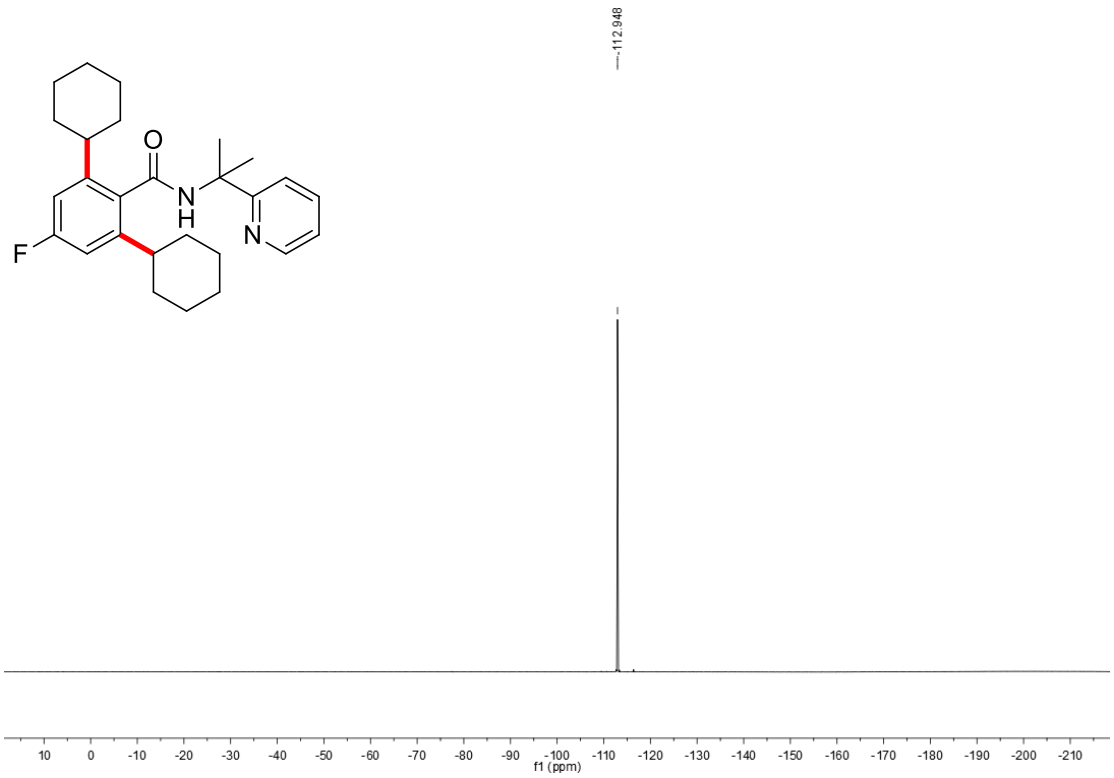


Compound 3k′


-112.948
O
N
H
N
F
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-180
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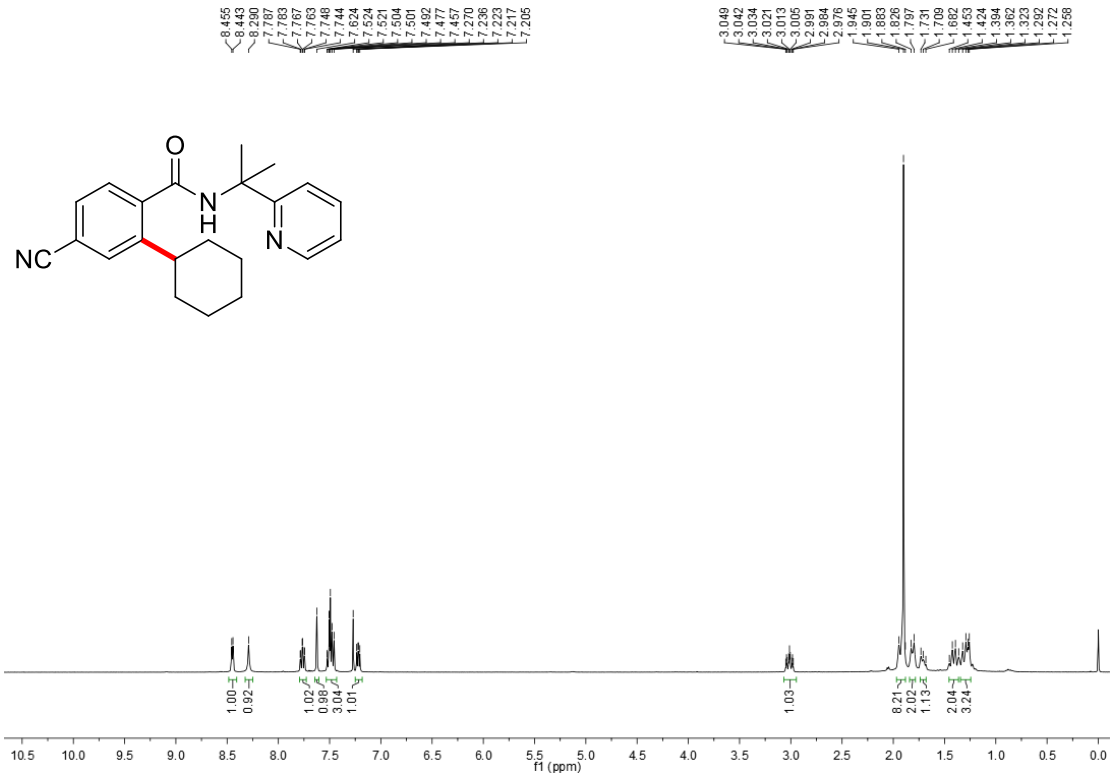
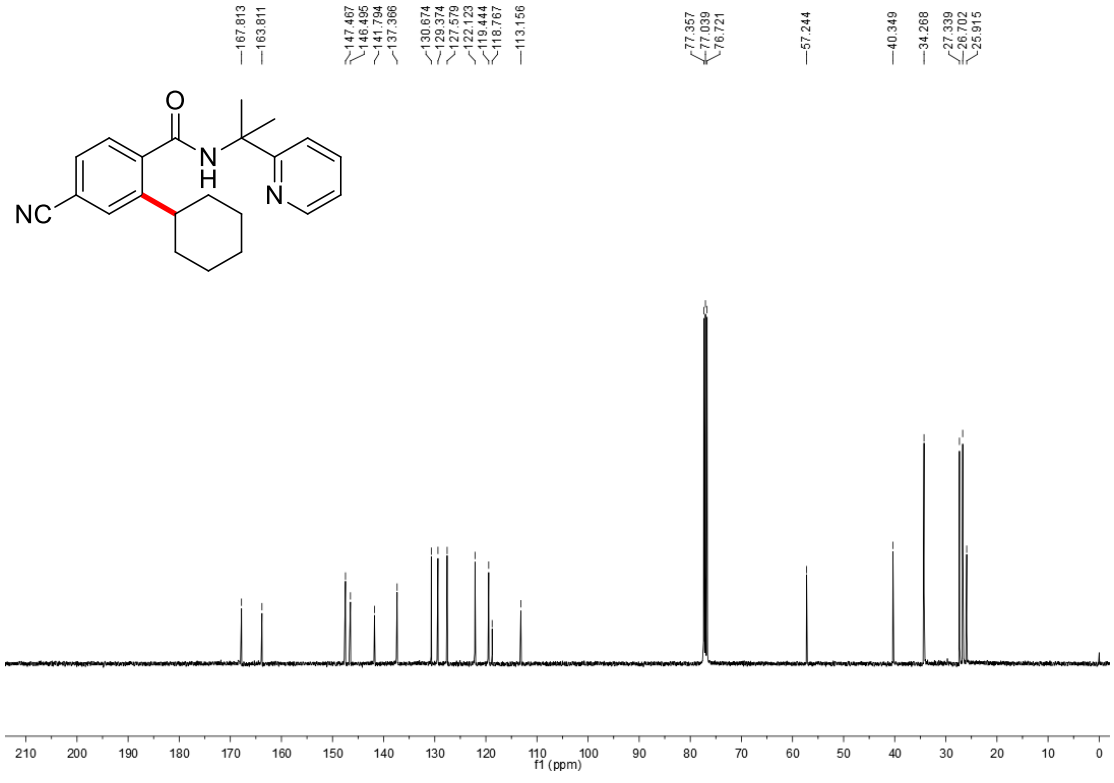
-200
-210
f1 (ppm)

Compound 3l



Compound 3l



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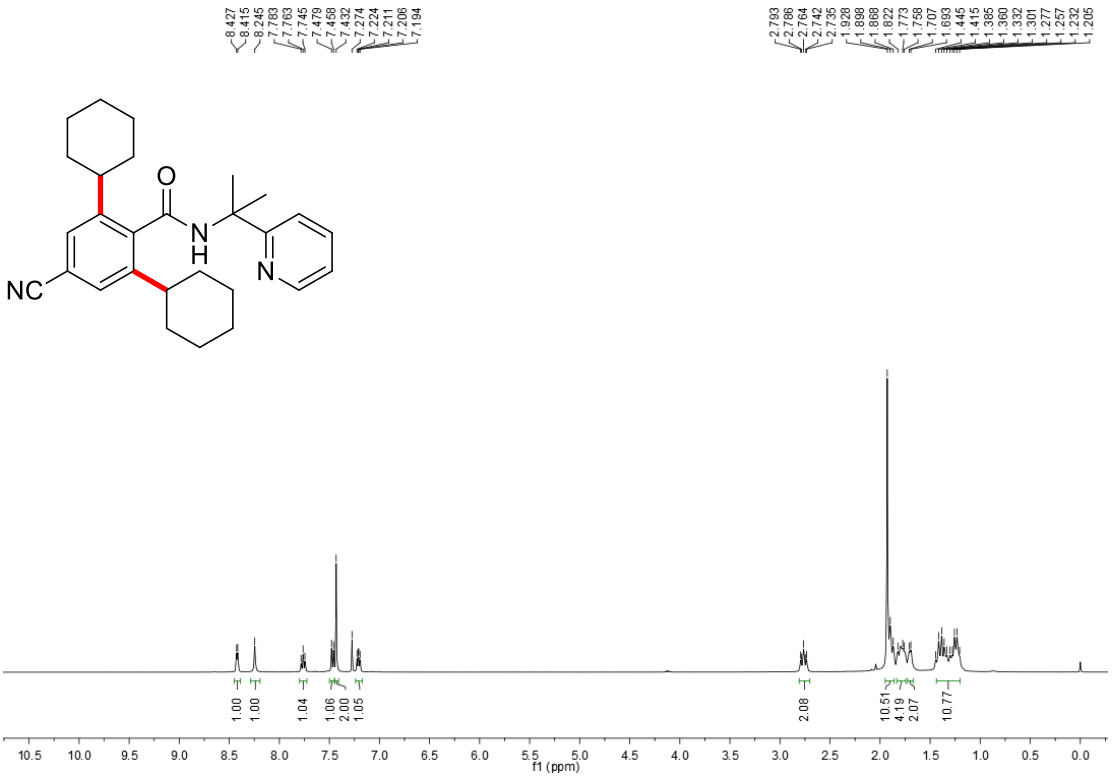
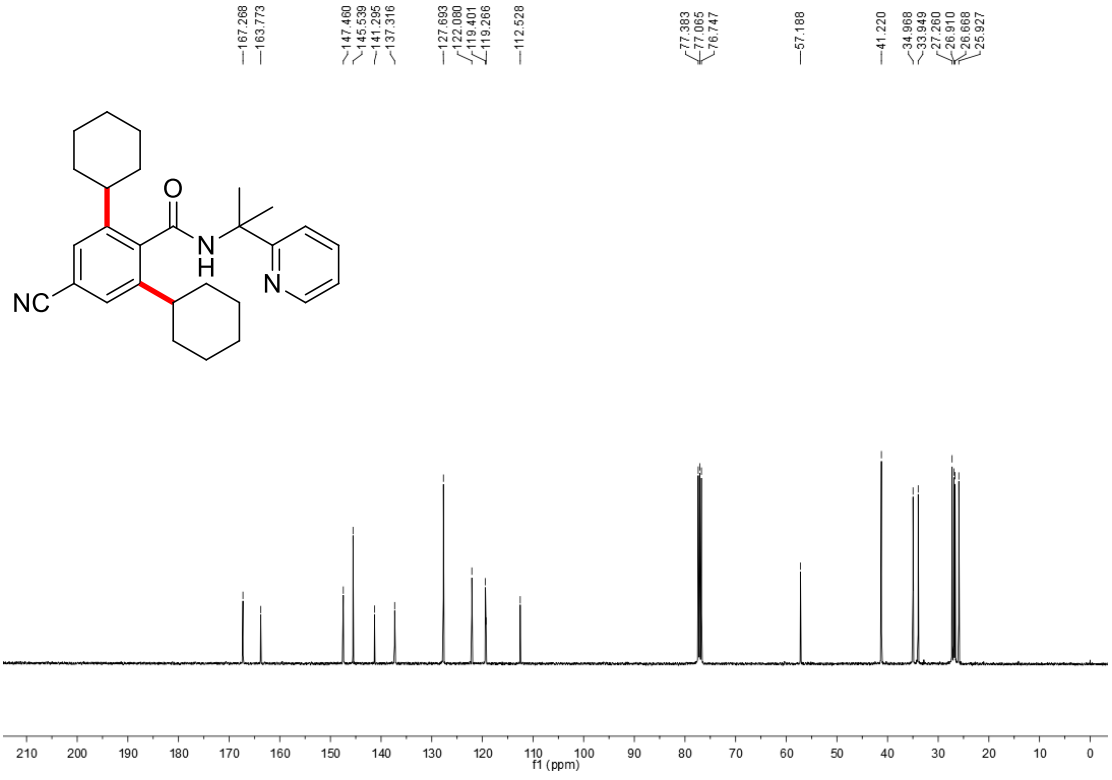
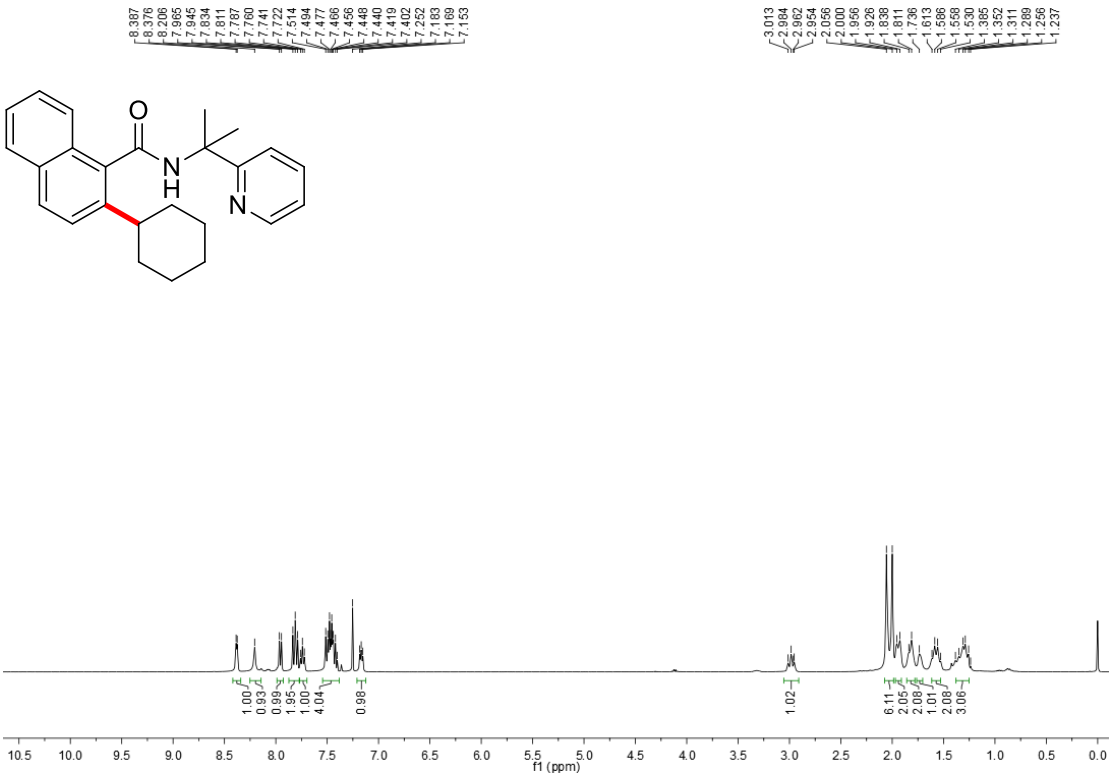


