

Copper-Catalyzed Carbonylative Synthesis of Pyrrolidine-Containing Amides from γ,δ -Unsaturated Aromatic Oxime Esters

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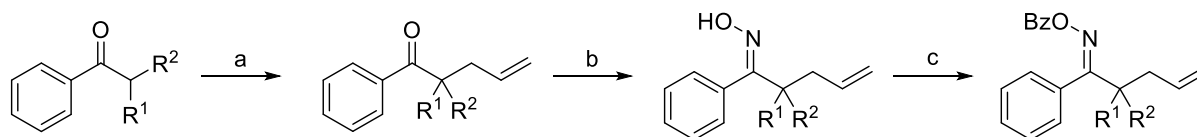
1. General conditions

All solvents and commercially available reagents were purchased from Sigma-Aldrich, Abcr, Acros, TCI or Alfa Aesar and used without further purification. Anhydrous solvents were purchased from Sigma-Aldrich and used as received. NMR spectra were recorded on Bruker Avance 300 and Bruker ARX 400 spectrometers. Chemical shifts (ppm) are given relative to solvent: references for CDCl_3 were 7.26 ppm (^1H NMR) and 77.00 ppm (^{13}C NMR). Multiplets were assigned as s (singlet), br.s (broad singlet), d (doublet), t (triplet), q (quartet), sept (septuplet), dd (doublet of doublet), dt (doublet of triplets), td (triplet of doublets) and m (multiplet). GC-yields were calculated using hexadecane as internal standard. All measurements were carried out at room temperature unless otherwise stated. Electron impact (EI) mass spectra were recorded on AMD 402 mass spectrometer (70 eV). High resolution mass spectra (HRMS) were recorded on Agilent 6210. The data are given as mass units per charge (m/z). Gas chromatography analysis was performed on an Agilent HP-7890A instrument with an FID detector and HP-5 capillary column (polydimethylsiloxane with 5% phenyl groups, 30 m, 0.32 mm i.d. 0.25 μm film thickness) using argon as carrier gas. The products were isolated from the reaction mixture by column chromatography on silica gel 60, 0.063-0.2 mm, 70-230 mesh (Merck).

2. General procedures

2.1 General methods to synthesis of oxime esters.^[1-5]

Method A



Reagents and conditions: (a) Allyl bromide, NaH, THF, 70 °C, overnight. (b) $\text{NH}_2\text{OH}\cdot\text{HCl}$, Pyridine, EtOH, 90 °C, overnight. (c) PhCOCl , Et_3N , DCM, rt, overnight.

Step 1

Under argon atmosphere, to a 100 mL bottomed flask was charged with ketone (10 mmol, 1.0 equiv.), dry THF (0.5 M) was added and the solution was cooled to 0 °C, then NaH (1.2 or 2.5 equiv. 60% dispersion in oil) was added into the solution in portions. After stirring for 0.5 hour at 0 °C, allyl bromide (1.1 or 2.2 equiv.) was added dropwise, then the solution was heated to 70 °C and stirred for overnight. The reaction was quenched with H_2O at 0 °C, and the aqueous layer was extracted with ethyl acetate. The combined organic layers were washed with brine, dried (Na_2SO_4). The solution was filtered, concentrated to give the corresponding crude unsaturated ketones, which were used in the next step without further purification.

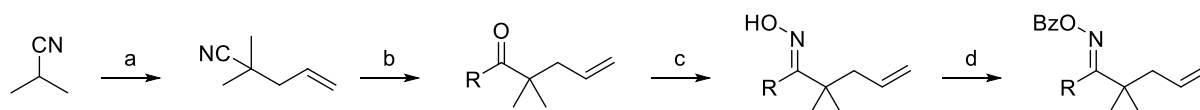
Step 2

A mixture of unsaturated ketone (1.0 equiv.), hydroxylamine hydrochloride (1.2 equiv.) and pyridine (2.0 equiv.) were dissolved in EtOH (0.5 M). The mixture stirred at 90 °C for overnight. Then EtOH was removed by concentration, added H_2O and the aqueous layer was extracted with ethyl acetate. The combined organic layers were washed with saturated NaHCO_3 solution, brine, dried (Na_2SO_4), and concentrated to give the crude unsaturated ketone oximes, which were used in the next step without further purification.

Step 3

To a mixture of unsaturated ketone oxime (1.0 equiv.), triethylamine (2.0 equiv.) and DCM (0.5 M) in a 100 mL three-necked flask was added benzoyl chloride (1.2 equiv) at room temperature. After addition, the reaction was allowed to continue for overnight. The reaction was quenched with an aqueous solution of saturated NaHCO_3 , and the aqueous layer was extracted with DCM. The combined organic layers were washed with brine, dried (Na_2SO_4). Then the solution was filtered, concentrated to give the crude oxime esters. Purification by column chromatography on silica gel (pentane/ethyl acetate 10:1), gave the corresponding products.

Method B



Reagents and conditions: (a) Et_2NH , $n\text{-BuLi}$, THF; Allyl bromide, 0 °C to rt, overnight. (b) Aryl Grignard reagent, 0 °C to 60 °C, overnight. (c) $\text{NH}_2\text{OH}\cdot\text{HCl}$, Pyridine, EtOH, 90 °C, overnight. (d) PhCOCl , Et_3N , DCM, rt, overnight.

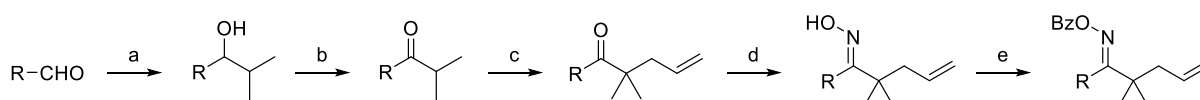
Step 1

Under argon atmosphere, to a 100 mL three-necked flask was charged with Et_2NH (11 mmol, 1.1 equiv.), dry THF (0.5 M) was added and the solution was cooled to 0 °C, then $n\text{-BuLi}$ (1.15 equiv. 2.5 M solution in hexanes) was added dropwise. After stirring for 1 hour at 0 °C, the isobutyronitrile (10 mmol, 1.0 equiv.) was added dropwise, and the solution was continued to stir for 1 hour at 0 °C. Next allyl bromide (11 mmol, 1.1 equiv. in 5 mL dry THF) was added dropwise at 0 °C, and the mixture was warmed to room temperature for overnight. The reaction was quenched with H_2O at 0 °C, and the aqueous layer was extracted with ethyl acetate. The combined organic layers were washed with brine, dried (Na_2SO_4). The solution was filtered, concentrated purification by column chromatography on silica gel (pentane/ethyl acetate 50:1) to give the corresponding product 2,2-dimethylpent-4-enenitrile.

Step 2

To a 100 mL three-necked flask was charged with 2,2-dimethylpent-4-enenitrile (1.0 equiv.), the flask was evacuated and backfilled with nitrogen (3 times). Dry THF (0.5 M) was added, and the solution was cooled to 0 °C, then aryl Grignard reagent (2.0 equiv.) was added dropwise. The mixture was heated to 60 °C and stirred for overnight. The reaction mixture was cooled to 0 °C and quenched with a 3 N hydrochloride solution, then warmed to room temperature and stirred for 3 hours. The aqueous layer was extracted with ethyl acetate. The combined organic layers were washed with brine, dried (Na_2SO_4). Then the solution was filtered, concentrated to give the crude unsaturated ketones, which were used in the next step without further purification. (Note: The main procedure follows the Method A, step 2 and Method A, step 3.)

Method C



Reagents and conditions: (a) Isopropyl or ethyl Grignard reagent, THF, 0 °C to rt, 30 h. (b) PCC, DCM, rt, 3 h. (c) Allyl bromide, NaH , THF, 70 °C, overnight. (d) $\text{NH}_2\text{OH}\cdot\text{HCl}$, Pyridine, EtOH, 90 °C, overnight. (e) PhCOCl , Et_3N , DCM, rt, overnight.

Step 1

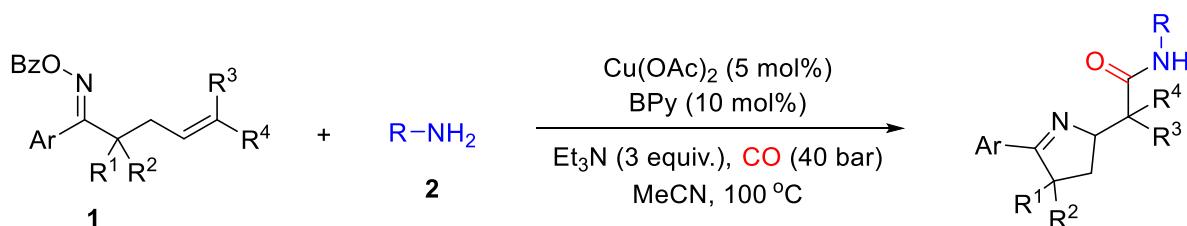
A 100 mL round bottomed flask charged with a solution of the aldehyde (10 mmol, 1.0 equiv.) in dry THF (0.5 M) was kept at 0 °C with stirring. The isopropyl or ethyl Grignard reagent (1.5 equiv.) was slowly added to the

solution and the resulting suspension was stirred at rt for 30 hours, then the reaction was quenched with saturated NH₄Cl solution at 0 °C, and the aqueous layer was extracted with ethyl acetate. The combined organic layers were washed with H₂O, brine, and dried over Na₂SO₄, next filtered and concentrated in vacuo. The crude product alcohol was directly used in the next step without further purification.

Step 2

To a solution of the alcohol in DCM was stirred at 0°C added pyridinium chlorochromate (PCC, 2.0 equiv.) slowly. The resulting mixture was allowed to warm to room temperature and stirred for 3 hours. The reaction was diluted with H₂O and extracted with ethyl acetate. The combined organic layers were washed with brine, dried over Na₂SO₄, filtered, and concentrated in vacuo. The crude ketone was purification by column chromatography on silica gel (pentane/ethyl acetate 50:1) to give the corresponding product ketone. (Note: The main procedure follows the Method A, step 1-3)

2.2 General procedure for carbonylation reactions

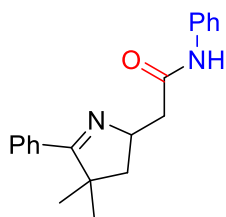


To each screw-cap vial (4 mL) equipped with a septum, a small cannula, and a stirring bar was added oxime ester **1** (0.3 mmol), 2,2'-bipyridine (3.1 mg, 10 mol%) and Cu(OAc)₂ (1.8 mg, 5 mol%), then added MeCN (2 mL), a mine **2** (0.2 mmol) and Et₃N (0.6 mmol). These vials were placed on an alloy plate and transferred into a 300 mL autoclave of the 4560 series from Parr instruments. After flushing the autoclave three times with CO, a pressure of 40 bar CO was set, and the reaction was performed for 20 hours at 100 °C (aluminum block). Afterward, the autoclave was cooled to room temperature and the pressure was released carefully. The organic phase was removed under reduced pressure and the crude products were purified by column chromatography on silica gel (eluent: pentane/ethyl acetate = 5:1 to 0:1).

1 mmol scale: To a screw-cap vial (12 mL) equipped with a septum, a small cannula, and a stirring bar was added 2,2-dimethyl-1-phenylpent-4-en-1-one *O*-benzoyl oxime **1a** (1.25 mmol), 2,2'-bipyridine (6.2 mg, 4 mol%) and Cu(OAc)₂ (3.6 mg, 2 mol%), then added MeCN (7 mL), aniline **2a** (1.0 mmol) and Et₃N (3.0 mmol). These vials were placed on an alloy plate and transferred into a 300 mL autoclave of the 4560 series from Parr instruments. After flushing the autoclave three times with CO, a pressure of 40 bar CO was set, and the reaction was performed for 20 hours at 100 °C (aluminum block). Afterward, the autoclave was cooled to room temperature and the pressure was released carefully. The organic phase was removed under reduced pressure and the crude products were purified by column chromatography on silica gel (eluent: pentane/ethyl acetate = 5:1 to 2:1) to give the product **3a** in 85% yield (260.4 mg).

3. Analytical data

2-(4,4-Dimethyl-5-phenyl-3,4-dihydro-2H-pyrrol-2-yl)-N-phenylacetamide (**3a**)



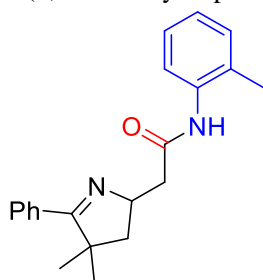
55.2 mg, yellow oil, yield: 90%. Eluent: pentane/ethyl acetate = 5/1 to 2/1.

¹H NMR (300 MHz, CDCl₃) δ 10.27 (br.s, 1H), 7.83 – 7.77 (m, 2H), 7.62 – 7.55 (m, 2H), 7.49 – 7.40 (m, 3H), 7.33 – 7.28 (m, 2H), 7.10 – 7.03 (m, 1H), 4.42 – 4.29 (m, 1H), 2.71 (dd, *J* = 15.6, 4.0 Hz, 1H), 2.61 (dd, *J* = 15.6, 10.3 Hz, 1H), 2.20 (dd, *J* = 12.6, 6.6 Hz, 1H), 1.61 (dd, *J* = 12.6, 9.3 Hz, 1H), 1.41 (s, 3H), 1.40 (s, 3H).

¹³C NMR (75 MHz, CDCl₃) δ 180.1, 170.1, 138.6, 133.8, 130.1, 128.8, 128.4, 127.9, 123.6, 119.7, 64.1, 50.0, 48.5, 44.2, 27.0, 25.5.

HR-MS (ESI-TOF) calcd. for C₂₀H₂₂N₂O [M+H]⁺: 307.1810; found: 307.1813; [M+Na]⁺: 329.1624; found: 329.1632.

2-(4,4-Dimethyl-5-phenyl-3,4-dihydro-2H-pyrrol-2-yl)-N-(*o*-tolyl)acetamide (**3b**)



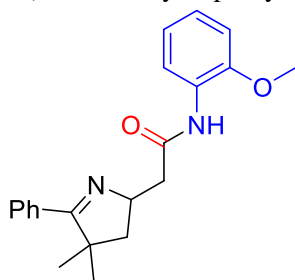
59.6 mg, yellow oil, yield: 93%. Eluent: pentane/ethyl acetate = 5/1 to 2/1.

¹H NMR (400 MHz, CDCl₃) δ 10.05 (br.s, 1H), 8.08 (dd, *J* = 8.3, 1.3 Hz, 1H), 7.84 – 7.74 (m, 2H), 7.49 – 7.41 (m, 3H), 7.23 (td, *J* = 7.8, 1.6 Hz, 1H), 7.17 (dd, *J* = 7.1, 1.3 Hz, 1H), 7.05 (td, *J* = 7.5, 1.3 Hz, 1H), 4.51 – 4.33 (m, 1H), 2.80 (dd, *J* = 15.5, 3.5 Hz, 1H), 2.69 (dd, *J* = 15.5, 10.7 Hz, 1H), 2.28 (s, 3H), 2.24 (dd, *J* = 12.6, 6.6 Hz, 1H), 1.67 (dd, *J* = 12.6, 9.3 Hz, 1H), 1.45 (s, 3H), 1.43 (s, 3H).

¹³C NMR (101 MHz, CDCl₃) δ 180.5, 170.2, 136.7, 133.7, 130.2, 130.0, 128.4, 128.2, 127.9, 126.4, 124.1, 122.3, 64.3, 50.0, 48.3, 44.2, 26.9, 25.6, 18.3.

HR-MS (ESI-TOF) calcd. for C₂₁H₂₄N₂O [M+H]⁺: 321.1967; found: 321.1965; [M+Na]⁺: 343.1781; found: 343.1785.

2-(4,4-Dimethyl-5-phenyl-3,4-dihydro-2H-pyrrol-2-yl)-N-(2-methoxyphenyl)acetamide (**3c**)



63.2 mg, yellow oil, yield: 94%. Eluent: pentane/ethyl acetate = 5/1 to 2/1.

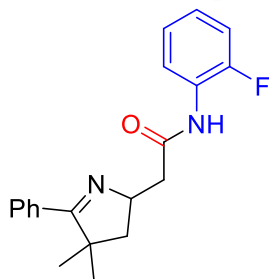
¹H NMR (300 MHz, CDCl₃) δ 10.09 (br.s, 1H), 8.48 (dd, *J* = 7.8, 1.9 Hz, 1H), 7.94 – 7.85 (m, 2H), 7.47 – 7.37 (m, 3H), 7.01 (td, *J* = 7.7, 1.9 Hz, 1H), 6.95 (td, *J* = 7.7, 1.7 Hz, 1H), 6.85 (dd, *J* = 7.8, 1.7 Hz, 1H), 4.43 – 4.31

(m, 1H), 3.75 (s, 3H), 2.77 (dd, $J = 15.0, 4.7$ Hz, 1H), 2.69 (dd, $J = 15.0, 9.3$ Hz, 1H), 2.20 (dd, $J = 12.5, 6.7$ Hz, 1H), 1.62 (dd, $J = 12.5, 9.3$ Hz, 1H), 1.41 (s, 6H).

^{13}C NMR (75 MHz, CDCl_3) δ 179.6, 170.0, 148.2, 134.0, 129.9, 128.3, 128.1, 123.2, 120.8, 120.0, 109.8, 64.2, 55.4, 50.0, 48.5, 44.8, 27.1, 25.6.

HR-MS (ESI-TOF) calcd. for $\text{C}_{21}\text{H}_{24}\text{N}_2\text{O}_2$ $[\text{M}+\text{H}]^+$: 337.1916; found: 337.1914; $[\text{M}+\text{Na}]^+$: 359.1730; found: 359.1734.

2-(4,4-Dimethyl-5-phenyl-3,4-dihydro-2H-pyrrol-2-yl)-N-(2-fluorophenyl)acetamide (**3d**)



51.9 mg, yellow oil, yield: 80%. Eluent: pentane/ethyl acetate = 5/1 to 2/1.

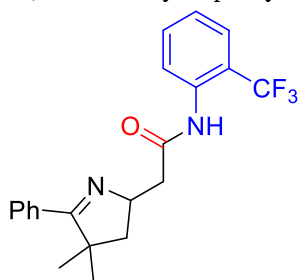
^1H NMR (300 MHz, CDCl_3) δ 10.59 (br.s, 1H), 8.43 (td, $J = 8.1, 1.8$ Hz, 1H), 7.95 – 7.83 (m, 2H), 7.47 – 7.39 (m, 3H), 7.14 – 6.99 (m, 3H), 4.41 – 4.30 (m, 1H), 2.76 (dd, $J = 15.6, 3.7$ Hz, 1H), 2.63 (dd, $J = 15.6, 10.7$ Hz, 1H), δ 2.21 (dd, $J = 12.6, 6.6$ Hz, 1H), 1.61 (dd, $J = 12.6, 9.2$ Hz, 1H), 1.44 (s, 3H), 1.42 (s, 3H).

^{13}C NMR (75 MHz, CDCl_3) δ 179.7, 170.3, 152.6 (d, $J = 244.0$ Hz), 133.4, 130.2, 128.3, 128.1 (d, $J = 1.7$ Hz), 127.1 (d, $J = 10.5$ Hz), 124.3 (d, $J = 3.6$ Hz), 123.6 (d, $J = 7.5$ Hz), 121.7 (d, $J = 1.6$ Hz), 114.7 (d, $J = 19.2$ Hz), 63.8, 50.0, 48.6, 44.4, 27.2, 25.6.

^{19}F NMR (282 MHz, CDCl_3) δ -129.2.

HR-MS (ESI-TOF) calcd. for $\text{C}_{20}\text{H}_{21}\text{FN}_2\text{O}$ $[\text{M}+\text{H}]^+$: 325.1716; found: 325.1716.

2-(4,4-Dimethyl-5-phenyl-3,4-dihydro-2H-pyrrol-2-yl)-N-(2-(trifluoromethyl)phenyl)acetamide (**3e**)



48.7 mg, yellow oil, yield: 65%. Eluent: pentane/ethyl acetate = 5/1 to 2/1.

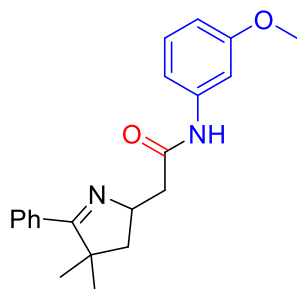
^1H NMR (300 MHz, CDCl_3) δ 10.14 (br.s, 1H), 8.08 (d, $J = 8.3$ Hz, 1H), 7.82 – 7.72 (m, 2H), 7.63 – 7.50 (m, 2H), 7.44 – 7.37 (m, 3H), 7.25 – 7.18 (m, 1H), 4.43 – 4.32 (m, 1H), 2.74 (dd, $J = 15.7, 4.3$ Hz, 1H), 2.66 (dd, $J = 15.7, 10.2$ Hz, 1H), 2.21 (dd, $J = 12.5, 6.6$ Hz, 1H), 1.60 (dd, $J = 12.5, 9.3$ Hz, 1H), 1.41 (s, 6H).

^{13}C NMR (75 MHz, CDCl_3) δ 180.1, 170.7, 135.5, 133.7, 132.4, 130.0, 128.1, 128.0, 126.2, 123.6 (q, $J = 5.5$ Hz), 124.5, 123.9 (q, $J = 273.2$ Hz), 63.9, 50.1, 48.5, 44.2, 27.1, 25.6.

^{19}F NMR (282 MHz, CDCl_3) δ -60.9.

HR-MS (ESI-TOF) calcd. for $\text{C}_{21}\text{H}_{21}\text{F}_3\text{N}_2\text{O}$ $[\text{M}+\text{H}]^+$: 375.1684; found: 375.1684; $[\text{M}+\text{Na}]^+$: 397.1498; found: 397.1503.

2-(4,4-Dimethyl-5-phenyl-3,4-dihydro-2H-pyrrol-2-yl)-N-(3-methoxyphenyl)acetamide (**3f**)



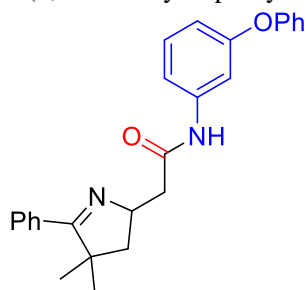
61.2 mg, yellow oil, yield: 91%. Eluent: pentane/ethyl acetate = 5/1 to 2/1.

¹H NMR (300 MHz, CDCl₃) δ 10.27 (br.s, 1H), 7.85 – 7.74 (m, 2H), 7.51 – 7.40 (m, 3H), 7.38 (t, *J* = 2.2 Hz, 1H), 7.19 (t, *J* = 8.1 Hz, 1H), 7.02 (ddd, *J* = 8.0, 2.0, 0.9 Hz, 1H), 6.63 (ddd, *J* = 8.2, 2.5, 1.0 Hz, 1H), 4.41 – 4.29 (m, 1H), 3.79 (s, 3H), 2.71 (dd, *J* = 15.5, 3.8 Hz, 1H), 2.59 (dd, *J* = 15.5, 10.4 Hz, 1H), 2.20 (dd, *J* = 12.6, 6.6 Hz, 1H), 1.60 (dd, *J* = 12.6, 9.3 Hz, 1H), 1.41 (s, 3H), 1.41 (s, 3H).

¹³C NMR (75 MHz, CDCl₃) δ 180.1, 170.1, 160.1, 139.8, 133.8, 130.2, 129.5, 128.4, 127.9, 111.9, 109.6, 105.3, 64.1, 55.2, 50.0, 48.5, 44.2, 27.1, 25.5.

HR-MS (ESI-TOF) calcd. for C₂₁H₂₄N₂O₂ [M+H]⁺: 337.1916; found: 337.1916.

2-(4,4-Dimethyl-5-phenyl-3,4-dihydro-2H-pyrrol-2-yl)-N-(3-phenoxyphenyl)acetamide (**3g**)



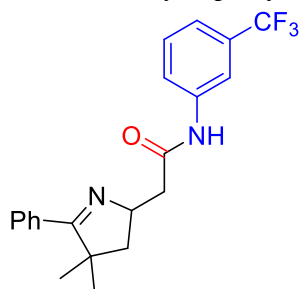
72.5 mg, yellow oil, yield: 91%. Eluent: pentane/ethyl acetate = 5/1 to 2/1.

¹H NMR (300 MHz, CDCl₃) δ 10.36 (br.s, 1H), 7.80 – 7.71 (m, 2H), 7.47 – 7.36 (m, 4H), 7.35 – 7.28 (m, 3H), 7.24 (t, *J* = 8.0 Hz, 1H), 7.12 – 7.06 (m, 1H), 7.06 – 7.00 (m, 2H), 6.72 (ddd, *J* = 7.9, 2.4, 1.3 Hz, 1H), 4.40 – 4.27 (m, 1H), 2.69 (dd, *J* = 15.6, 4.0 Hz, 1H), 2.58 (dd, *J* = 15.6, 10.3 Hz, 1H), 2.19 (dd, *J* = 12.6, 6.6 Hz, 1H), 1.59 (dd, *J* = 12.6, 9.3 Hz, 1H), 1.40 (s, 6H).

¹³C NMR (75 MHz, CDCl₃) δ 180.1, 170.1, 157.6, 157.0, 140.0, 133.7, 130.1, 129.8, 129.6, 128.3, 127.8, 123.2, 118.9, 114.5, 113.9, 110.4, 64.0, 50.0, 48.4, 44.1, 27.0, 25.5.

HR-MS (ESI-TOF) calcd. for C₂₆H₂₆N₂O₂ [M+H]⁺: 399.2072; found: 399.2075; [M+Na]⁺: 421.1886; found: 421.1889.