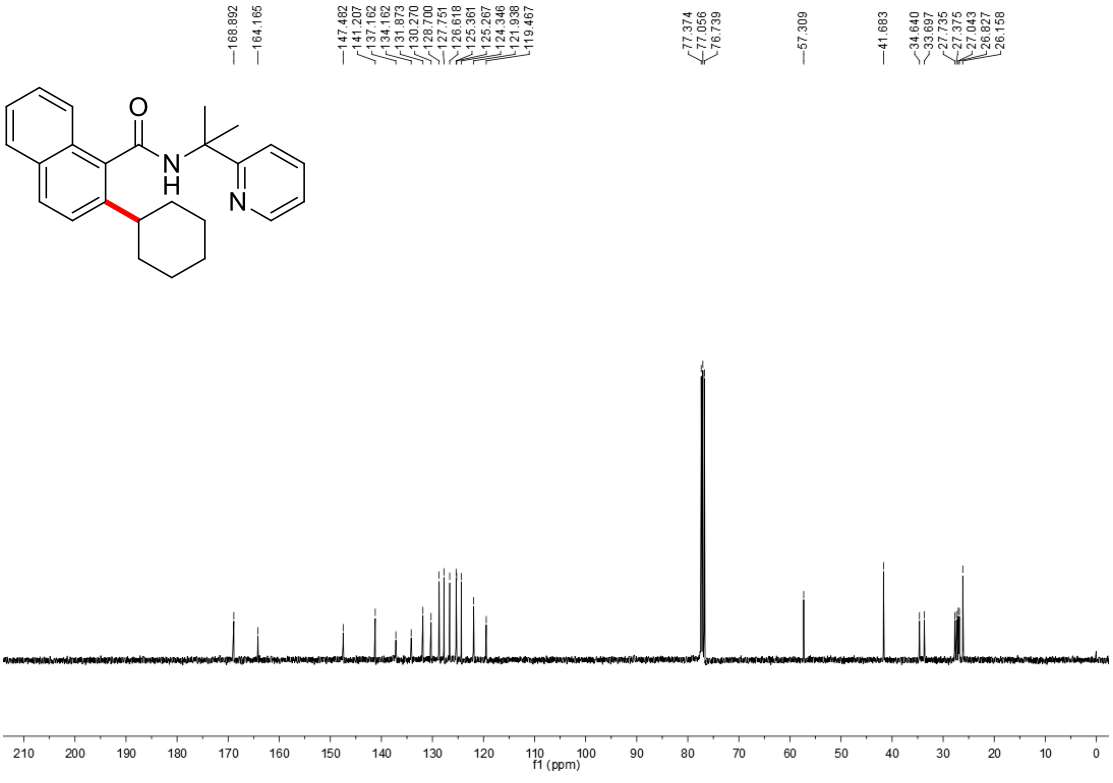
Compound 3l′



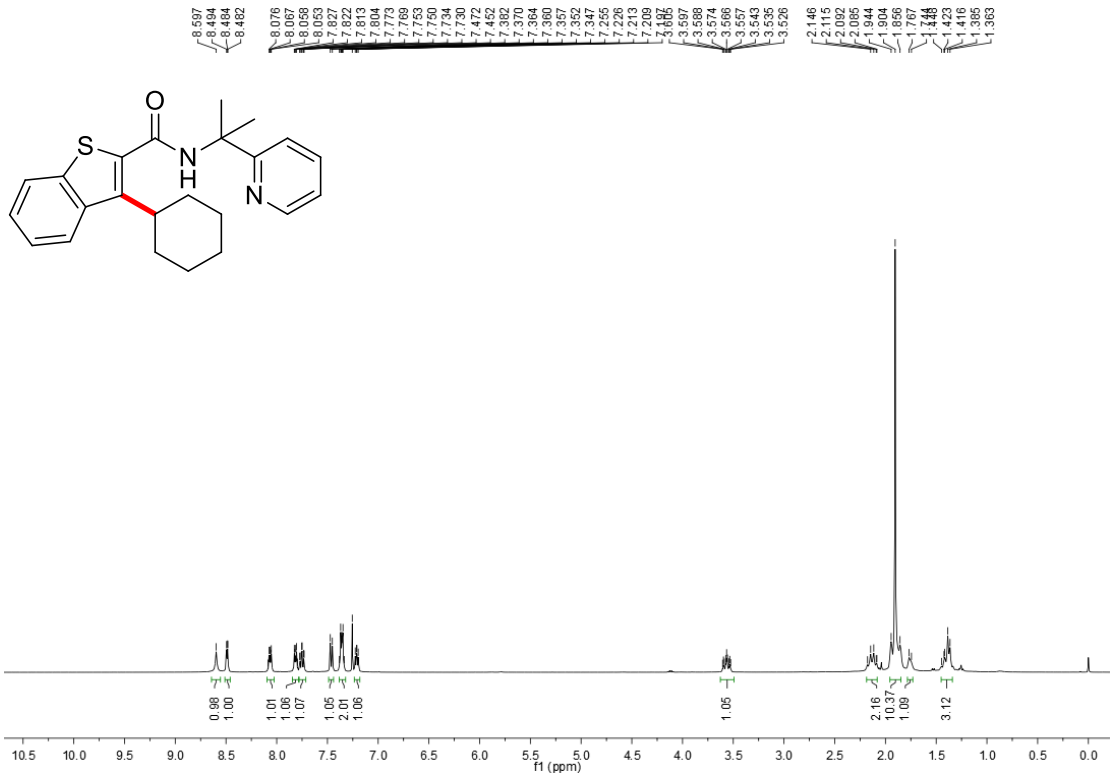
Compound 3m



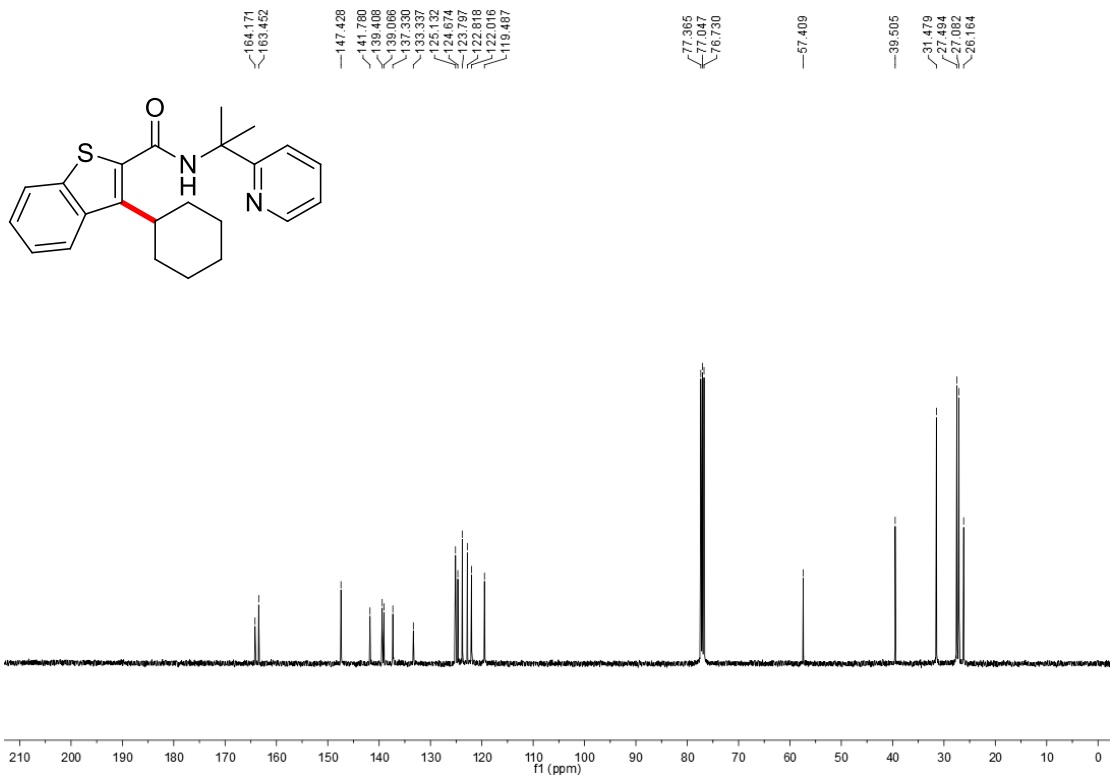
Compound 3m



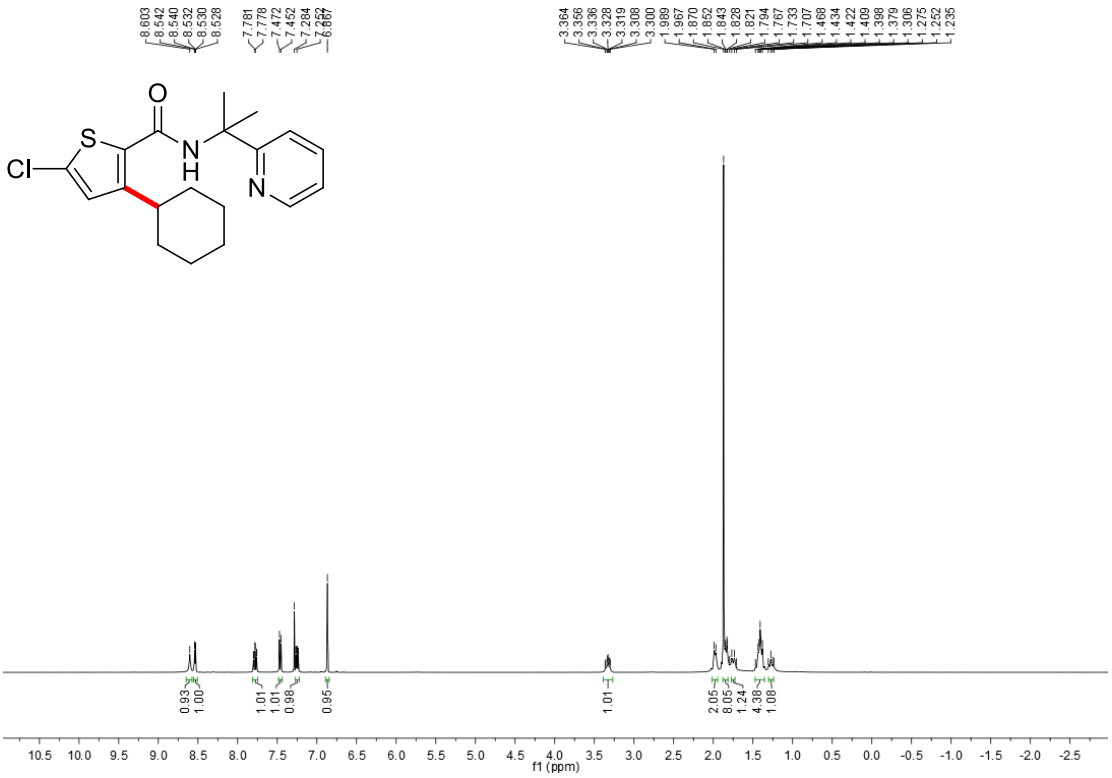
Compound 3n



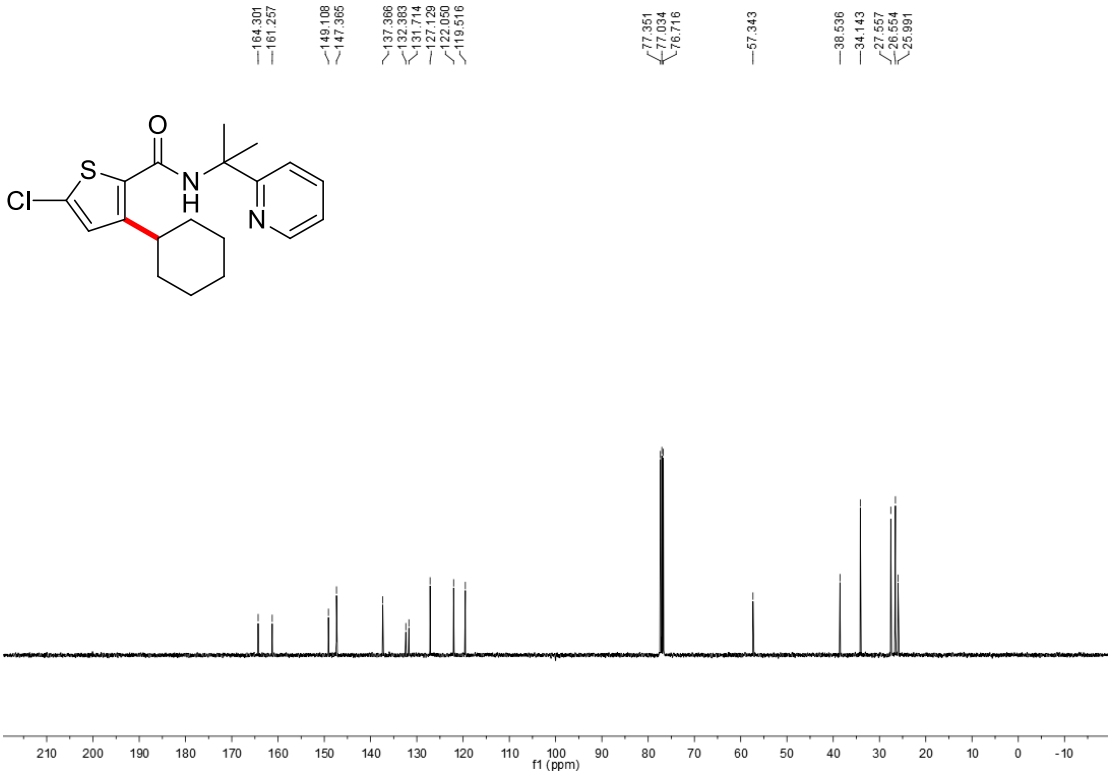
Compound 3n



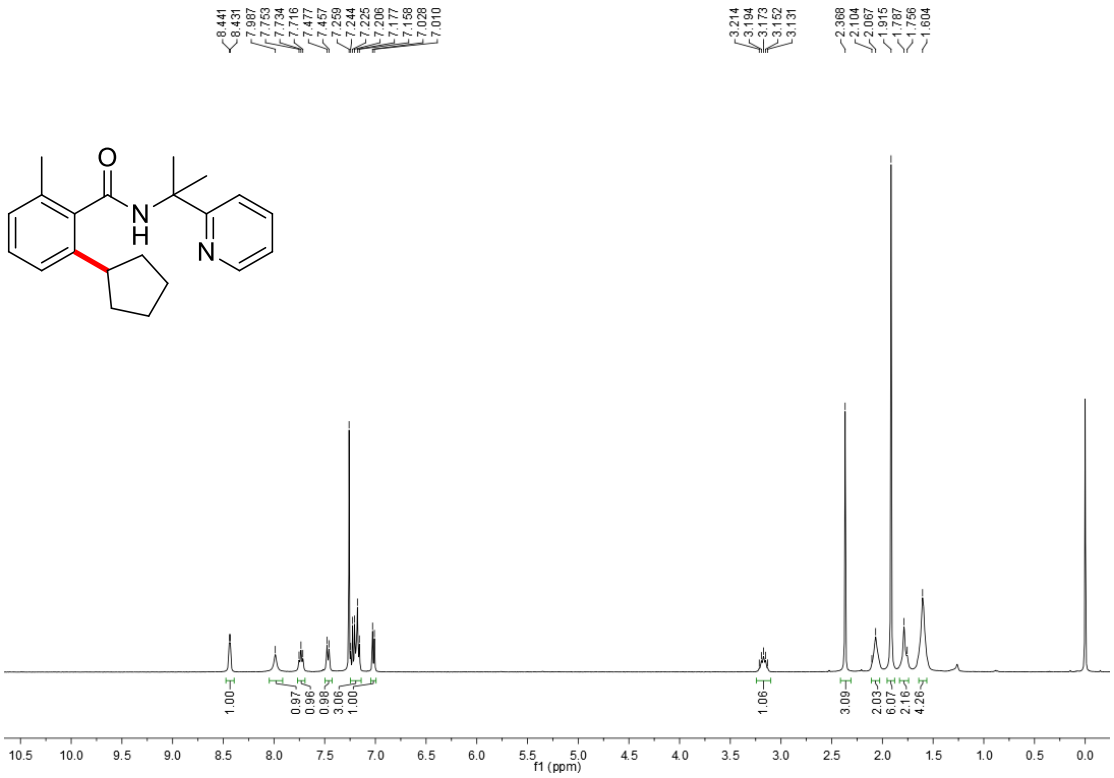
Compound 3o



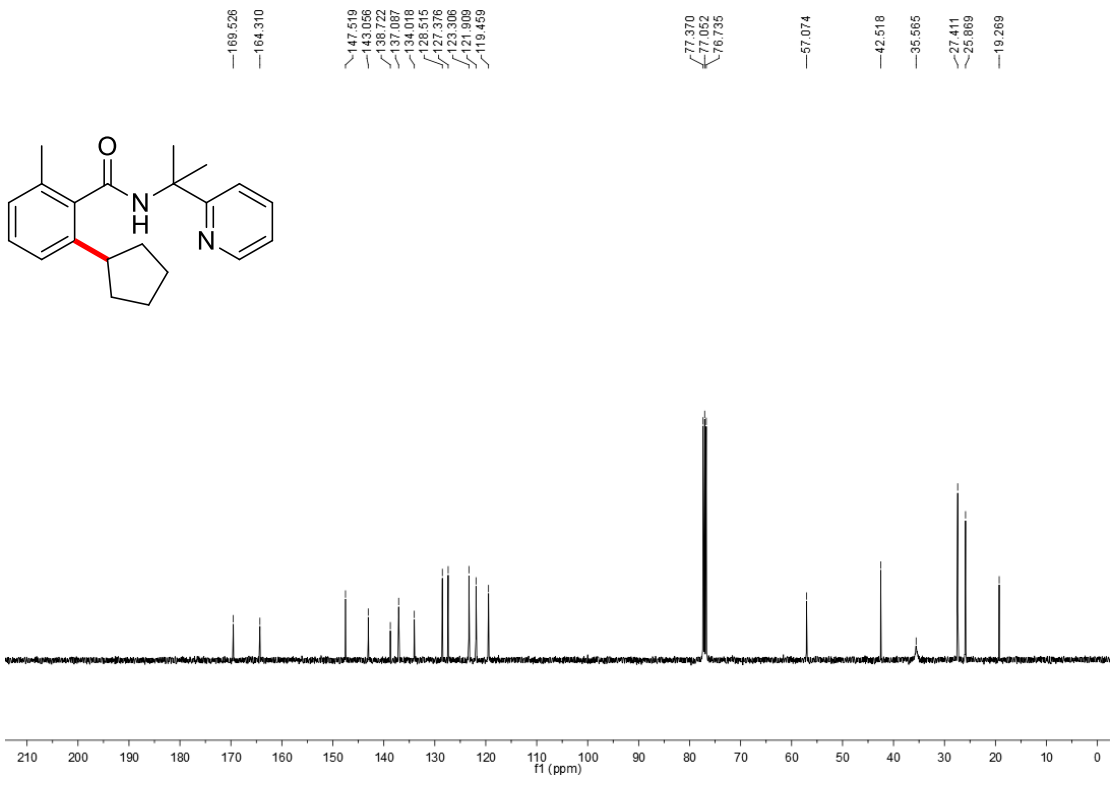
Compound 3o



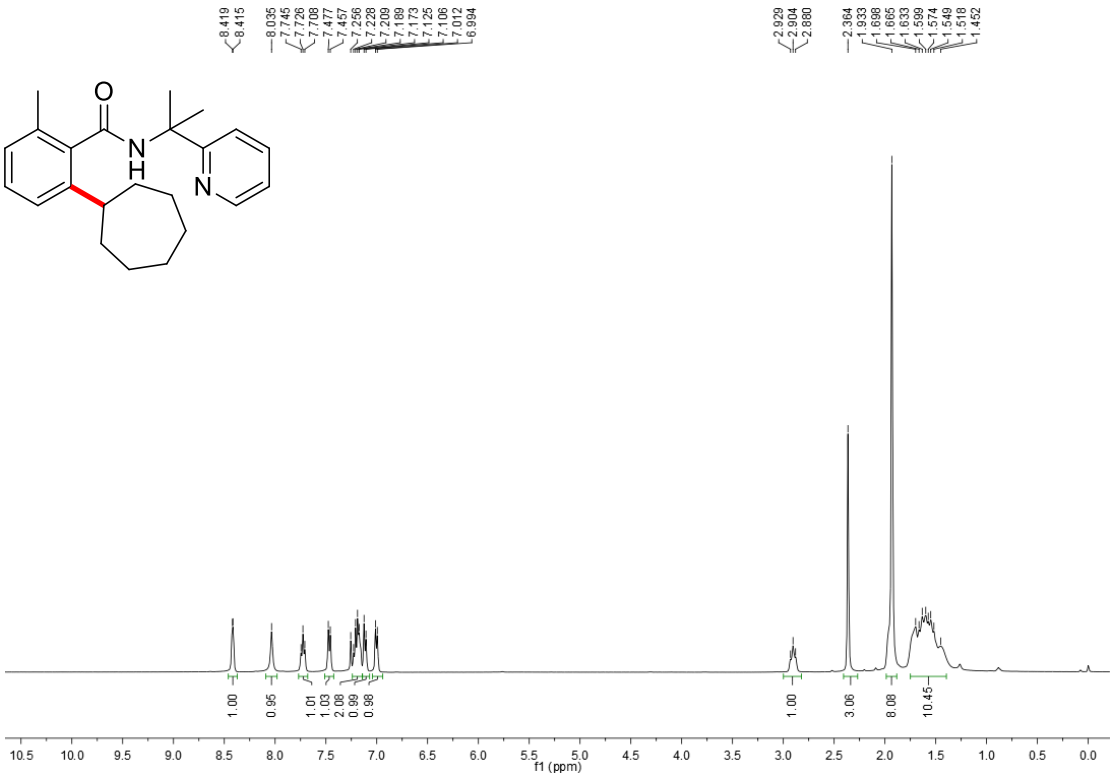
Compound 3p



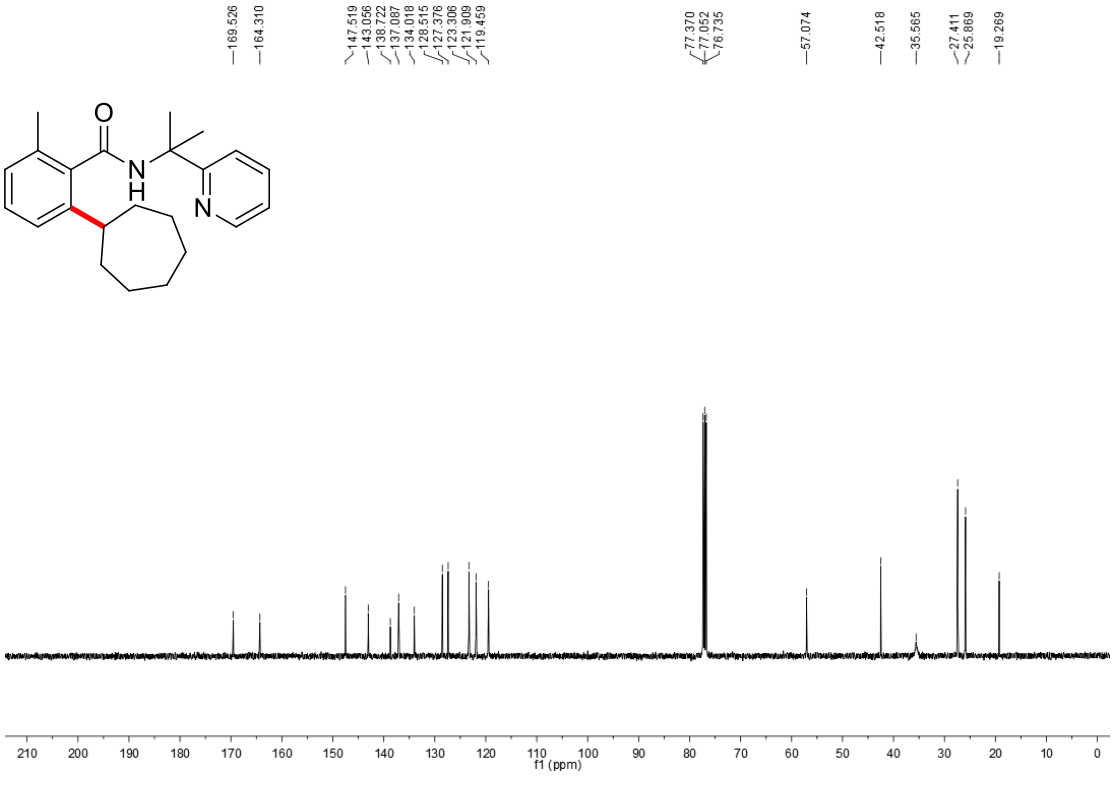
Compound 3p



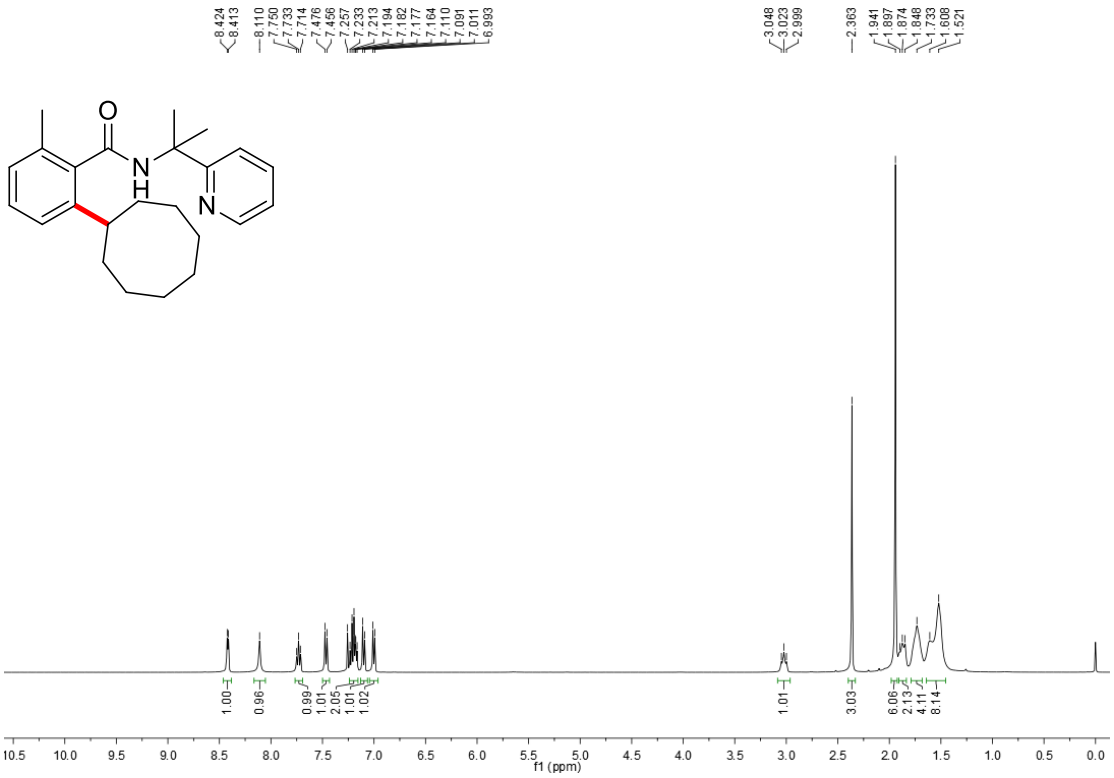
Compound 3q



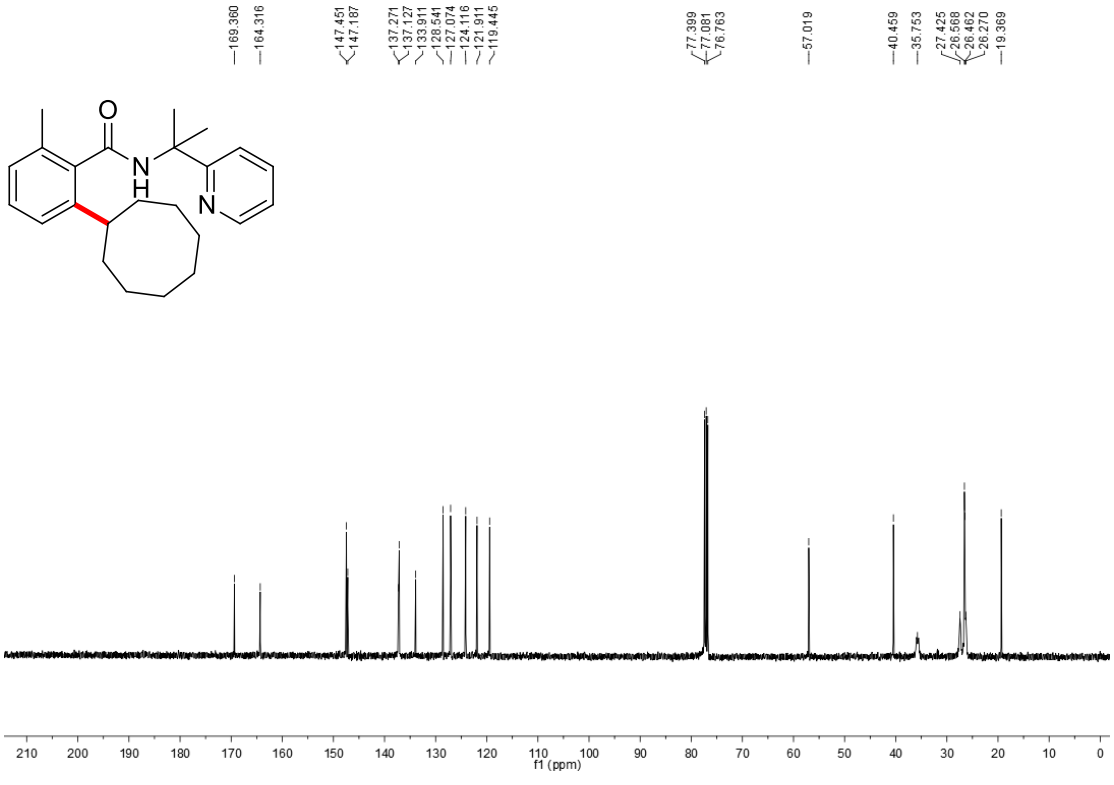
Compound 3q



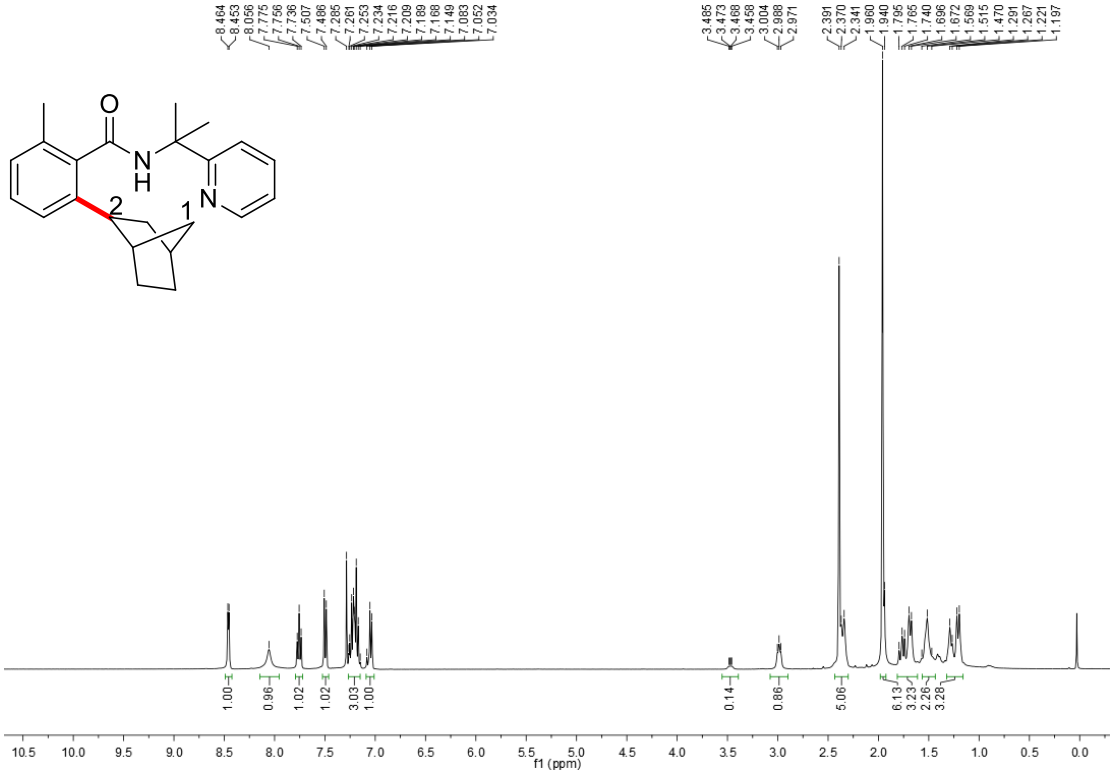
Compound 3r



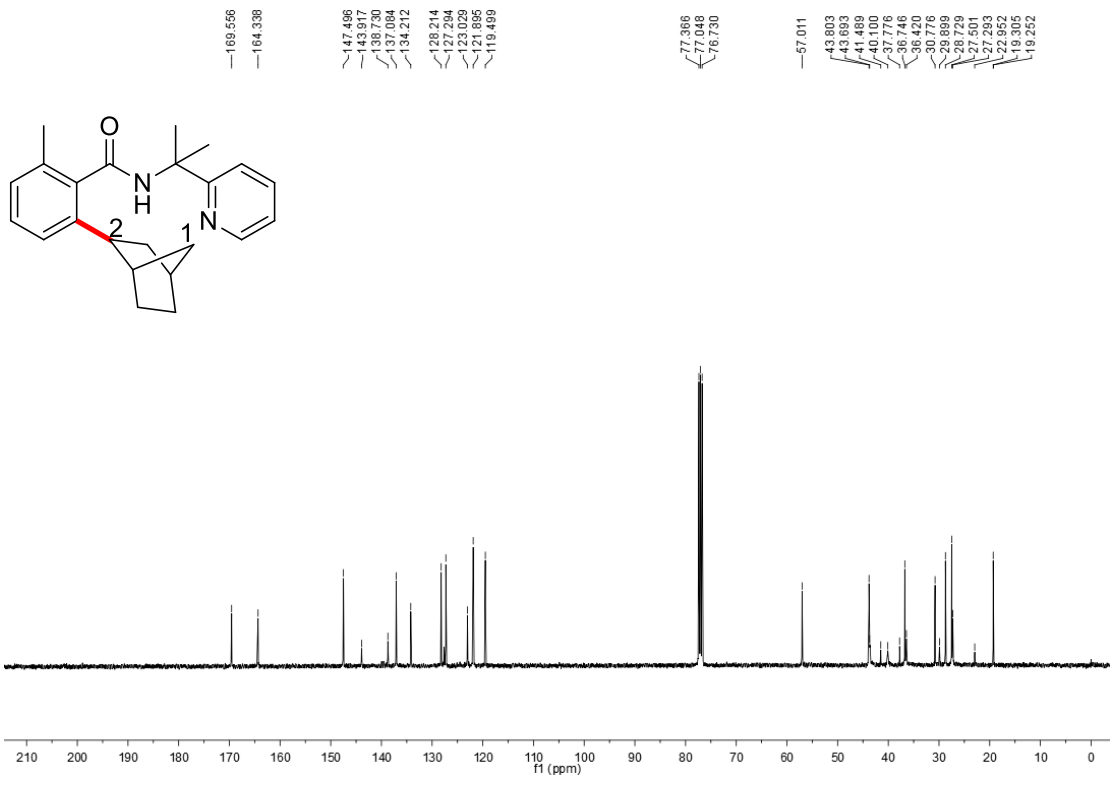
Compound 3r



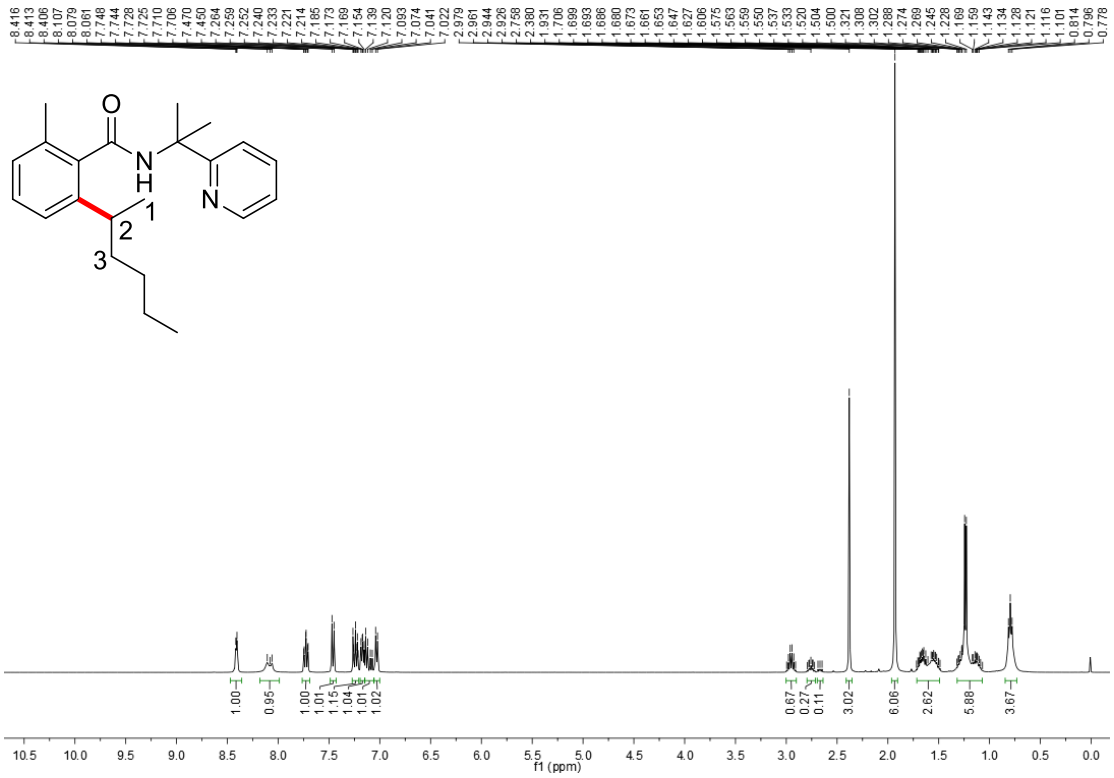
Compound 3s



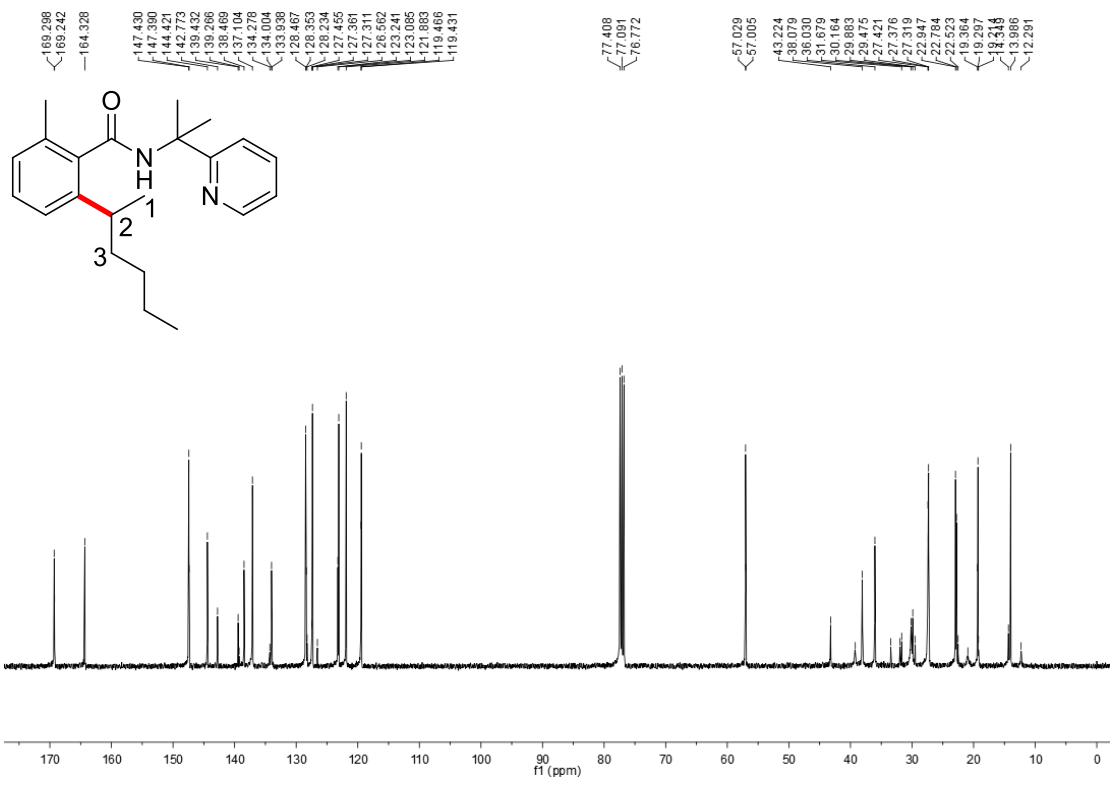
Compound 3s



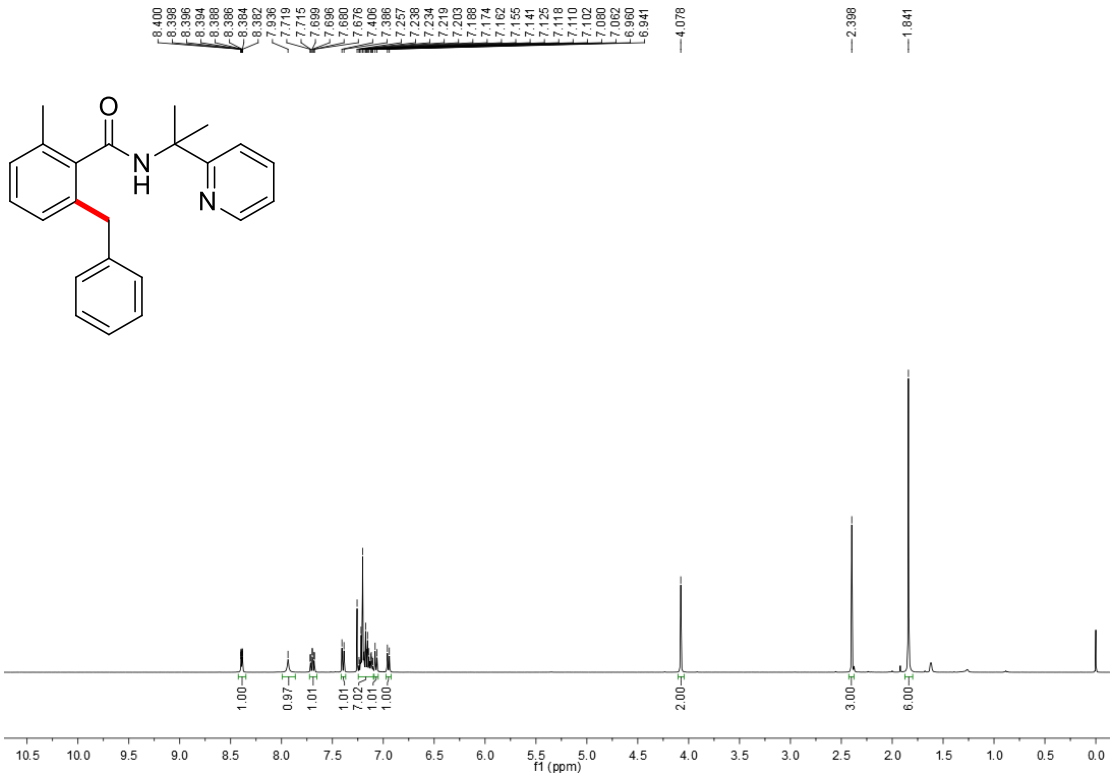
Compound 3t



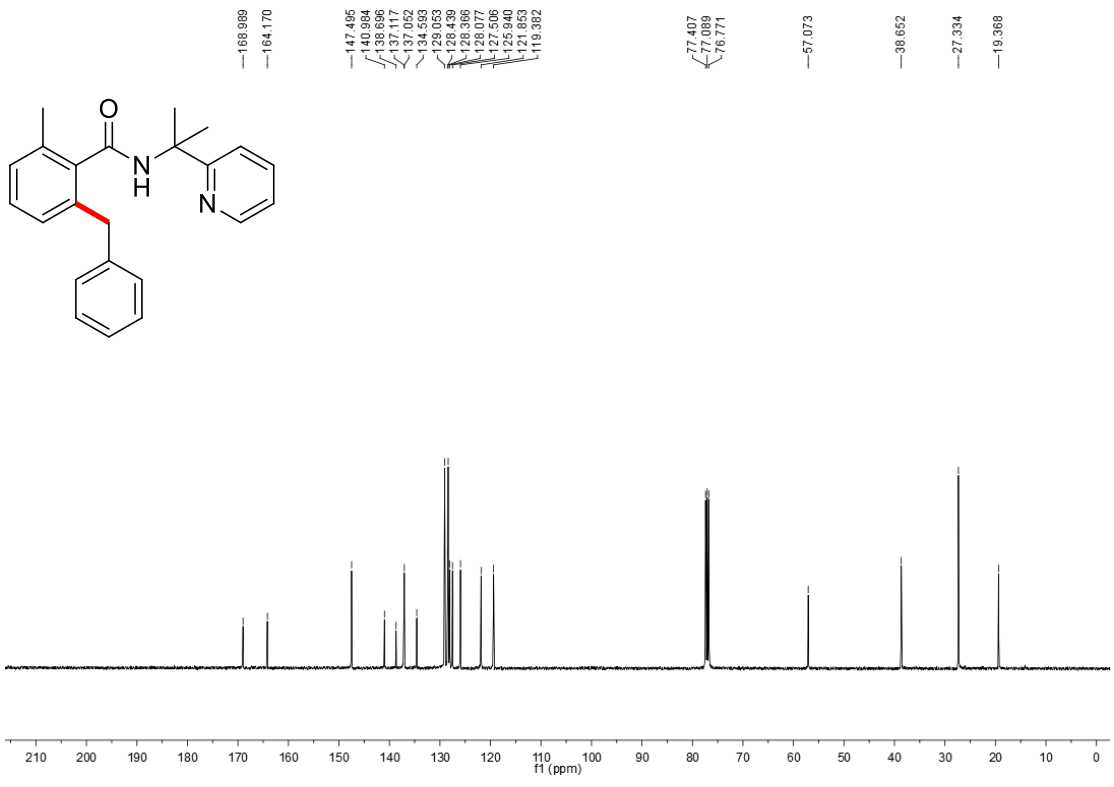
Compound 3t



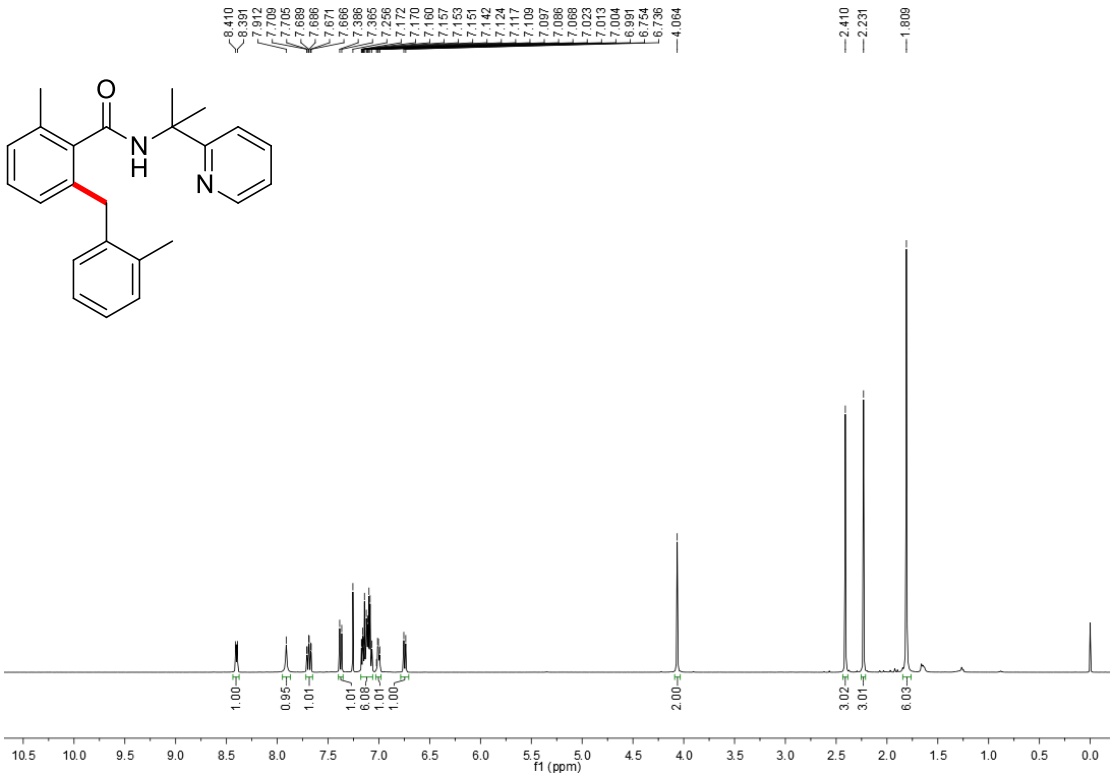
Compound 4a



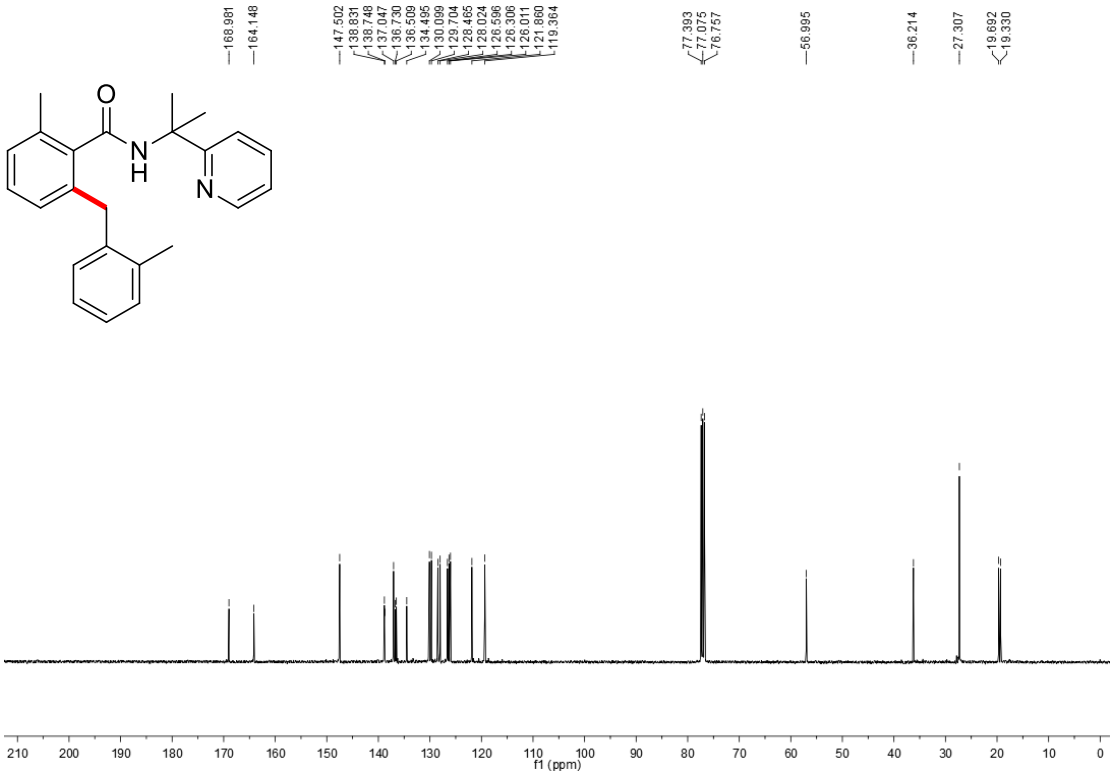
Compound 4a



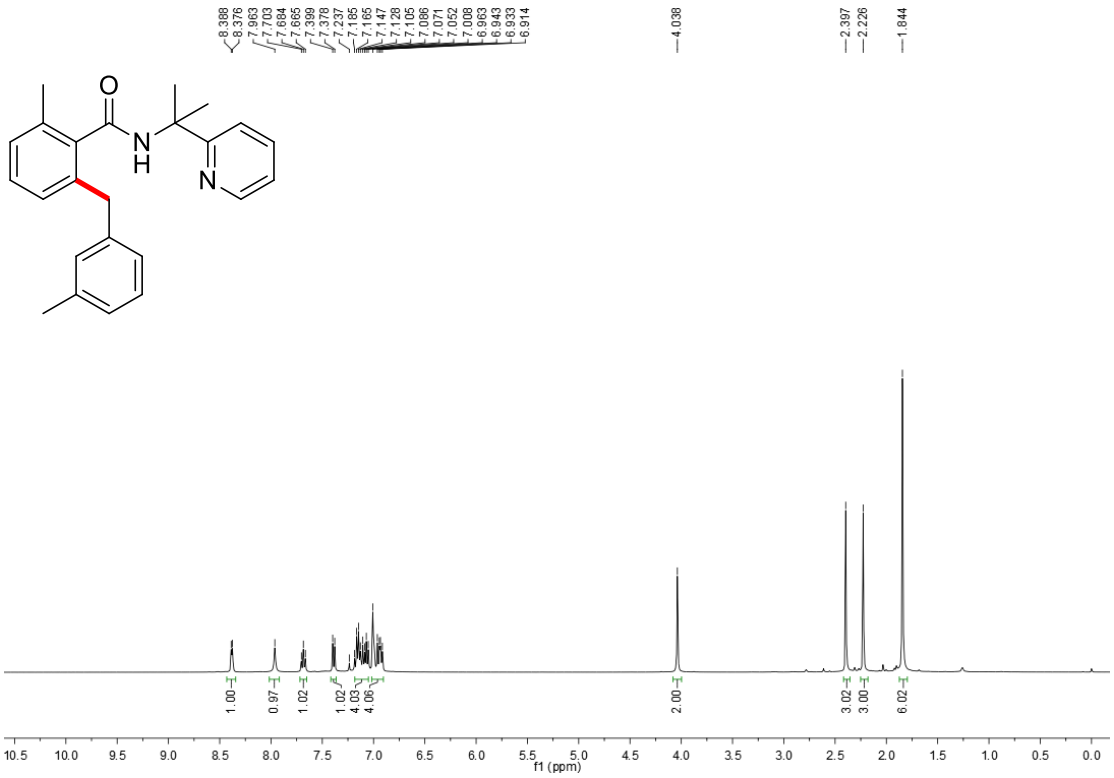
Compound 4b



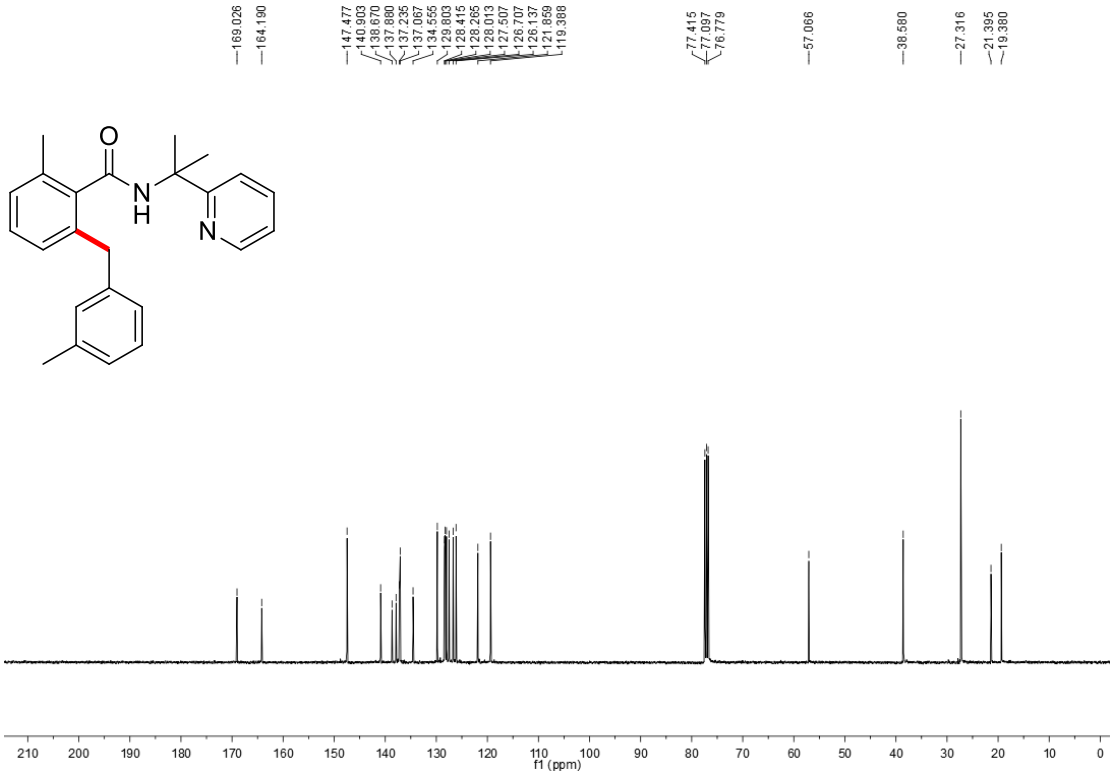
Compound 4b



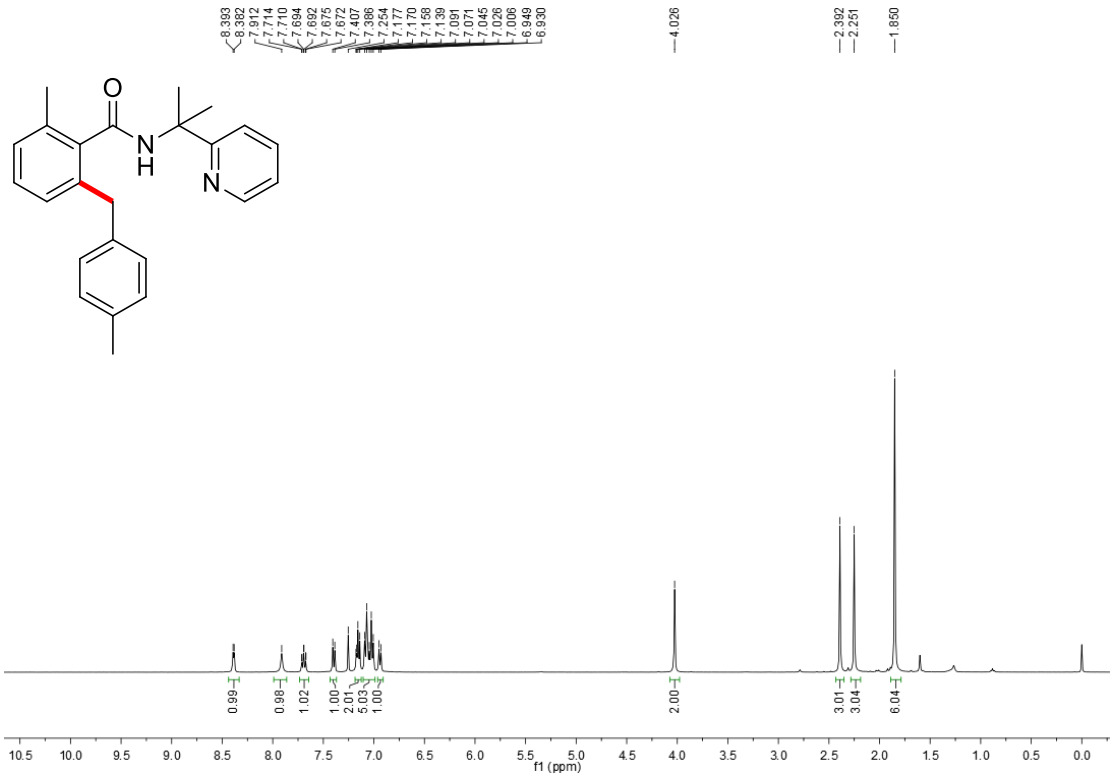
Compound 4c



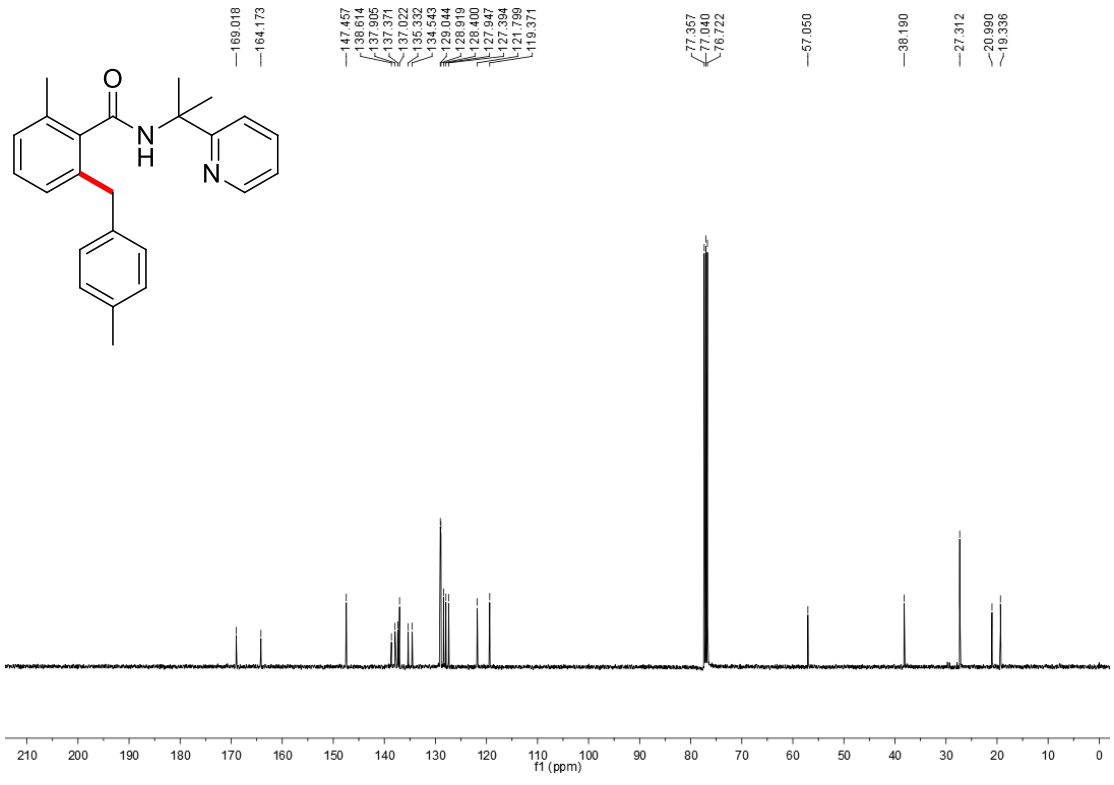
Compound 4c



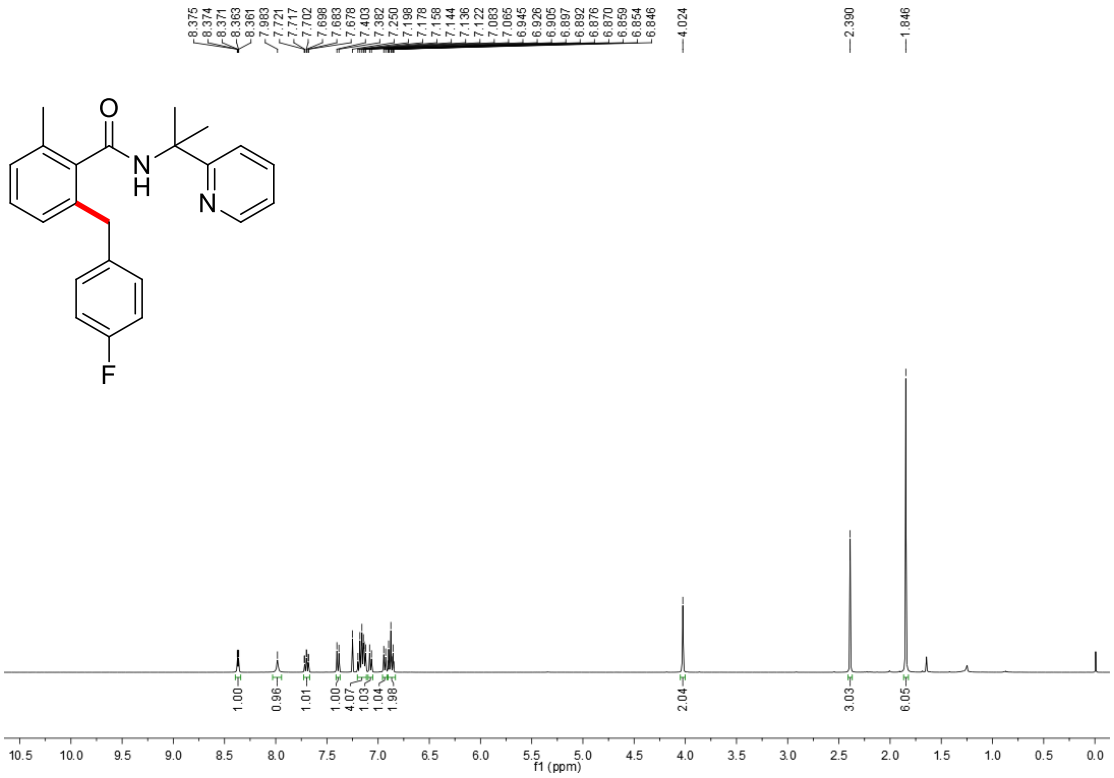
Compound 4d



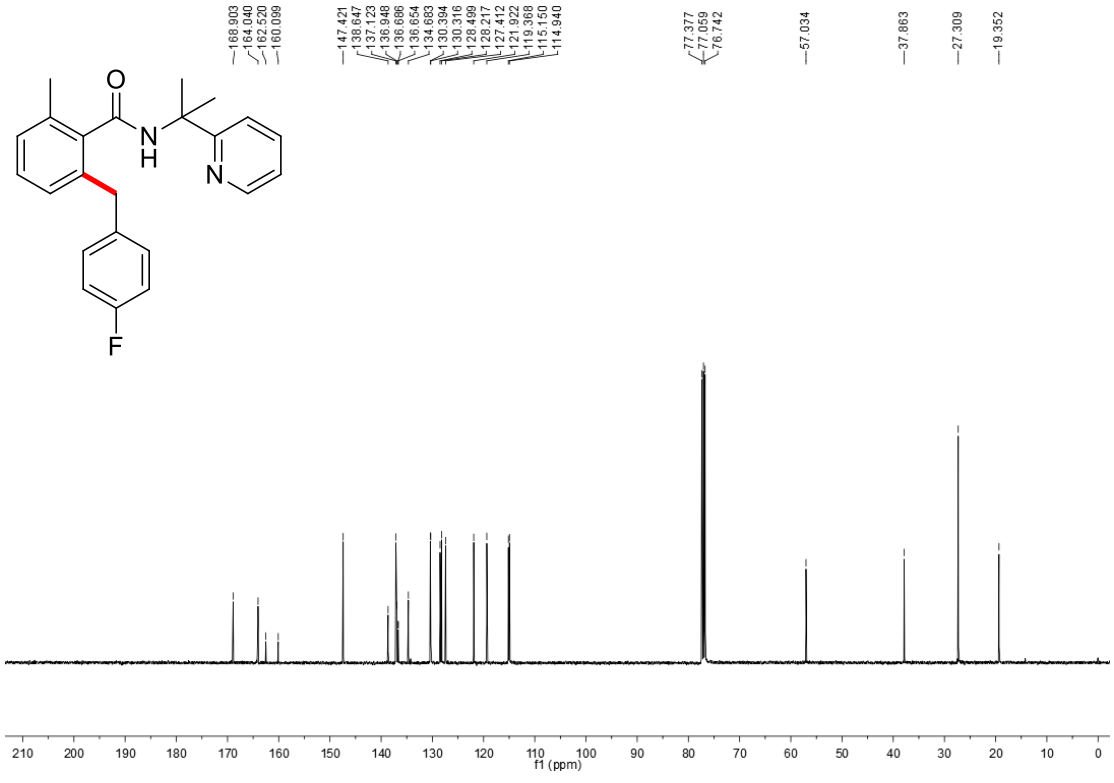
Compound 4d



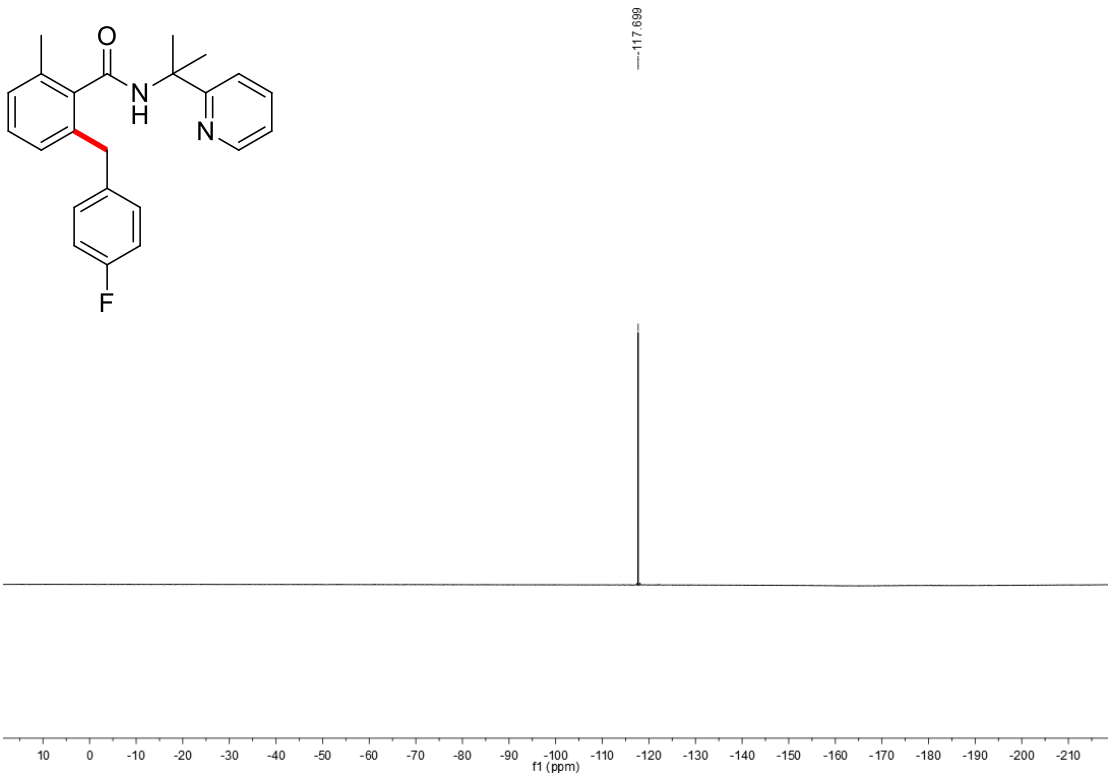
Compound 4e



Compound 4e



Compound 4e


O
N
H
N
F
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10
0
-10
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-40