2-(4,4-Dimethyl-5-phenyl-3,4-dihydro-2H-pyrrol-2-yl)-N-(3-(trifluoromethyl)phenyl)acetamide (**3h**)



67.4 mg, yellow oil, yield: 90%. Eluent: pentane/ethyl acetate = 5/1 to 2/1.

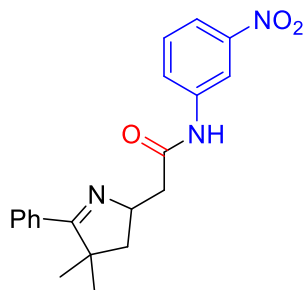
¹H NMR (400 MHz, CDCl₃) δ 10.63 (br.s, 1H), 7.92 (s, 1H), 7.80 – 7.73 (m, 3H), 7.48 – 7.38 (m, 4H), 7.34 – 7.28 (m, 1H), 4.43 – 4.34 (m, 1H), 2.77 (dd, *J* = 15.4, 3.6 Hz, 1H), 2.62 (dd, *J* = 15.4, 10.3 Hz, 1H), 2.22 (dd, *J* = 12.6, 6.6 Hz, 1H), 1.67 (dd, *J* = 12.6, 9.3 Hz, 1H), 1.42 (s, 3H), 1.40 (s, 3H).

¹³C NMR (101 MHz, CDCl₃) δ 180.9, 170.3, 139.1, 133.5, 131.2 (q, *J* = 32.2 Hz), 130.3, 129.3, 128.4, 127.9, 123.9 (q, *J* = 272.3 Hz), 122.6, 120.1 (q, *J* = 3.9 Hz), 116.3 (q, *J* = 4.0 Hz), 64.0, 50.2, 48.1, 43.9, 27.0, 25.6.

¹⁹F NMR (376 MHz, CDCl₃) δ -62.7.

HR-MS (ESI-TOF) calcd. for C₂₁H₂₁F₃N₂O [M+H]⁺: 375.1684; found: 375.1687; [M+Na]⁺: 397.1498; found: 397.1502.

2-(4,4-Dimethyl-5-phenyl-3,4-dihydro-2*H*-pyrrol-2-yl)-*N*-(3-nitrophenyl)acetamide (**3i**)



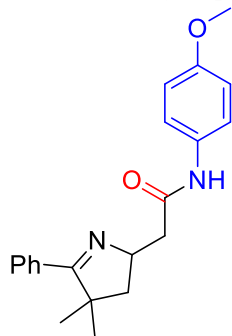
52.7 mg, yellow oil, yield: 75%. Eluent: pentane/ethyl acetate = 5/1 to 2/1.

¹H NMR (300 MHz, CDCl₃) δ 10.92 (br.s, 1H), 8.46 (t, *J* = 2.2 Hz, 1H), 7.96 – 7.86 (m, 2H), 7.84 – 7.73 (m, 2H), 7.52 – 7.40 (m, 4H), 4.42 – 4.29 (m, 1H), 2.75 (dd, *J* = 15.8, 3.4 Hz, 1H), 2.59 (dd, *J* = 15.8, 11.0 Hz, 1H), 2.23 (dd, *J* = 12.6, 6.6 Hz, 1H), 1.61 (dd, *J* = 12.6, 9.3 Hz, 1H), 1.42 (s, 6H).

¹³C NMR (75 MHz, CDCl₃) δ 180.6, 170.6, 148.5, 139.7, 133.6, 130.4, 129.6, 128.5, 127.8, 125.3, 118.2, 114.4, 63.8, 50.1, 48.5, 44.0, 27.0, 25.5.

HR-MS (ESI-TOF) calcd. for C₂₀H₂₁N₃O₃ [M+H]⁺: 352.1661; found: 352.1664; [M+Na]⁺: 374.1475; found: 374.1483.

2-(4,4-Dimethyl-5-phenyl-3,4-dihydro-2*H*-pyrrol-2-yl)-*N*-(4-methoxyphenyl)acetamide (**3j**)



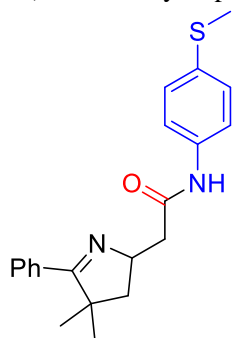
57.2 mg, yellow oil, yield: 85%. Eluent: pentane/ethyl acetate = 5/1 to 2/1.

¹H NMR (300 MHz, CDCl₃) δ 10.04 (br.s, 1H), 7.81 – 7.74 (m, 2H), 7.52 – 7.46 (m, 2H), 7.46 – 7.39 (m, 3H), 6.87 – 6.81 (m, 2H), 4.44 – 4.30 (m, 1H), 3.77 (s, 3H), 2.72 (dd, *J* = 15.4, 4.1 Hz, 1H), 2.61 (dd, *J* = 15.4, 9.8 Hz, 1H), 2.19 (dd, *J* = 12.6, 6.6 Hz, 1H), 1.65 (dd, *J* = 12.6, 9.2 Hz, 1H), 1.40 (s, 3H), 1.39 (s, 3H).

¹³C NMR (75 MHz, CDCl₃) δ 180.3, 169.7, 155.9, 133.7, 131.8, 130.1, 128.3, 127.8, 121.3, 114.0, 64.2, 55.4, 50.1, 48.1, 43.8, 27.0, 25.6.

HR-MS (ESI-TOF) calcd. for C₂₁H₂₄N₂O₂ [M+H]⁺: 337.1916; found: 337.1921.

2-(4,4-Dimethyl-5-phenyl-3,4-dihydro-2H-pyrrol-2-yl)-N-(4-(methylthio)phenyl)acetamide (**3k**)



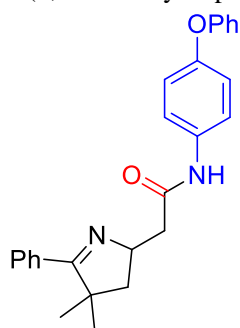
62.0 mg, yellow oil, yield: 88%. Eluent: pentane/ethyl acetate = 5/1 to 2/1.

¹H NMR (300 MHz, CDCl₃) δ 10.27 (br.s, 1H), 7.80 – 7.72 (m, 2H), 7.55 – 7.48 (m, 2H), 7.48 – 7.39 (m, 3H), 7.25 – 7.19 (m, 2H), 4.41 – 4.29 (m, 1H), 2.71 (dd, *J* = 15.5, 3.8 Hz, 1H), 2.59 (dd, *J* = 15.5, 10.3 Hz, 1H), 2.45 (s, 3H), 2.19 (dd, *J* = 12.6, 6.6 Hz, 1H), 1.62 (dd, *J* = 12.6, 9.3 Hz, 1H), 1.41 (s, 3H), 1.39 (s, 3H).

¹³C NMR (75 MHz, CDCl₃) δ 180.3, 170.0, 136.4, 133.7, 132.5, 130.1, 128.4, 128.1, 127.8, 120.3, 64.1, 50.1, 48.3, 44.0, 27.0, 25.6, 16.9.

HR-MS (ESI-TOF) calcd. for C₂₁H₂₄N₂OS [M+H]⁺: 353.1687; found: 353.1688; [M+Na]⁺: 375.1501; found: 375.1508.

2-(4,4-Dimethyl-5-phenyl-3,4-dihydro-2H-pyrrol-2-yl)-N-(4-phenoxyphenyl)acetamide (**3l**)



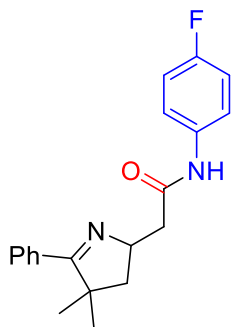
62.9 mg, yellow oil, yield: 79%. Eluent: pentane/ethyl acetate = 5/1 to 2/1.

¹H NMR (300 MHz, CDCl₃) δ 10.27 (br.s, 1H), 7.82 – 7.74 (m, 2H), 7.61 – 7.53 (m, 2H), 7.48 – 7.41 (m, 3H), 7.34 – 7.27 (m, 2H), 7.10 – 7.03 (m, 1H), 7.01 – 6.95 (m, 4H), 4.44 – 4.32 (m, 1H), 2.75 (dd, *J* = 15.4, 3.9 Hz, 1H), 2.63 (dd, *J* = 15.4, 10.1 Hz, 1H), 2.21 (dd, *J* = 12.6, 6.6 Hz, 1H), 1.65 (dd, *J* = 12.6, 9.2 Hz, 1H), 1.42 (s, 3H), 1.41 (s, 3H).

¹³C NMR (75 MHz, CDCl₃) δ 180.4, 169.9, 157.8, 152.7, 134.3, 133.7, 130.1, 129.6, 128.4, 127.8, 122.7, 121.3, 119.7, 118.1, 64.1, 50.1, 48.2, 43.9, 27.0, 25.6.

HR-MS (ESI-TOF) calcd. for C₂₆H₂₆N₂O₂ [M+H]⁺: 399.2072; found: 399.2065; [M+Na]⁺: 421.1886; found: 421.1880.

2-(4,4-Dimethyl-5-phenyl-3,4-dihydro-2H-pyrrol-2-yl)-N-(4-fluorophenyl)acetamide (**3m**)



53.8 mg, yellow oil, yield: 83%. Eluent: pentane/ethyl acetate = 5/1 to 2/1.

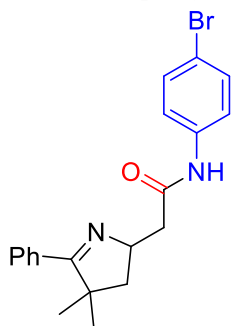
¹H NMR (300 MHz, CDCl₃) δ 10.30 (br.s, 1H), 7.79 – 7.72 (m, 2H), 7.57 – 7.51 (m, 2H), 7.47 – 7.41 (m, 3H), 7.03 – 6.93 (m, 2H), 4.42 – 4.30 (m, 1H), 2.73 (dd, *J* = 15.5, 3.8 Hz, 1H), 2.59 (dd, *J* = 15.5, 10.3 Hz, 1H), 2.20 (dd, *J* = 12.6, 6.6 Hz, 1H), 1.64 (dd, *J* = 12.6, 9.2 Hz, 1H), 1.41 (s, 3H), 1.39 (s, 3H).

¹³C NMR (75 MHz, CDCl₃) δ 180.5, 170.0, 158.9 (d, *J* = 242.4 Hz), 134.7 (d, *J* = 2.8 Hz), 133.7, 130.2, 128.4, 127.8, 121.3 (d, *J* = 7.7 Hz), 115.4 (d, *J* = 22.3 Hz), 64.1, 50.1, 48.2, 43.9, 27.0, 25.6.

¹⁹F NMR (282 MHz, CDCl₃) δ -119.0.

HR-MS (ESI-TOF) calcd. for C₂₀H₂₁FN₂O [M+H]⁺: 325.1716; found: 325.1716; [M+Na]⁺: 347.1530; found: 347.1536.

N-(4-Bromophenyl)-2-(4,4-dimethyl-5-phenyl-3,4-dihydro-2H-pyrrol-2-yl)acetamide (**3n**)



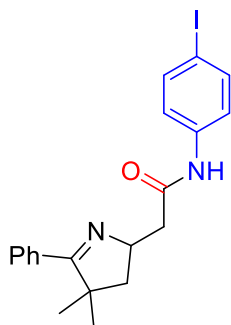
68.6 mg, yellow oil, yield: 89%. Eluent: pentane/ethyl acetate = 5/1 to 2/1.

¹H NMR (300 MHz, CDCl₃) δ 10.42 (br.s, 1H), 7.80 – 7.72 (m, 2H), 7.52 – 7.44 (m, 4H), 7.44 – 7.36 (m, 3H), 4.41 – 4.29 (m, 1H), 2.72 (dd, *J* = 15.5, 3.7 Hz, 1H), 2.58 (dd, *J* = 15.5, 10.4 Hz, 1H), 2.20 (dd, *J* = 12.6, 6.6 Hz, 1H), 1.63 (dd, *J* = 12.6, 9.3 Hz, 1H), 1.41 (s, 3H), 1.39 (s, 3H).

¹³C NMR (75 MHz, CDCl₃) δ 180.6, 170.1, 137.7, 133.6, 131.7, 130.2, 128.4, 127.8, 121.2, 116.0, 64.0, 50.1, 48.2, 44.0, 27.0, 25.6.

HR-MS (ESI-TOF) calcd. for C₂₀H₂₁BrN₂O [M+H]⁺: 385.0916; found: 385.0924; [M+Na]⁺: 407.0729; found: 407.0739.

2-(4,4-Dimethyl-5-phenyl-3,4-dihydro-2H-pyrrol-2-yl)-N-(4-iodophenyl)acetamide (**3o**)



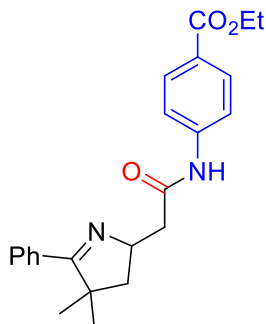
76.9 mg, yellow oil, yield: 89%. Eluent: pentane/ethyl acetate = 5/1 to 2/1.

$^1\text{H NMR}$ (300 MHz, CDCl_3) δ 10.44 (br.s, 1H), 7.81 – 7.72 (m, 2H), 7.62 – 7.55 (m, 2H), 7.50 – 7.40 (m, 3H), 7.39 – 7.32 (m, 2H), 4.39 – 4.26 (m, 1H), 2.69 (dd, $J = 15.7, 3.6$ Hz, 1H), 2.56 (dd, $J = 15.7, 10.7$ Hz, 1H), 2.20 (dd, $J = 12.5, 6.5$ Hz, 1H), 1.59 (dd, $J = 12.5, 9.3$ Hz, 1H), 1.41 (s, 3H), 1.40 (s, 3H).

$^{13}\text{C NMR}$ (75 MHz, CDCl_3) δ 180.3, 170.2, 138.4, 137.7, 133.7, 130.2, 128.4, 127.8, 121.5, 86.5, 64.0, 50.0, 48.4, 44.1, 27.0, 25.5.

HR-MS (ESI-TOF) calcd. for $\text{C}_{20}\text{H}_{21}\text{IN}_2\text{O}$ $[\text{M}+\text{H}]^+$: 433.0777; found: 433.0782; $[\text{M}+\text{H}]^+$: 455.0591; found: 455.0598.

Ethyl 4-(2-(4,4-dimethyl-5-phenyl-3,4-dihydro-2H-pyrrol-2-yl)acetamido)benzoate (**3p**)



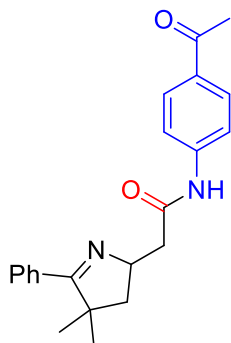
65.9 mg, yellow oil, yield: 87%. Eluent: pentane/ethyl acetate = 5/1 to 2/1.

$^1\text{H NMR}$ (300 MHz, CDCl_3) δ 10.62 (br.s, 1H), 8.02 – 7.96 (m, 2H), 7.78 – 7.72 (m, 2H), 7.70 – 7.63 (m, 2H), 7.47 – 7.40 (m, 3H), 4.44 – 4.29 (m, 1H), 4.34 (q, $J = 7.0$ Hz, 2H), 2.78 (dd, $J = 15.4, 3.8$ Hz, 1H), 2.62 (dd, $J = 15.4, 10.0$ Hz, 1H), 2.20 (dd, $J = 12.7, 6.7$ Hz, 1H), 1.67 (dd, $J = 12.7, 9.2$ Hz, 1H), 1.42 (s, 3H), 1.38 (s, 3H), 1.37 (t, $J = 7.1$ Hz, 3H).

$^{13}\text{C NMR}$ (75 MHz, CDCl_3) δ 180.9, 170.3, 166.2, 142.7, 133.4, 130.6, 130.3, 128.4, 127.8, 125.2, 118.7, 63.9, 60.6, 50.2, 47.8, 44.0, 26.9, 25.6, 14.3.

HR-MS (ESI-TOF) calcd. for $\text{C}_{23}\text{H}_{26}\text{N}_2\text{O}_3$ $[\text{M}+\text{H}]^+$: 379.2021; found: 379.2023.

N-(4-acetylphenyl)-2-(4,4-dimethyl-5-phenyl-3,4-dihydro-2H-pyrrol-2-yl)acetamide (**3q**)



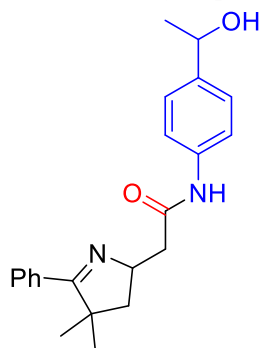
64.8 mg, yellow oil, yield: 93%. Eluent: pentane/ethyl acetate = 5/1 to 2/1.

¹H NMR (300 MHz, CDCl₃) δ 10.72 (br.s, 1H), 7.94 – 7.87 (m, 2H), 7.82 – 7.72 (m, 2H), 7.70 – 7.63 (m, 2H), 7.50 – 7.39 (m, 3H), 4.41 – 4.29 (m, 1H), 2.72 (dd, *J* = 15.6, 3.9 Hz, 1H), 2.60 (dd, *J* = 15.6, 10.4 Hz, 1H), 2.54 (s, 3H), 2.20 (dd, *J* = 12.5, 6.5 Hz, 1H), 1.60 (dd, *J* = 12.5, 9.3 Hz, 1H), 1.40 (s, 3H), 1.39 (s, 3H).

¹³C NMR (75 MHz, CDCl₃) δ 196.9, 180.5, 170.4, 143.0, 133.6, 132.2, 130.2, 129.6, 128.4, 127.8, 118.8, 63.9, 50.1, 48.2, 44.1, 26.9, 26.3, 25.5.

HR-MS (ESI-TOF) calcd. for C₂₂H₂₄N₂O₂ [M+H]⁺: 349.1916; found: 349.1921; [M+Na]⁺: 371.1730; found: 371.1740.

2-(4,4-Dimethyl-5-phenyl-3,4-dihydro-2*H*-pyrrol-2-yl)-*N*-(4-(1-hydroxyethyl)phenyl)acetamide (**3r**)



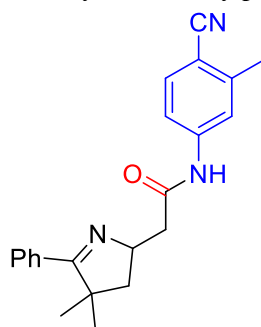
58.9 mg, yellow oil, yield: 84%. Eluent: pentane/ethyl acetate = 5/1 to 0/1.

¹H NMR (300 MHz, CDCl₃) δ 10.13 (br.s, 1H), 7.74 (dt, *J* = 7.6, 1.4 Hz, 2H), 7.50 (d, *J* = 8.5 Hz, 2H), 7.46 – 7.39 (m, 3H), 7.27 (d, *J* = 8.5 Hz, 2H), 4.80 (q, *J* = 6.4 Hz, 1H), 4.39 – 4.24 (m, 1H), 2.96 (br.s, 1H), 2.65 (dd, *J* = 15.5, 4.8 Hz, 1H), 2.58 (dd, *J* = 15.5, 9.2 Hz, 1H), 2.17 (dd, *J* = 12.6, 6.6 Hz, 1H), 1.60 (dd, *J* = 12.6, 9.3 Hz, 1H), 1.43 (d, *J* = 6.4 Hz, 3H), 1.37 (s, 3H), 1.37 (s, 3H).

¹³C NMR (75 MHz, CDCl₃) δ 180.3, 170.1, 141.4, 137.5, 133.7, 130.0, 128.3, 127.8, 125.9, 119.8, 69.7, 64.1, 50.1, 48.1, 43.8, 27.0, 25.5, 25.0.

HR-MS (ESI-TOF) calcd. for C₂₂H₂₆N₂O₂ [M+H]⁺: 351.2072; found: 351.2067; [M+H]⁺: 373.1886; found: 373.1881.

N-(4-Cyano-3-methylphenyl)-2-(4,4-dimethyl-5-phenyl-3,4-dihydro-2*H*-pyrrol-2-yl)acetamide (**3s**)



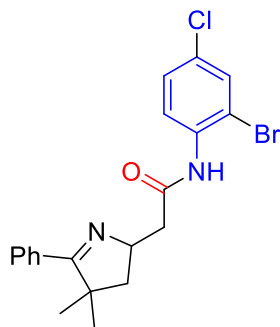
47.0 mg, yellow oil, yield: 68%. Eluent: pentane/ethyl acetate = 5/1 to 2/1.

¹H NMR (300 MHz, CDCl₃) δ 10.60 (br.s, 1H), 7.90 (d, *J* = 2.3 Hz, 1H), 7.79 – 7.72 (m, 2H), 7.61 (dd, *J* = 8.4, 2.4 Hz, 1H), 7.50 – 7.41 (m, 3H), 7.21 (dt, *J* = 8.4, 0.7 Hz, 1H), 4.39 – 4.28 (m, 1H), 2.70 (dd, *J* = 15.7, 3.4 Hz, 1H), 2.56 (dd, *J* = 15.7, 11.0 Hz, 1H), 2.48 (s, 3H), 2.21 (dd, *J* = 12.6, 6.6 Hz, 1H), 1.59 (dd, *J* = 12.6, 9.3 Hz, 1H), 1.41 (s, 3H), 1.40 (s, 3H).

¹³C NMR (75 MHz, CDCl₃) δ 180.6, 170.4, 136.9, 136.7, 133.6, 130.6, 130.3, 128.5, 127.8, 123.9, 123.0, 117.9, 112.9, 63.9, 50.1, 48.4, 44.0, 27.0, 25.5, 19.8.

HR-MS (ESI-TOF) calcd. for C₂₂H₂₃N₃O [M+H]⁺: 346.1919; found: 346.1917.

N-(2-Bromo-4-chlorophenyl)-2-(4,4-dimethyl-5-phenyl-3,4-dihydro-2*H*-pyrrol-2-yl)acetamide (**3t**)



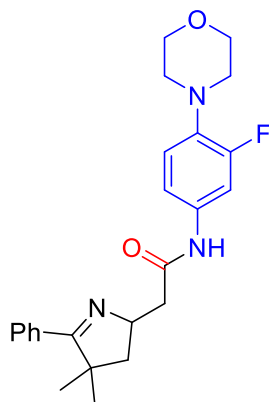
69.7 mg, yellow oil, yield: 83%. Eluent: pentane/ethyl acetate = 5/1 to 2/1.

$^1\text{H NMR}$ (300 MHz, CDCl_3) δ 10.26 (br.s, 1H), 8.34 (d, $J = 8.9$ Hz, 1H), 7.88–7.74 (m, 2H), 7.51 (d, $J = 2.4$ Hz, 1H), 7.44–7.37 (m, 3H), 7.26 (dd, $J = 8.9, 2.4$ Hz, 1H), 4.44–4.31 (m, 1H), 2.76 (dd, $J = 15.6, 3.9$ Hz, 1H), 2.66 (dd, $J = 15.6, 10.3$ Hz, 1H), 2.21 (dd, $J = 12.6, 6.6$ Hz, 1H), 1.61 (dd, $J = 12.6, 9.3$ Hz, 1H), 1.41 (s, 6H).

$^{13}\text{C NMR}$ (75 MHz, CDCl_3) δ 180.4, 170.5, 135.6, 133.6, 131.8, 130.1, 129.0, 128.2, 128.1, 128.0, 123.3, 113.9, 63.9, 50.2, 48.4, 44.5, 27.0, 25.5.

HR-MS (ESI-TOF) calcd. for $\text{C}_{20}\text{H}_{20}\text{BrClN}_2\text{O}$ $[\text{M}+\text{H}]^+$: 419.0526; found: 419.0528.

2-(4,4-Dimethyl-5-phenyl-3,4-dihydro-2*H*-pyrrol-2-yl)-*N*-(3-fluoro-4-morpholinophenyl)acetamide (**3u**)



77.0 mg, yellow oil, yield: 94%. Eluent: pentane/ethyl acetate = 5/1 to 2/1.

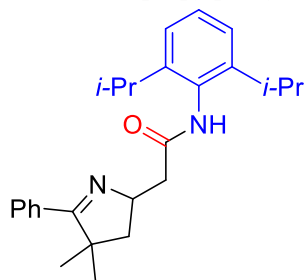
$^1\text{H NMR}$ (300 MHz, CDCl_3) δ 10.29 (br.s, 1H), 7.83–7.71 (m, 2H), 7.51 (dd, $J = 14.3, 2.4$ Hz, 1H), 7.48–7.36 (m, 3H), 7.13 (ddd, $J = 8.6, 2.5, 1.1$ Hz, 1H), 6.85 (t, $J = 9.0$ Hz, 1H), 4.42–4.22 (m, 1H), 3.90–3.78 (m, 4H), 3.08–2.94 (m, 4H), 2.68 (dd, $J = 15.6, 3.9$ Hz, 1H), 2.56 (dd, $J = 15.6, 10.4$ Hz, 1H), 2.22–2.15 (m, 1H), 1.58 (dd, $J = 12.6, 9.3$ Hz, 1H), 1.39 (s, 3H), 1.39 (s, 3H).

$^{13}\text{C NMR}$ (75 MHz, CDCl_3) δ 180.2, 169.9, 155.4 (d, $J = 245.3$ Hz), 135.8 (d, $J = 9.2$ Hz), 133.9 (d, $J = 10.7$ Hz), 133.7, 130.1, 128.4, 127.8, 118.7 (d, $J = 4.2$ Hz), 115.4 (d, $J = 3.3$ Hz), 108.7 (d, $J = 25.4$ Hz), 66.9, 64.0, 51.1 (d, $J = 2.9$ Hz), 50.0, 48.4, 44.0, 27.0, 25.5.

$^{19}\text{F NMR}$ (282 MHz, CDCl_3) δ -121.4.