-50
-60
-70
-80
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-160
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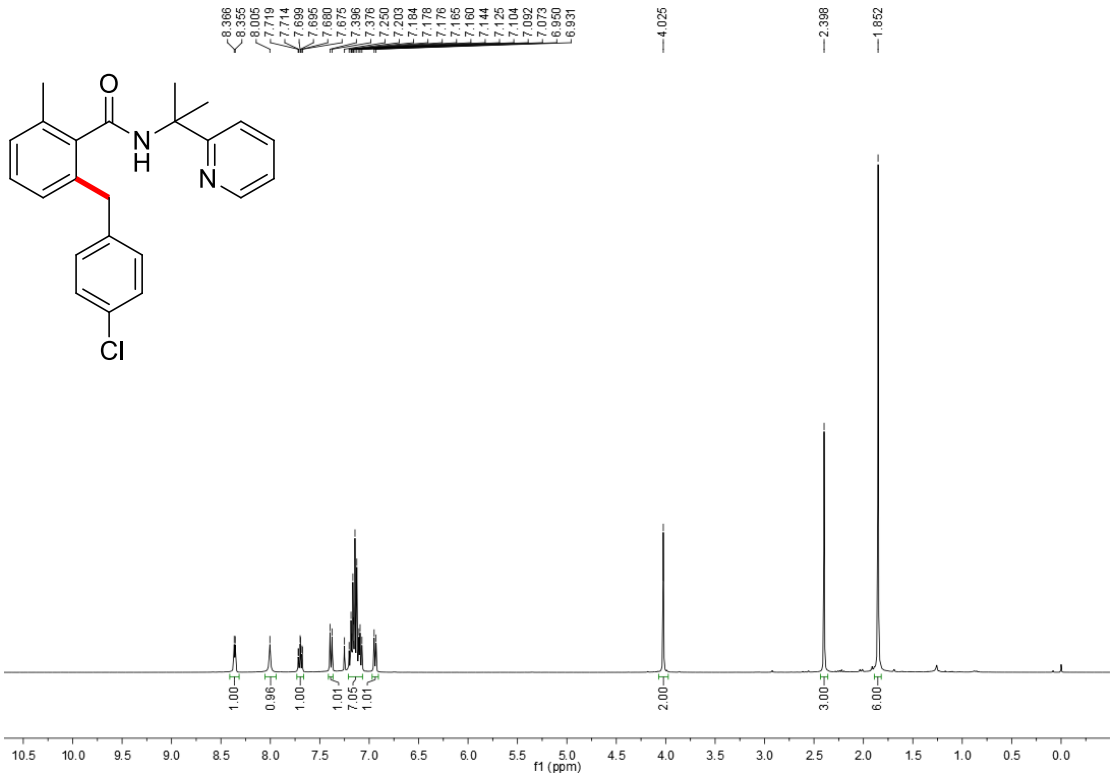
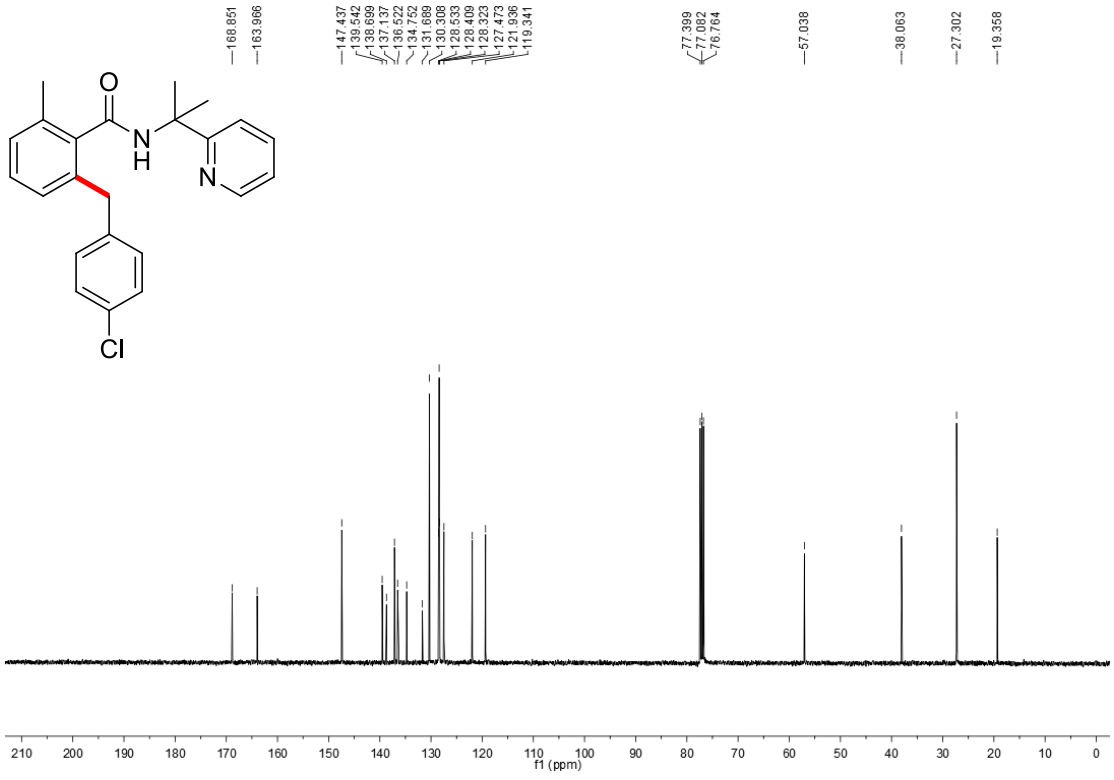
-180
-190
-200
-210
f1 (ppm)

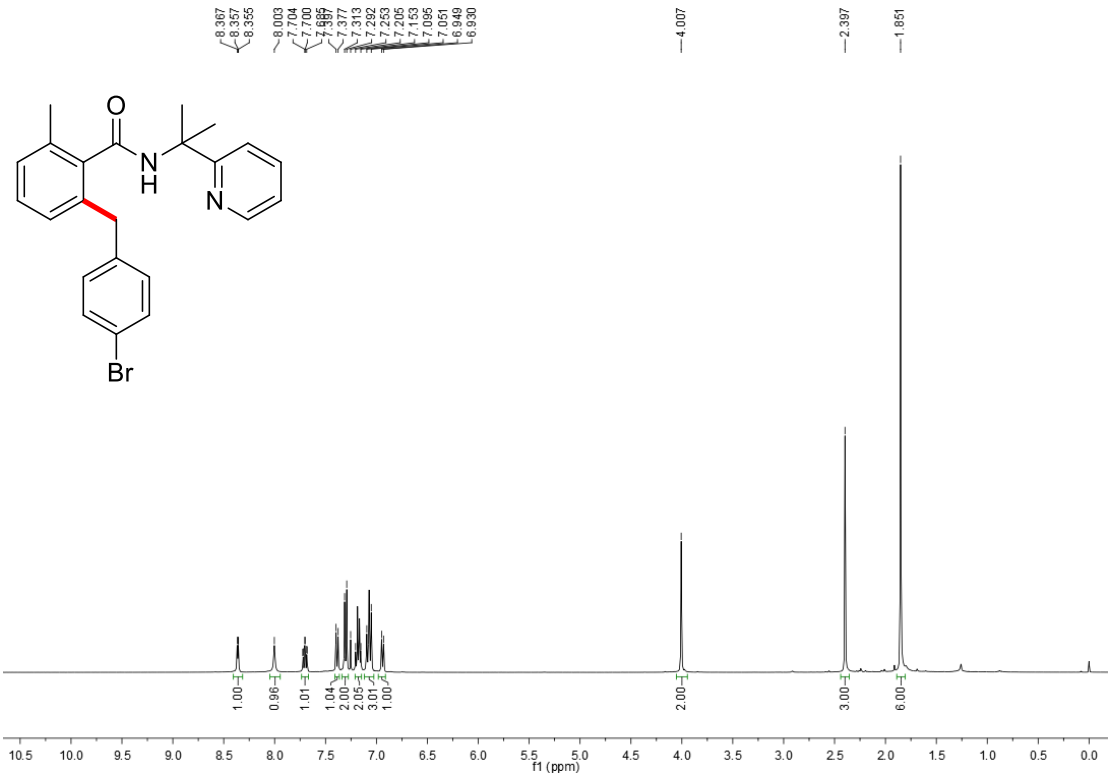
Compound 4f



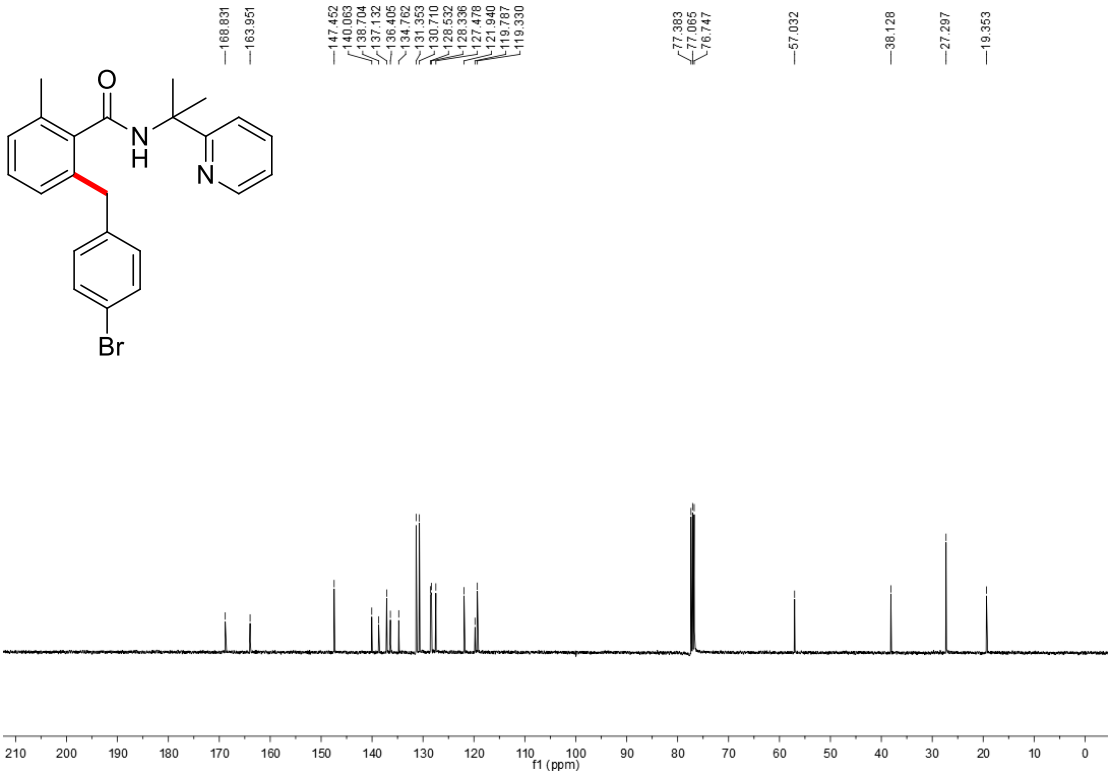
Compound 4f



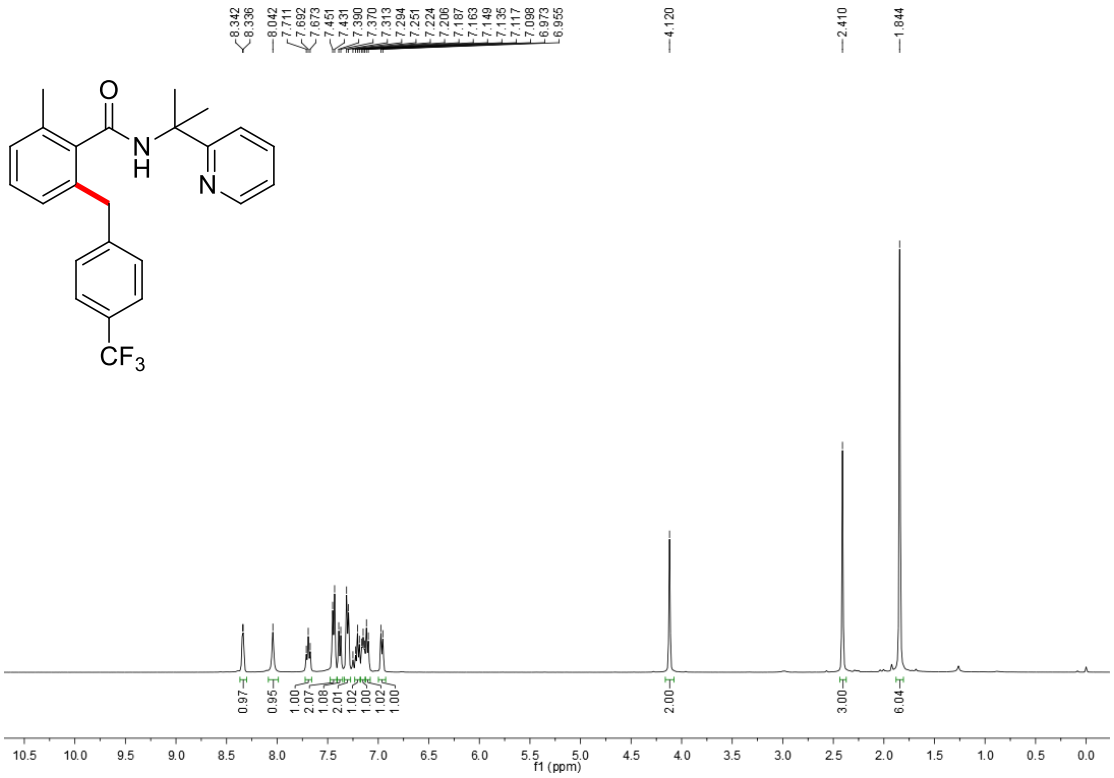
Compound 4g



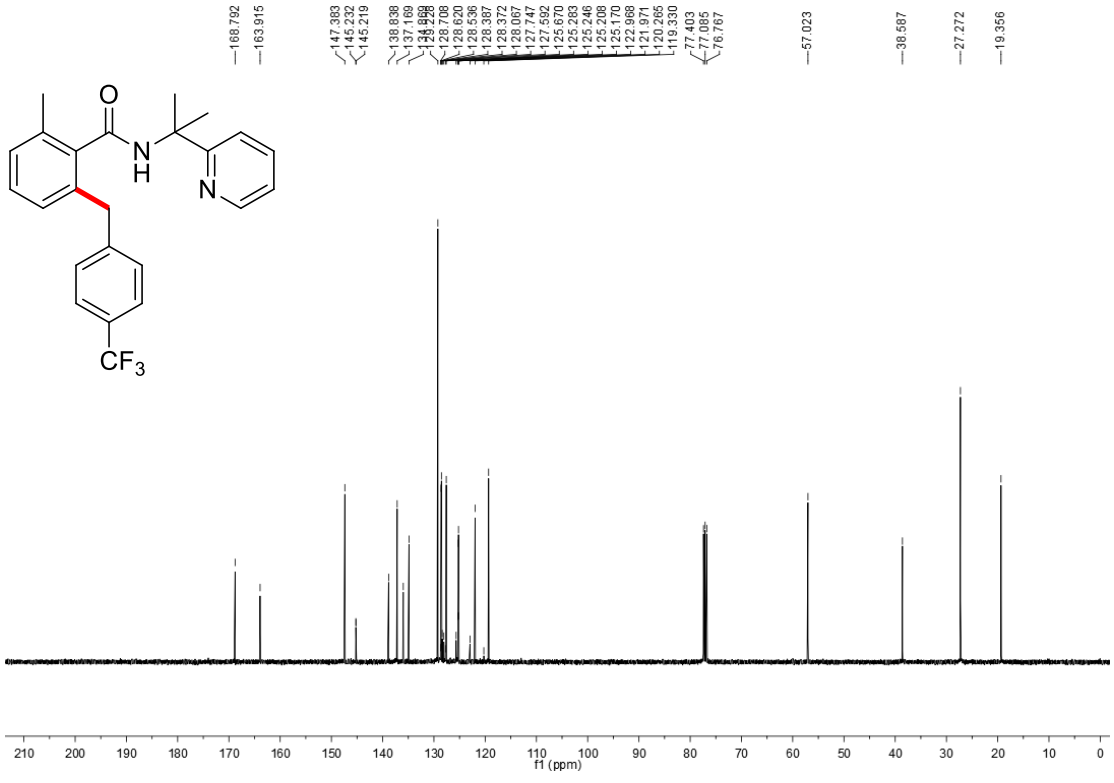
Compound 4g



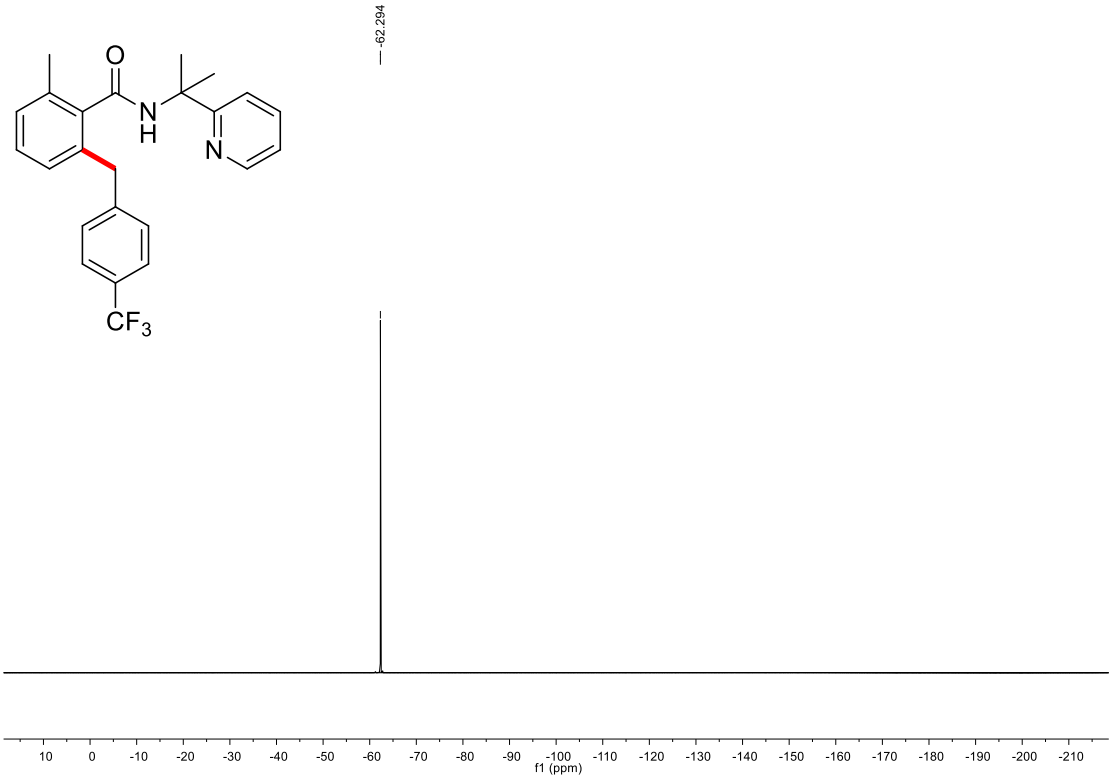
Compound 4h



Compound 4h



Compound 4h


-62.294
O
N
H
N
CF3
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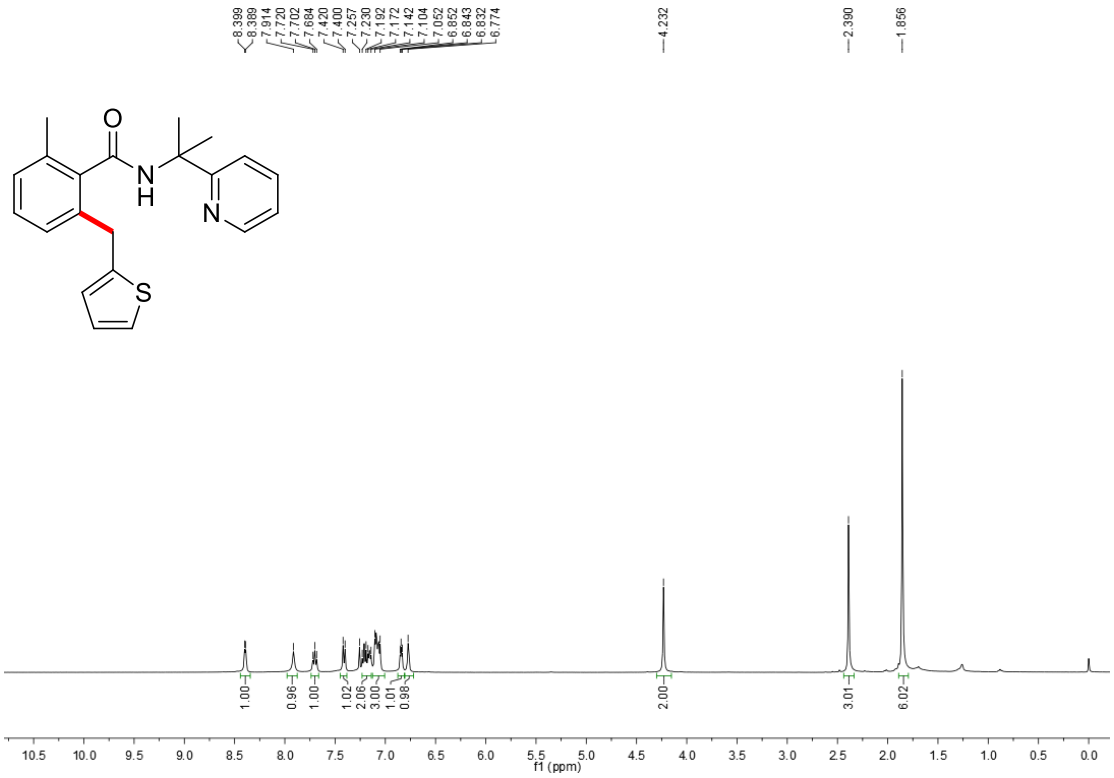
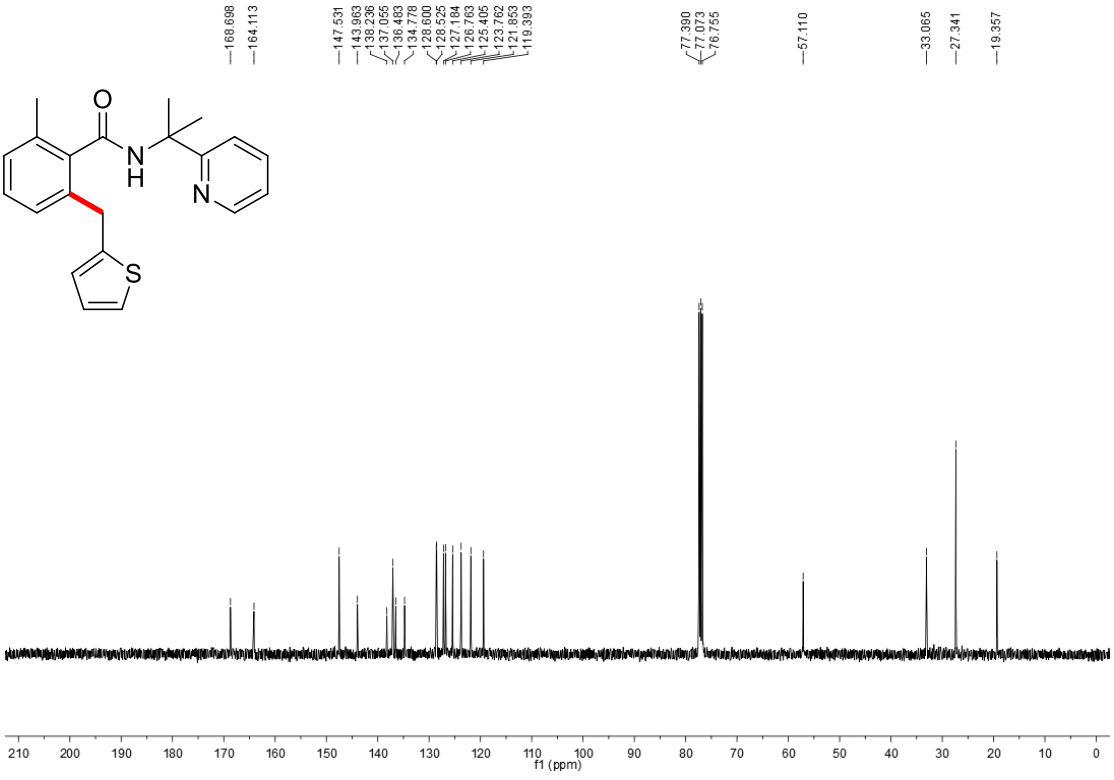
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
-160
-170
-180
-190
-200
-210
f1 (ppm)

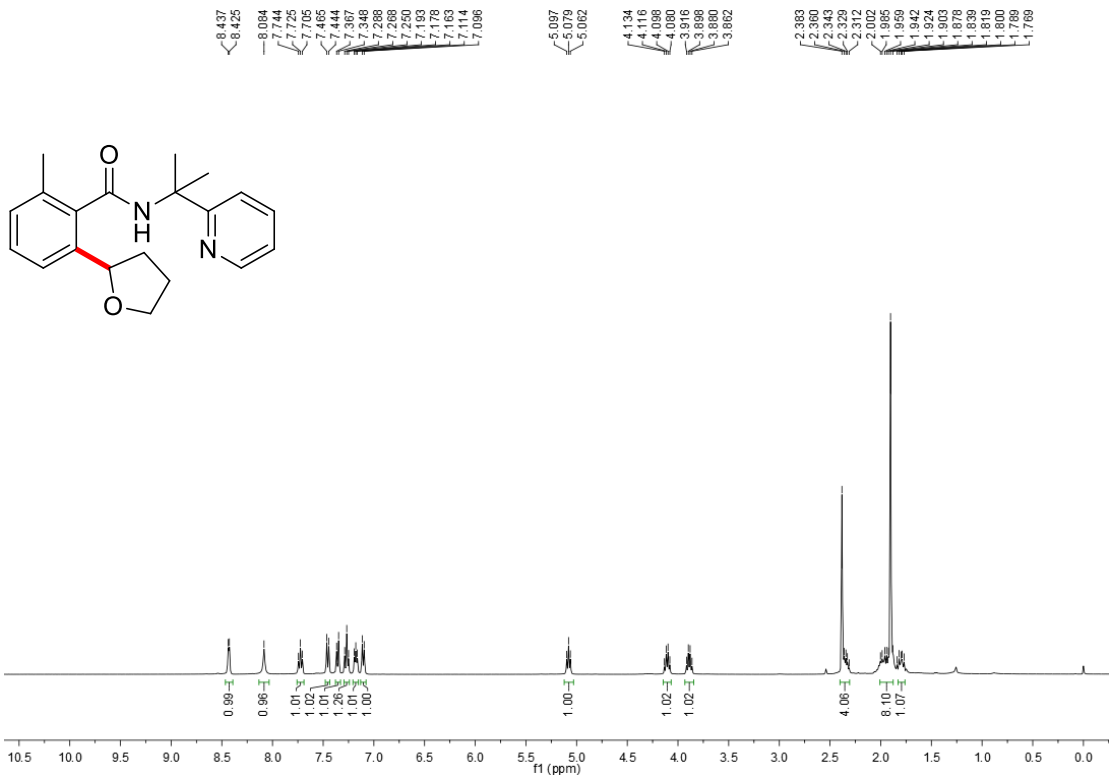
Compound 4i



Compound 4i



Compound 5a



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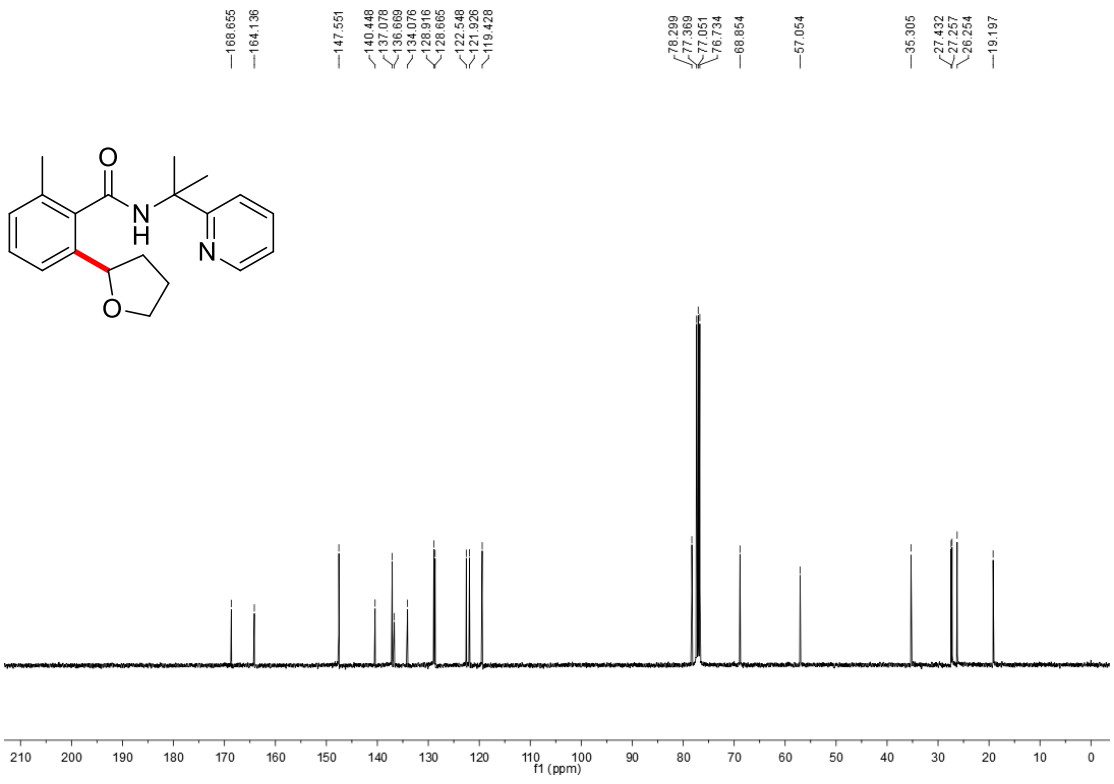
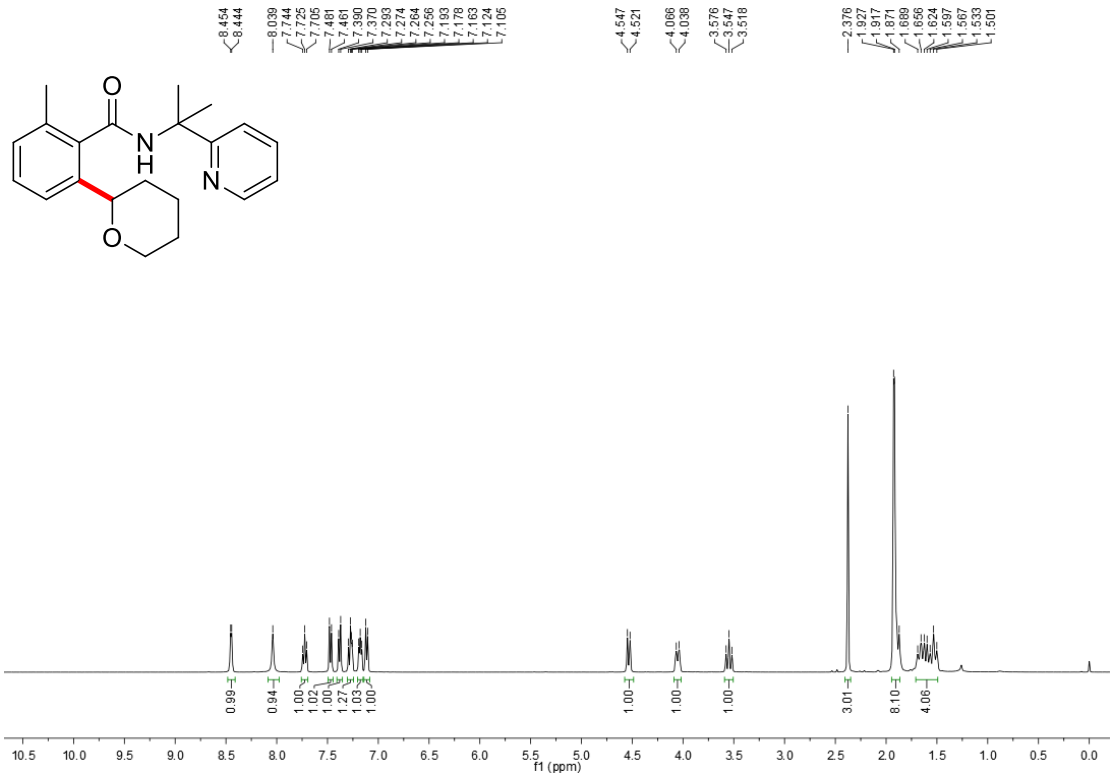


Compound 5b



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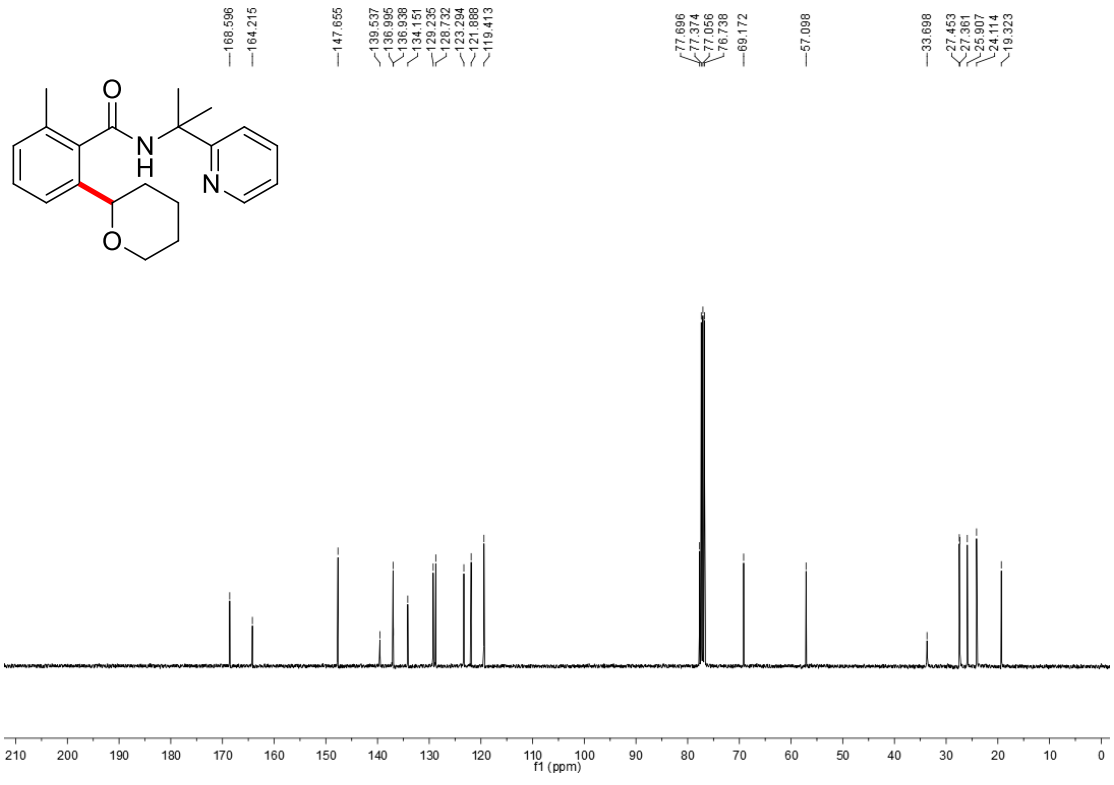

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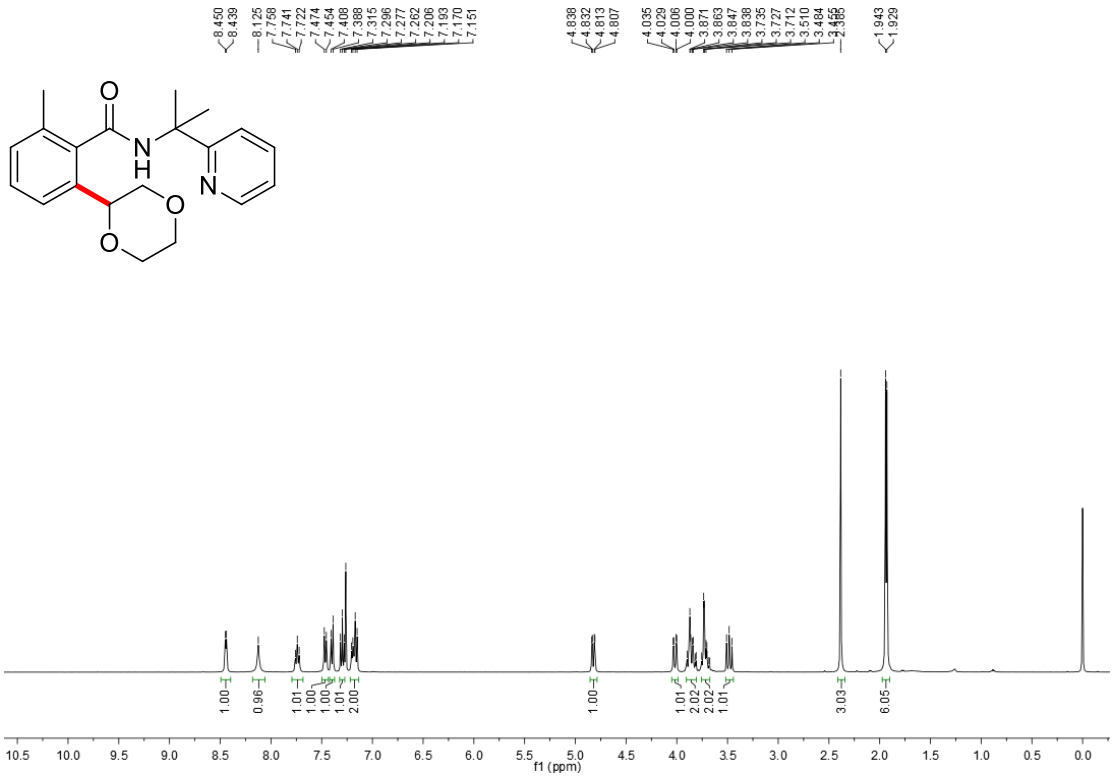

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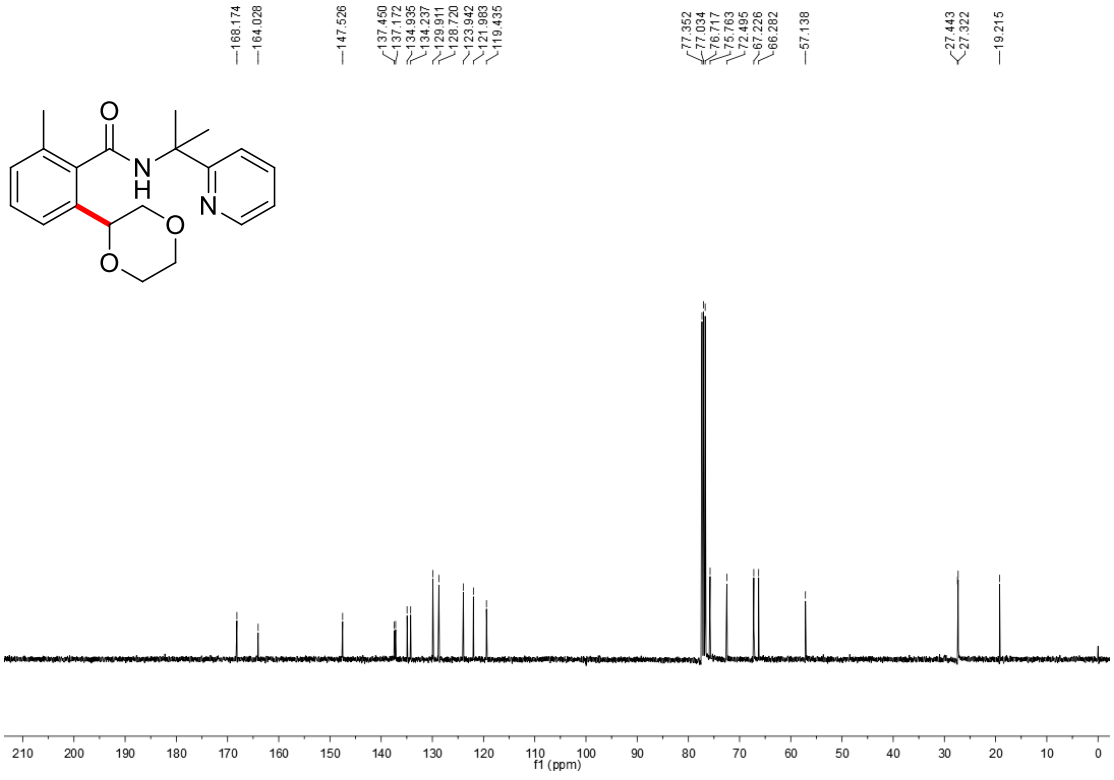

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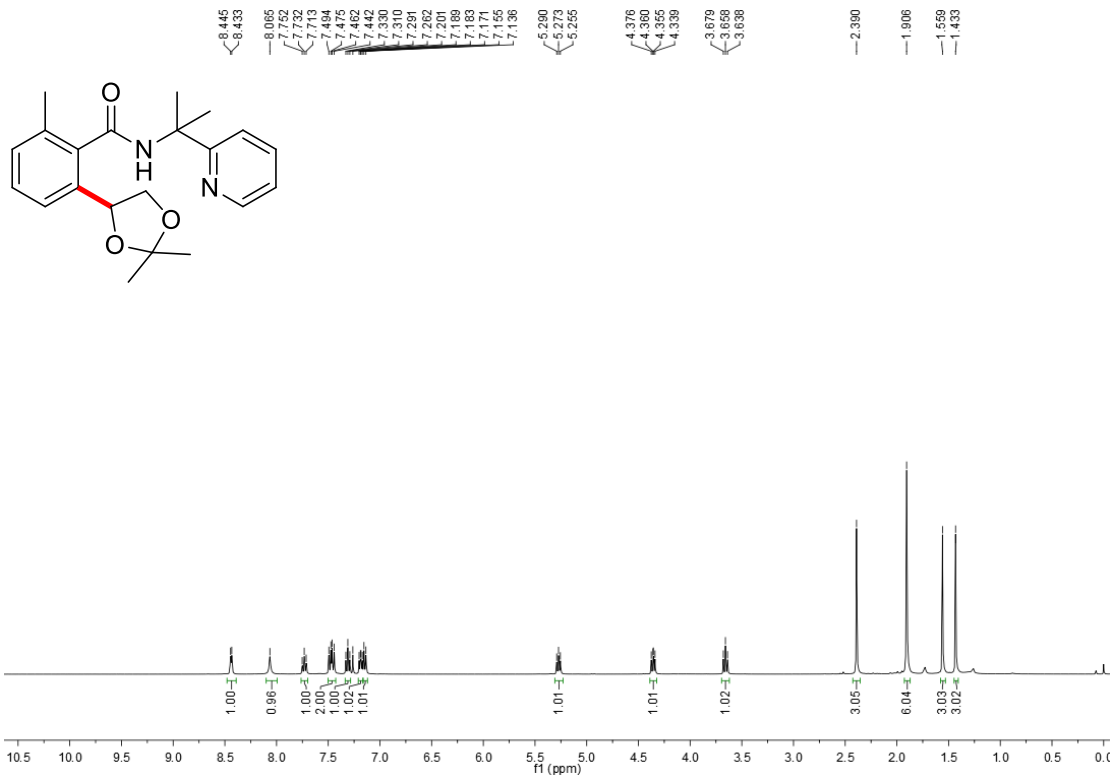

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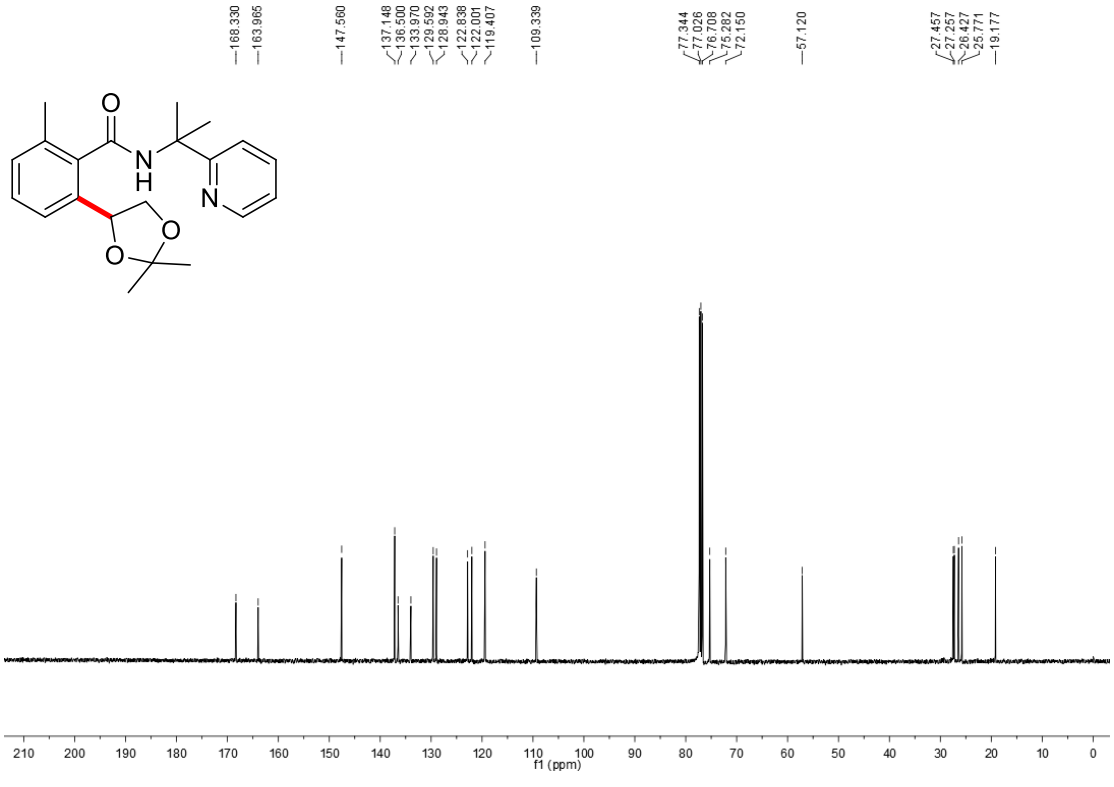

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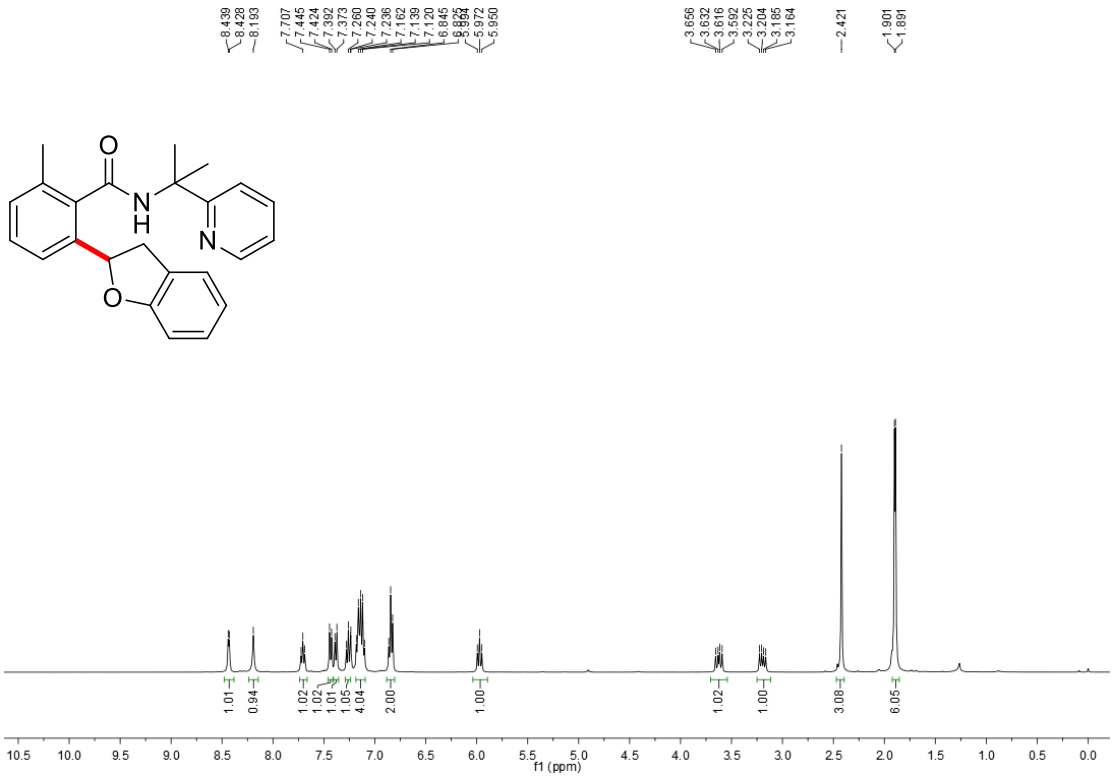