HR-MS (ESI-TOF) calcd. for $\text{C}_{24}\text{H}_{28}\text{FN}_3\text{O}_2$ $[\text{M}+\text{H}]^+$: 410.2244; found: 410.2244; $[\text{M}+\text{Na}]^+$: 432.2057; found: 432.2060.

N-(2,6-Diisopropylphenyl)-2-(4,4-dimethyl-5-phenyl-3,4-dihydro-2*H*-pyrrol-2-yl)acetamide (**3v**)



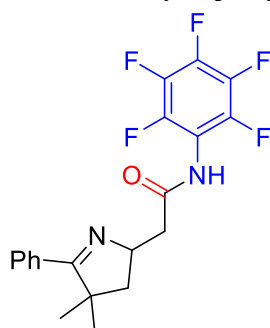
71.8 mg, yellow oil, yield: 92%. Eluent: pentane/ethyl acetate = 5/1 to 2/1.

¹H NMR (300 MHz, CDCl₃) δ 9.52 (br.s, 1H), 7.81–7.72 (m, 2H), 7.43–7.34 (m, 3H), 7.32–7.25 (m, 1H), 7.21–7.17 (m, 2H), 4.49–4.37 (m, 1H), 3.19 (sept, *J* = 6.9 Hz, 2H), 2.80 (dd, *J* = 15.6, 3.5 Hz, 1H), 2.64 (dd, *J* = 15.6, 10.8 Hz, 1H), 2.25 (dd, *J* = 12.6, 6.6 Hz, 1H), 1.66 (dd, *J* = 12.6, 9.2 Hz, 1H), 1.45 (s, 3H), 1.44 (s, 3H), 1.22 (t, *J* = 6.5 Hz, 12H).

¹³C NMR (75 MHz, CDCl₃) δ 179.9, 171.3, 145.9, 133.7, 132.0, 130.1, 128.2, 127.9, 127.8, 123.3, 64.4, 50.1, 48.6, 43.5, 28.8, 27.1, 25.7, 23.6.

HR-MS (ESI-TOF) calcd. for C₂₆H₃₄N₂O [M+H]⁺: 391.2749; found: 391.2750; [M+Na]⁺: 413.2563; found: 413.2571.

2-(4,4-Dimethyl-5-phenyl-3,4-dihydro-2*H*-pyrrol-2-yl)-*N*-(perfluorophenyl)acetamide (**3w**)



39.6 mg, yellow oil, yield: 50%. Eluent: pentane/ethyl acetate = 5/1 to 3/1.

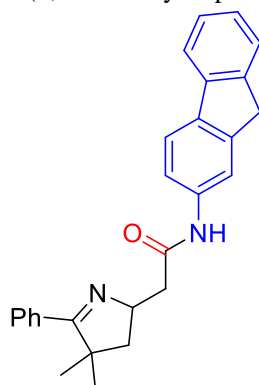
¹H NMR (300 MHz, CDCl₃) δ 10.38 (br.s, 1H), 7.80–7.70 (m, 2H), 7.48–7.37 (m, 3H), 4.43–4.31 (m, 1H), 2.84 (dd, *J* = 15.8, 3.4 Hz, 1H), 2.60 (dd, *J* = 15.8, 11.1 Hz, 1H), 2.23 (dd, *J* = 12.6, 6.6 Hz, 1H), 1.63 (dd, *J* = 12.6, 9.4 Hz, 1H), 1.43 (s, 3H), 1.42 (s, 3H).

¹³C NMR (75 MHz, CDCl₃) δ 180.6, 170.4, 133.4, 130.3, 128.4, 127.9, 63.7, 50.4, 48.3, 42.8, 27.0, 25.6.

¹⁹F NMR (282 MHz, CDCl₃) δ -143.5–-146.8 (m), -158.4 (t, *J* = 21.5 Hz), -161.9–-163.5 (m).

HR-MS (ESI-TOF) calcd. for C₂₀H₁₇F₅N₂O [M+H]⁺: 397.1339; found: 397.1339; [M+Na]⁺: 419.1153; found: 419.1155.

2-(4,4-Dimethyl-5-phenyl-3,4-dihydro-2*H*-pyrrol-2-yl)-*N*-(9*H*-fluoren-2-yl)acetamide (**3x**)



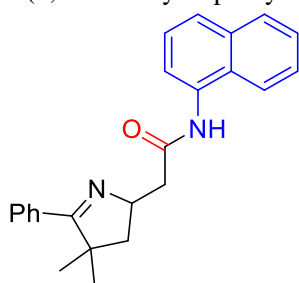
67.0 mg, yellow oil, yield: 85%. Eluent: pentane/ethyl acetate = 5/1 to 2/1.

¹H NMR (300 MHz, CDCl₃) δ 10.38 (br.s, 1H), 8.02 (s, 1H), 7.89 – 7.80 (m, 2H), 7.78 – 7.70 (m, 2H), 7.56 – 7.45 (m, 5H), 7.38 (t, *J* = 7.4 Hz, 1H), 7.29 (t, *J* = 7.4 Hz, 1H), 4.51 – 4.34 (m, 1H), 3.90 (s, 2H), 2.79 (dd, *J* = 15.5, 4.1 Hz, 1H), 2.69 (dd, *J* = 15.5, 10.0 Hz, 1H), 2.24 (dd, *J* = 12.5, 6.7 Hz, 1H), 1.68 (dd, *J* = 12.5, 9.2 Hz, 1H), 1.45 (s, 3H), 1.44 (s, 3H).

¹³C NMR (75 MHz, CDCl₃) δ 180.3, 170.0, 144.2, 143.1, 141.4, 137.5, 137.4, 133.7, 130.1, 128.3, 127.9, 126.6, 126.0, 124.8, 119.9, 119.3, 118.4, 116.6, 64.2, 50.0, 48.3, 44.1, 37.0, 27.0, 25.5.

HR-MS (ESI-TOF) calcd. for C₂₇H₂₆N₂O [M+H]⁺: 395.2123; found: 395.2126; [M+Na]⁺: 417.1937; found: 417.1943.

2-(4,4-Dimethyl-5-phenyl-3,4-dihydro-2*H*-pyrrol-2-yl)-*N*-(naphthalen-1-yl)acetamide (**3y**)



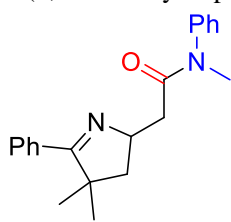
68.4 mg, yellow oil, yield: 96%. Eluent: pentane/ethyl acetate = 5/1 to 2/1.

¹H NMR (300 MHz, CDCl₃) δ 11.07 (br.s, 1H), 8.42 (d, *J* = 7.6 Hz, 1H), 8.22 (d, *J* = 8.6 Hz, 1H), 7.94 – 7.83 (m, 3H), 7.65 (d, *J* = 8.2 Hz, 1H), 7.56 – 7.44 (m, 5H), 7.33 – 7.24 (m, 1H), 4.58 – 4.43 (m, 1H), 2.92 (dd, *J* = 15.6, 3.4 Hz, 1H), 2.79 (dd, *J* = 15.6, 10.9 Hz, 1H), 2.28 (dd, *J* = 12.6, 6.6 Hz, 1H), 1.72 (dd, *J* = 12.6, 9.2 Hz, 1H), 1.48 (s, 3H), 1.47 (s, 3H).

¹³C NMR (75 MHz, CDCl₃) δ 180.9, 170.5, 133.9, 133.8, 133.7, 130.2, 129.8, 128.4, 128.3, 128.0, 125.9, 125.6, 125.6, 124.0, 121.4, 118.0, 64.3, 50.1, 48.2, 44.4, 27.0, 25.5.

HR-MS (ESI-TOF) calcd. for C₂₄H₂₄N₂O [M+H]⁺: 357.1967; found: 357.1973; [M+Na]⁺: 379.1781; found: 379.1788.

2-(4,4-Dimethyl-5-phenyl-3,4-dihydro-2*H*-pyrrol-2-yl)-*N*-methyl-*N*-phenylacetamide (**3z**)



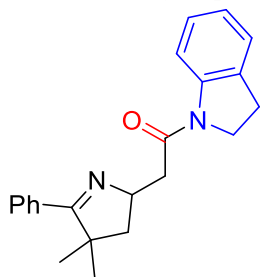
55.1 mg, yellow oil, yield: 86%. Eluent: pentane/ethyl acetate = 5/1 to 2/1.

¹H NMR (300 MHz, CDCl₃) δ 7.60 (dd, *J* = 7.4, 2.3 Hz, 2H), 7.41 – 7.27 (m, 6H), 7.25 – 7.17 (m, 2H), 4.51 – 4.38 (m, 1H), 3.28 (s, 3H), 2.87 (dd, *J* = 15.6, 5.3 Hz, 1H), 2.27 (dd, *J* = 12.6, 6.7 Hz, 1H), 2.14 (dd, *J* = 15.6, 9.2 Hz, 1H), 1.48 (dd, *J* = 12.6, 8.8 Hz, 1H), 1.31 (s, 3H), 1.24 (s, 3H).

¹³C NMR (75 MHz, CDCl₃) δ 179.7, 171.2, 143.9, 134.6, 129.6, 129.2, 127.9, 127.7, 127.6, 127.4, 65.2, 50.4, 48.4, 41.1, 37.2, 27.1, 25.7.

HR-MS (ESI-TOF) calcd. for C₂₁H₂₄N₂O [M+H]⁺: 321.1967; found: 321.1958; [M+H]⁺: 343.1781; found: 343.1785.

2-(4,4-Dimethyl-5-phenyl-3,4-dihydro-2H-pyrrol-2-yl)-1-(indolin-1-yl)ethan-1-one (**3aa**)



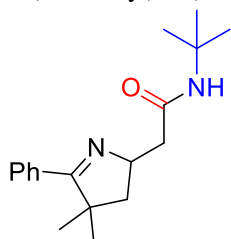
43.2 mg, yellow oil, yield: 65%. Eluent: pentane/ethyl acetate = 5/1 to 2/1.

¹H NMR (300 MHz, CDCl₃) δ 8.27 (d, *J* = 7.9 Hz, 1H), 7.74–7.65 (m, 2H), 7.41–7.34 (m, 3H), 7.24–7.15 (m, 2H), 7.01 (td, *J* = 7.4, 1.1 Hz, 1H), 4.64–4.50 (m, 1H), 4.23–4.03 (m, 2H), 3.26 (dd, *J* = 15.8, 4.7 Hz, 1H), 3.20 (t, *J* = 8.5 Hz, 2H), 2.52 (dd, *J* = 15.8, 9.3 Hz, 1H), 2.43 (dd, *J* = 12.7, 6.7 Hz, 1H), 1.67 (dd, *J* = 12.5, 8.8 Hz, 1H), 1.38 (s, 3H), 1.37 (s, 3H).

¹³C NMR (75 MHz, CDCl₃) δ 180.2, 169.6, 143.0, 134.7, 131.1, 129.5, 128.1, 127.8, 127.5, 124.5, 123.6, 117.0, 64.8, 50.7, 48.9, 48.1, 43.2, 28.0, 27.3, 25.7.

HR-MS (ESI-TOF) calcd. for C₂₂H₂₄N₂O [M+H]⁺: 333.1967; found: 333.1973; [M+Na]⁺: 355.1781; found: 355.1791.

N-(*tert*-Butyl)-2-(4,4-dimethyl-5-phenyl-3,4-dihydro-2H-pyrrol-2-yl)acetamide (**3ab**)



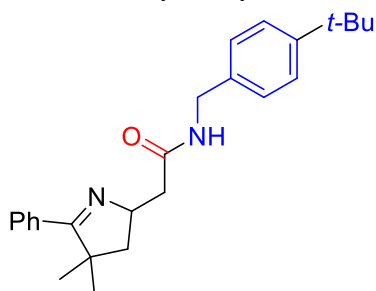
31.5 mg, yellow oil, yield: 55%. Eluent: pentane/ethyl acetate = 5/1 to 2/1.

¹H NMR (300 MHz, CDCl₃) δ 7.79–7.70 (m, 2H), 7.43–7.35 (m, 3H), 7.32 (br.s, 1H), 4.28–4.19 (m, 1H), 2.50 (dd, *J* = 15.0, 5.3 Hz, 1H), 2.44 (dd, *J* = 15.0, 8.2 Hz, 1H), 2.12 (dd, *J* = 12.6, 6.7 Hz, 1H), 1.59 (dd, *J* = 12.6, 9.3 Hz, 1H), 1.37 (s, 3H), 1.37 (s, 3H), 1.35 (s, 9H).

¹³C NMR (75 MHz, CDCl₃) δ 179.5, 170.9, 133.9, 129.9, 128.2, 127.8, 64.6, 50.7, 50.1, 48.0, 44.0, 28.8, 27.1, 25.6.

HR-MS (ESI-TOF) calcd. for C₁₈H₂₆N₂O [M+H]⁺: 287.2123; found: 287.2125; [M+Na]⁺: 309.1937; found: 309.1945.

N-(4-(*tert*-Butyl)benzyl)-2-(4,4-dimethyl-5-phenyl-3,4-dihydro-2H-pyrrol-2-yl)acetamide (**3ac**)



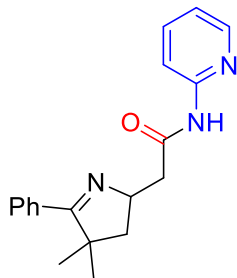
24.9 mg, yellow oil, yield: 33%. Eluent: pentane/ethyl acetate = 5/1 to 2/1.

¹H NMR (400 MHz, CDCl₃) δ 7.85 (br.s, 1H), 7.62–7.55 (m, 2H), 7.34–7.31 (m, 1H), 7.29–7.23 (m, 4H), 7.19–7.16 (m, 2H), 4.45 (dd, *J* = 14.8, 5.9 Hz, 1H), 4.32 (dd, *J* = 14.8, 5.2 Hz, 1H), 4.27–4.17 (m, 1H), 2.58 (dd, *J* = 15.2, 4.4 Hz, 1H), 2.44 (dd, *J* = 15.2, 9.4 Hz, 1H), 2.08 (dd, *J* = 12.5, 6.6 Hz, 1H), 1.52 (dd, *J* = 12.5, 9.2 Hz, 1H), 1.29 (s, 3H), 1.27 (s, 3H), 1.22 (s, 9H).

¹³C NMR (101 MHz, CDCl₃) δ 179.9, 171.6, 150.0, 135.6, 133.8, 129.9, 128.2, 127.9, 127.4, 125.4, 64.4, 50.1, 48.2, 43.0, 34.4, 31.3, 31.3, 27.1, 25.6.

HR-MS (ESI-TOF) calcd. for C₂₅H₃₂N₂O [M+H]⁺: 377.2593; found: 377.2585; [M+Na]⁺: 399.2407; found: 399.2414.

2-(4,4-Dimethyl-5-phenyl-3,4-dihydro-2H-pyrrol-2-yl)-N-(pyridin-2-yl)acetamide (**3ad**)



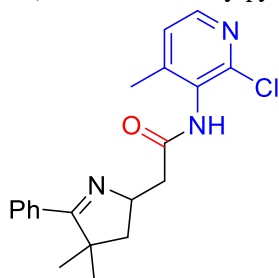
41.8 mg, yellow oil, yield: 68%. Eluent: pentane/ethyl acetate = 5/1 to 1/1.

¹H NMR (300 MHz, CDCl₃) δ 10.23 (br.s, 1H), 8.19–8.13 (m, 2H), 7.75–7.65 (m, 2H), 7.57 (ddd, *J* = 8.5, 7.3, 2.0 Hz, 1H), 7.33–7.27 (m, 3H), 6.92–6.86 (m, 1H), 4.39–4.26 (m, 1H), 2.67 (dd, *J* = 15.3, 8.8 Hz, 1H), 2.59 (dd, *J* = 15.3, 5.4 Hz, 1H), 2.10 (dd, *J* = 12.5, 6.6 Hz, 1H), 1.52 (dd, *J* = 12.5, 9.3 Hz, 1H), 1.29 (s, 3H), 1.27 (s, 3H).

¹³C NMR (75 MHz, CDCl₃) δ 180.1, 170.5, 151.8, 147.7, 138.1, 133.9, 129.9, 128.2, 128.0, 119.3, 114.2, 64.1, 50.2, 48.4, 44.3, 27.0, 25.5.

HR-MS (ESI-TOF) calcd. for C₁₉H₂₁N₃O [M+H]⁺: 308.1763; found: 308.1767.

N-(2-Chloro-4-methylpyridin-3-yl)-2-(4,4-dimethyl-5-phenyl-3,4-dihydro-2H-pyrrol-2-yl)acetamide (**3ae**)



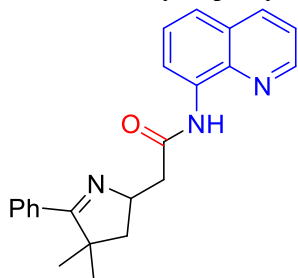
24.9 mg, yellow oil, yield: 35%. Eluent: pentane/ethyl acetate = 5/1 to 1/1.

¹H NMR (300 MHz, CDCl₃) δ 10.18 (br.s, 1H), 8.13 (d, *J* = 4.9 Hz, 1H), 7.87–7.70 (m, 2H), 7.44–7.36 (m, 3H), 7.12 (d, *J* = 4.9 Hz, 1H), 4.49–4.38 (m, 1H), 2.81 (dd, *J* = 15.6, 3.9 Hz, 1H), 2.66 (dd, *J* = 15.6, 10.6 Hz, 1H), 2.32 (s, 3H), 2.24 (dd, *J* = 12.6, 6.6 Hz, 1H), 1.67 (dd, *J* = 12.6, 9.3 Hz, 1H), 1.44 (s, 3H), 1.43 (s, 3H).

¹³C NMR (75 MHz, CDCl₃) δ 180.4, 170.3, 148.3, 147.8, 146.4, 133.5, 130.7, 130.3, 128.3, 128.0, 124.9, 64.0, 50.2, 48.3, 43.2, 27.1, 25.6, 19.0.

HR-MS (ESI-TOF) calcd. for C₂₀H₂₂ClN₃O [M+H]⁺: 356.1530; found: 356.1525.

2-(4,4-Dimethyl-5-phenyl-3,4-dihydro-2H-pyrrol-2-yl)-N-(quinolin-8-yl)acetamide (**3af**)



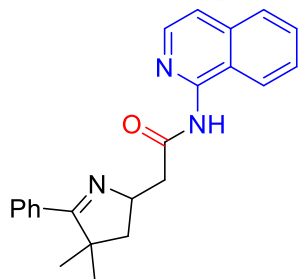
50.1 mg, yellow oil, yield: 70%. Eluent: pentane/ethyl acetate = 5/1 to 1/5.

¹H NMR (300 MHz, CDCl₃) δ 11.21 (br.s, 1H), 8.88 (dd, *J* = 7.4, 1.7 Hz, 1H), 8.78 (dd, *J* = 4.2, 1.7 Hz, 1H), 8.13 (dd, *J* = 8.3, 1.7 Hz, 1H), 8.10 – 8.01 (m, 2H), 7.57 – 7.47 (m, 2H), 7.46 – 7.39 (m, 4H), 4.57 – 4.45 (m, 1H), 2.94 (dd, *J* = 14.9, 8.8 Hz, 1H), 2.85 (dd, *J* = 14.9, 5.1 Hz, 1H), 2.26 (dd, *J* = 12.6, 6.6 Hz, 1H), 1.71 (dd, *J* = 12.6, 9.3 Hz, 1H), 1.43 (s, 6H).

¹³C NMR (75 MHz, CDCl₃) δ 179.7, 170.6, 148.1, 138.9, 136.1, 135.3, 134.1, 129.9, 128.4, 128.1, 128.0, 127.4, 121.4, 121.3, 116.9, 64.5, 50.2, 48.6, 45.3, 27.3, 25.7.

HR-MS (ESI-TOF) calcd. for C₂₃H₂₃N₃O [M+H]⁺: 358.1919; found: 358.1921; [M+Na]⁺: 380.1733; found: 380.1738.

2-(4,4-Dimethyl-5-phenyl-3,4-dihydro-2H-pyrrol-2-yl)-*N*-(isoquinolin-1-yl)acetamide (**3ag**)



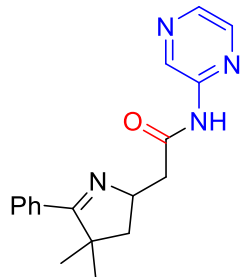
60.8 mg, yellow oil, yield: 85%. Eluent: pentane/ethyl acetate = 5/1 to 0/1.

¹H NMR (300 MHz, CDCl₃) δ 8.33 (d, *J* = 5.8 Hz, 1H), 8.19 (d, *J* = 8.5 Hz, 1H), 7.82 – 7.73 (m, 3H), 7.64 – 7.58 (m, 1H), 7.46 – 7.33 (m, 5H), 4.56 – 4.44 (m, 1H), 2.88 (dd, *J* = 15.5, 4.5 Hz, 1H), 2.80 (dd, *J* = 15.5, 10.2 Hz, 1H), 2.26 (dd, *J* = 12.6, 6.6 Hz, 1H), 1.67 (dd, *J* = 12.5, 9.3 Hz, 1H), 1.42 (s, 6H).

¹³C NMR (75 MHz, CDCl₃) δ 180.8, 170.8, 149.9, 140.8, 137.5, 133.9, 130.2, 130.0, 128.2, 128.0, 127.0, 126.9, 124.2, 121.9, 117.9, 64.2, 50.2, 48.4, 44.6, 27.0, 25.5.

HR-MS (ESI-TOF) calcd. for C₂₃H₂₃N₃O [M+H]⁺: 358.1919; found: 358.1920. [M+Na]⁺: 380.1733; found: 380.1736.

2-(4,4-Dimethyl-5-phenyl-3,4-dihydro-2H-pyrrol-2-yl)-*N*-(pyrazin-2-yl)acetamide (**3ah**)



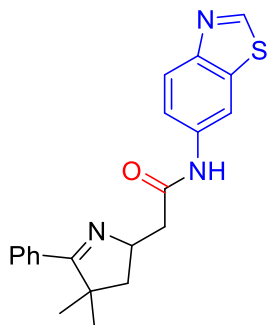
42.5 mg, yellow oil, yield: 69%. Eluent: pentane/ethyl acetate = 5/1 to 1/5.

¹H NMR (300 MHz, CDCl₃) δ 10.77 (br.s, 1H), 9.56 (d, *J* = 1.6 Hz, 1H), 8.28 (dd, *J* = 2.7, 0.5 Hz, 1H), 8.23 (dd, *J* = 2.6, 1.5 Hz, 1H), 7.88 – 7.76 (m, 2H), 7.45 – 7.37 (m, 3H), 4.44 – 4.32 (m, 1H), 2.77 (dd, *J* = 15.5, 4.1 Hz, 1H), 2.66 (dd, *J* = 15.5, 10.1 Hz, 1H), 2.21 (dd, *J* = 12.6, 6.6 Hz, 1H), 1.61 (dd, *J* = 12.6, 9.3 Hz, 1H), 1.41 (s, 3H), 1.39 (s, 3H).

¹³C NMR (75 MHz, CDCl₃) δ 180.3, 170.5, 148.6, 142.2, 139.7, 137.2, 133.5, 130.1, 128.3, 128.0, 63.7, 50.1, 48.4, 43.9, 27.0, 25.5.

HR-MS (ESI-TOF) calcd. for C₁₈H₂₀N₄O [M+H]⁺: 309.1715; found: 309.1712; [M+Na]⁺: 331.1529; found: 331.1534.

N-(Benzo[*d*]thiazol-6-yl)-2-(4,4-dimethyl-5-phenyl-3,4-dihydro-2*H*-pyrrol-2-yl)acetamide (**3ai**)



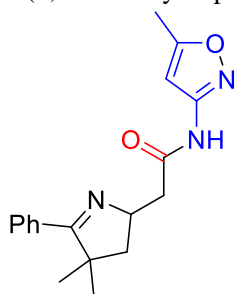
66.9 mg, yellow oil, yield: 92%. Eluent: pentane/ethyl acetate = 5/1 to 1/5.

¹H NMR (300 MHz, CDCl₃) δ 10.67 (br.s, 1H), 8.86 (s, 1H), 8.63 (d, *J* = 2.1 Hz, 1H), 7.99 (d, *J* = 8.8 Hz, 1H), 7.82 – 7.74 (m, 2H), 7.49 – 7.40 (m, 3H), 7.35 (dd, *J* = 8.8, 2.1 Hz, 1H), 4.43 – 4.31 (m, 1H), 2.73 (dd, *J* = 15.7, 3.7 Hz, 1H), 2.62 (dd, *J* = 15.7, 10.4 Hz, 1H), 2.20 (dd, *J* = 12.6, 6.2 Hz, 1H), 1.60 (dd, *J* = 12.6, 9.3 Hz, 1H), 1.40 (s, 3H), 1.39 (s, 3H).

¹³C NMR (75 MHz, CDCl₃) δ 180.4, 170.3, 152.8, 149.4, 136.4, 134.6, 133.7, 130.1, 128.4, 127.8, 123.3, 118.9, 112.0, 64.0, 50.0, 48.3, 44.0, 27.0, 25.5.

HR-MS (ESI-TOF) calcd. for C₂₁H₂₁N₃OS [M+H]⁺: 364.1483; found: 364.1489; [M+Na]⁺: 386.1297; found: 386.1308.

2-(4,4-Dimethyl-5-phenyl-3,4-dihydro-2*H*-pyrrol-2-yl)-*N*-(5-methylisoxazol-3-yl)acetamide (**3aj**)



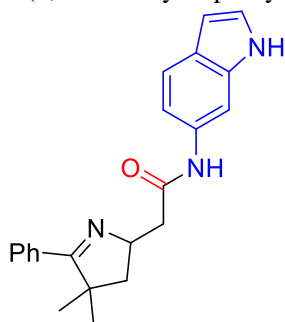
44.8 mg, yellow oil, yield: 72%. Eluent: pentane/ethyl acetate = 5/1 to 1/5.

¹H NMR (400 MHz, CDCl₃) δ 10.84 (br.s, 1H), 7.81 – 7.72 (m, 2H), 7.45 – 7.37 (m, 3H), 6.71 (s, 1H), 4.39 – 4.29 (m, 1H), 2.71 (dd, *J* = 15.5, 4.6 Hz, 1H), 2.63 (ddd, *J* = 15.5, 10.0, 1.6 Hz, 1H), 2.38 (s, 3H), 2.19 (dd, *J* = 12.5, 6.5 Hz, 1H), 1.59 (dd, *J* = 12.5, 9.3 Hz, 1H), 1.39 (s, 3H), 1.38 (s, 3H).

¹³C NMR (101 MHz, CDCl₃) δ 180.3, 170.1, 169.5, 158.1, 133.5, 130.1, 128.3, 128.0, 96.6, 63.7, 50.2, 48.3, 43.6, 27.1, 25.5, 12.6.

HR-MS (ESI-TOF) calcd. for C₁₈H₂₁N₃O₂ [M+H]⁺: 312.1712; found: 312.1715; [M+Na]⁺: 334.1526; found: 334.1536.

2-(4,4-Dimethyl-5-phenyl-3,4-dihydro-2*H*-pyrrol-2-yl)-*N*-(1*H*-indol-6-yl)acetamide (**3ak**)



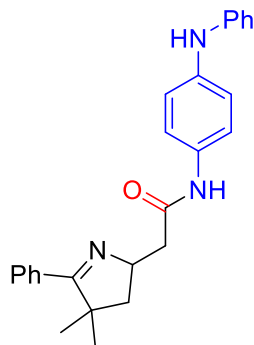
61.5 mg, yellow oil, yield: 89%. Eluent: pentane/ethyl acetate = 3/1 to 1/5.

¹H NMR (300 MHz, CDCl₃) δ 9.88 (br.s, 1H), 8.38 (br.s, 1H), 7.85 (s, 1H), 7.74–7.65 (m, 2H), 7.39–7.29 (m, 3H), 7.21–7.14 (m, 2H), 7.05 (t, *J* = 2.7 Hz, 1H), 6.39 (t, *J* = 2.6 Hz, 1H), 4.39–4.25 (m, 1H), 2.68 (dd, *J* = 15.4, 4.3 Hz, 1H), 2.58 (dd, *J* = 15.4, 9.6 Hz, 1H), 2.11 (dd, *J* = 12.6, 6.4 Hz, 1H), 1.58 (dd, *J* = 12.6, 9.3 Hz, 1H), 1.32 (s, 3H), 1.30 (s, 3H).

¹³C NMR (75 MHz, CDCl₃) δ 180.3, 170.0, 133.8, 133.0, 131.0, 130.0, 128.3, 128.0, 127.9, 125.0, 116.2, 112.2, 111.1, 102.5, 64.4, 50.1, 48.2, 44.0, 27.0, 25.6.

HR-MS (ESI-TOF) calcd. for C₂₂H₂₃N₃O [M+H]⁺: 346.1919; found: 346.1919; [M+H]⁺: 368.1733; found: 368.1741.

2-(4,4-Dimethyl-5-phenyl-3,4-dihydro-2*H*-pyrrol-2-yl)-*N*-(4-(phenylamino)phenyl)acetamide (**3al**)



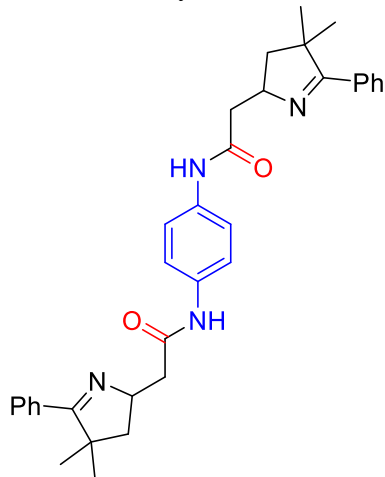
57.2 mg, yellow oil, yield: 72%. Eluent: pentane/ethyl acetate = 3/1 to 0/1.

¹H NMR (300 MHz, CDCl₃) δ 10.01 (br.s, 1H), 7.76–7.63 (m, 2H), 7.43–7.31 (m, 5H), 7.18–7.10 (m, 2H), 6.98–6.87 (m, 4H), 6.83–6.73 (m, 1H), 5.25 (br.s, 1H), 4.35–4.22 (m, 1H), 2.65 (dd, *J* = 15.4, 4.0 Hz, 1H), 2.53 (dd, *J* = 15.4, 9.9 Hz, 1H), 2.11 (dd, *J* = 12.6, 6.6 Hz, 1H), 1.57 (dd, *J* = 12.6, 9.2 Hz, 1H), 1.32 (s, 3H), 1.31 (s, 3H).

¹³C NMR (75 MHz, CDCl₃) δ 180.4, 169.8, 143.8, 138.8, 133.7, 132.6, 130.1, 129.3, 128.4, 127.9, 121.2, 120.2, 119.3, 116.7, 64.2, 50.1, 48.1, 43.9, 27.0, 25.6.

HR-MS (ESI-TOF) calcd. for C₂₆H₂₇N₃O [M+H]⁺: 398.2232; found: 398.2239; [M+Na]⁺: 420.2046; found: 420.2058.

N,N'-(1,4-Phenylene)bis(2-(4,4-dimethyl-5-phenyl-3,4-dihydro-2*H*-pyrrol-2-yl)acetamide) (**3am**)



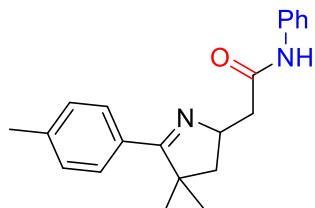
34.8 mg, yellow oil, yield: 65%. Eluent: pentane/ethyl acetate = 3/1 to 0/1.

¹H NMR (300 MHz, CDCl₃) δ 10.21 (br.s, 2H), 7.84–7.72 (m, 4H), 7.57–7.48 (m, 4H), 7.48–7.39 (m, 6H), 4.41–4.27 (m, 2H), 2.70 (dd, *J* = 15.6, 3.8 Hz, 2H), 2.58 (dd, *J* = 15.6, 10.4 Hz, 2H), 2.19 (dd, *J* = 12.6, 6.6 Hz, 2H), 1.60 (dd, *J* = 12.6, 9.2 Hz, 2H), 1.40 (s, 12H).

^{13}C NMR (75 MHz, CDCl_3) δ 180.1, 169.9, 134.5, 133.7, 130.2, 128.4, 127.9, 120.2, 64.1, 50.0, 48.4, 44.1, 27.1, 25.6.

HR-MS (ESI-TOF) calcd. for $\text{C}_{34}\text{H}_{38}\text{N}_4\text{O}_2$ $[\text{M}+\text{H}]^+$: 535.3073; found: 535.3068; $[\text{M}+\text{Na}]^+$: 557.2887; found: 557.2892.

2-(4,4-Dimethyl-5-(*p*-tolyl)-3,4-dihydro-2*H*-pyrrol-2-yl)-*N*-phenylacetamide (**4a**)



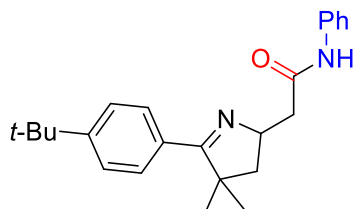
59.6 mg, yellow oil, yield: 93%. Eluent: pentane/ethyl acetate = 5/1 to 2/1.

^1H NMR (300 MHz, CDCl_3) δ 10.36 (br.s, 1H), 7.75–7.67 (m, 2H), 7.60–7.54 (m, 2H), 7.32–7.25 (m, 2H), 7.26–7.20 (m, 2H), 7.08–7.01 (m, 1H), 4.38–4.26 (m, 1H), 2.68 (dd, J = 15.6, 3.9 Hz, 1H), 2.58 (dd, J = 15.6, 10.3 Hz, 1H), 2.39 (s, 3H), 2.17 (dd, J = 12.6, 6.5 Hz, 1H), 1.57 (dd, J = 12.6, 9.3 Hz, 1H), 1.39 (s, 6H).

^{13}C NMR (75 MHz, CDCl_3) δ 179.7, 170.1, 140.3, 138.6, 130.9, 129.0, 128.8, 127.8, 123.5, 119.6, 63.9, 49.9, 48.5, 44.2, 27.1, 25.5, 21.3.

HR-MS (ESI-TOF) calcd. for $\text{C}_{21}\text{H}_{24}\text{N}_2\text{O}$ $[\text{M}+\text{H}]^+$: 321.1967; found: 321.1960; $[\text{M}+\text{Na}]^+$: 343.1781; found: 343.1792.

2-(5-(4-(*tert*-Butyl)phenyl)-4,4-dimethyl-3,4-dihydro-2*H*-pyrrol-2-yl)-*N*-phenylacetamide (**4b**)



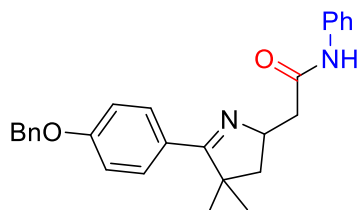
66.0 mg, yellow oil, yield: 91%. Eluent: pentane/ethyl acetate = 5/1 to 2/1.

^1H NMR (300 MHz, CDCl_3) δ 10.40 (br.s, 1H), 7.83–7.74 (m, 2H), 7.64–7.57 (m, 2H), 7.49–7.43 (m, 2H), 7.36–7.28 (m, 2H), 7.11–7.04 (m, 1H), 4.41–4.29 (m, 1H), 2.72 (dd, J = 15.5, 3.7 Hz, 1H), 2.59 (dd, J = 15.5, 10.4 Hz, 1H), 2.19 (dd, J = 12.6, 6.6 Hz, 1H), 1.61 (dd, J = 12.6, 9.2 Hz, 1H), 1.43 (s, 3H), 1.42 (s, 3H), 1.37 (s, 9H).

^{13}C NMR (75 MHz, CDCl_3) δ 179.7, 170.2, 153.5, 138.6, 130.7, 128.8, 127.7, 125.3, 123.6, 119.7, 63.9, 49.9, 48.5, 44.2, 34.8, 31.1, 27.2, 25.6.

HR-MS (ESI-TOF) calcd. for $\text{C}_{24}\text{H}_{30}\text{N}_2\text{O}$ $[\text{M}+\text{H}]^+$: 363.2436; found: 363.2438; $[\text{M}+\text{Na}]^+$: 385.2250; found: 385.2255.

2-(5-(4-(Benzyloxy)phenyl)-4,4-dimethyl-3,4-dihydro-2*H*-pyrrol-2-yl)-*N*-phenylacetamide (**4c**)



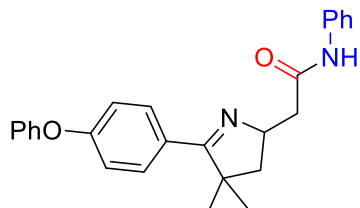
72.6 mg, yellow oil, yield: 88%. Eluent: pentane/ethyl acetate = 5/1 to 2/1.

^1H NMR (300 MHz, CDCl_3) δ 10.42 (br.s, 1H), 7.90–7.78 (m, 2H), 7.68–7.58 (m, 2H), 7.50–7.28 (m, 7H), 7.14–7.00 (m, 3H), 5.13 (s, 2H), 4.41–4.25 (m, 1H), 2.70 (dd, J = 15.6, 3.7 Hz, 1H), 2.59 (dd, J = 15.6, 10.5 Hz, 1H), 2.19 (dd, J = 12.6, 6.3 Hz, 1H), 1.59 (dd, J = 12.6, 9.3 Hz, 1H), 1.43 (s, 3H), 1.42 (s, 3H).

¹³C NMR (75 MHz, CDCl₃) δ 178.9, 170.2, 160.3, 138.6, 136.4, 129.6, 128.8, 128.6, 128.1, 127.4, 126.3, 123.6, 119.7, 114.6, 70.0, 63.7, 49.7, 48.7, 44.2, 27.2, 25.6.

HR-MS (ESI-TOF) calcd. for C₂₇H₂₈N₂O₂ [M+H]⁺: 413.2229; found: 413.2229; [M+Na]⁺: 435.2043; found: 435.2049.

2-(4,4-Dimethyl-5-(4-phenoxyphenyl)-3,4-dihydro-2H-pyrrol-2-yl)-N-phenylacetamide (**4d**)



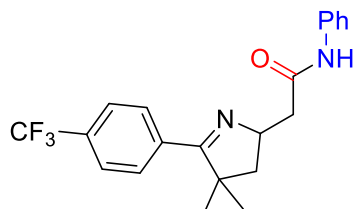
58.2 mg, yellow oil, yield: 73%. Eluent: pentane/ethyl acetate = 5/1 to 2/1.

¹H NMR (300 MHz, CDCl₃) δ 10.29 (br.s, 1H), 7.89–7.76 (m, 2H), 7.66–7.51 (m, 2H), 7.43–7.28 (m, 4H), 7.22–7.14 (m, 1H), 7.12–7.01 (m, 5H), 4.41–4.27 (m, 1H), 2.71 (dd, *J* = 15.6, 3.7 Hz, 1H), 2.59 (dd, *J* = 15.6, 10.5 Hz, 1H), 2.20 (dd, *J* = 12.5, 6.6 Hz, 1H), 1.61 (dd, *J* = 12.5, 9.3 Hz, 1H), 1.43 (s, 3H), 1.41 (s, 3H).

¹³C NMR (75 MHz, CDCl₃) δ 179.0, 170.1, 159.4, 156.1, 138.6, 129.9, 129.7, 128.9, 128.1, 124.1, 123.7, 119.7, 117.8, 63.9, 49.8, 48.7, 44.2, 27.2, 25.6.

HR-MS (ESI-TOF) calcd. for C₂₆H₂₆N₂O₂ [M+H]⁺: 399.2072; found: 399.2073; [M+Na]⁺: 421.1886; found: 421.1891.

2-(4,4-Dimethyl-5-(4-(trifluoromethyl)phenyl)-3,4-dihydro-2H-pyrrol-2-yl)-N-phenylacetamide (**4e**)



38.9 mg, yellow oil, yield: 52%. Eluent: pentane/ethyl acetate = 5/1 to 2/1.

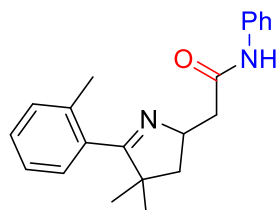
¹H NMR (300 MHz, CDCl₃) δ 9.88 (br.s, 1H), 7.92–7.80 (m, 2H), 7.74–7.65 (m, 2H), 7.59–7.51 (m, 2H), 7.35–7.26 (m, 2H), 7.13–7.02 (m, 1H), 4.46–4.34 (m, 1H), 2.72 (dd, *J* = 15.5, 4.4 Hz, 1H), 2.63 (dd, *J* = 15.5, 9.9 Hz, 1H), 2.24 (dd, *J* = 12.6, 6.6 Hz, 1H), 1.64 (dd, *J* = 12.6, 9.3 Hz, 1H), 1.40 (s, 3H), 1.39 (s, 3H).

¹³C NMR (75 MHz, CDCl₃) δ 179.4, 169.8, 138.4, 137.4, 131.86 (q, *J* = 32.6 Hz), 128.9, 128.2, 125.4 (q, *J* = 3.8 Hz), 123.8 (q, *J* = 272.7 Hz), 123.8, 119.7, 64.7, 50.3, 48.2, 44.0, 26.9, 25.4.

¹⁹F NMR (282 MHz, CDCl₃) δ -62.9.

HR-MS (ESI-TOF) calcd. for C₂₁H₂₁F₃N₂O [M+H]⁺: 375.1684; found: 375.1683; [M+Na]⁺: 397.1498; found: 397.1503.

2-(4,4-Dimethyl-5-(*o*-tolyl)-3,4-dihydro-2H-pyrrol-2-yl)-N-phenylacetamide (**4f**)



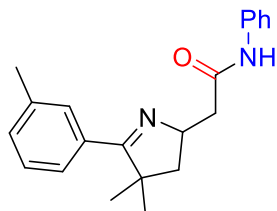
55.1 mg, yellow oil, yield: 86%. Eluent: pentane/ethyl acetate = 5/1 to 2/1.

¹H NMR (300 MHz, CDCl₃) δ 9.85 (br.s, 1H), 7.54–7.48 (m, 2H), 7.34–7.17 (m, 6H), 7.08–7.00 (m, 1H), 4.51–4.34 (m, 1H), 2.75 (dd, *J* = 15.4, 4.1 Hz, 1H), 2.65 (dd, *J* = 15.4, 9.8 Hz, 1H), 2.32 (s, 3H), 2.22 (dd, *J* = 12.7, 6.8 Hz, 1H), 1.64 (dd, *J* = 12.7, 9.0 Hz, 1H), 1.24 (s, 3H), 1.20 (s, 3H).

^{13}C NMR (75 MHz, CDCl_3) δ 182.2, 170.0, 138.4, 136.2, 134.4, 130.7, 128.8, 128.5, 127.3, 125.0, 123.7, 119.8, 65.4, 52.3, 46.2, 44.3, 26.5, 25.0, 20.1.

HR-MS (ESI-TOF) calcd. for $\text{C}_{21}\text{H}_{24}\text{N}_2\text{O}$ $[\text{M}+\text{H}]^+$: 321.1967; found: 321.1963; $[\text{M}+\text{Na}]^+$: 343.1781; found: 343.1785.

2-(4,4-Dimethyl-5-(*m*-tolyl)-3,4-dihydro-2*H*-pyrrol-2-yl)-*N*-phenylacetamide (**4g**)



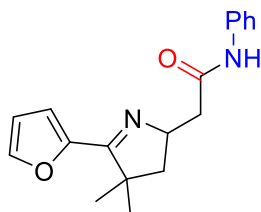
50.0 mg, yellow oil, yield: 78%. Eluent: pentane/ethyl acetate = 5/1 to 2/1.

^1H NMR (300 MHz, CDCl_3) δ 10.24 (br.s, 1H), 7.65–7.52 (m, 4H), 7.36–7.25 (m, 4H), 7.11–7.03 (m, 1H), 4.41–4.29 (m, 1H), 2.72 (dd, J = 15.5, 3.9 Hz, 1H), 2.61 (dd, J = 15.5, 10.2 Hz, 1H), 2.42 (s, 3H), 2.20 (dd, J = 12.6, 6.6 Hz, 1H), 1.60 (dd, J = 12.6, 9.3 Hz, 1H), 1.41 (s, 3H), 1.40 (s, 3H).

^{13}C NMR (75 MHz, CDCl_3) δ 180.3, 170.1, 138.6, 138.0, 133.8, 130.8, 128.8, 128.6, 128.2, 124.9, 123.6, 119.7, 64.1, 50.1, 48.4, 44.2, 27.1, 25.6, 21.5.

HR-MS (ESI-TOF) calcd. for $\text{C}_{21}\text{H}_{24}\text{N}_2\text{O}$ $[\text{M}+\text{H}]^+$: 321.1967; found: 321.1960; $[\text{M}+\text{Na}]^+$: 343.1781; found: 343.1778.

2-(5-(Furan-2-yl)-4,4-dimethyl-3,4-dihydro-2*H*-pyrrol-2-yl)-*N*-phenylacetamide (**4h**)



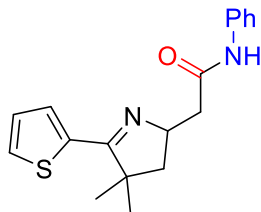
53.3 mg, yellow oil, yield: 90%. Eluent: pentane/ethyl acetate = 5/1 to 2/1.

^1H NMR (300 MHz, CDCl_3) δ 9.86 (br.s, 1H), 7.63–7.53 (m, 3H), 7.33–7.25 (m, 2H), 7.09–7.02 (m, 1H), 7.01 (dt, J = 3.5, 0.7 Hz, 1H), 6.50 (dd, J = 3.5, 1.8 Hz, 1H), 4.49–4.36 (m, 1H), 2.74 (dd, J = 15.1, 4.8 Hz, 1H), 2.67 (dd, J = 15.1, 8.3 Hz, 1H), 2.17 (dd, J = 12.8, 7.1 Hz, 1H), 1.62 (dd, J = 12.8, 8.7 Hz, 1H), 1.44 (s, 3H), 1.34 (s, 3H).

^{13}C NMR (75 MHz, CDCl_3) δ 170.7, 169.8, 148.6, 144.5, 138.5, 128.8, 123.6, 119.7, 113.6, 111.6, 65.3, 49.9, 46.6, 44.1, 27.1, 25.5.

HR-MS (ESI-TOF) calcd. for $\text{C}_{18}\text{H}_{20}\text{N}_2\text{O}_2$ $[\text{M}+\text{H}]^+$: 297.1603; found: 297.1598; $[\text{M}+\text{Na}]^+$: 319.1417; found: 319.1420.

2-(4,4-Dimethyl-5-(thiophen-2-yl)-3,4-dihydro-2*H*-pyrrol-2-yl)-*N*-phenylacetamide (**4i**)



38.1 mg, yellow oil, yield: 61%. Eluent: pentane/ethyl acetate = 5/1 to 2/1.

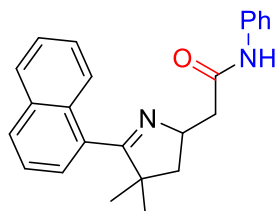
^1H NMR (300 MHz, CDCl_3) δ 10.24 (br.s, 1H), 7.71–7.59 (m, 2H), 7.57–7.53 (m, 1H), 7.46 (dd, J = 5.1, 1.0 Hz, 1H), 7.38–7.28 (m, 2H), 7.11 (dd, J = 5.1, 3.7 Hz, 1H), 7.11–7.03 (m, 1H), 4.40–4.29 (m, 1H), 2.72 (dd, J

= 15.4, 3.8 Hz, 1H), 2.59 (dd, $J = 15.4, 10.4$ Hz, 1H), 2.22 (dd, $J = 12.7, 7.0$ Hz, 1H), 1.64 (dd, $J = 12.7, 8.8$ Hz, 1H), 1.51 (s, 3H), 1.40 (s, 3H).

^{13}C NMR (75 MHz, CDCl_3) δ 174.1, 169.9, 138.6, 137.4, 129.4, 128.8, 128.5, 127.8, 123.6, 119.6, 64.4, 50.0, 47.9, 44.2, 27.5, 25.8.

HR-MS (ESI-TOF) calcd. for $\text{C}_{18}\text{H}_{20}\text{N}_2\text{OS}$ $[\text{M}+\text{H}]^+$: 313.1375; found: 313.1366; $[\text{M}+\text{Na}]^+$: 335.1188; found: 335.1189.

2-(4,4-Dimethyl-5-(naphthalen-1-yl)-3,4-dihydro-2H-pyrrol-2-yl)-N-phenylacetamide (**4j**)



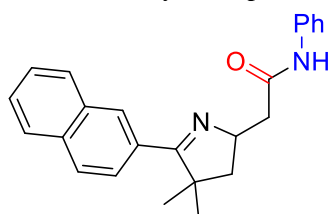
58.4 mg, yellow oil, yield: 82%. Eluent: pentane/ethylacetate = 5/1 to 2/1.

^1H NMR (300 MHz, CDCl_3) δ 9.66 (br.s, 1H), 7.94–7.86 (m, 3H), 7.53–7.47 (m, 2H), 7.46–7.36 (m, 4H), 7.25–7.17 (m, 2H), 7.06–6.97 (m, 1H), 4.63–4.52 (m, 1H), 2.87 (dd, $J = 15.3, 4.2$ Hz, 1H), 2.77 (dd, $J = 15.3, 9.3$ Hz, 1H), 2.31 (dd, $J = 12.7, 6.7$ Hz, 1H), 1.79 (dd, $J = 12.7, 9.2$ Hz, 1H), 1.27 (s, 3H), 1.20 (s, 3H).

^{13}C NMR (75 MHz, CDCl_3) δ 181.8, 169.9, 138.4, 133.7, 132.5, 131.7, 129.1, 128.7, 128.3, 126.5, 126.1, 125.4, 125.0, 124.5, 123.7, 119.8, 65.8, 52.7, 46.1, 44.2, 26.6, 25.0.

HR-MS (ESI-TOF) calcd. for $\text{C}_{24}\text{H}_{24}\text{N}_2\text{O}$ $[\text{M}+\text{H}]^+$: 357.1967; found: 357.1972; $[\text{M}+\text{Na}]^+$: 379.1781; found: 379.1790.

2-(4,4-Dimethyl-5-(naphthalen-2-yl)-3,4-dihydro-2H-pyrrol-2-yl)-N-phenylacetamide (**4k**)



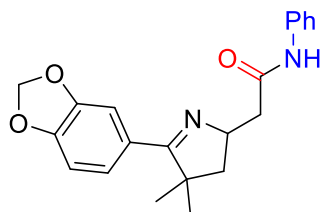
67.7 mg, yellow oil, yield: 95%. Eluent: pentane/ethylacetate = 5/1 to 2/1.

^1H NMR (300 MHz, CDCl_3) δ 10.23 (br.s, 1H), 8.16 (s, 1H), 7.91–7.76 (m, 4H), 7.56–7.40 (m, 4H), 7.28–7.18 (m, 2H), 7.05–6.93 (m, 1H), 4.39–4.25 (m, 1H), 2.67 (dd, $J = 15.6, 3.9$ Hz, 1H), 2.56 (dd, $J = 15.6, 10.3$ Hz, 1H), 2.16 (dd, $J = 12.6, 6.6$ Hz, 1H), 1.57 (dd, $J = 12.6, 9.3$ Hz, 1H), 1.42 (s, 3H), 1.41 (s, 3H).