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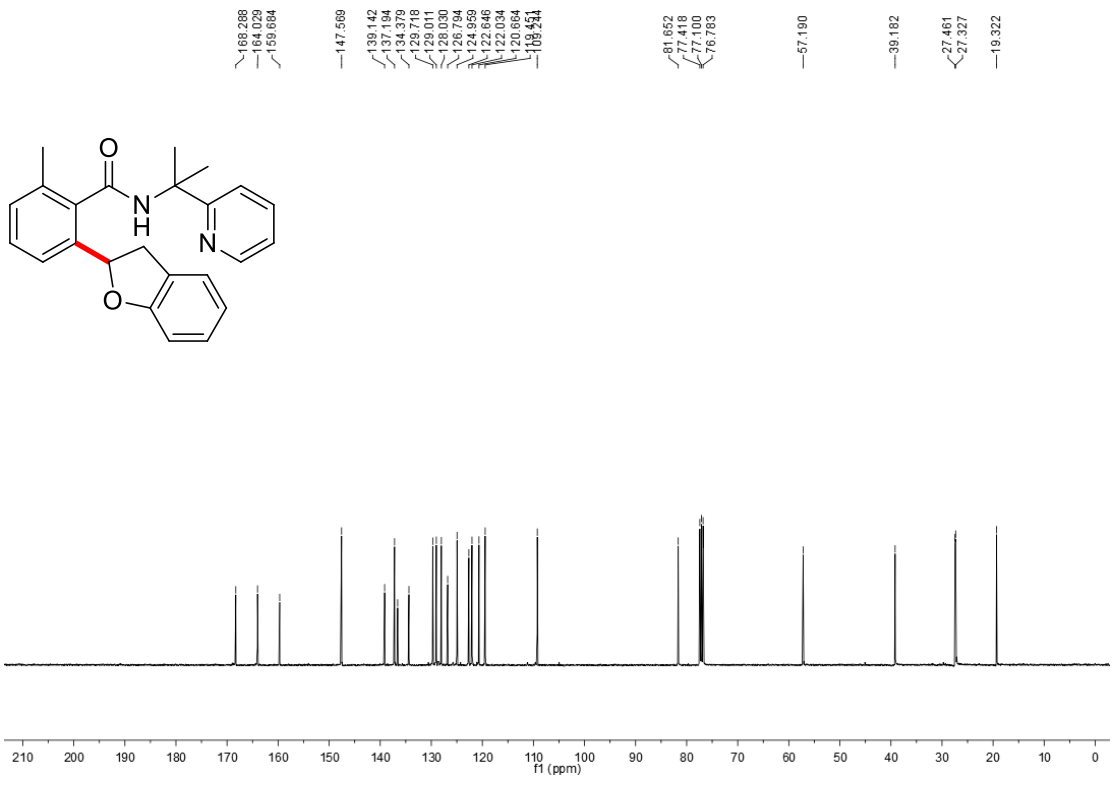
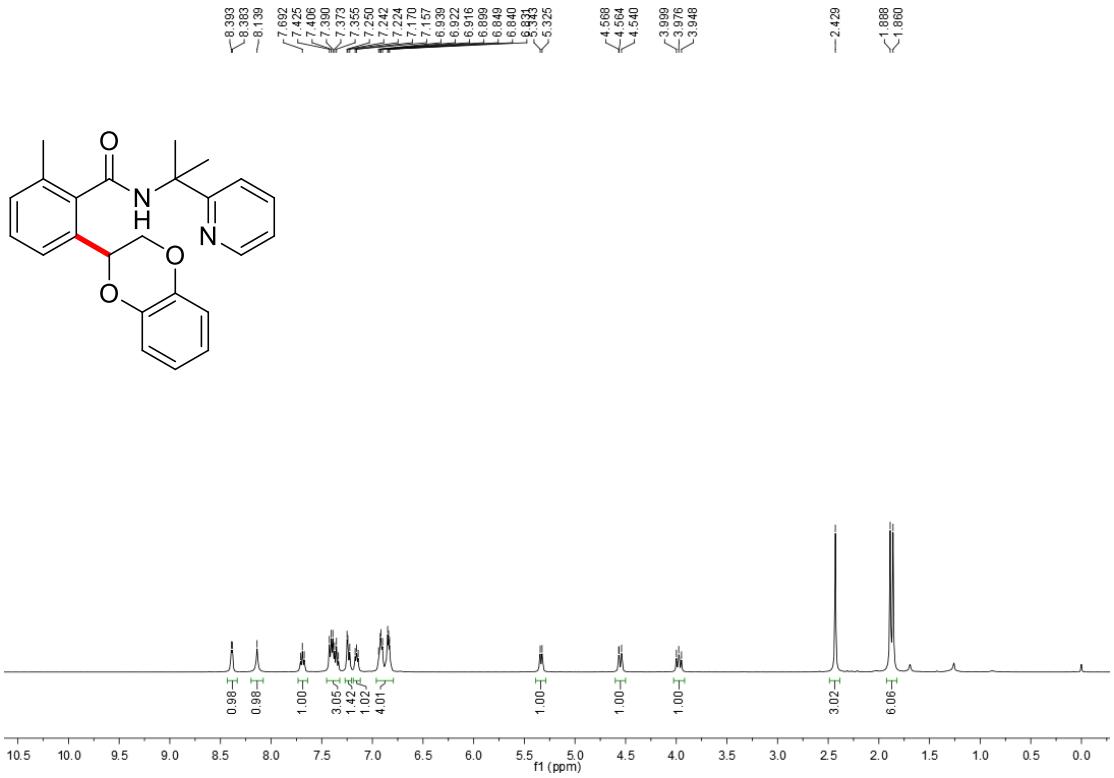


Compound 5f



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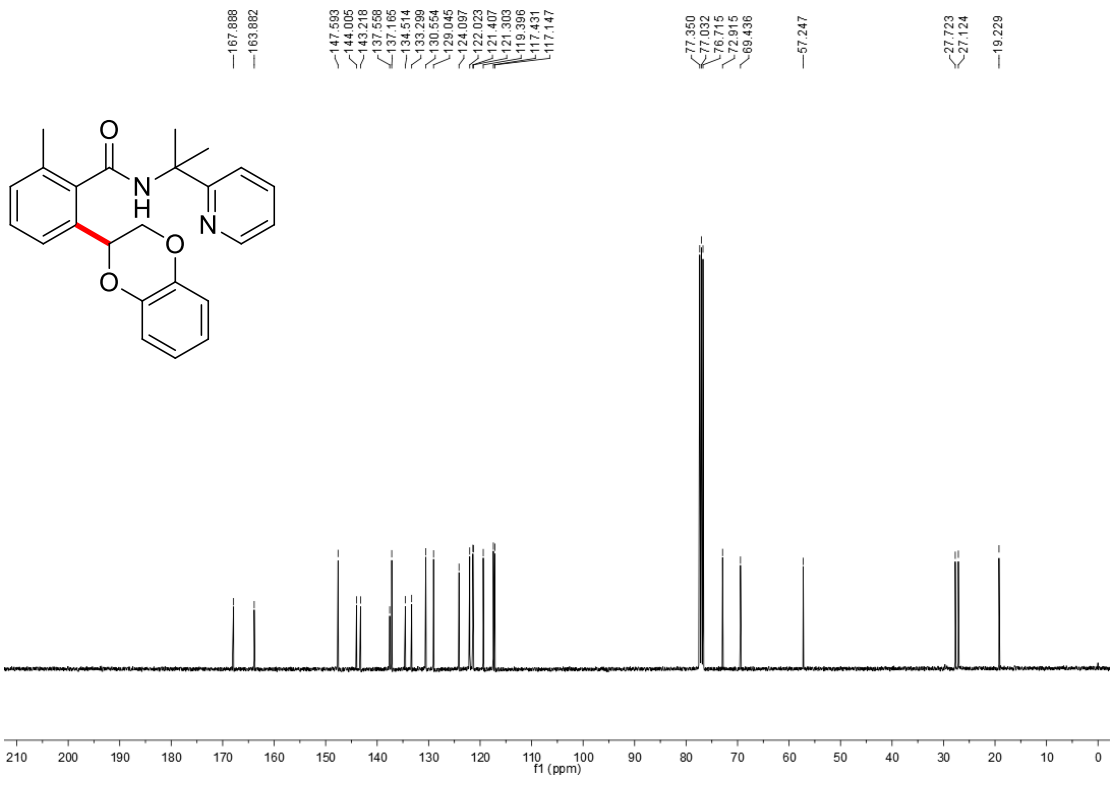
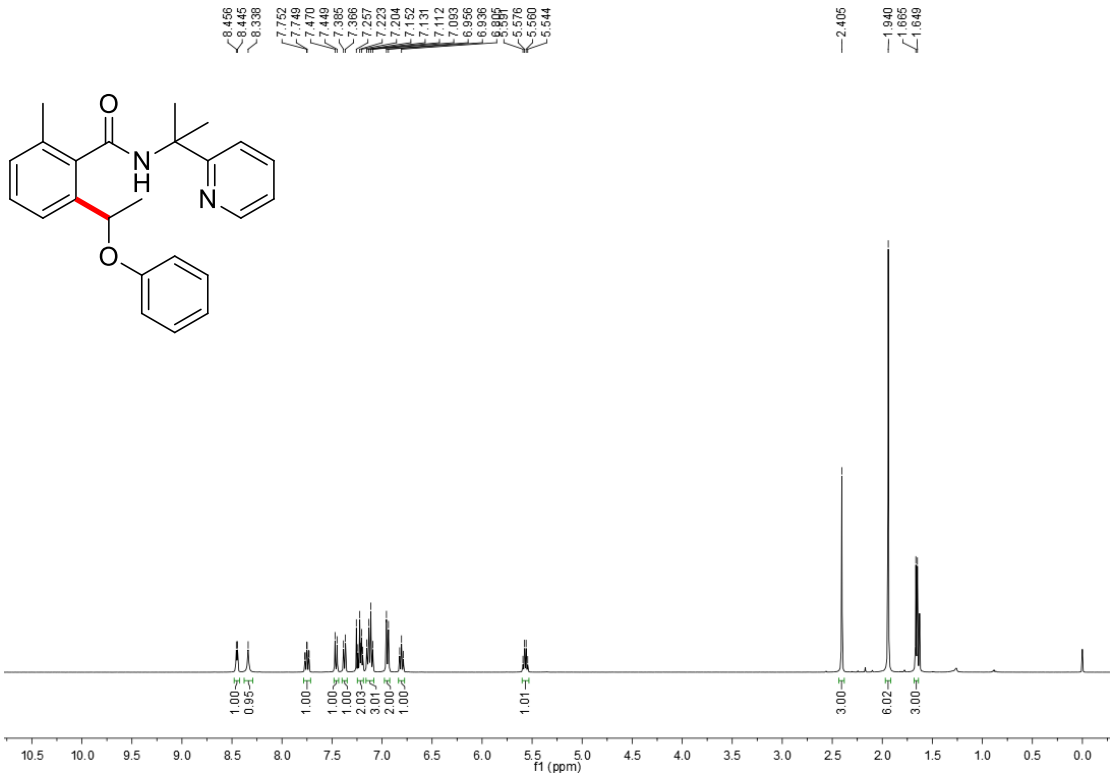


Compound 5g



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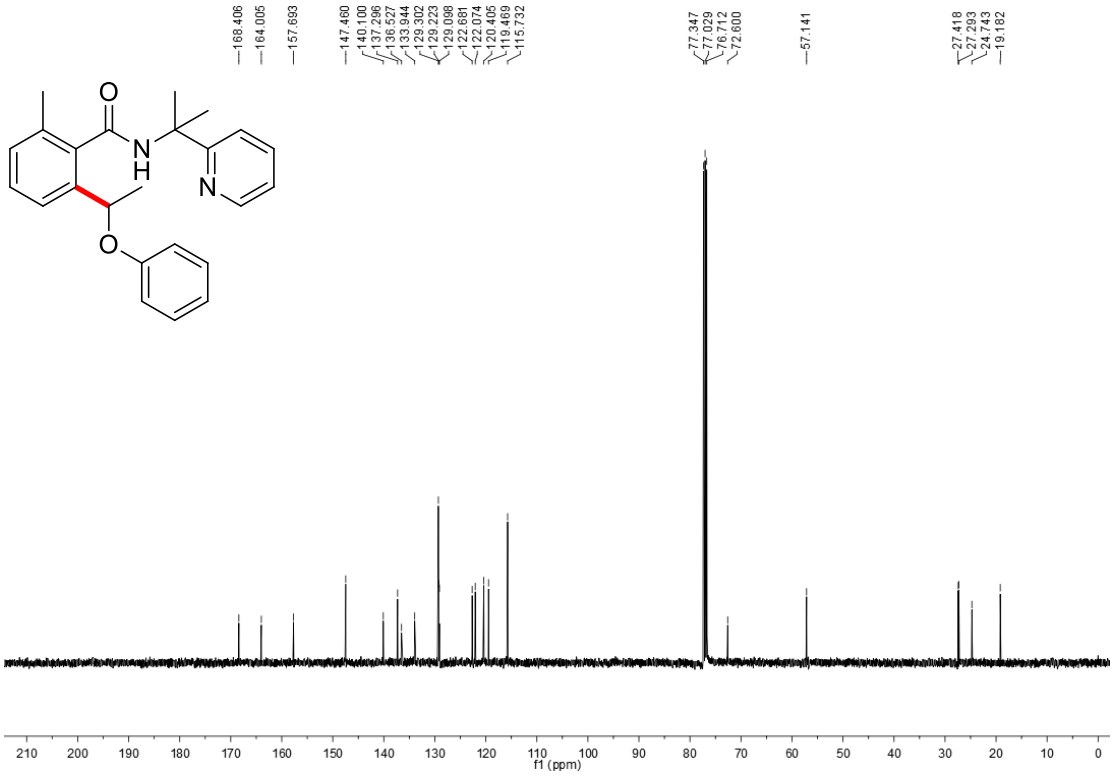
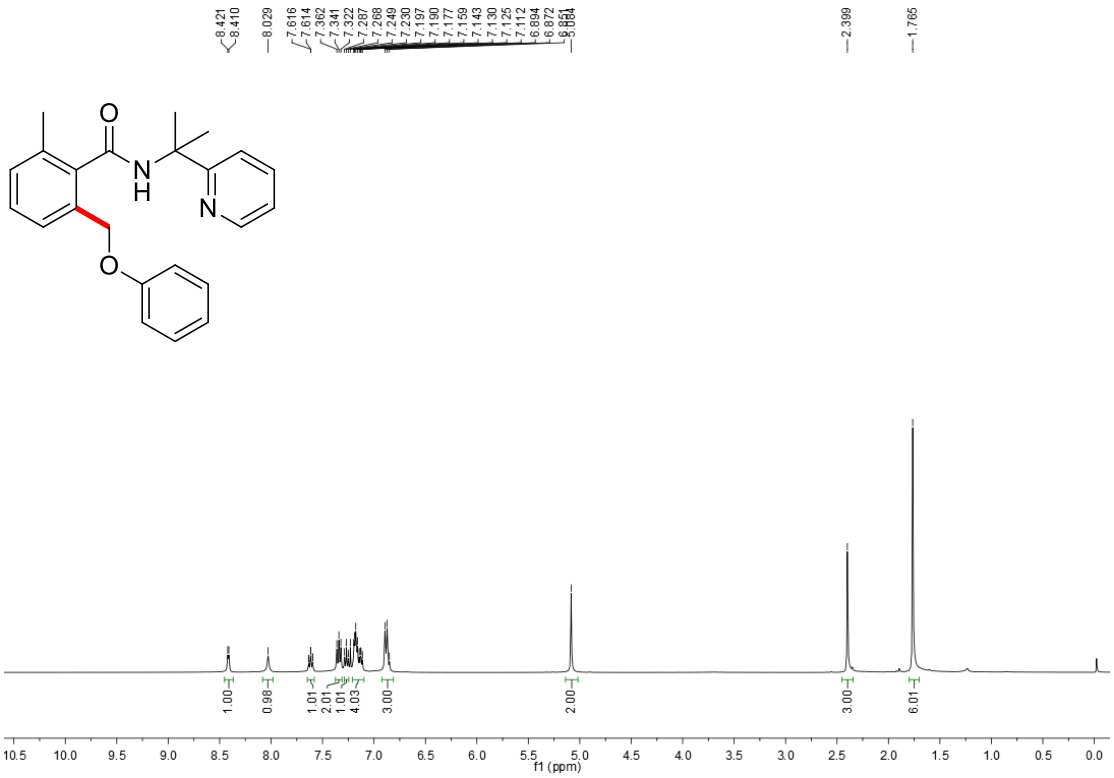


Compound 5h



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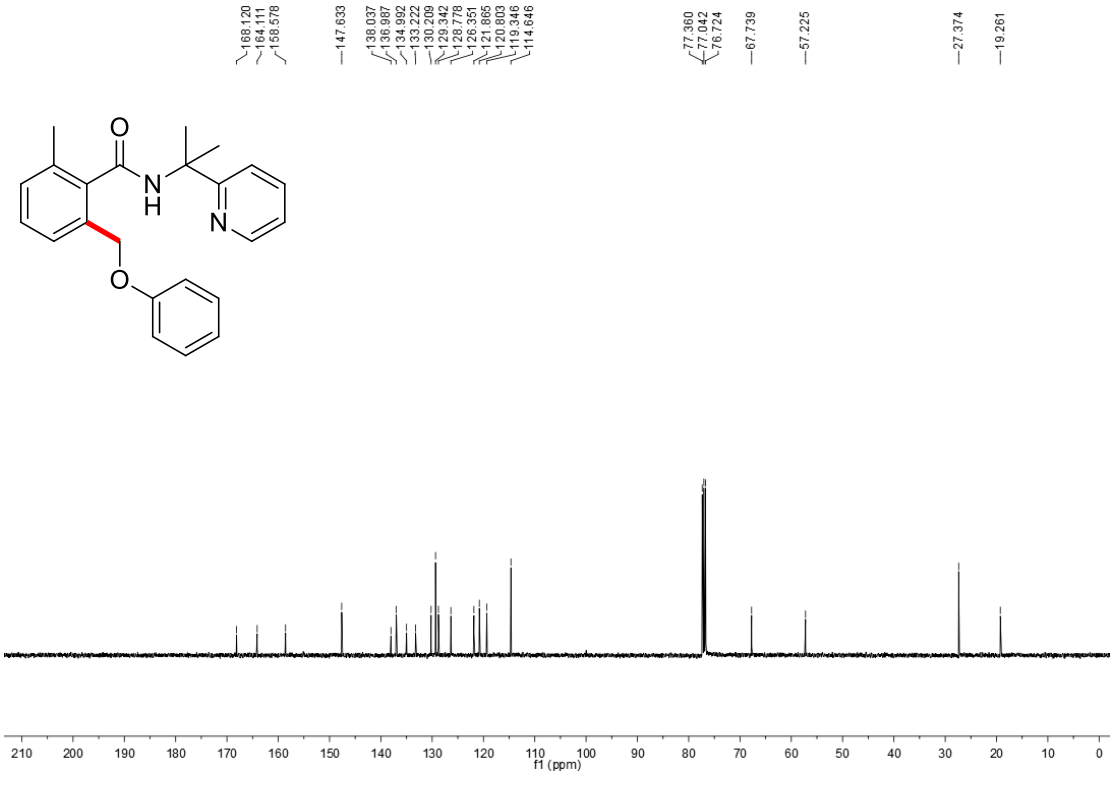
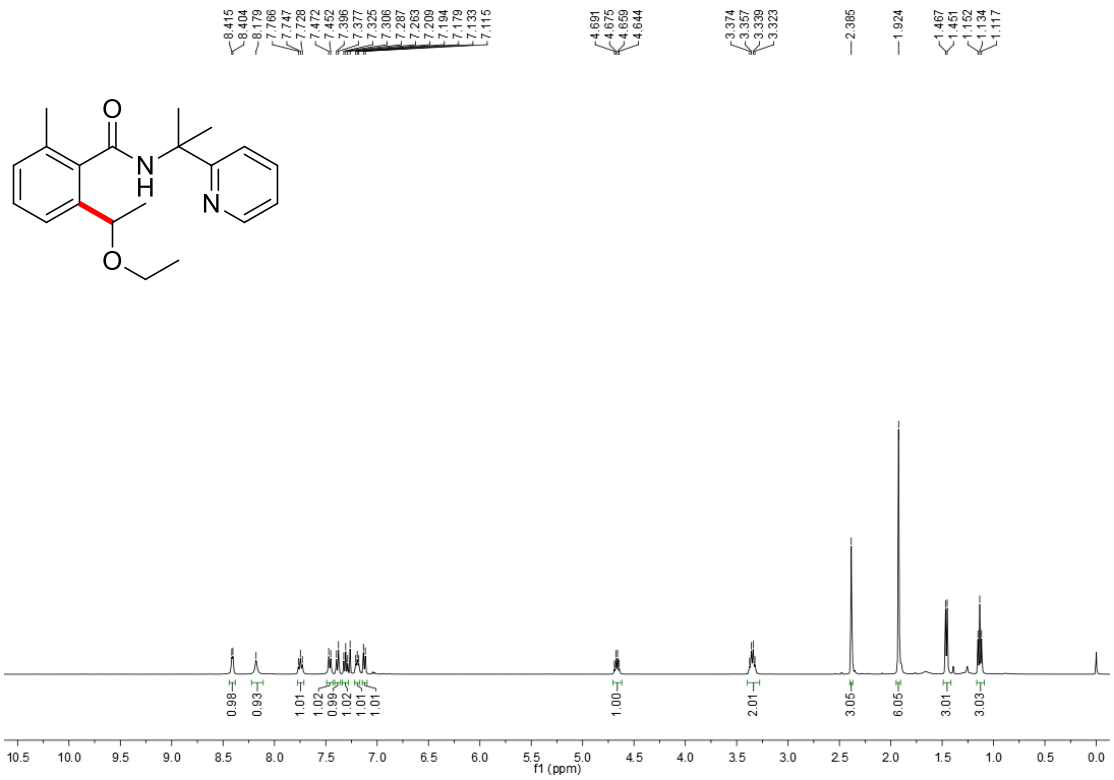
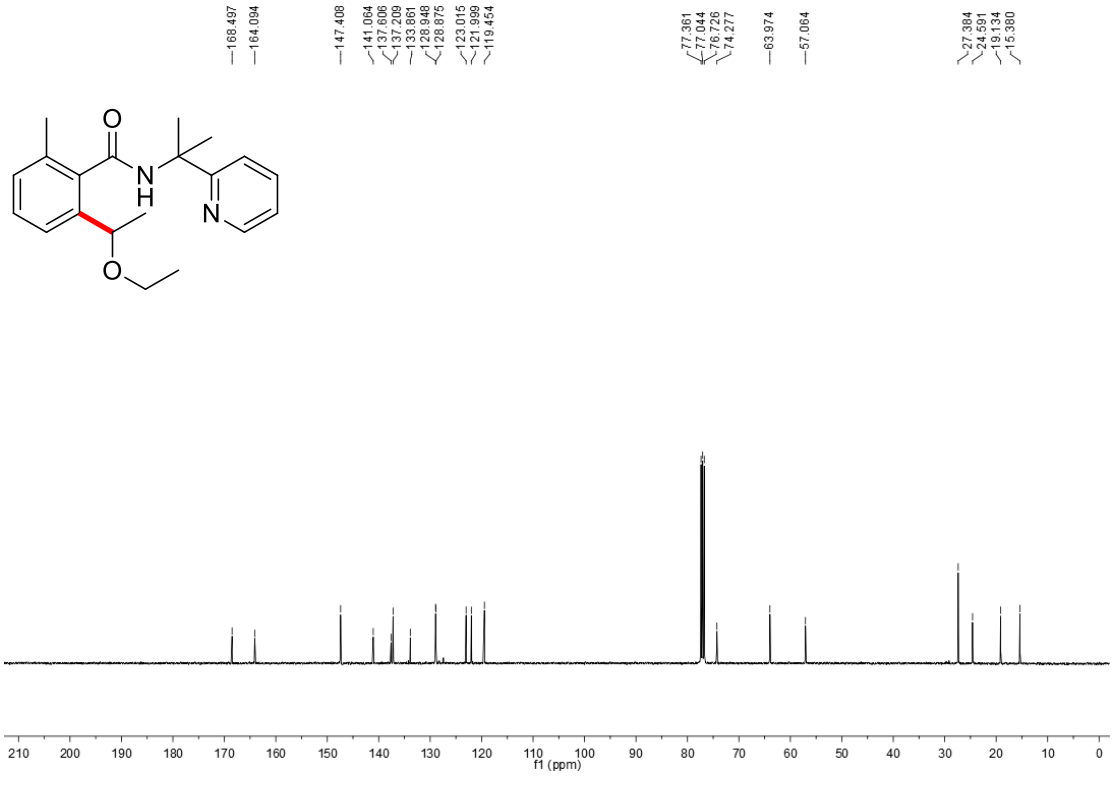


Compound 5i



Compound 5i



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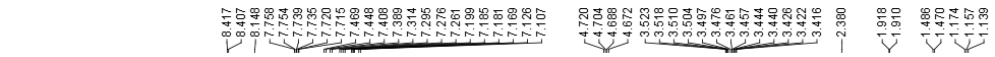

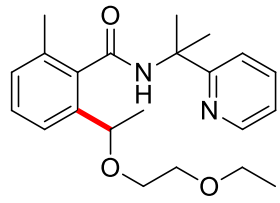

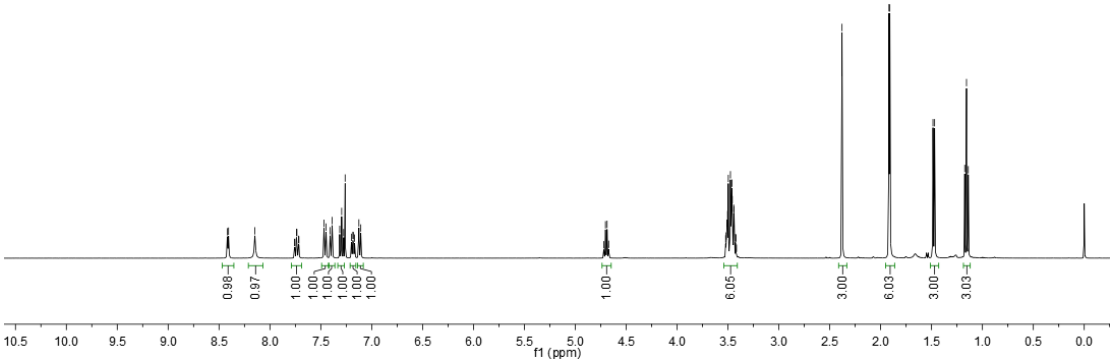

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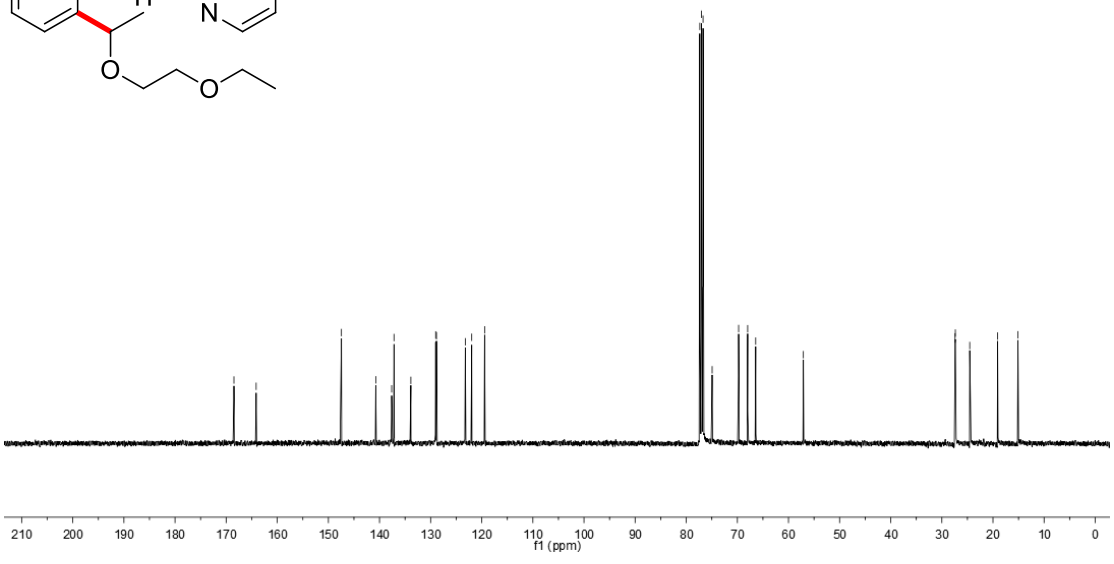

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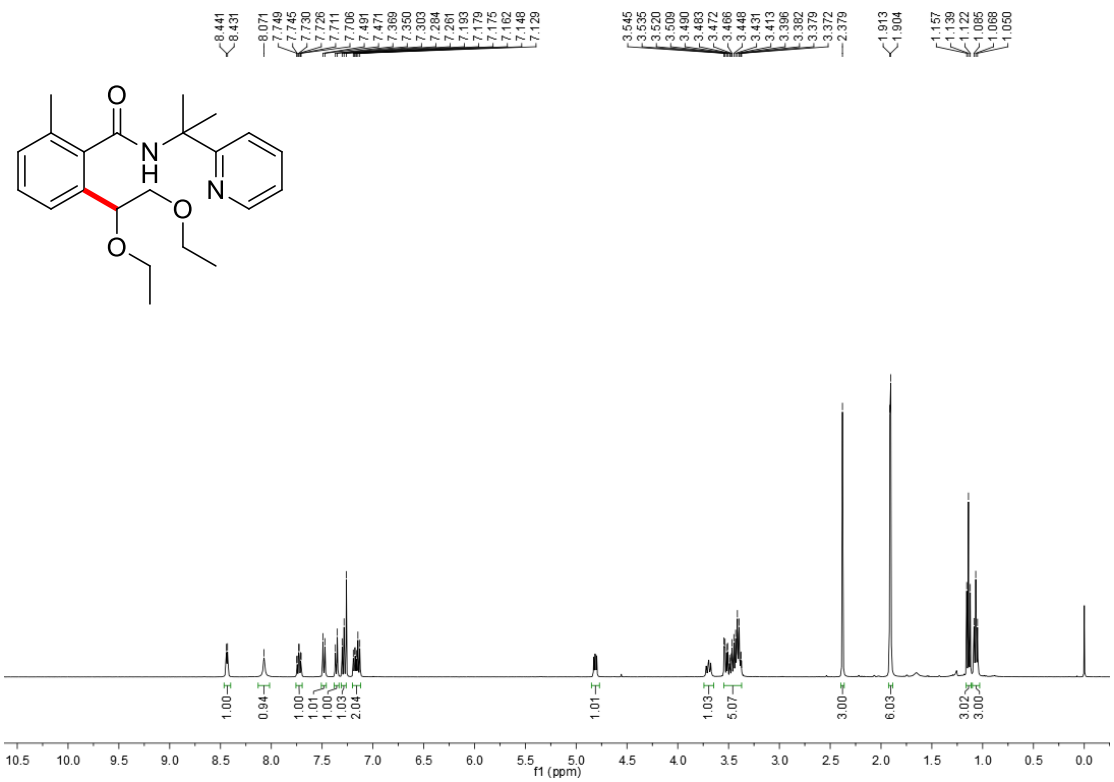

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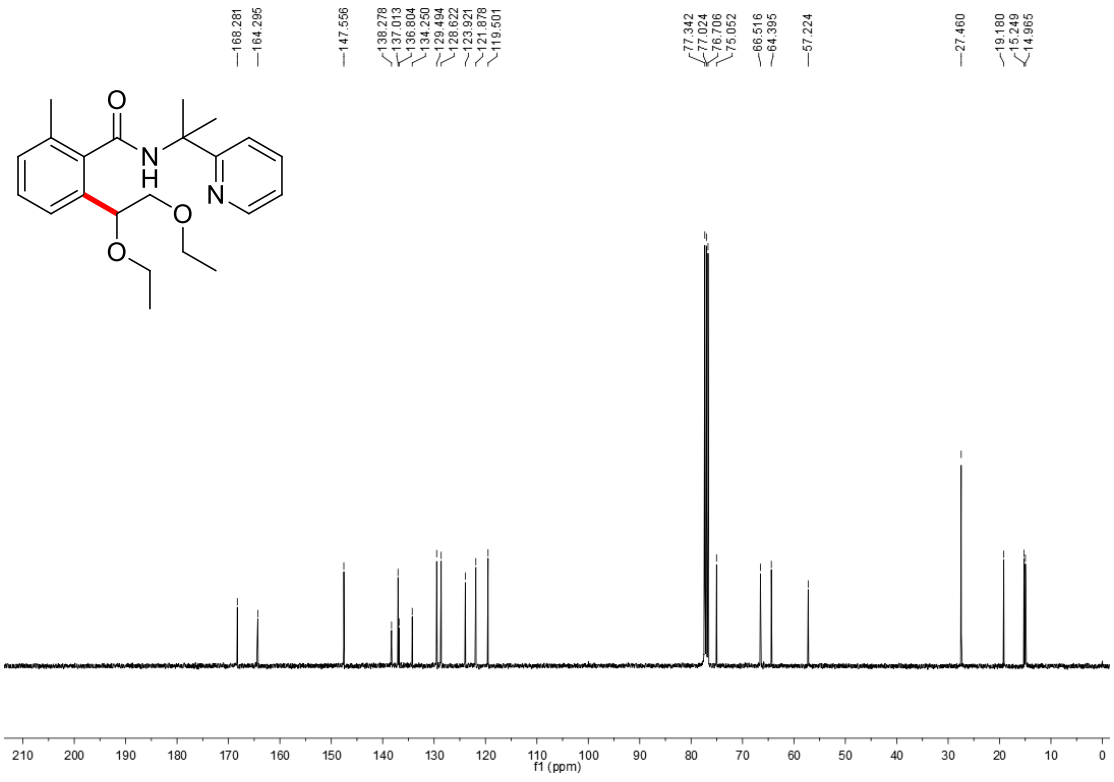

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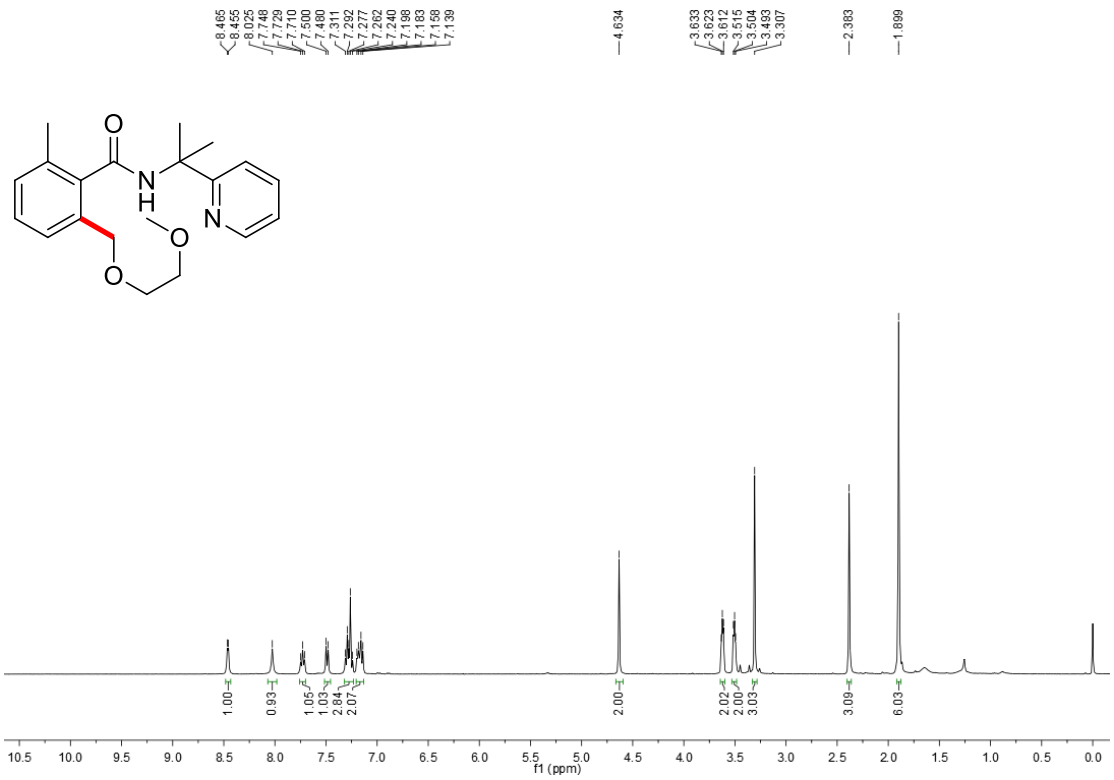

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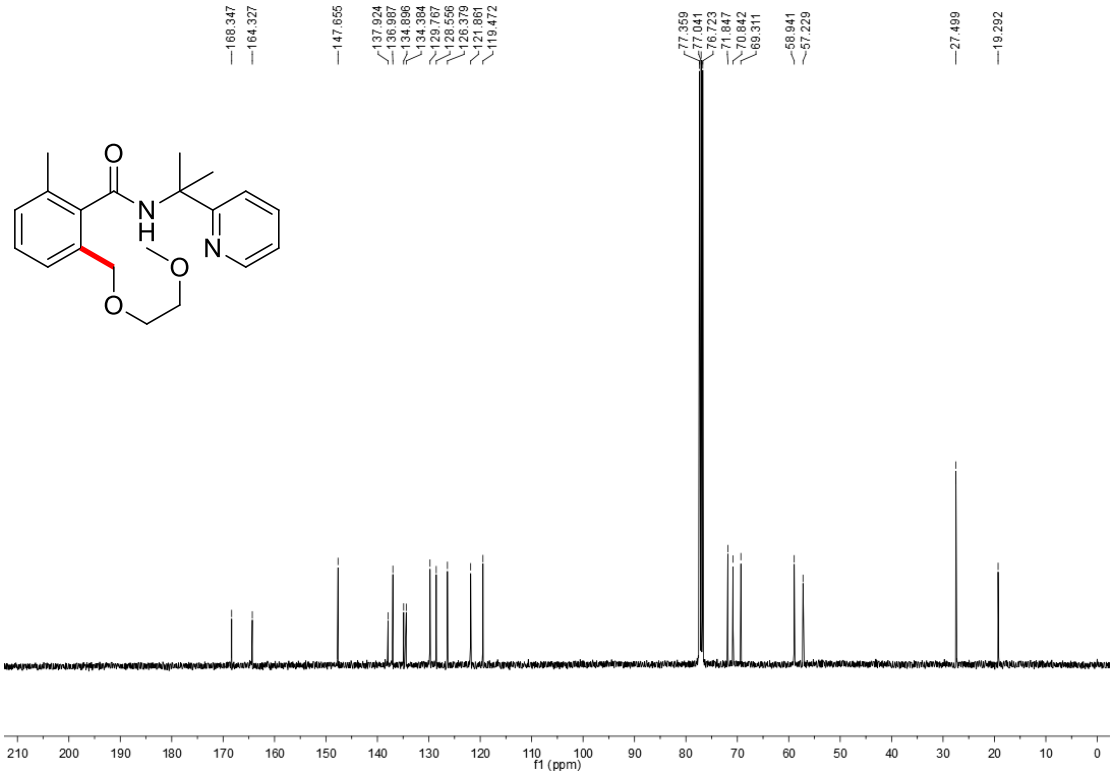

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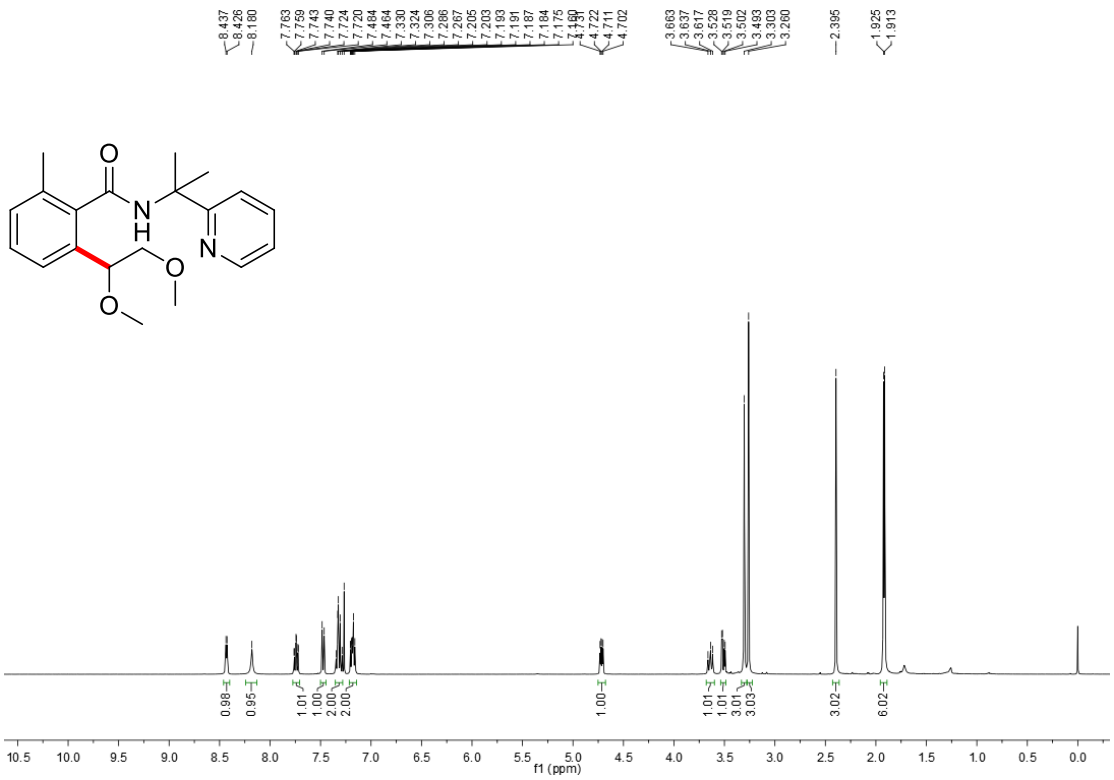

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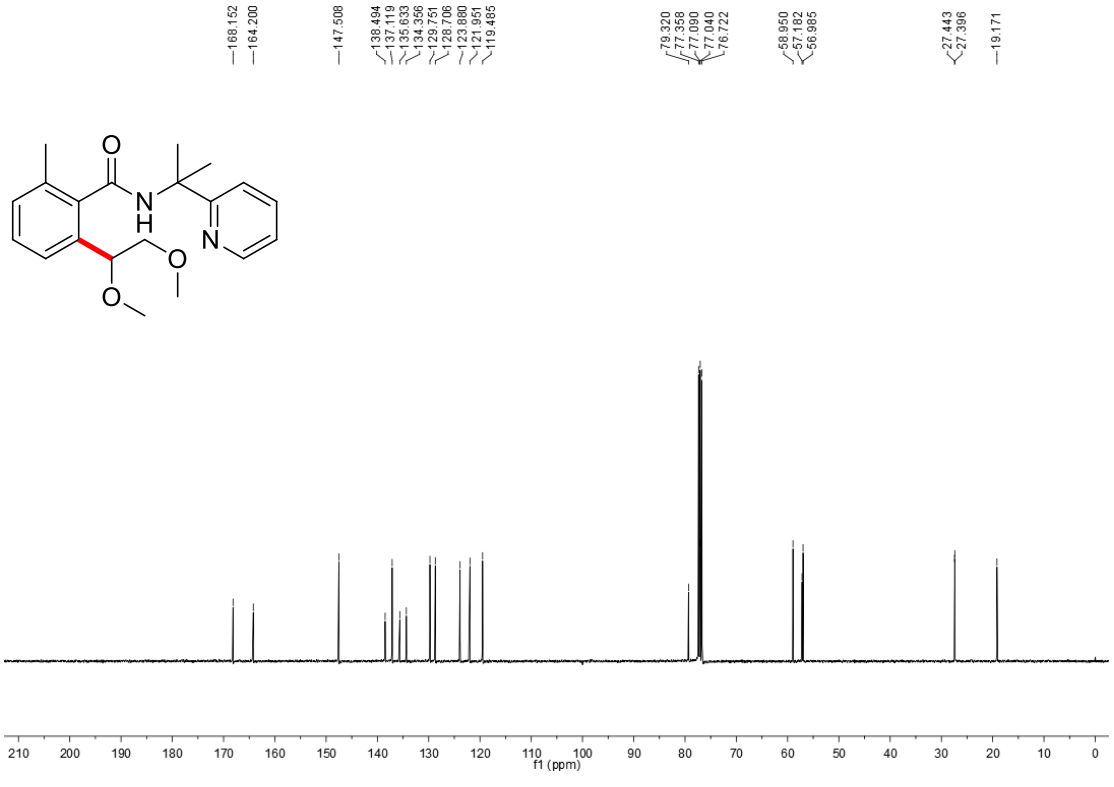
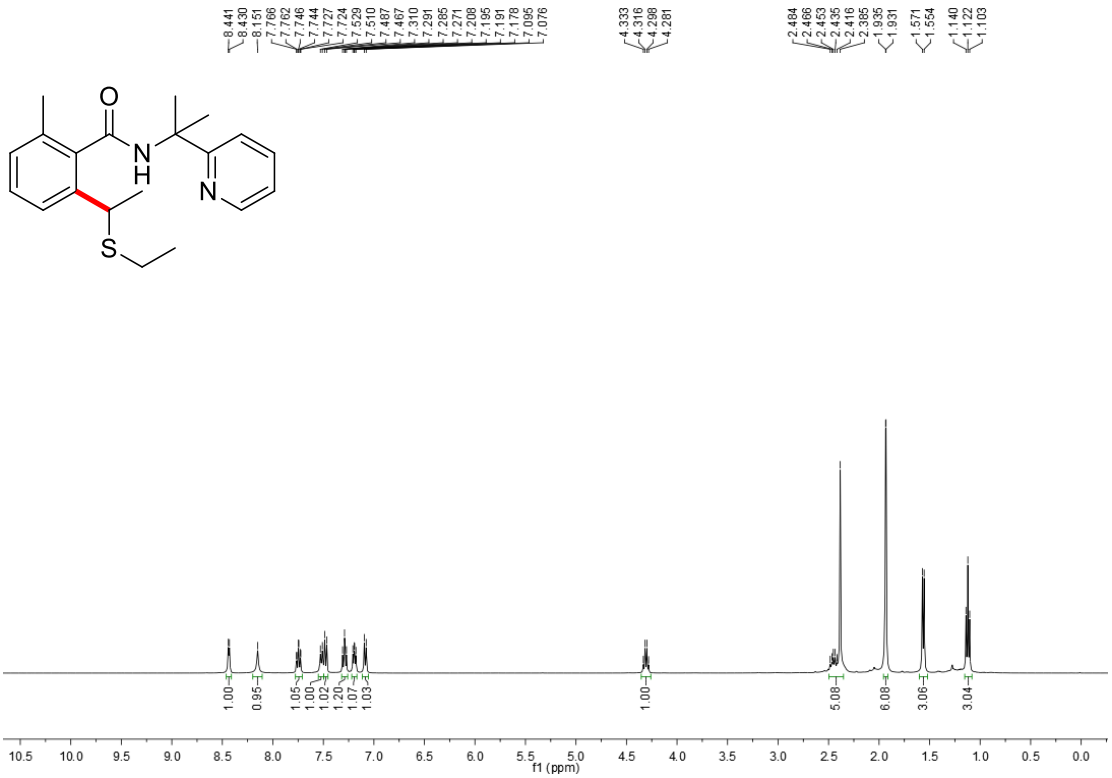
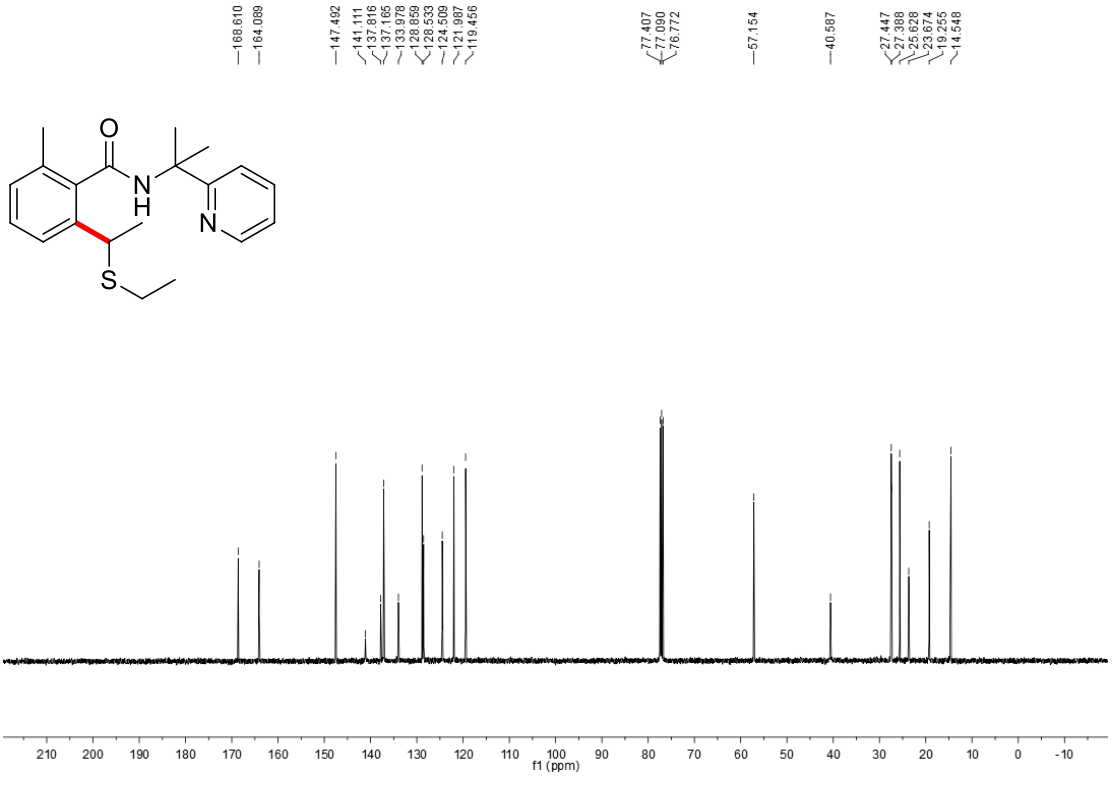


Compound 6a



Compound 6a



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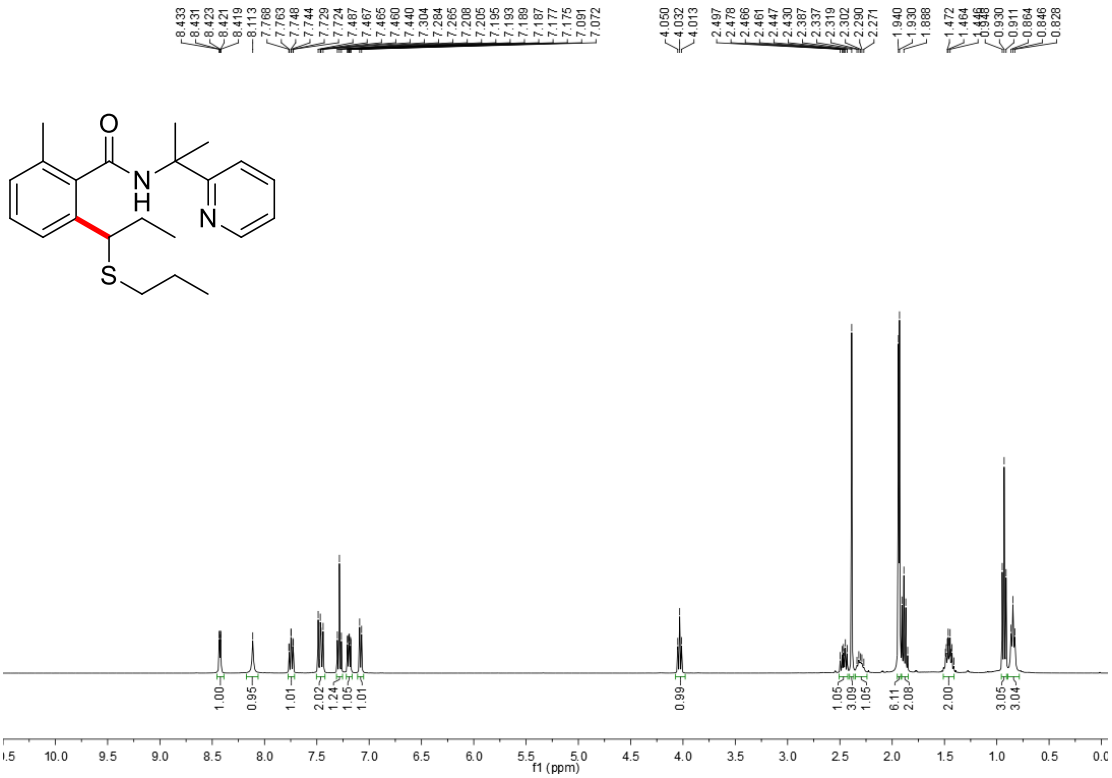