^{13}C NMR (75 MHz, CDCl_3) δ 179.9, 170.1, 138.6, 134.0, 132.7, 131.0, 128.9, 128.7, 128.1, 127.8, 127.7, 127.2, 126.5, 125.3, 123.7, 119.7, 64.2, 50.1, 48.6, 44.2, 27.3, 25.7.

HR-MS (ESI-TOF) calcd. for $\text{C}_{24}\text{H}_{24}\text{N}_2\text{O}$ $[\text{M}+\text{H}]^+$: 357.1967; found: 357.1969; $[\text{M}+\text{Na}]^+$: 379.1781; found: 379.1786.

2-(5-(Benzo[d][1,3]dioxol-5-yl)-4,4-dimethyl-3,4-dihydro-2H-pyrrol-2-yl)-N-phenylacetamide (**4l**)



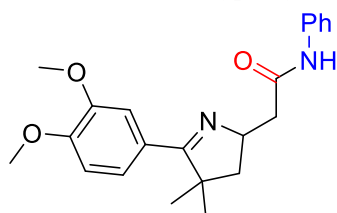
65.2 mg, yellow oil, yield: 93%. Eluent: pentane/ethylacetate = 5/1 to 2/1.

¹H NMR (300 MHz, CDCl₃) δ 10.22 (br.s, 1H), 7.64–7.54 (m, 2H), 7.36–7.27 (m, 4H), 7.10–7.03 (m, 1H), 6.85 (d, *J* = 8.6 Hz, 1H), 6.01 (s, 2H), 4.37–4.24 (m, 1H), 2.68 (dd, *J* = 15.6, 4.0 Hz, 1H), 2.58 (dd, *J* = 15.6, 10.2 Hz, 1H), 2.17 (dd, *J* = 12.5, 6.6 Hz, 1H), 1.58 (dd, *J* = 12.5, 9.3 Hz, 1H), 1.40 (s, 3H), 1.38 (s, 3H).

¹³C NMR (75 MHz, CDCl₃) δ 178.9, 170.1, 149.3, 147.8, 138.5, 128.8, 127.7, 123.6, 122.4, 119.7, 108.2, 107.9, 101.4, 63.7, 49.8, 48.8, 44.1, 27.2, 25.6.

HR-MS (ESI-TOF) calcd. for C₂₁H₂₂N₂O₃ [M+H]⁺: 351.1709; found: 351.1704; [M+Na]⁺: 373.1523; found: 373.1521.

2-(5-(3,4-Dimethoxyphenyl)-4,4-dimethyl-3,4-dihydro-2H-pyrrol-2-yl)-N-phenylacetamide (**4m**)



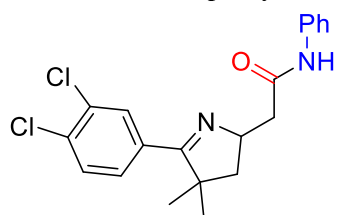
63.0 mg, yellow oil, yield: 86%. Eluent: pentane/ethyl acetate = 5/1 to 1/1.

¹H NMR (300 MHz, CDCl₃) δ 10.38 (br.s, 1H), 7.63–7.53 (m, 2H), 7.46 (d, *J* = 2.0 Hz, 1H), 7.40 (dd, *J* = 8.4, 2.0 Hz, 1H), 7.33–7.23 (m, 2H), 7.10–6.99 (m, 1H), 6.88 (d, *J* = 8.4 Hz, 1H), 4.38–4.25 (m, 1H), 3.92 (s, 3H), 3.90 (s, 3H), 2.70 (dd, *J* = 15.5, 4.0 Hz, 1H), 2.58 (dd, *J* = 15.5, 10.2 Hz, 1H), 2.18 (dd, *J* = 12.6, 6.6 Hz, 1H), 1.60 (dd, *J* = 12.6, 9.2 Hz, 1H), 1.44 (s, 3H), 1.40 (s, 3H).

¹³C NMR (75 MHz, CDCl₃) ¹³C NMR (75 MHz, CDCl₃) δ 178.9, 170.1, 150.9, 148.8, 138.6, 128.8, 126.1, 123.6, 121.1, 119.5, 111.0, 110.3, 63.6, 55.9, 55.8, 49.8, 48.7, 44.1, 27.4, 25.7.

HR-MS (ESI-TOF) calcd. for C₂₂H₂₆N₂O₃ [M+H]⁺: 367.2021; found: 367.2013; [M+Na]⁺: 389.1835; found: 389.1832.

2-(5-(3,4-Dichlorophenyl)-4,4-dimethyl-3,4-dihydro-2H-pyrrol-2-yl)-N-phenylacetamide (**4n**)



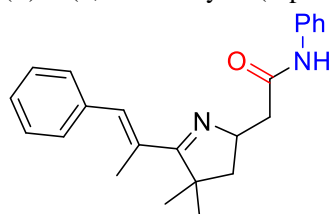
31.5 mg, yellow oil, yield: 42%. Eluent: pentane/ethyl acetate = 5/1 to 2/1.

¹H NMR (300 MHz, CDCl₃) δ 9.78 (br.s, 1H), 7.88 (d, *J* = 2.0 Hz, 1H), 7.61 (dd, *J* = 8.4, 2.0 Hz, 1H), 7.58–7.52 (m, 2H), 7.51 (d, *J* = 8.4 Hz, 1H), 7.35–7.28 (m, 2H), 7.12–7.03 (m, 1H), 4.42–4.31 (m, 1H), 2.70 (dd, *J* = 15.5, 4.3 Hz, 1H), 2.61 (dd, *J* = 15.5, 9.9 Hz, 1H), 2.22 (dd, *J* = 12.7, 6.6 Hz, 1H), 1.62 (dd, *J* = 12.7, 9.3 Hz, 1H), 1.38 (s, 6H).

¹³C NMR (75 MHz, CDCl₃) δ 178.2, 169.7, 138.4, 134.5, 133.7, 132.8, 130.4, 129.9, 128.9, 127.0, 123.9, 119.7, 64.5, 50.1, 48.3, 44.0, 27.0, 25.4.

HR-MS (ESI-TOF) calcd. for C₂₀H₂₀Cl₂N₂O [M+H]⁺: 375.1031; found: 375.1029; [M+Na]⁺: 397.0845; found: 397.0851.

(*E*)-2-(4,4-Dimethyl-5-(1-phenylprop-1-en-2-yl)-3,4-dihydro-2H-pyrrol-2-yl)-N-phenylacetamide (**4o**)



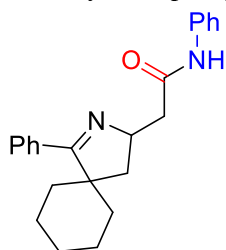
35.3 mg, yellow oil, yield: 51%. Eluent: pentane/ethyl acetate = 5/1 to 2/1.

¹H NMR (300 MHz, CDCl₃) δ 10.53 (br.s, 1H), 7.63 – 7.56 (m, 2H), 7.43 – 7.35 (m, 4H), 7.34 – 7.28 (m, 3H), 7.20 (s, 1H), 7.10 – 7.03 (m, 1H), 4.29 – 4.16 (m, 1H), 2.70 (dd, *J* = 15.5, 3.4 Hz, 1H), 2.53 (dd, *J* = 15.5, 10.9 Hz, 1H), 2.24 (d, *J* = 1.3 Hz, 3H), 2.14 (dd, *J* = 12.6, 6.6 Hz, 1H), 1.57 (dd, *J* = 12.6, 9.5 Hz, 1H), 1.49 (s, 3H), 1.41 (s, 3H).

¹³C NMR (75 MHz, CDCl₃) δ 181.4, 170.2, 138.7, 136.7, 134.4, 132.0, 129.3, 128.9, 128.3, 127.6, 123.5, 119.5, 63.2, 49.6, 49.4, 44.2, 27.8, 26.1, 16.6.

HR-MS (ESI-TOF) calcd. for C₂₃H₂₆N₂O [M+H]⁺: 347.2123; found: 347.2119; [M+Na]⁺: 369.1937; found: 369.1940.

N-Phenyl-2-(1-phenyl-2-azaspiro[4.5]dec-1-en-3-yl)acetamide (**4p**)



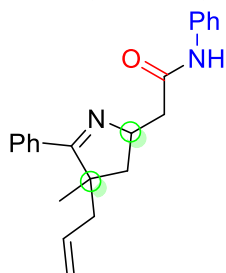
64.4 mg, yellow oil, yield: 93%. Eluent: pentane/ethyl acetate = 5/1 to 2/1.

¹H NMR (300 MHz, CDCl₃) δ 10.12 (br.s, 1H), 7.72 – 7.63 (m, 2H), 7.62 – 7.55 (m, 2H), 7.48 – 7.41 (m, 3H), 7.35 – 7.27 (m, 2H), 7.12 – 7.04 (m, 1H), 4.45 – 4.32 (m, 1H), 2.77 (dd, *J* = 15.4, 4.2 Hz, 1H), 2.66 (dd, *J* = 15.4, 9.8 Hz, 1H), 2.54 (dd, *J* = 12.8, 7.0 Hz, 1H), 1.92 (td, *J* = 12.9, 3.7 Hz, 1H), 1.83 – 1.61 (m, 5H), 1.55 – 1.42 (m, 3H), 1.36 – 1.20 (m, 2H).

¹³C NMR (75 MHz, CDCl₃) δ 181.0, 170.0, 138.5, 134.8, 129.5, 128.8, 128.1, 128.0, 123.6, 119.7, 64.9, 56.1, 44.4, 41.4, 35.6, 31.3, 25.4, 23.2, 23.0.

HR-MS (ESI-TOF) calcd. for C₂₃H₂₆N₂O [M+H]⁺: 347.2123; found: 347.2121; [M+Na]⁺: 369.1937; found: 369.1937.

2-(4-Allyl-4-methyl-5-phenyl-3,4-dihydro-2*H*-pyrrol-2-yl)-*N*-phenylacetamide (**4q**)



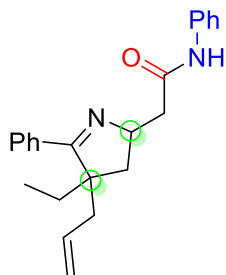
53.2 mg, yellow oil, dr = 3:1, yield: 80%. Eluent: pentane/ethyl acetate = 5/1 to 2/1.

¹H NMR (400 MHz, CDCl₃) δ 10.1 (br.s, 1H), 7.87 – 7.73 (m, 2H), 7.62 – 7.54 (m, 2H), 7.50 – 7.40 (m, 3H), 7.35 – 7.27 (m, 2H), 7.11 – 7.02 (m, 1H), 5.80 – 5.69 (m, 1H), 5.17 – 5.07 (m, 2H), 4.36 – 4.28 (m, 1H), 2.72 (dd, *J* = 15.5, 3.7 Hz, 1H), 2.60 (dd, *J* = 15.5, 10.3 Hz, 1H), 2.51 (dd, *J* = 13.9, 6.7 Hz, 1H), 2.42 (dd, *J* = 13.0, 7.3 Hz, 1H), 2.39 (dd, *J* = 13.9, 8.0 Hz, 1H), 1.54 (dd, *J* = 13.0, 8.6 Hz, 1H), 1.41 (s, 3H).

¹³C NMR (101 MHz, CDCl₃) δ 178.8, 170.0, 138.5, 133.9, 133.4, 130.1, 128.8, 128.4, 128.0, 127.8, 123.7, 119.7, 65.0, 54.3, 44.5, 44.4, 43.4, 26.3.

HR-MS (ESI-TOF) calcd. for C₂₂H₂₄N₂O [M+H]⁺: 333.1967; found: 333.1964.

2-(4-Allyl-4-ethyl-5-phenyl-3,4-dihydro-2H-pyrrol-2-yl)-N-phenylacetamide (**4r**)



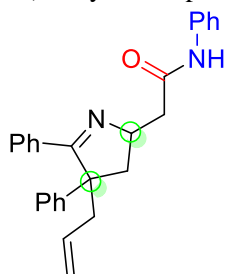
47.1 mg, yellow oil, dr = 10:3, yield: 68%. Eluent: pentane/ethyl acetate = 5/1 to 2/1.

¹H NMR (300 MHz, CDCl₃) δ 10.24 (br.s, 1H), 7.88–7.70 (m, 2H), 7.66–7.52 (m, 2H), 7.51–7.40 (m, 3H), 7.35–7.27 (m, 2H), 7.12–7.02 (m, 1H), 5.80–5.64 (m, 1H), 5.16–5.04 (m, 2H), 4.43–4.23 (m, 1H), 2.71 (dd, *J* = 15.5, 3.8 Hz, 1H), 2.64–2.51 (m, 2H), 2.43 (dd, *J* = 14.0, 8.4 Hz, 1H), 2.24 (dd, *J* = 13.2, 7.7 Hz, 1H), 1.86 (dd, *J* = 14.0, 7.3 Hz, 1H), 1.81–1.63 (m, 2H), 0.82 (t, *J* = 7.4 Hz, 3H).

¹³C NMR (75 MHz, CDCl₃) δ 177.0, 170.0, 138.6, 134.4, 133.5, 130.2, 128.8, 128.5, 127.8, 123.6, 119.7, 118.6, 65.2, 59.4, 44.6, 43.5, 40.6, 30.9, 9.1.

HR-MS (ESI-TOF) calcd. for C₂₃H₂₆N₂O [M+H]⁺: 347.2123; found: 347.2128, [M+H]⁺: 369.1937; found: 369.1945.

2-(4-Allyl-4,5-diphenyl-3,4-dihydro-2H-pyrrol-2-yl)-N-phenylacetamide (**4s**)



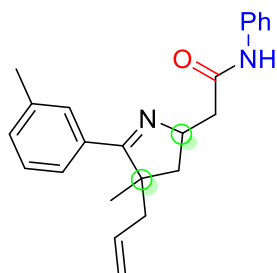
41.0 mg, yellow oil, dr = 20:9, yield: 52%. Eluent: pentane/ethyl acetate = 5/1 to 2/1.

¹H NMR (400 MHz, CDCl₃) δ 10.24 (br.s, 1H), 7.68–7.62 (m, 2H), 7.61–7.55 (m, 2H), 7.39–7.23 (m, 10H), 7.14–7.09 (m, 1H), 5.73–5.60 (m, 1H), 5.17–5.07 (m, 2H), 4.47–4.39 (m, 1H), 3.04–2.87 (m, 2H), 2.75–2.63 (m, 3H), 1.92 (dd, *J* = 13.6, 7.8 Hz, 1H).

¹³C NMR (101 MHz, CDCl₃) δ 174.7, 169.8, 146.6, 138.5, 133.4, 132.9, 130.5, 129.0, 129.0, 128.3, 126.8, 126.1, 123.8, 119.7, 119.5, 66.8, 61.6, 49.0, 45.0, 40.6.

HR-MS (ESI-TOF) calcd. for C₂₇H₂₆N₂O [M+H]⁺: 395.2123; found: 395.2122, [M+H]⁺: 417.1937; found: 417.1947.

2-(4-Allyl-4-methyl-5-(*m*-tolyl)-3,4-dihydro-2H-pyrrol-2-yl)-N-phenylacetamide (**4t**)



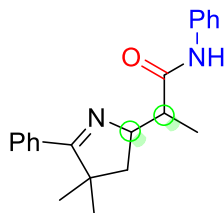
52.6 mg, yellow oil, dr = 20:7, yield: 76%. Eluent: pentane/ethyl acetate = 5/1 to 2/1.

¹H NMR (300 MHz, CDCl₃) δ 10.16 (s, 1H), 7.66–7.52 (m, 4H), 7.36–7.26 (m, 4H), 7.12–7.02 (m, 1H), 5.83–5.67 (m, 1H), 5.17–5.06 (m, 2H), 4.45–4.24 (m, 1H), 2.71 (dd, *J* = 15.5, 4.0 Hz, 1H), 2.58 (dd, *J* = 15.5, 4.0 Hz, 1H), 2.54–2.46 (m, 1H), 2.45–2.34 (m, 2H), 2.42 (s, 3H), 1.51 (dd, *J* = 13.0, 8.7 Hz, 1H), 1.40 (s, 3H).

^{13}C NMR (75 MHz, CDCl_3) δ 178.8, 170.0, 138.6, 138.1, 134.0, 133.6, 130.9, 128.8, 128.7, 128.3, 125.0, 123.6, 119.7, 118.7, 64.9, 54.3, 44.6, 44.5, 43.4, 26.3, 21.5.

HR-MS (ESI-TOF) calcd. for $\text{C}_{23}\text{H}_{26}\text{N}_2\text{O}$ $[\text{M}+\text{H}]^+$: 347.2123; found: 347.2119; $[\text{M}+\text{Na}]^+$: 369.1937; found: 369.1942.

2-(4,4-Dimethyl-5-phenyl-3,4-dihydro-2H-pyrrol-2-yl)-*N*-phenylpropanamide (**4u**)



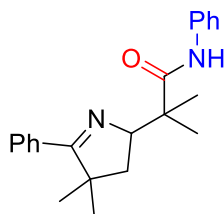
59.6 mg, yellow oil, dr = 10:3, yield: 93%. Eluent: pentane/ethyl acetate = 5/1 to 2/1.

^1H NMR (400 MHz, CDCl_3) δ 10.72 (br.s, 1H), 7.83 – 7.77 (m, 2H), 7.63 – 7.56 (m, 2H), 7.50 – 7.42 (m, 3H), 7.32 – 7.27 (m, 2H), 7.08 – 7.01 (m, 1H), 4.11 – 4.03 (m, 1H), 2.53 – 2.44 (m, 1H), 2.18 (dd, J = 12.4, 6.1 Hz, 1H), 1.68 (dd, J = 12.4, 10.0 Hz, 1H), 1.41 (s, 6H), 1.30 (d, J = 7.0 Hz, 3H).

^{13}C NMR (101 MHz, CDCl_3) δ 179.9, 172.9, 138.9, 133.8, 130.2, 128.8, 128.4, 127.9, 123.4, 119.6, 69.6, 49.7, 48.2, 46.1, 26.8, 25.1, 13.2.

HR-MS (ESI-TOF) calcd. for $\text{C}_{21}\text{H}_{24}\text{N}_2\text{O}$ $[\text{M}+\text{H}]^+$: 321.1967; found: 321.1968; $[\text{M}+\text{Na}]^+$: 343.1781; found: 343.1789.

2-(4,4-Dimethyl-5-phenyl-3,4-dihydro-2H-pyrrol-2-yl)-2-methyl-*N*-phenylpropanamide (**4v**)



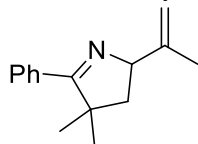
28.1 mg, yellow oil, yield: 42%. Eluent: pentane/ethyl acetate = 5/1 to 2/1.

^1H NMR (300 MHz, CDCl_3) δ 10.73 (br.s, 1H), 7.91 – 7.81 (m, 2H), 7.63 – 7.56 (m, 2H), 7.55 – 7.46 (m, 3H), 7.35 – 7.27 (m, 2H), 7.12 – 7.03 (m, 1H), 4.20 (dd, J = 10.3, 6.5 Hz, 1H), 2.02 (dd, J = 12.6, 6.5 Hz, 1H), 1.79 (dd, J = 12.6, 10.3 Hz, 1H), 1.46 (s, 3H), 1.42 (s, 3H), 1.35 (s, 3H), 1.21 (s, 3H).

^{13}C NMR (75 MHz, CDCl_3) δ 180.2, 176.1, 139.1, 133.8, 130.2, 128.8, 128.4, 127.8, 123.3, 119.6, 72.3, 49.8, 45.3, 43.9, 26.8, 25.4, 22.8, 20.7.

HR-MS (ESI-TOF) calcd. for $\text{C}_{22}\text{H}_{26}\text{N}_2\text{O}$ $[\text{M}+\text{H}]^+$: 335.2123; found: 335.2120; $[\text{M}+\text{Na}]^+$: 357.1937; found: 357.1942.

2-(4,4-Dimethyl-5-phenyl-3,4-dihydro-2H-pyrrol-2-yl)-2-methyl-*N*-phenylpropanamide (**4v'**)^[6]



29.4 mg, yellow oil, yield: 46%. Eluent: pentane/ethyl acetate = 5/1.

^1H NMR (300 MHz, CDCl_3) δ 7.81 – 7.71 (m, 2H), 7.41 – 7.34 (m, 3H), 5.06 – 5.01 (m, 1H), 4.88 – 4.85 (m, 1H), 4.53 (t, J = 8.1, 1H), 2.14 (dd, J = 12.4, 7.2 Hz, 1H), 1.82 (s, 3H), 1.75 (dd, J = 12.4, 9.0 Hz, 1H), 1.39 (s, 3H), 1.35 (s, 3H).

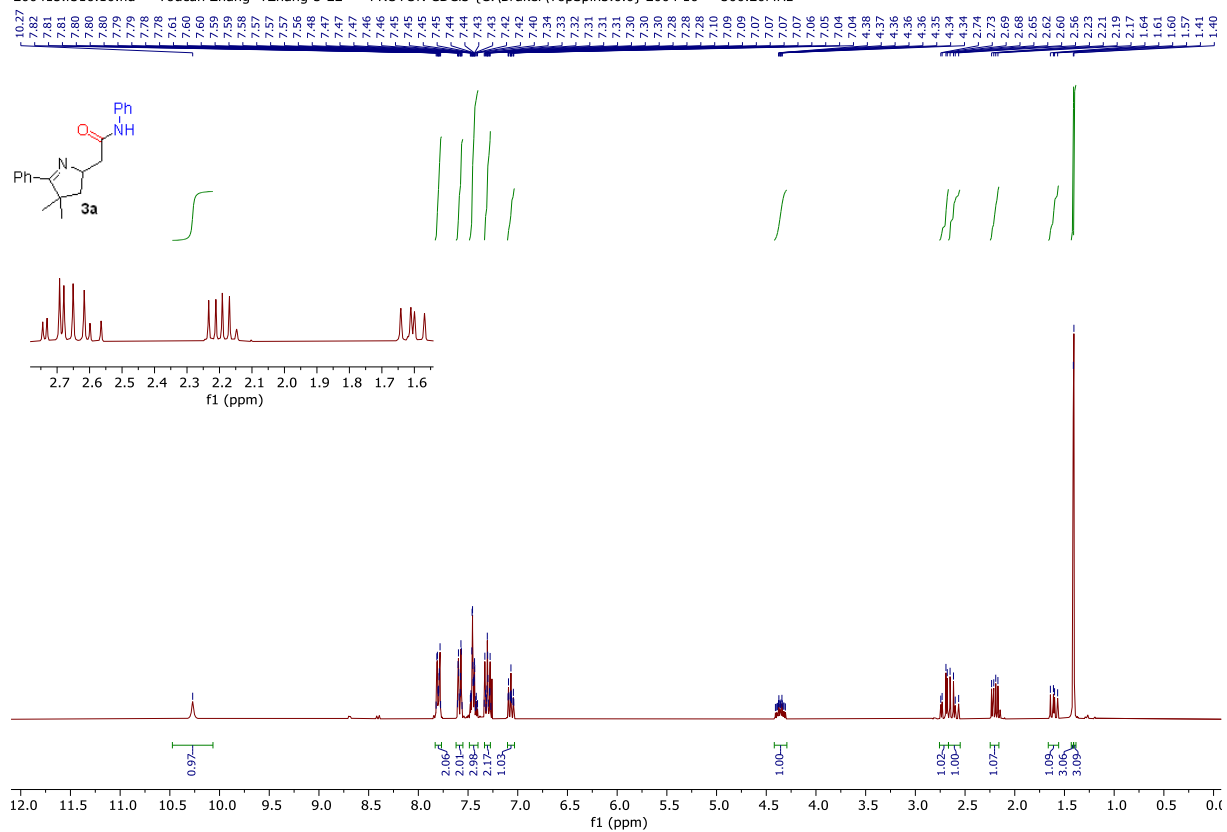
^{13}C NMR (75 MHz, CDCl_3) δ 179.6, 146.9, 134.6, 129.4, 128.0, 127.9, 110.0, 72.2, 50.3, 47.2, 27.0, 25.8, 19.8.

4. Reference

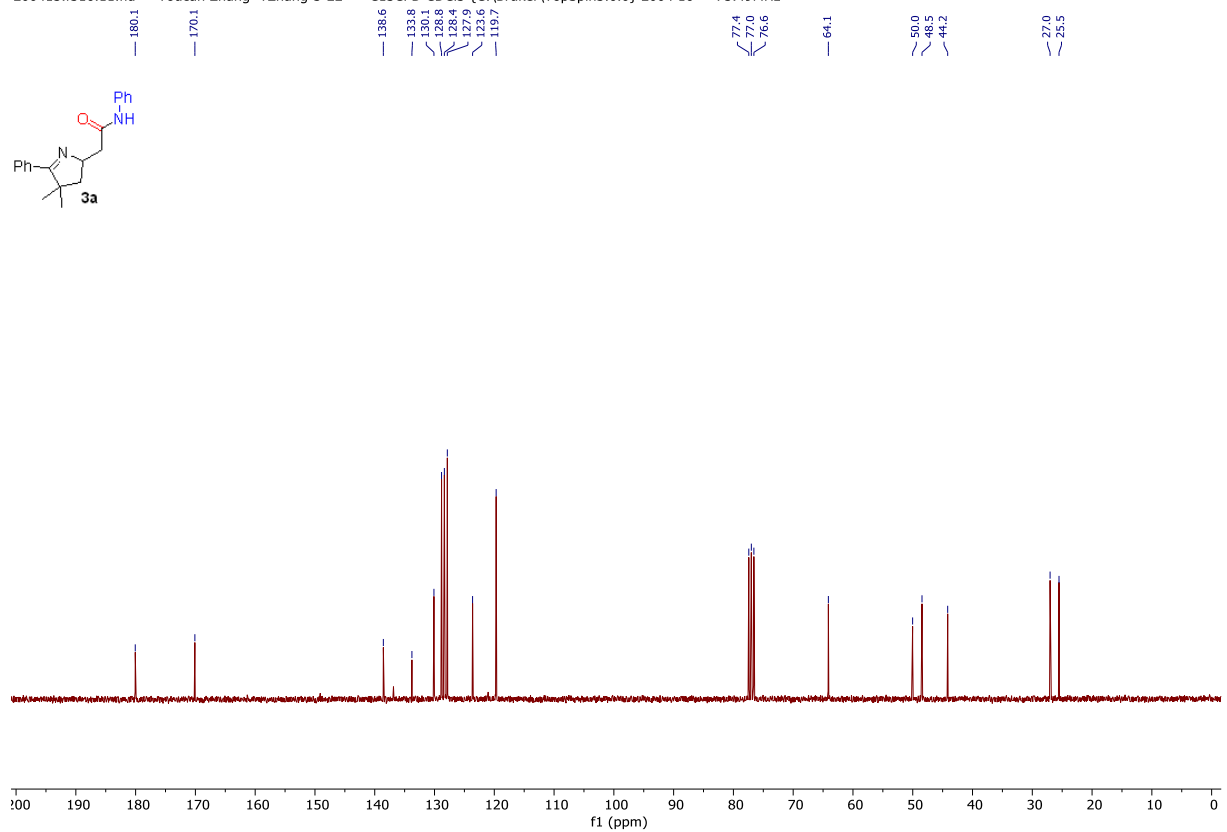
- [1] Liu, R.-H.; Wei, D.; Han, B.; Yu, W. *ACS Catal.* **2016**, *6*, 6525-6530.
- [2] Wang, L.; Wang C. *J. Org. Chem.* **2019**, *84*, 6547-6556.
- [3] Zhang, M.; Liu, S.; Li, H.; Guo, Y.; Li, N.; Guan, M.; Mehfooz, H.; Zhao, J.; Zhang, Q. *Chem. Eur. J.* **2019**, *25*, 12620-12627.
- [4] Cai, S.-H.; Xie, J.-H.; Song, S.; Ye, L.; Feng, C.; Loh, T.-P. *ACS Catal.* **2016**, *6*, 5571-5574.
- [5] Zhang, Y.; Yin, Y.; Wang H.; Wu, X.-F. *Chem. Commun.* **2020**, *56*, 7045-7048.
- [6] Du, W.; Zhao, M.-N.; Ren, Z.-H.; Wang, Y.-Y.; Guan, Z.-H. *Chem. Commun.* **2014**, *50*, 7437-7439.

5. ¹H-, ¹³C- and ¹⁹F-NMR spectra copy of products

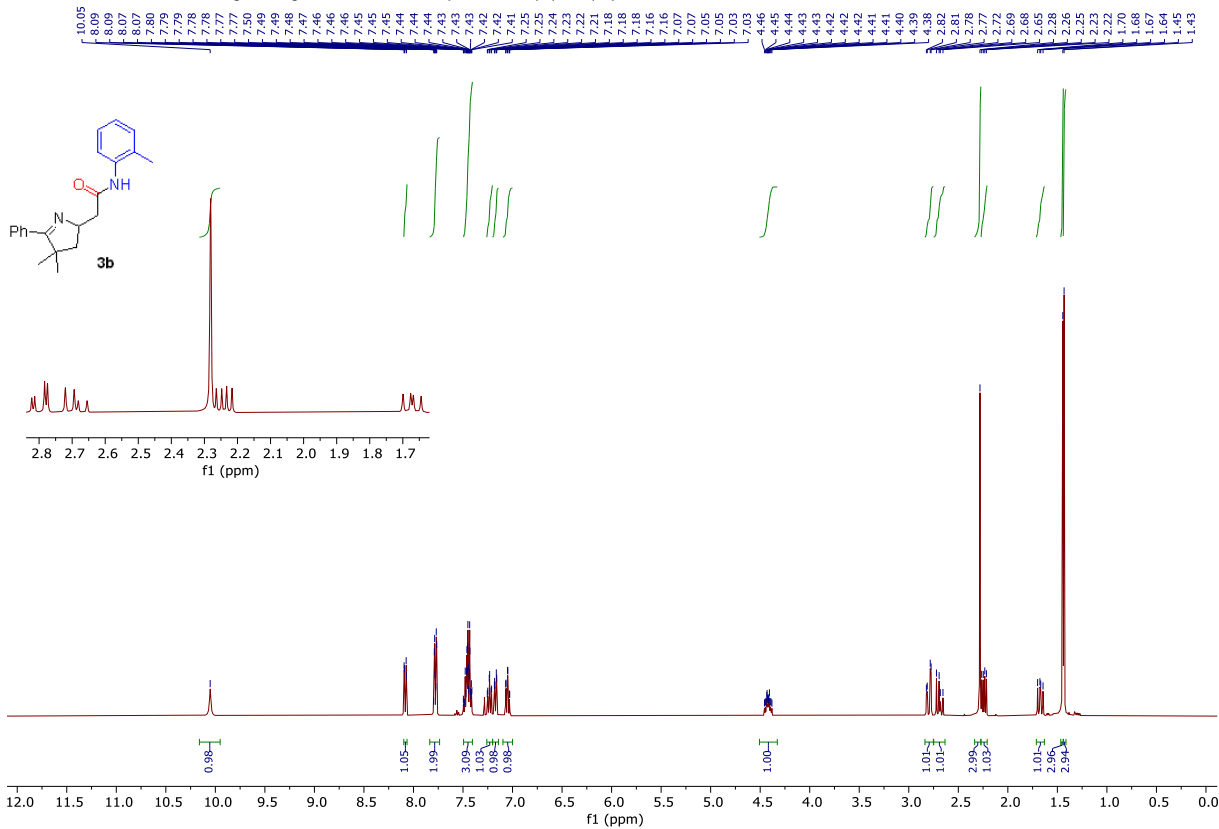
200415.f316.10.fid — Youcan Zhang YZhang-3-22 — PROTON CDCl₃ {C:\Bruker\TopSpin3.6.0} 2004 16 — 300.20MHz



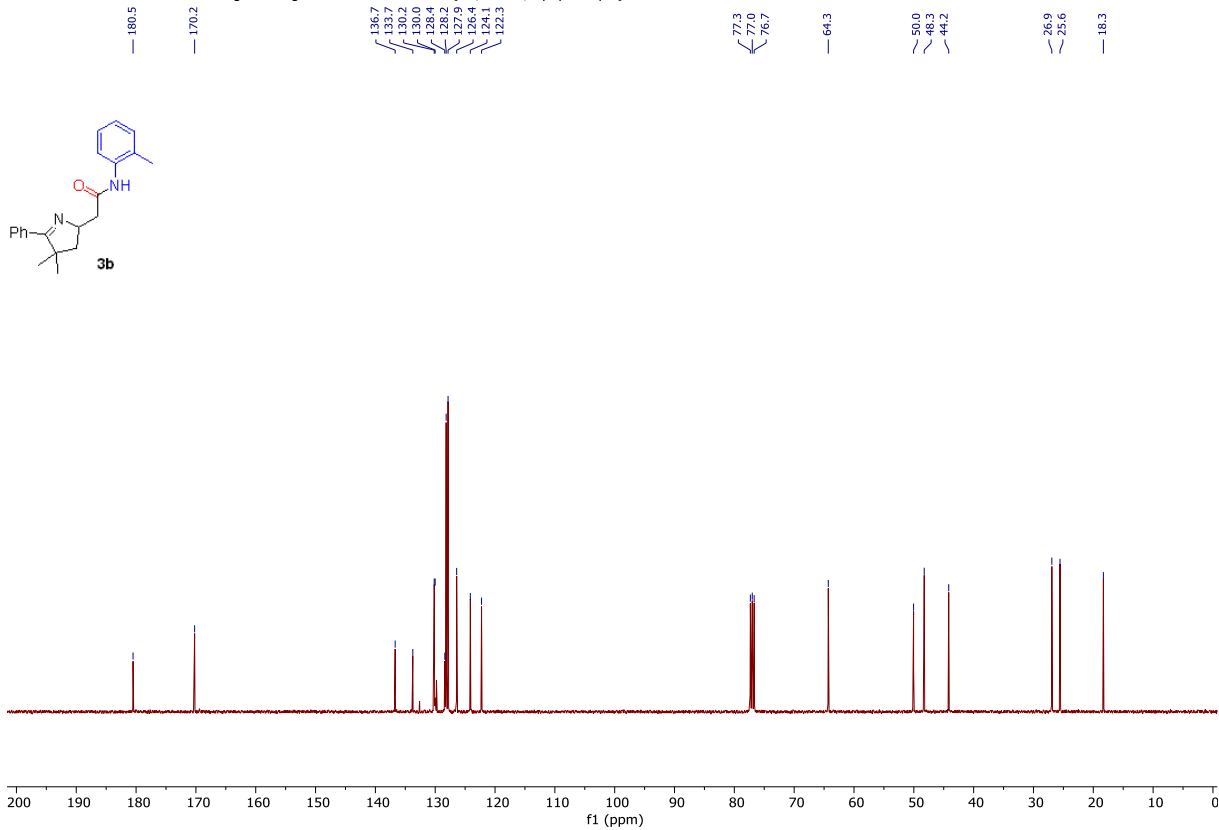
200415.f316.11.fid — Youcan Zhang YZhang-3-22 — C13CPD CDCl₃ {C:\Bruker\TopSpin3.6.0} 2004 16 — 75.49MHz



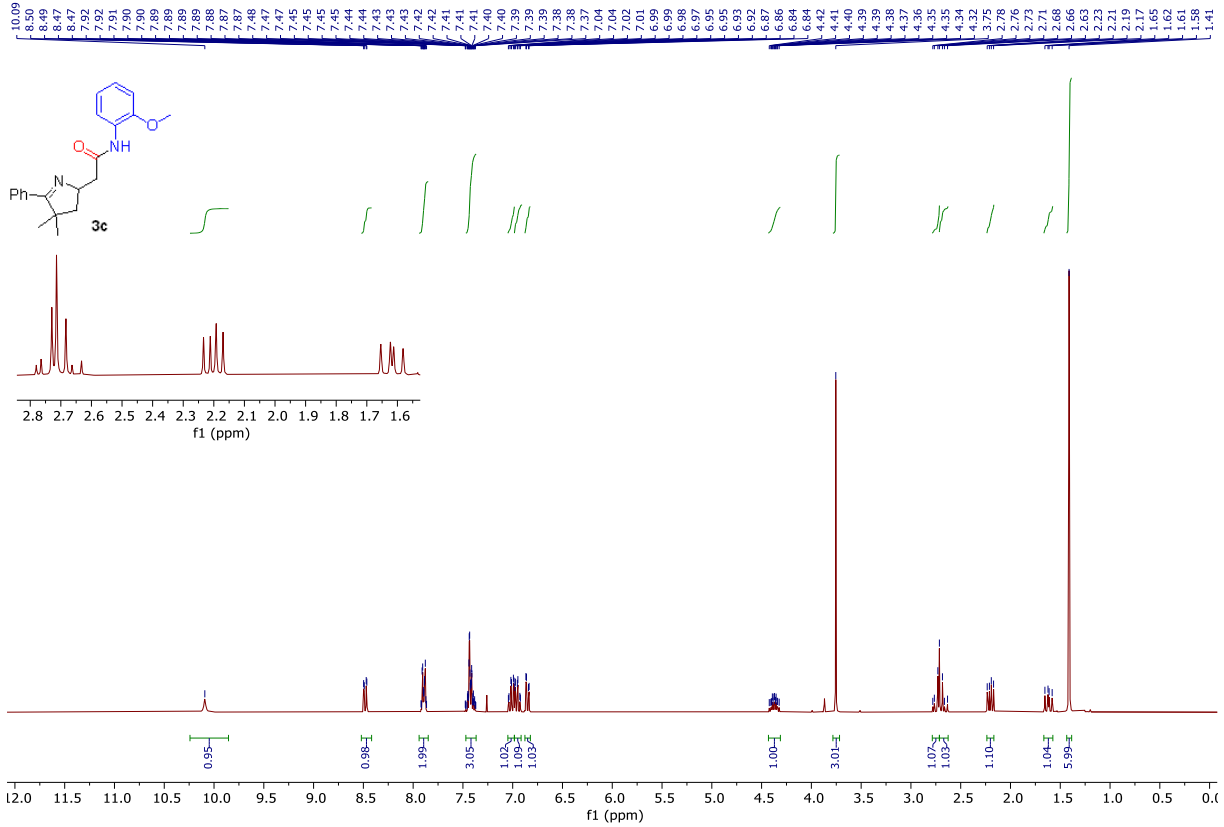
200414.423.10.fid — Youcan Zhang YZhang-3-48 — Au1H CDCl3 {C:\Bruker\TopSpin3.5pl6} 2004 23 — 400.13MHz



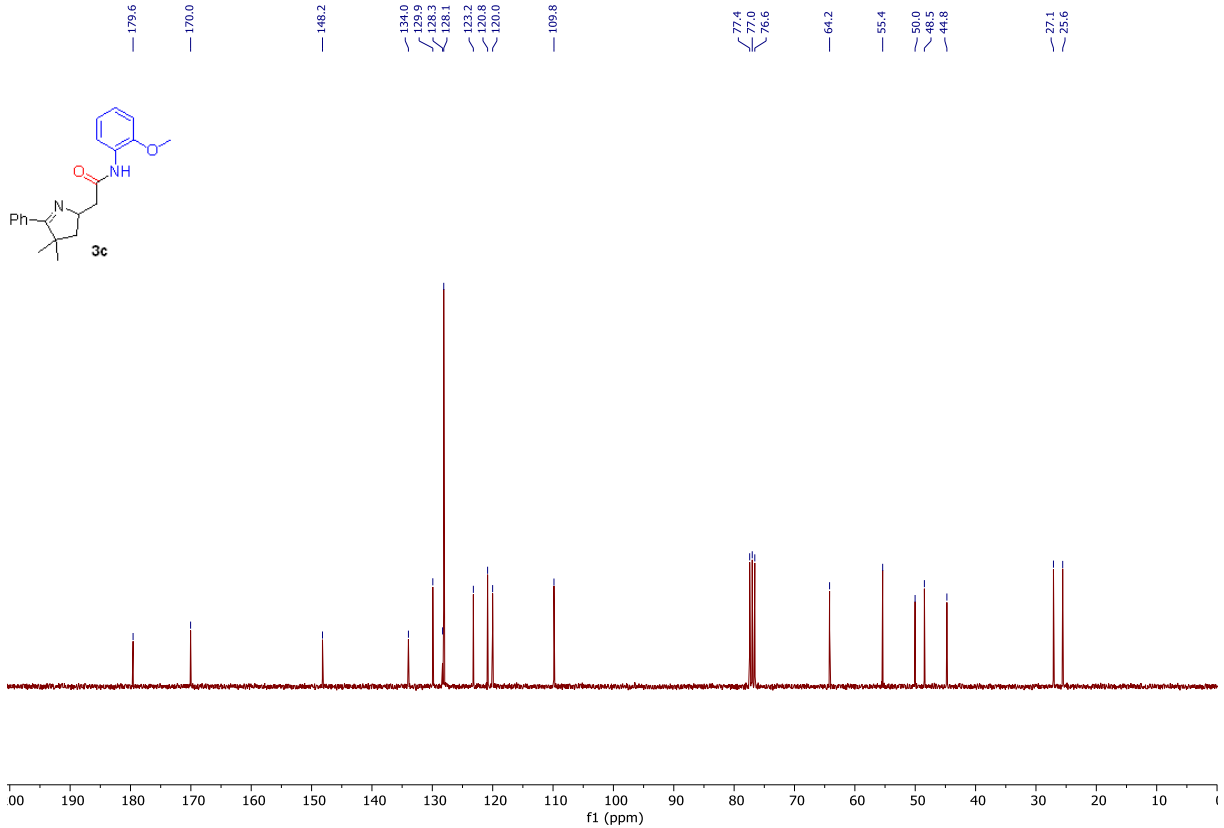
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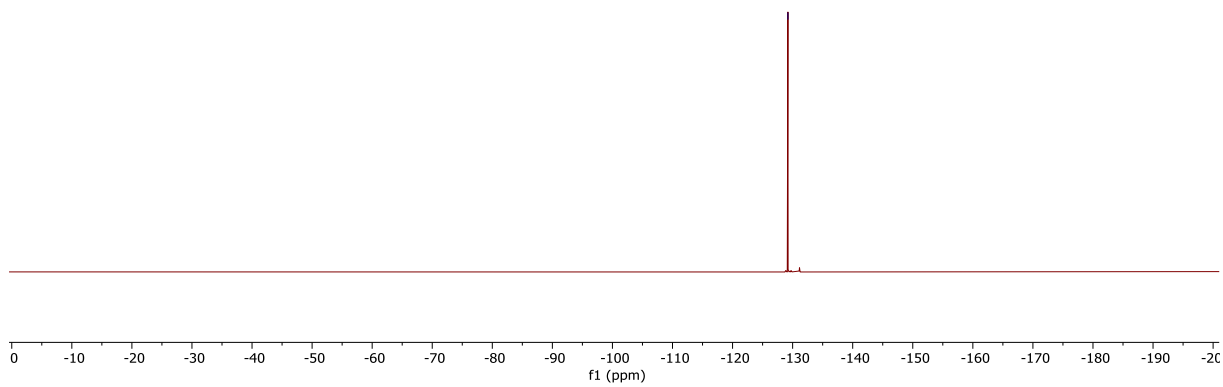
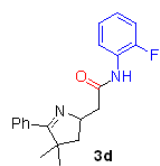


200417.f331.10.fid — Youcan Zhang YZhang-3-50 — PROTON CDCl3 {C:\Bruker\TopSpin3.6.0} 2004 31 — 300.20MHz

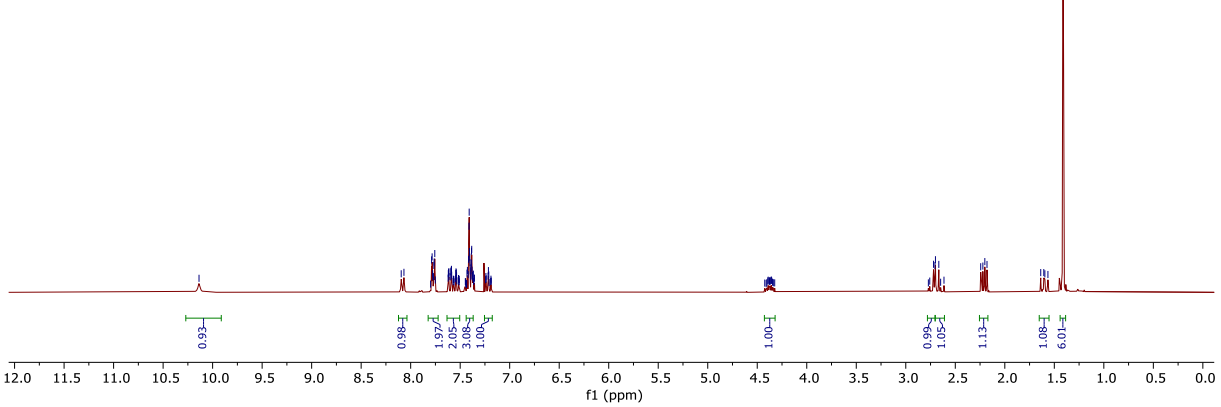
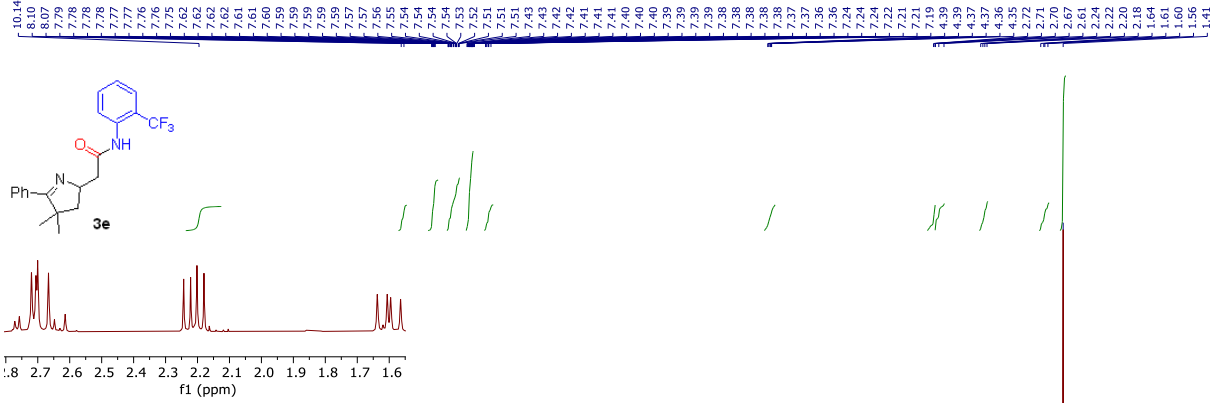


200417.f331.11.fid — Youcan Zhang YZhang-3-50 — C13CPD CDCl3 {C:\Bruker\TopSpin3.6.0} 2004 31 — 75.49MHz

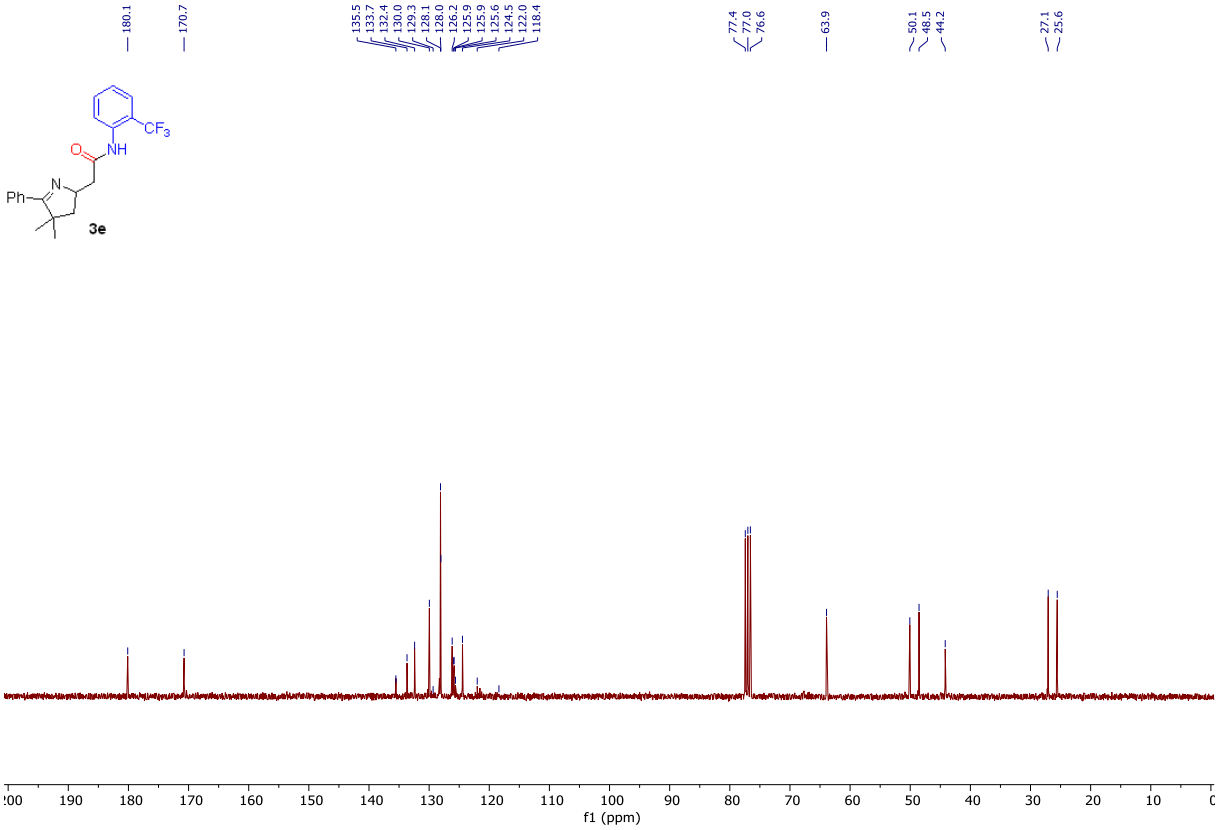


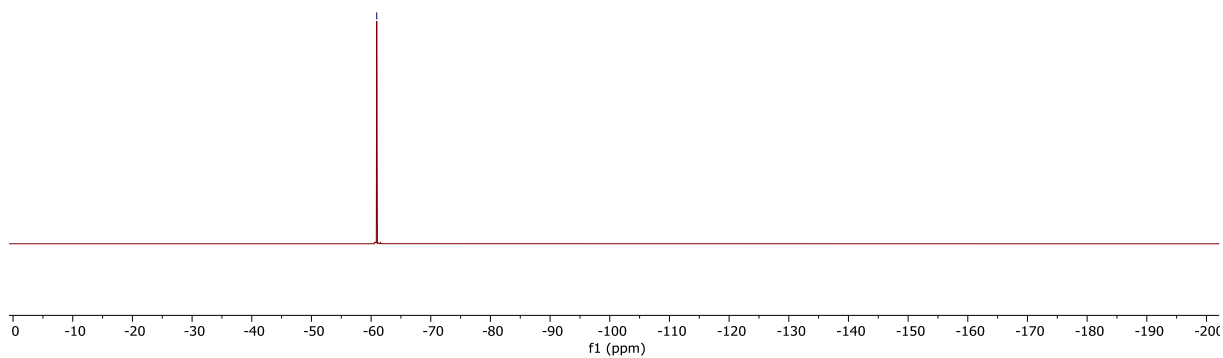
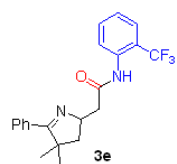