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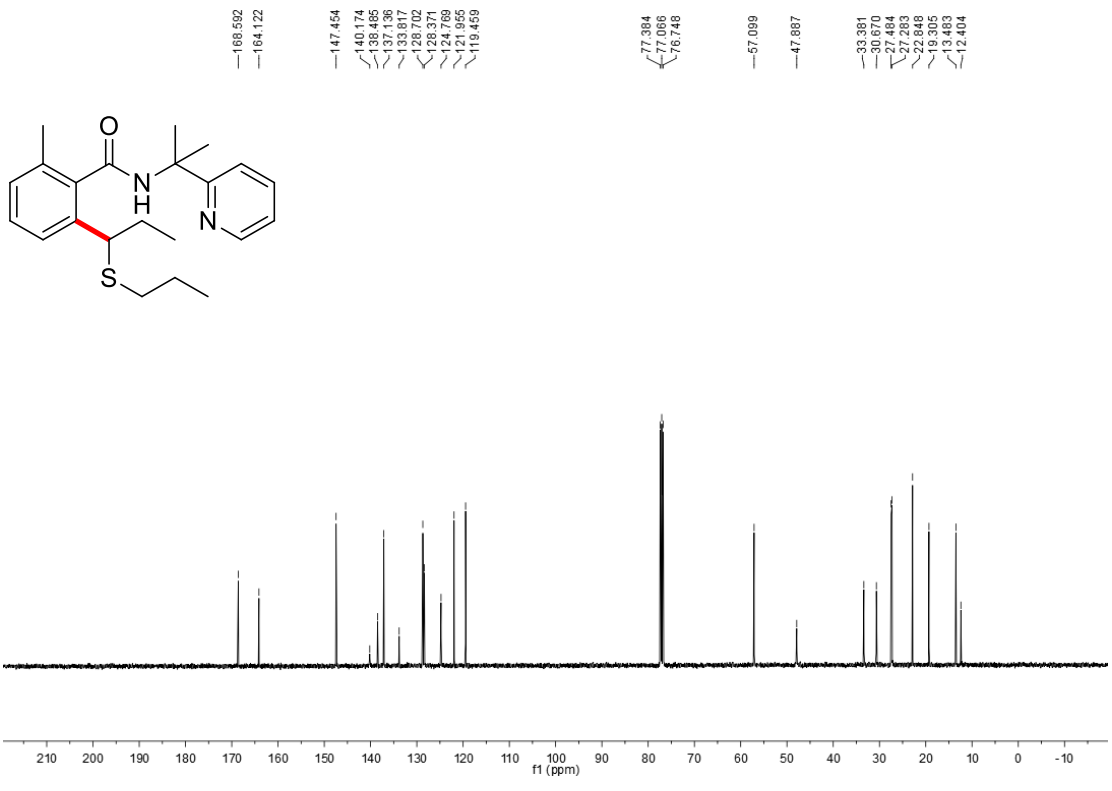

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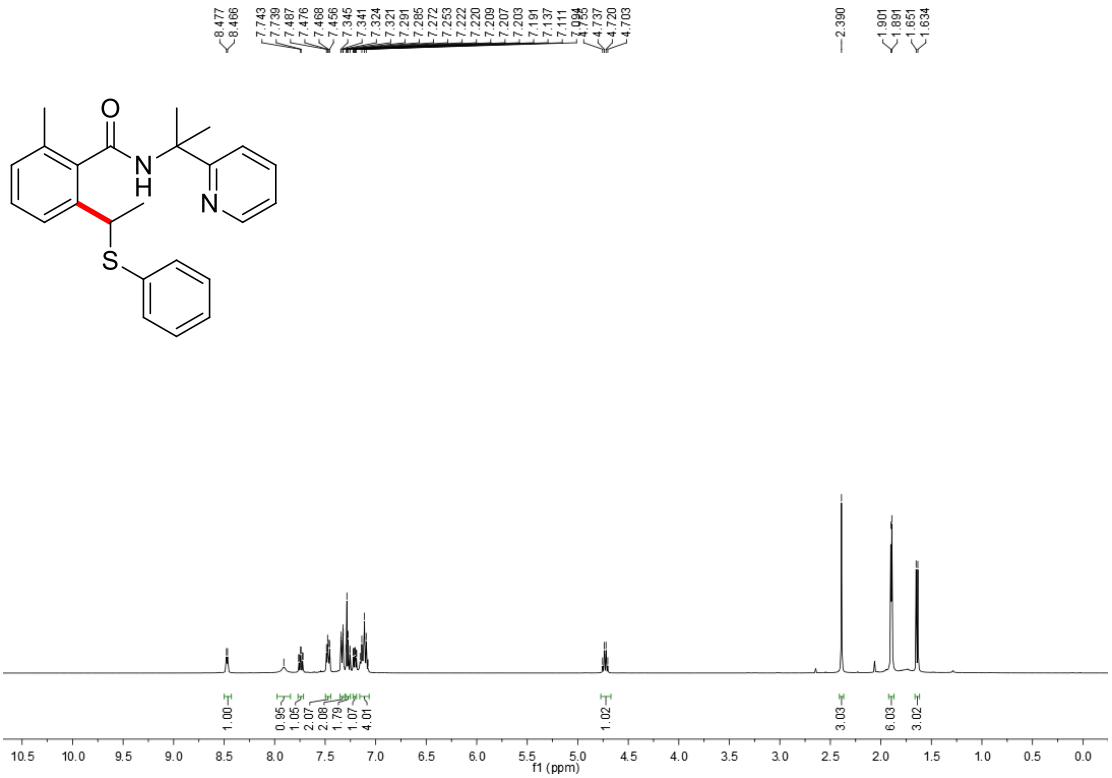

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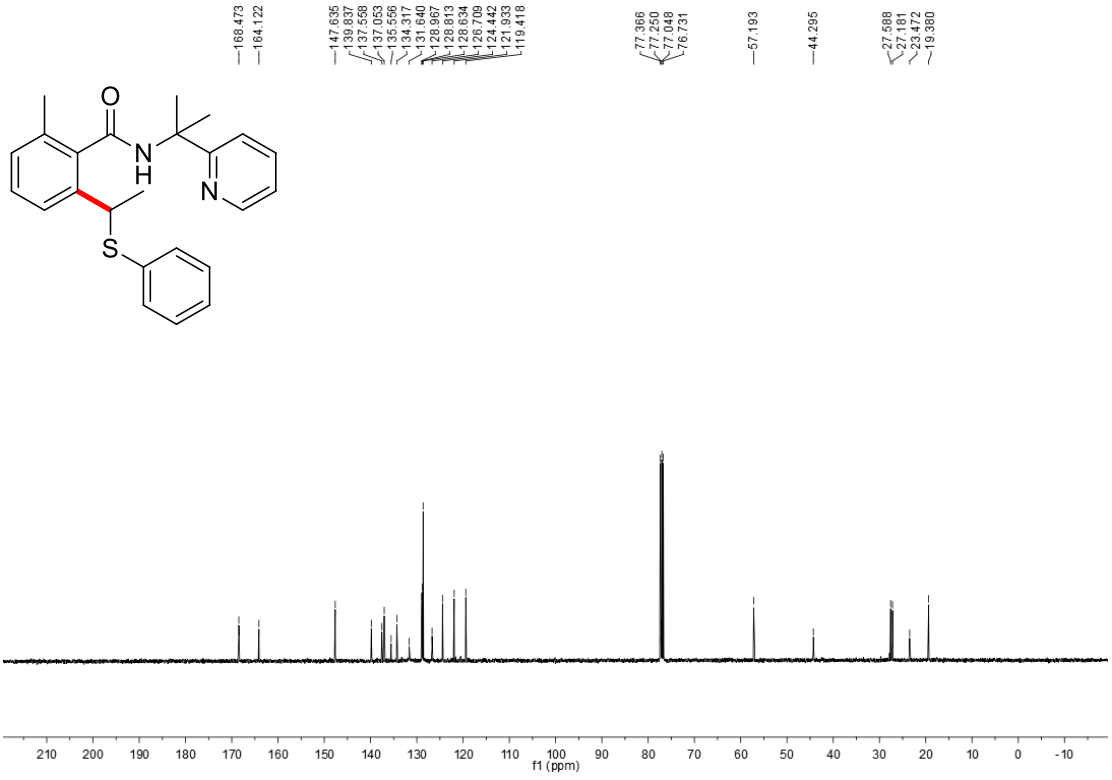
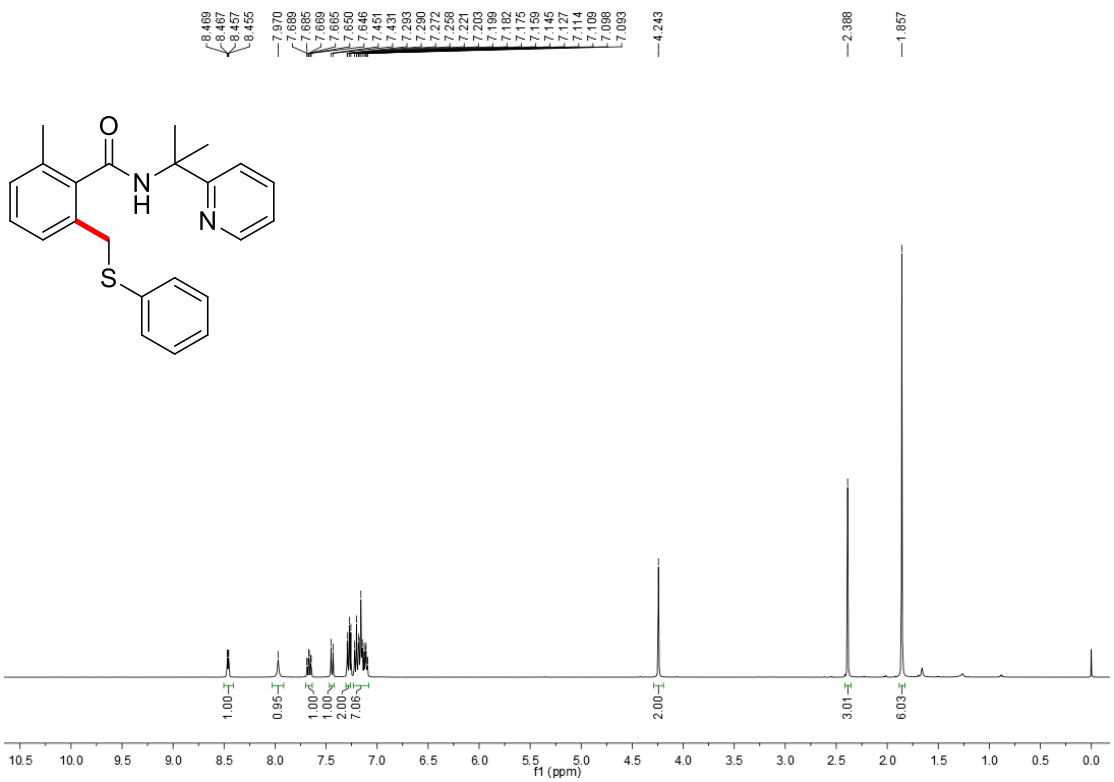
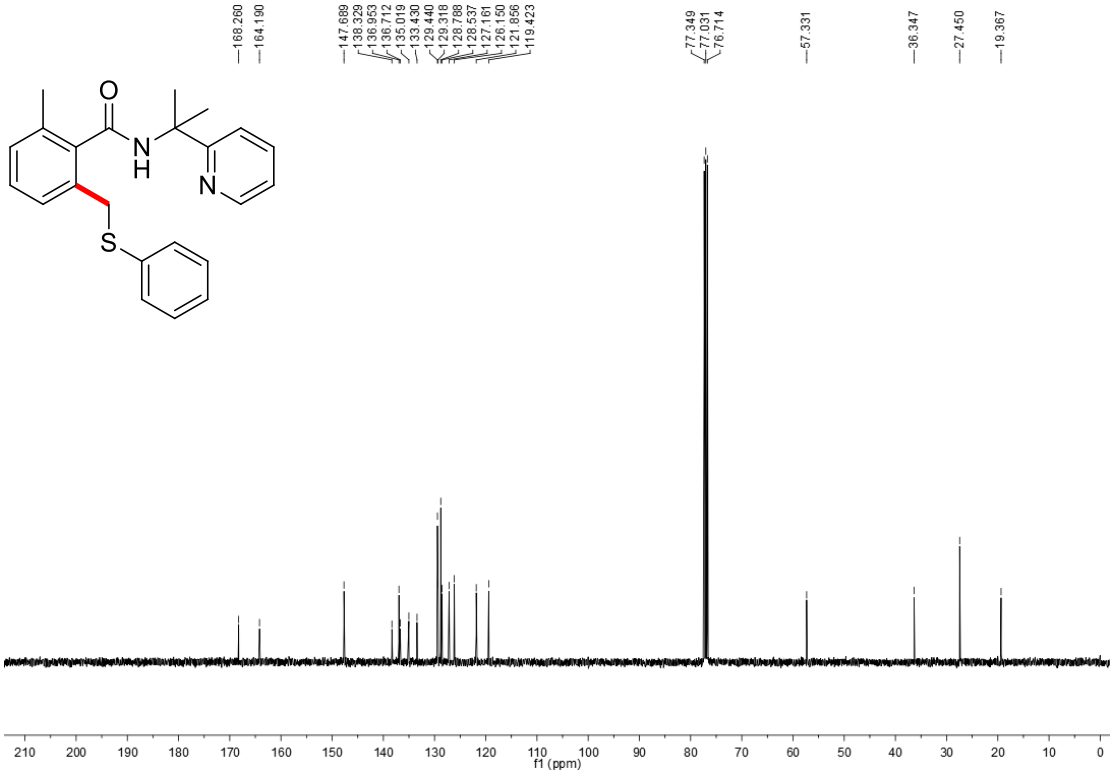


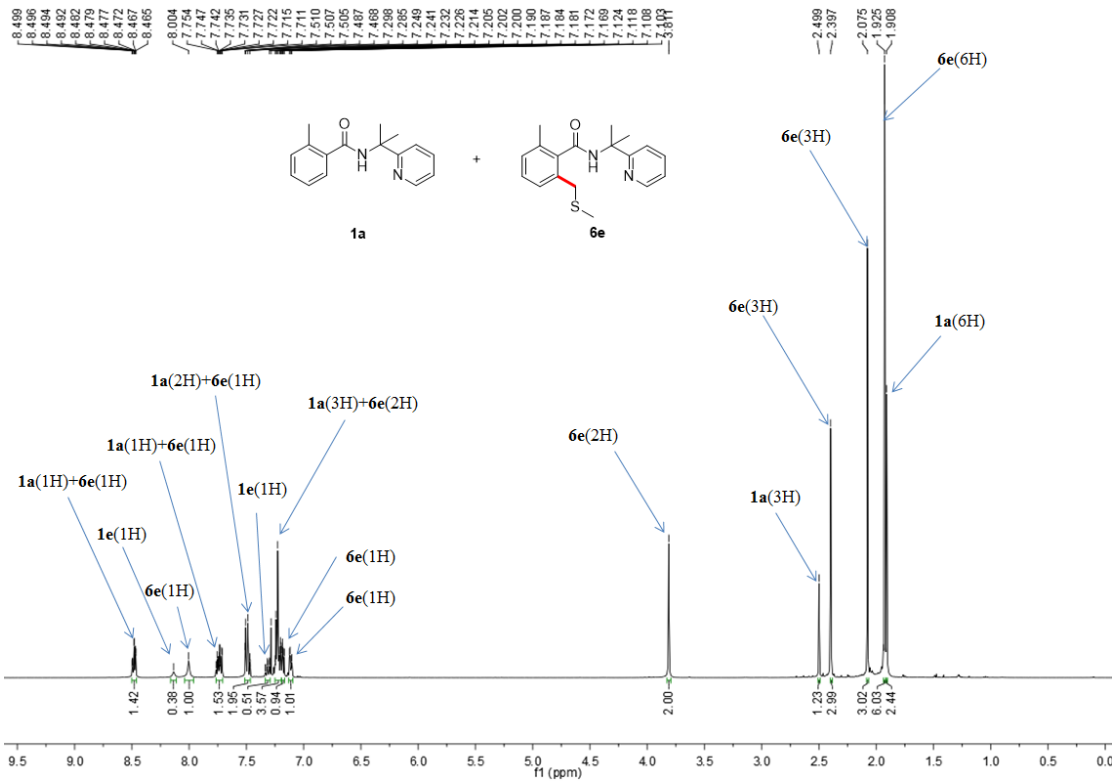
Compound 6d



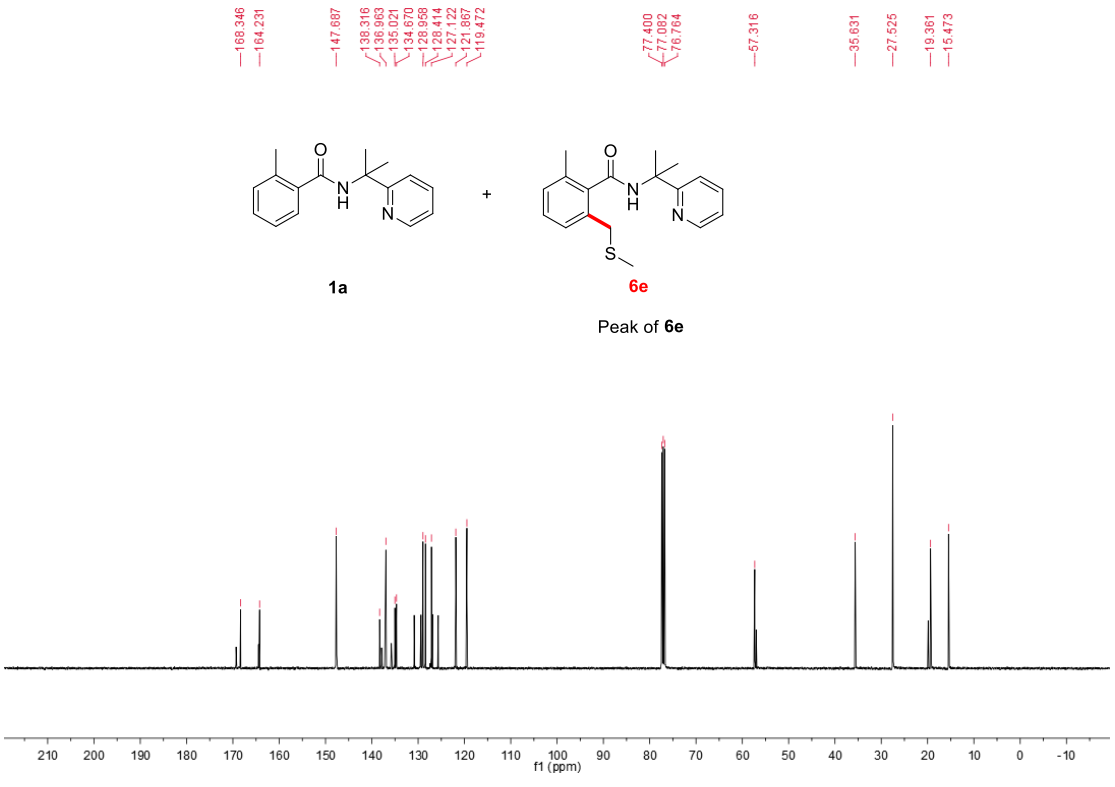
Compound 6d



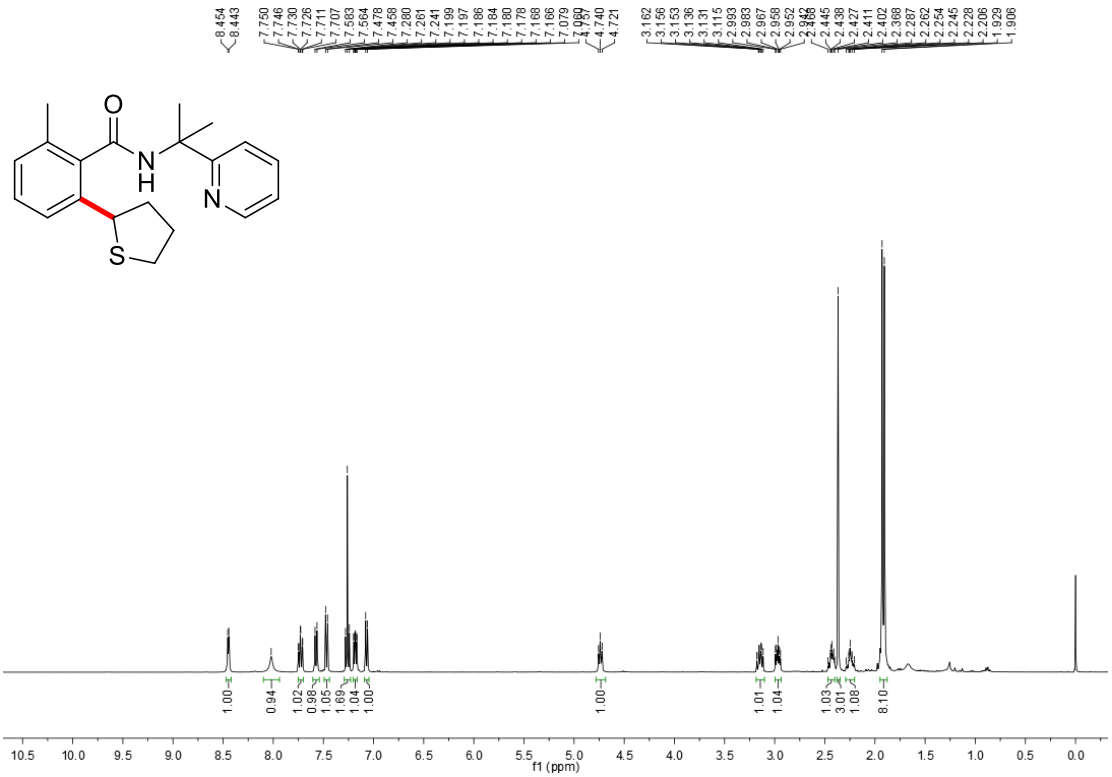
Compound 1a+6e



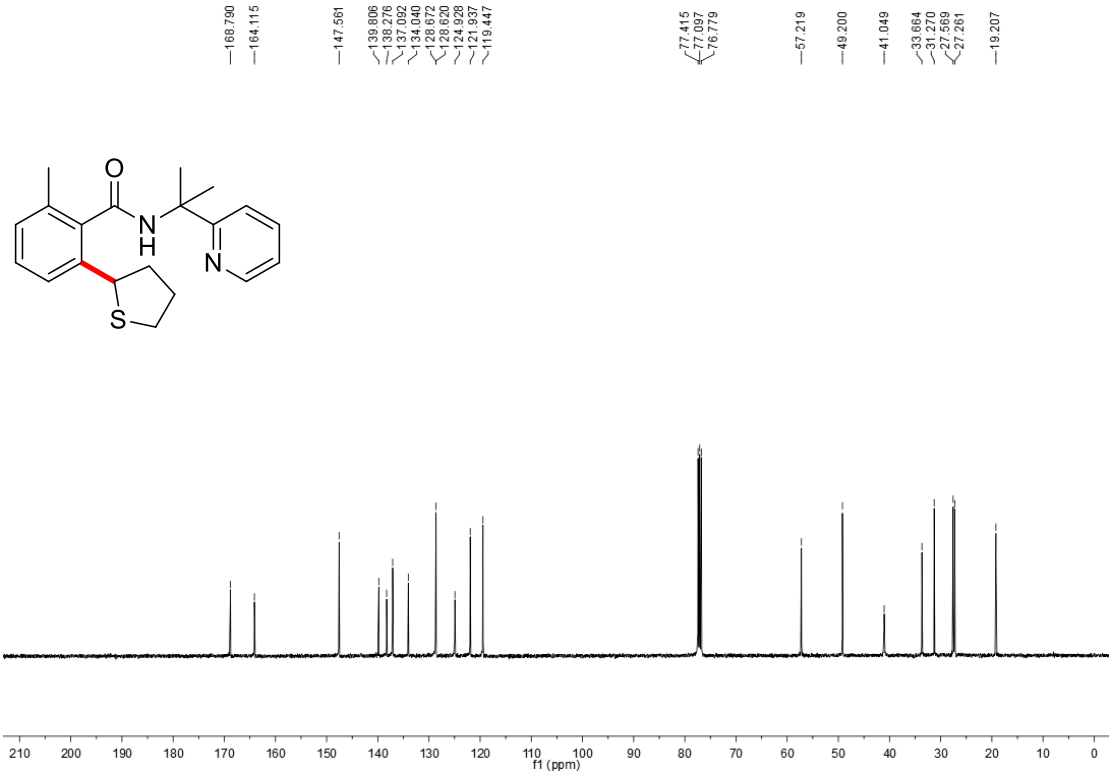
Compound 1a+6e



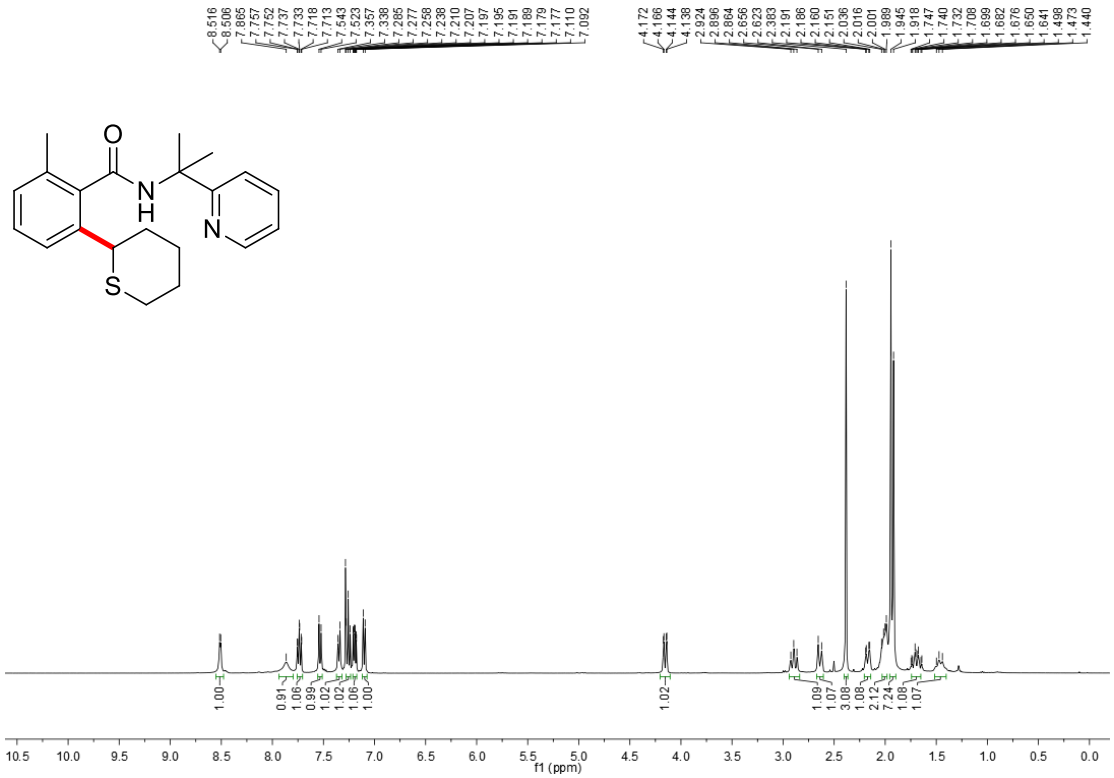
Compound 6f



Compound 6f



Compound 6g



Compound 6g