200409.f353.10.fid — Youcan Zhang YZhang-3-28 — PROTON CDCl3 {C:\Bruker\TopSpin3.6.0} 2004 53 — 300.20MHz

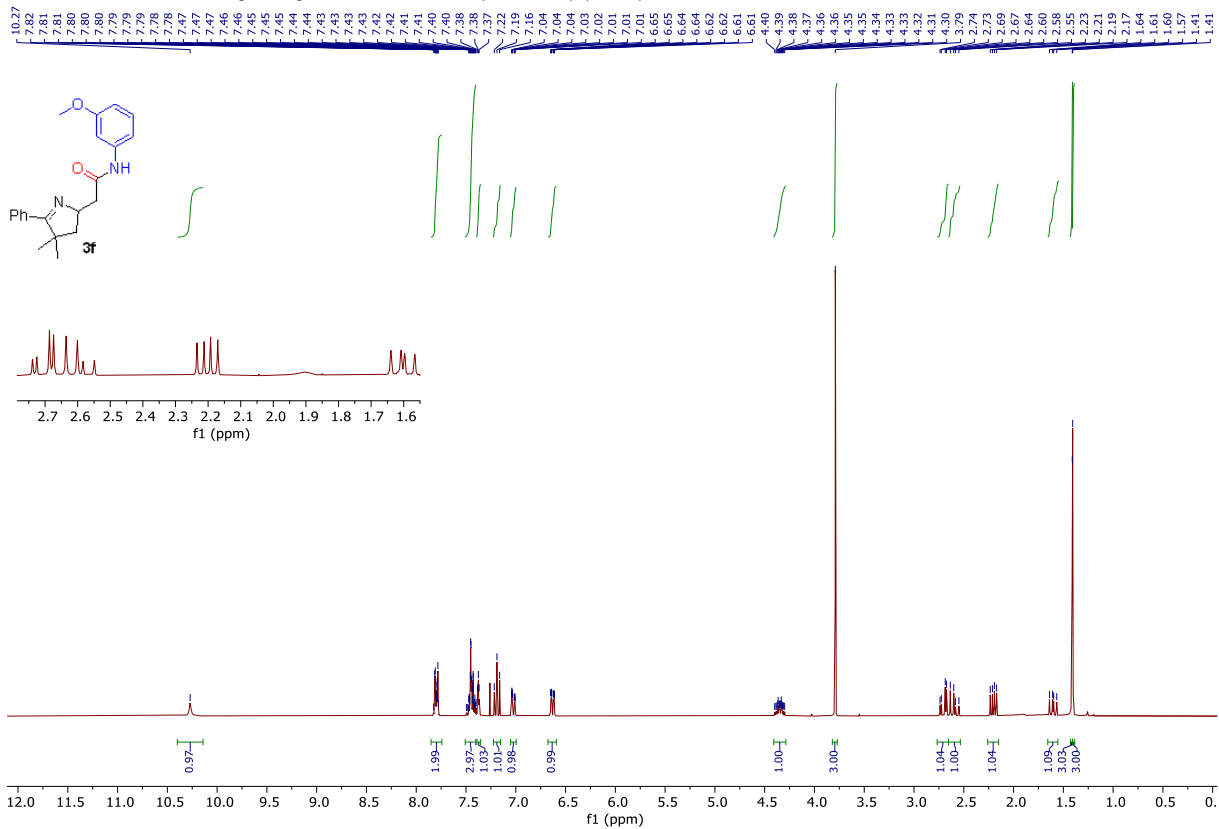


200409.f353.11.fid — Youcan Zhang YZhang-3-28 — C13CPD CDCl3 {C:\Bruker\TopSpin3.6.0} 2004 53 — 75.49MHz

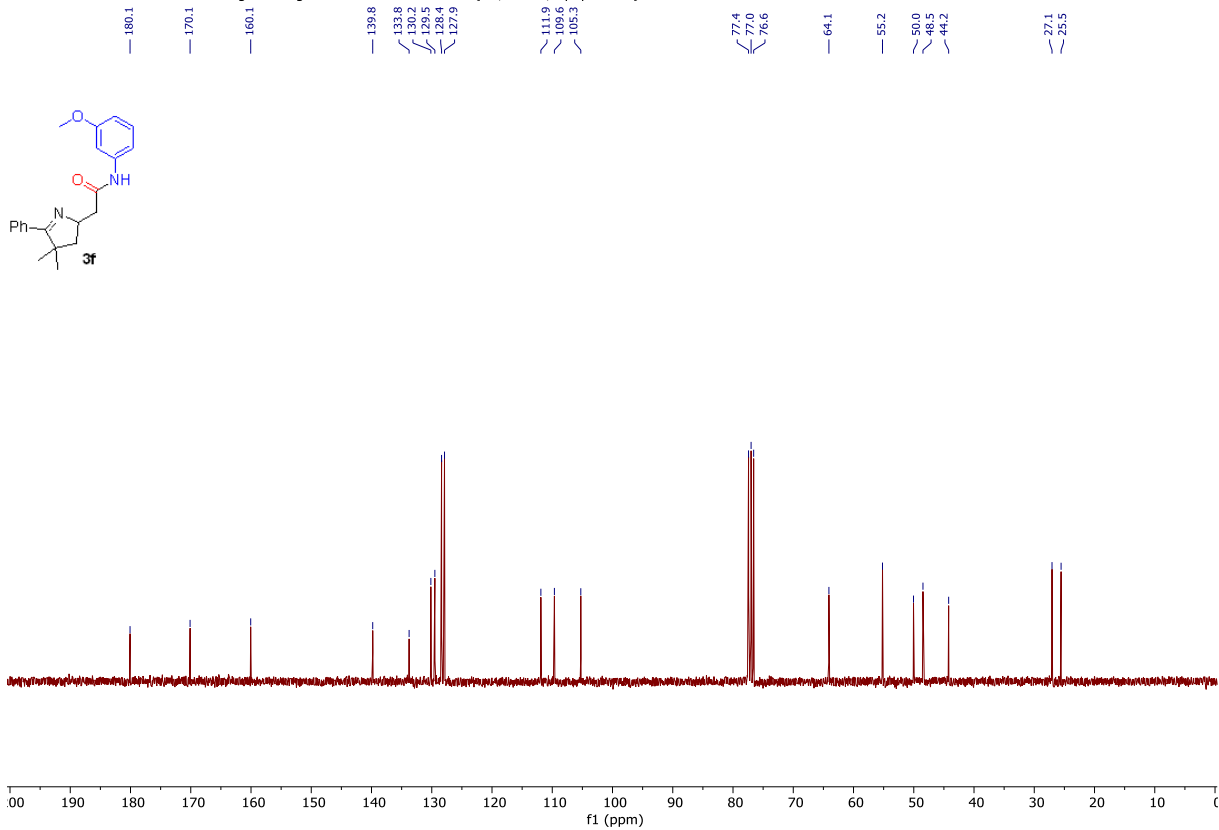




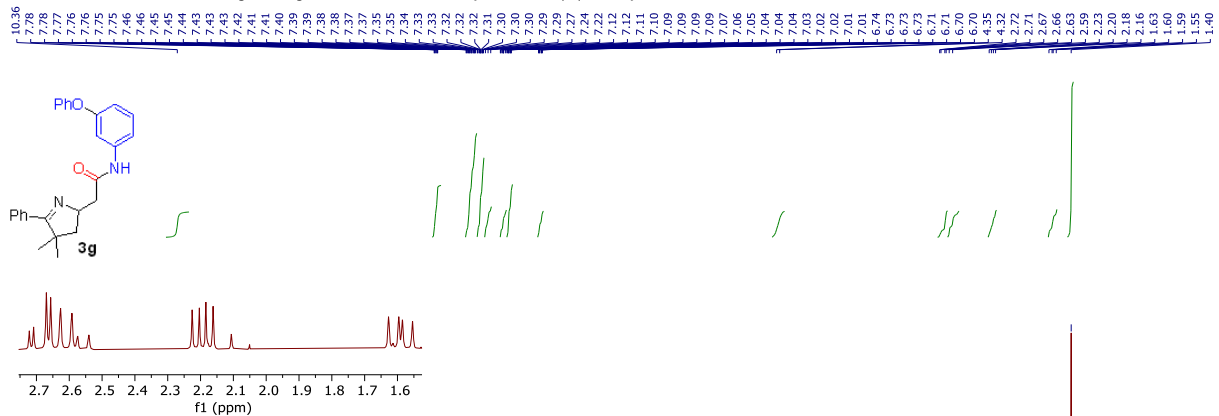
200508.f357.10.fid — Youcan Zhang YZhang-3-140 — PROTON CDCl3 {C:\Bruker\TopSpin3.6.0} 2005 57 — 300.20MHz



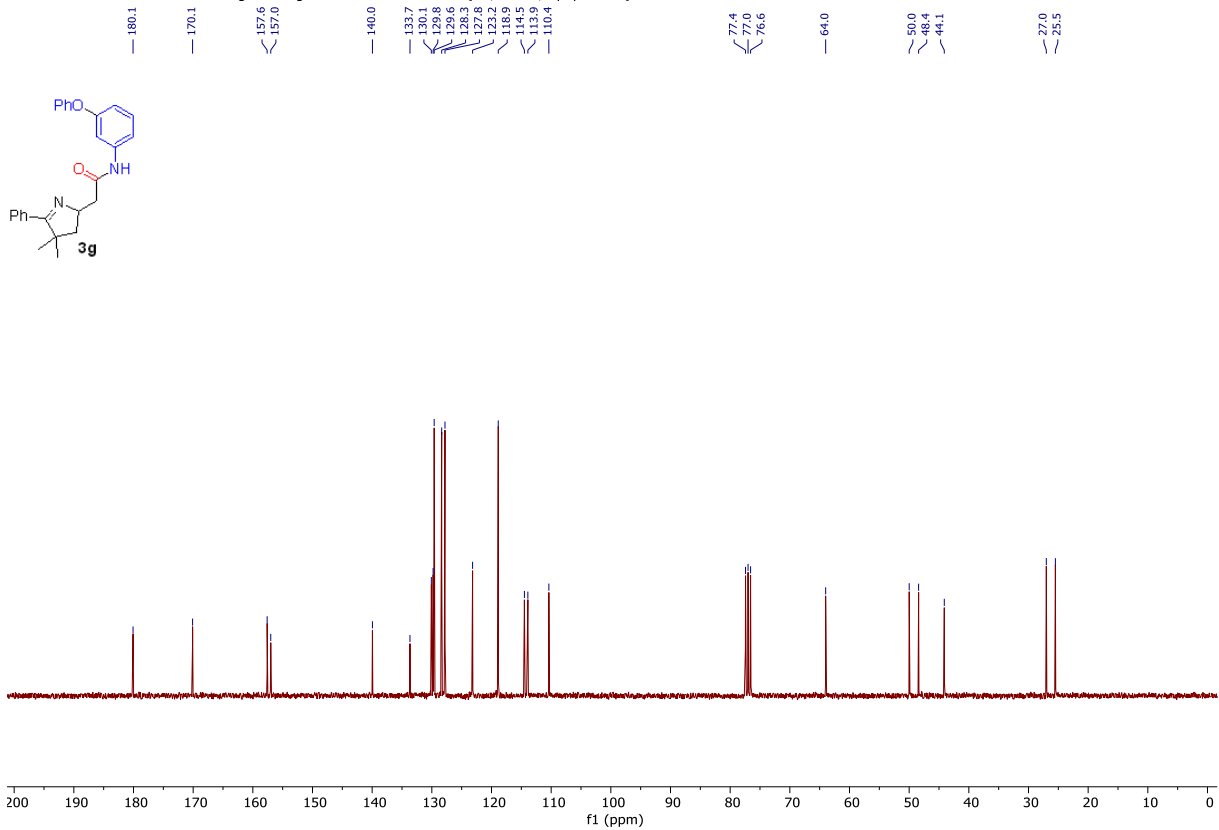
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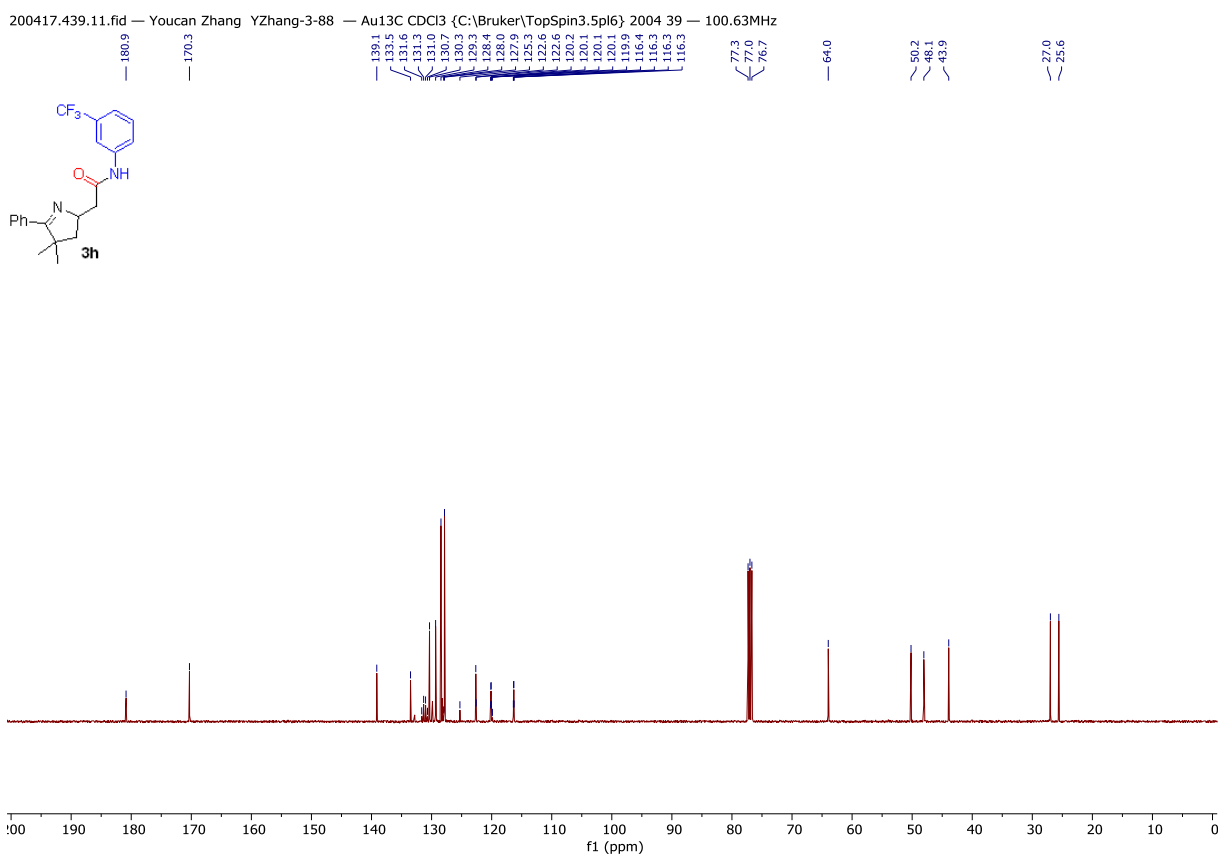
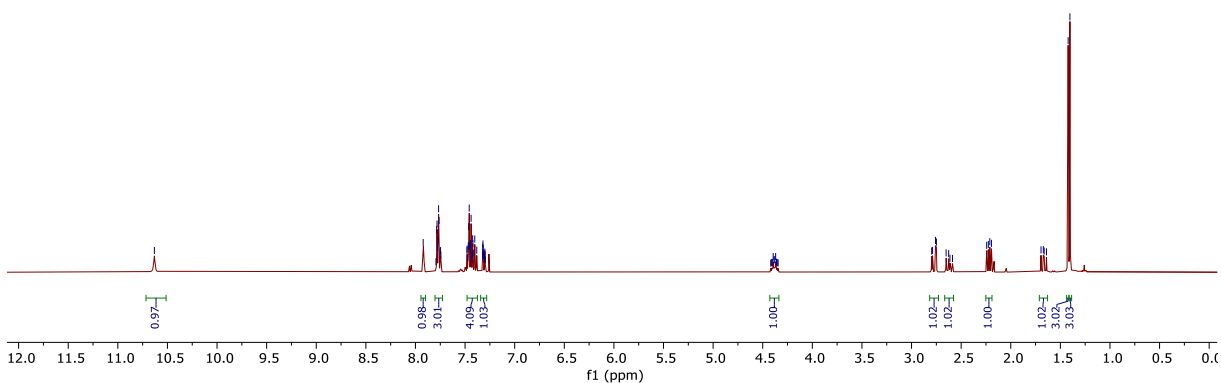
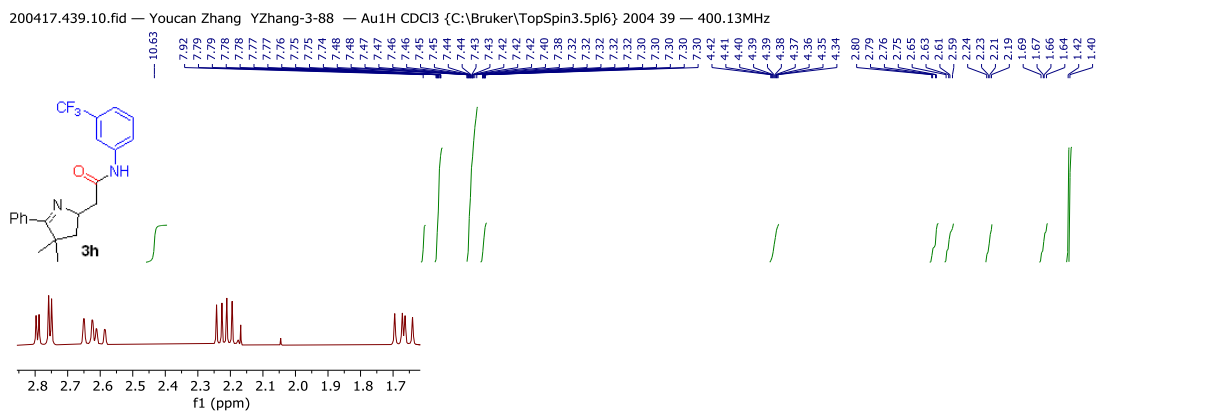


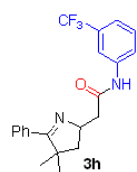
200420.f341.10.fid — Youcan Zhang YZhang-3-61 — PROTON CDCl3 {C:\Bruker\TopSpin3.6.0} 2004 41 — 300.20MHz



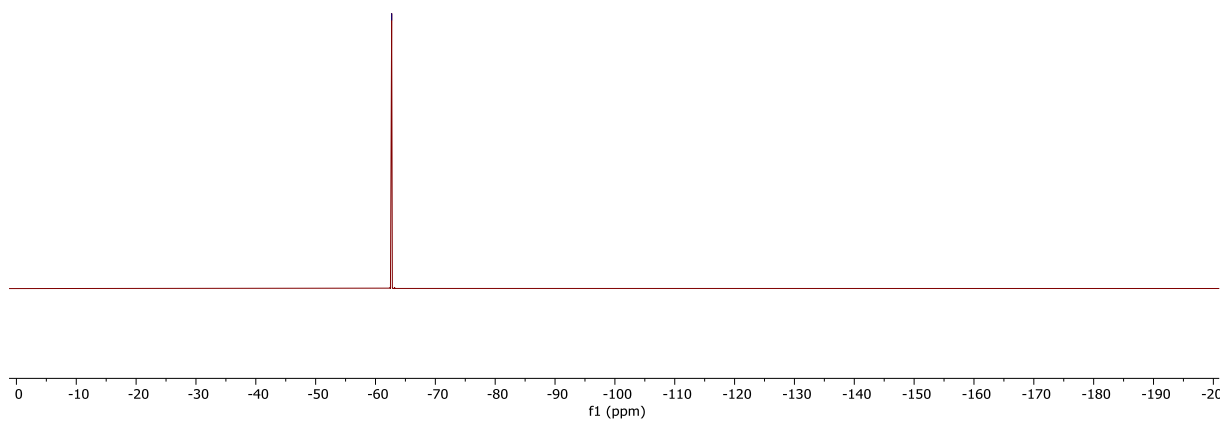
200420.f341.11.fid — Youcan Zhang YZhang-3-61 — C13CPD CDCl3 {C:\Bruker\TopSpin3.6.0} 2004 41 — 75.49MHz



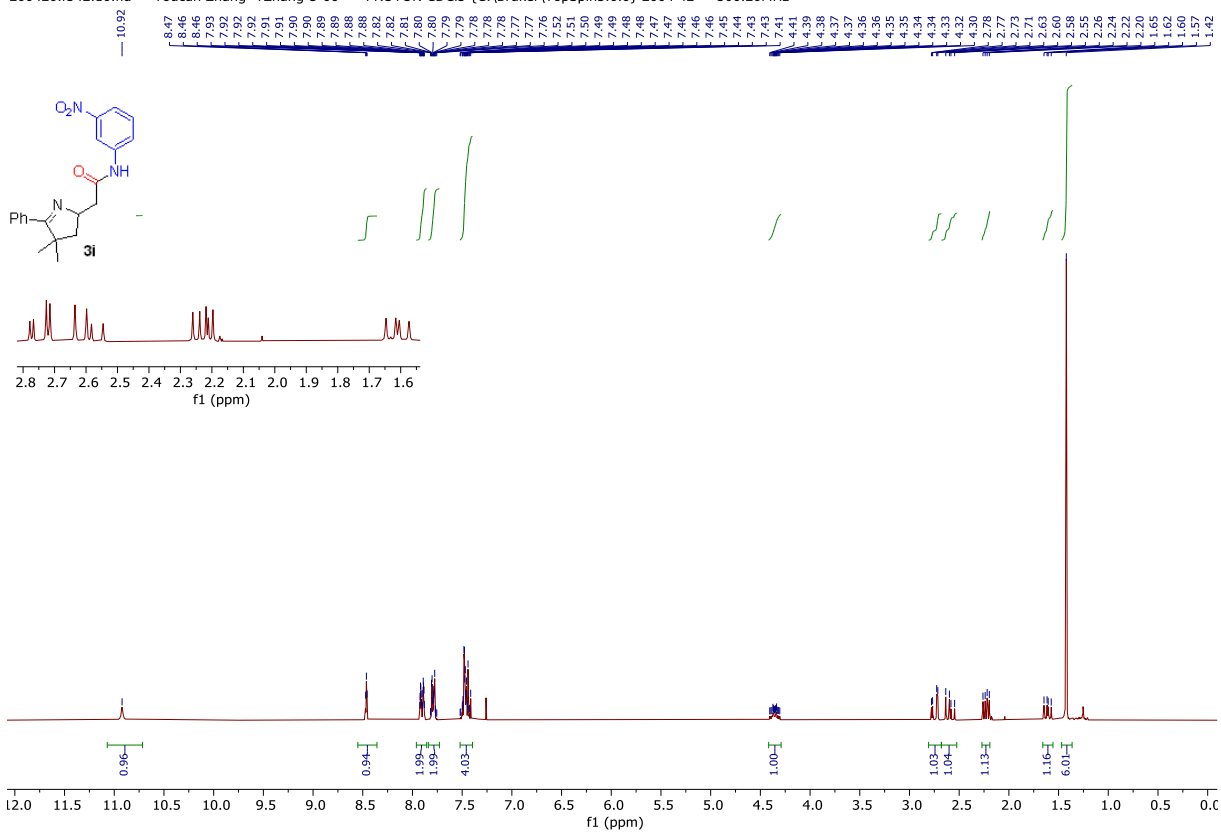




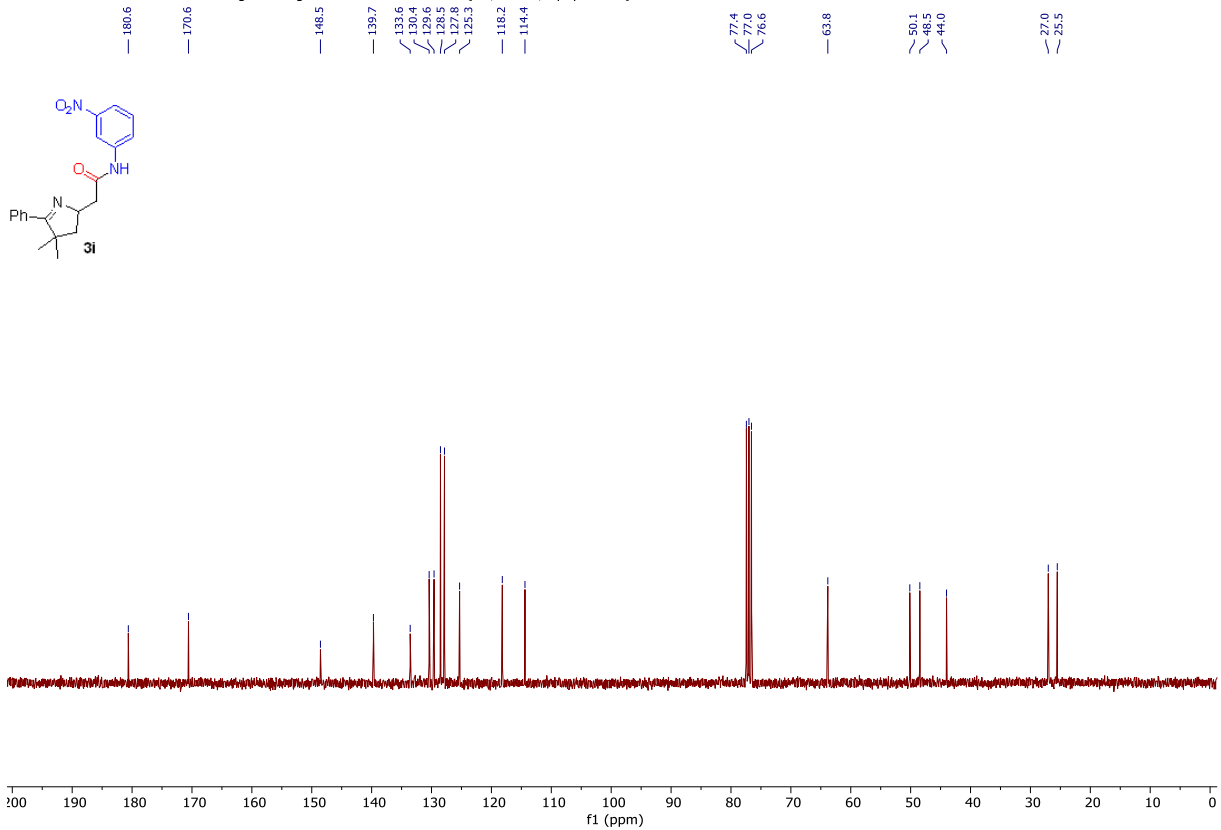
— 62.7



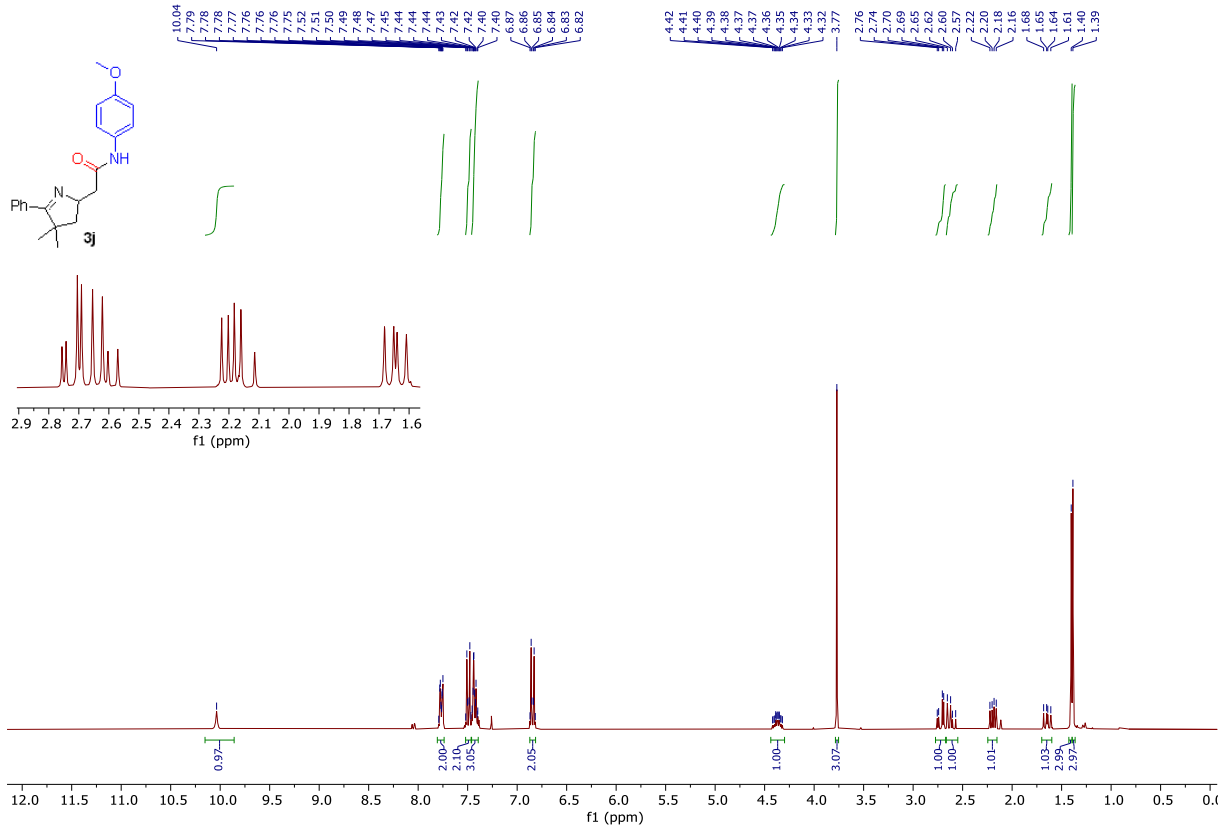
200420.f342.10.fid — Youcan Zhang YZhang-3-66 — PROTON CDCl3 {C:\Bruker\TopSpin3.6.0} 2004 42 — 300.20MHz



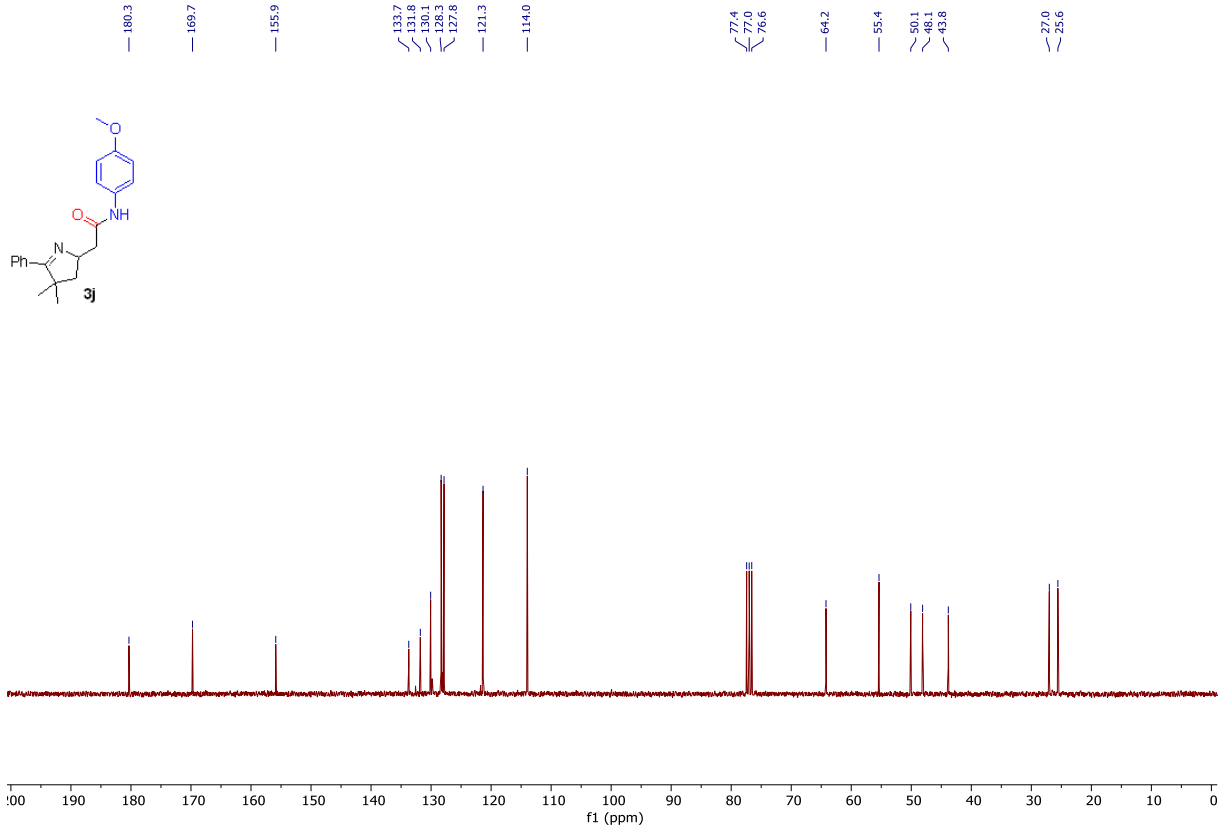
200420.f342.11.fid — Youcan Zhang YZhang-3-66 — C13CPD CDCl3 {C:\Bruker\TopSpin3.6.0} 2004 42 — 75.49MHz



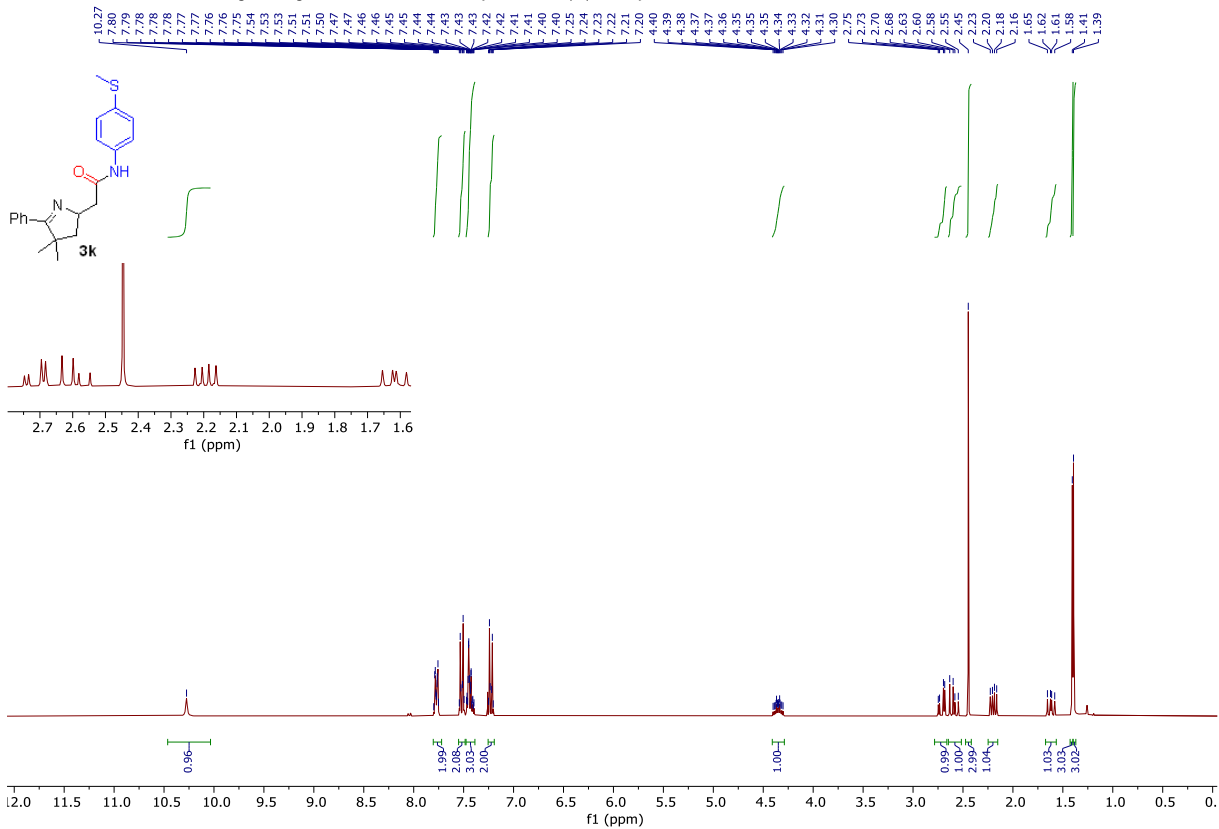
200406.f350.10.fid — Youcan Zhang YZhang-3-45 — PROTON CDCl3 {C:\Bruker\TopSpin3.6.0} 2004 50 — 300.20MHz



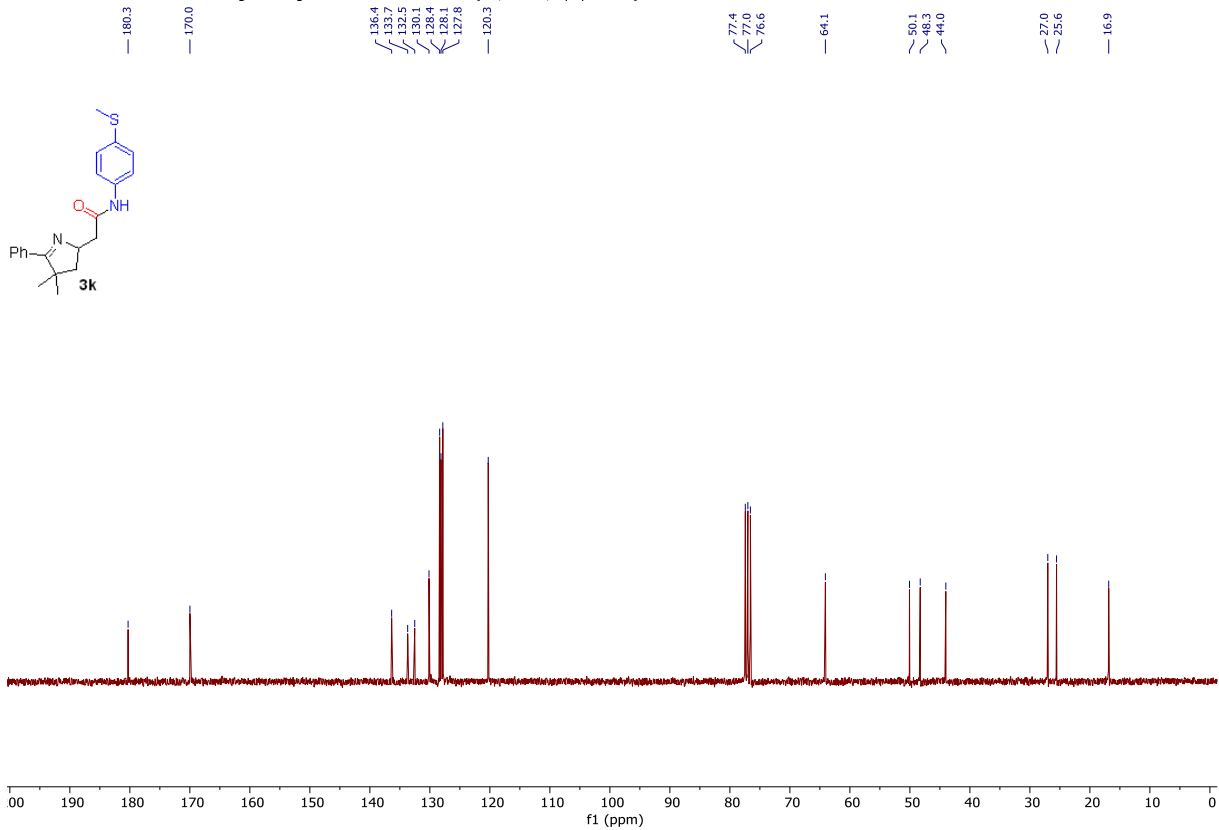
200406.f350.11.fid — Youcan Zhang YZhang-3-45 — C13CPD CDCl3 {C:\Bruker\TopSpin3.6.0} 2004 50 — 75.49MHz



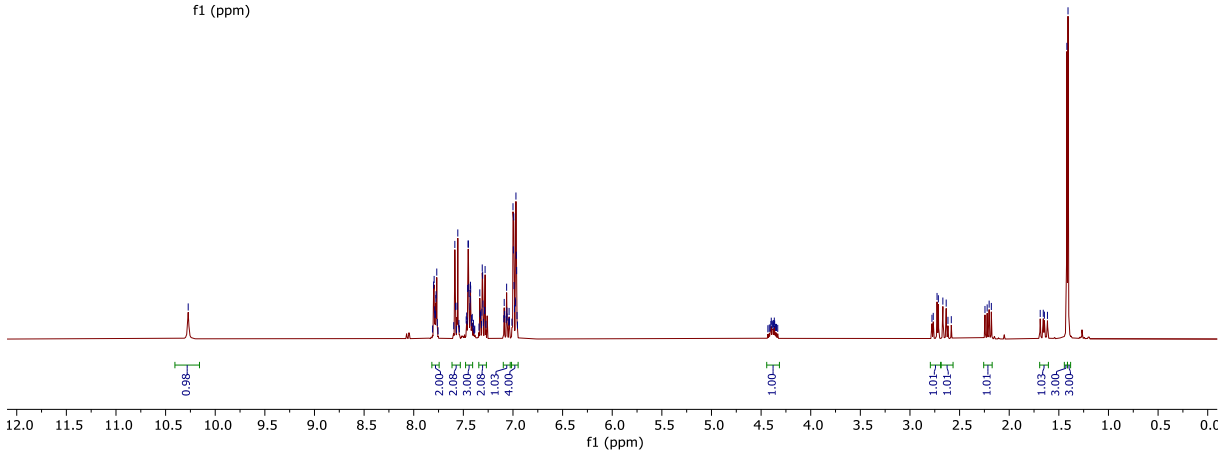
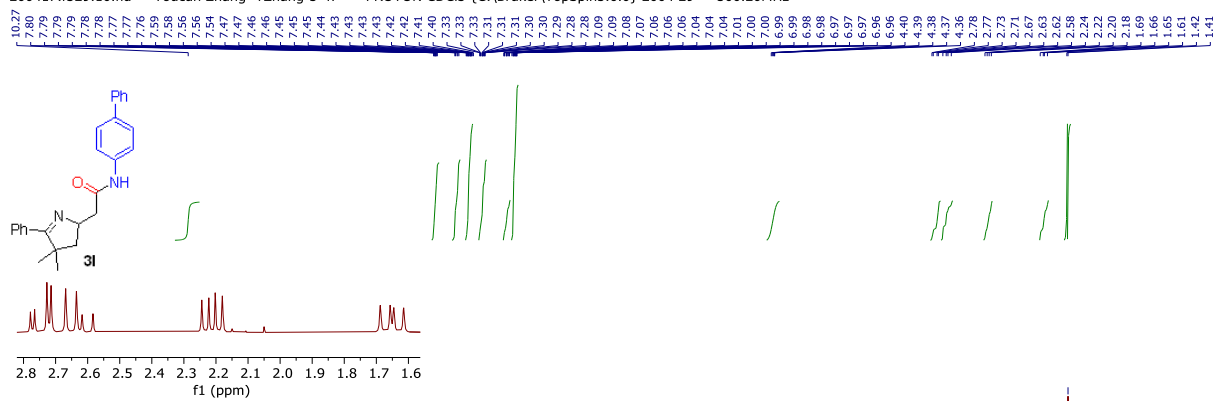
200508.f358.10.fid — Youcan Zhang YZhang-3-144 — PROTON CDCl3 {C:\Bruker\TopSpin3.6.0} 2005 58 — 300.20MHz



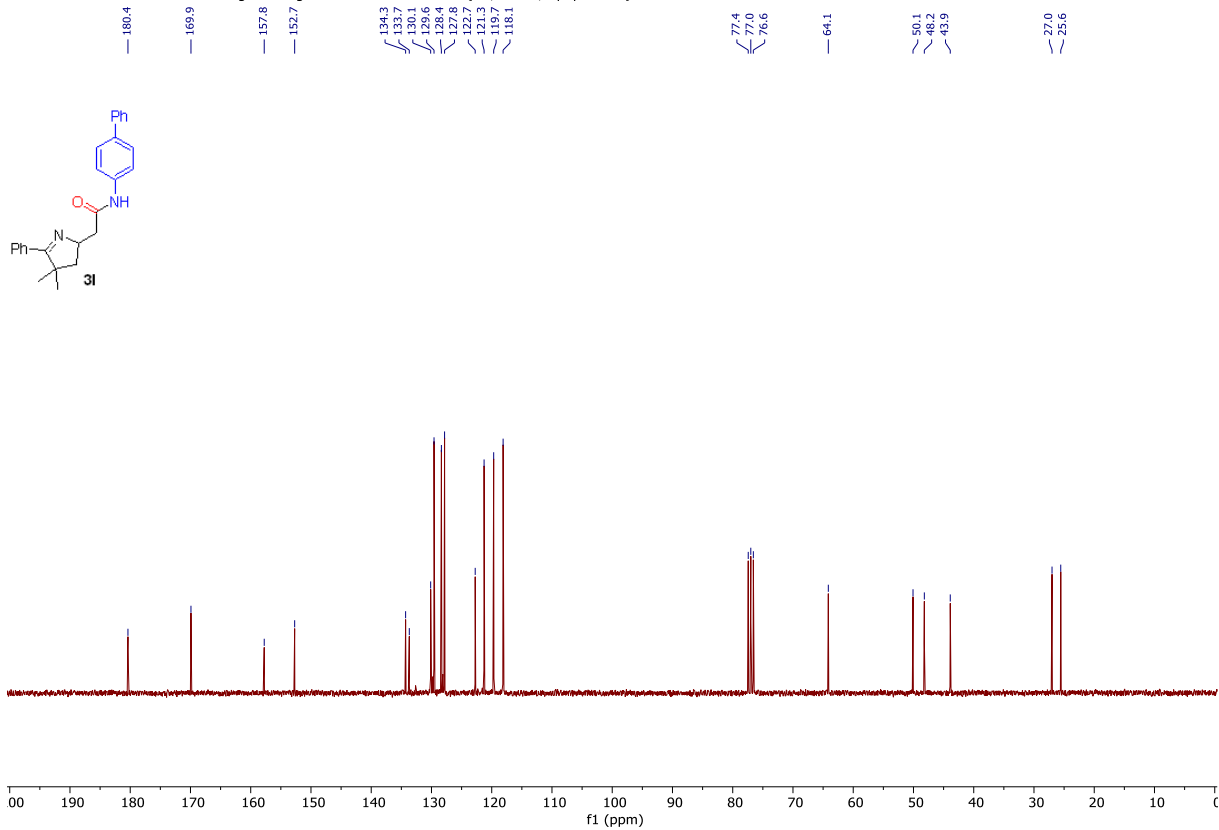
200508.f358.11.fid — Youcan Zhang YZhang-3-144 — C13CPD CDCl3 {C:\Bruker\TopSpin3.6.0} 2005 58 — 75.49MHz



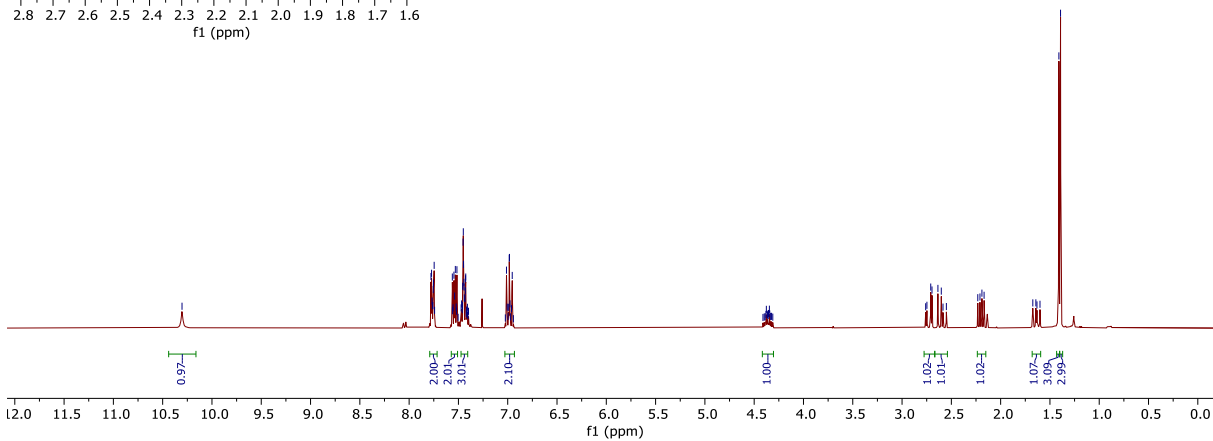
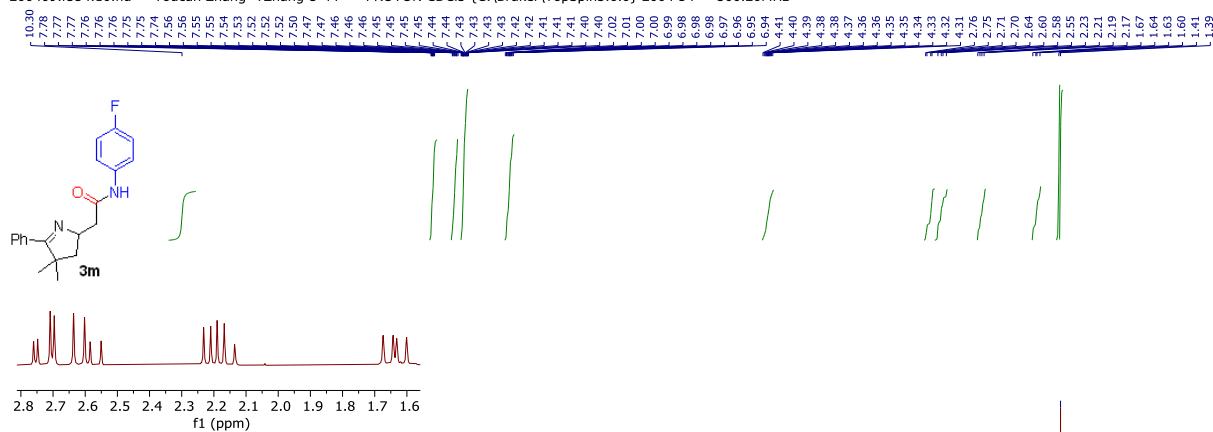
200417.f329.10.fid — Youcan Zhang YZhang-3-47 — PROTON CDCl3 {C:\Bruker\TopSpin3.6.0} 2004 29 — 300.20MHz



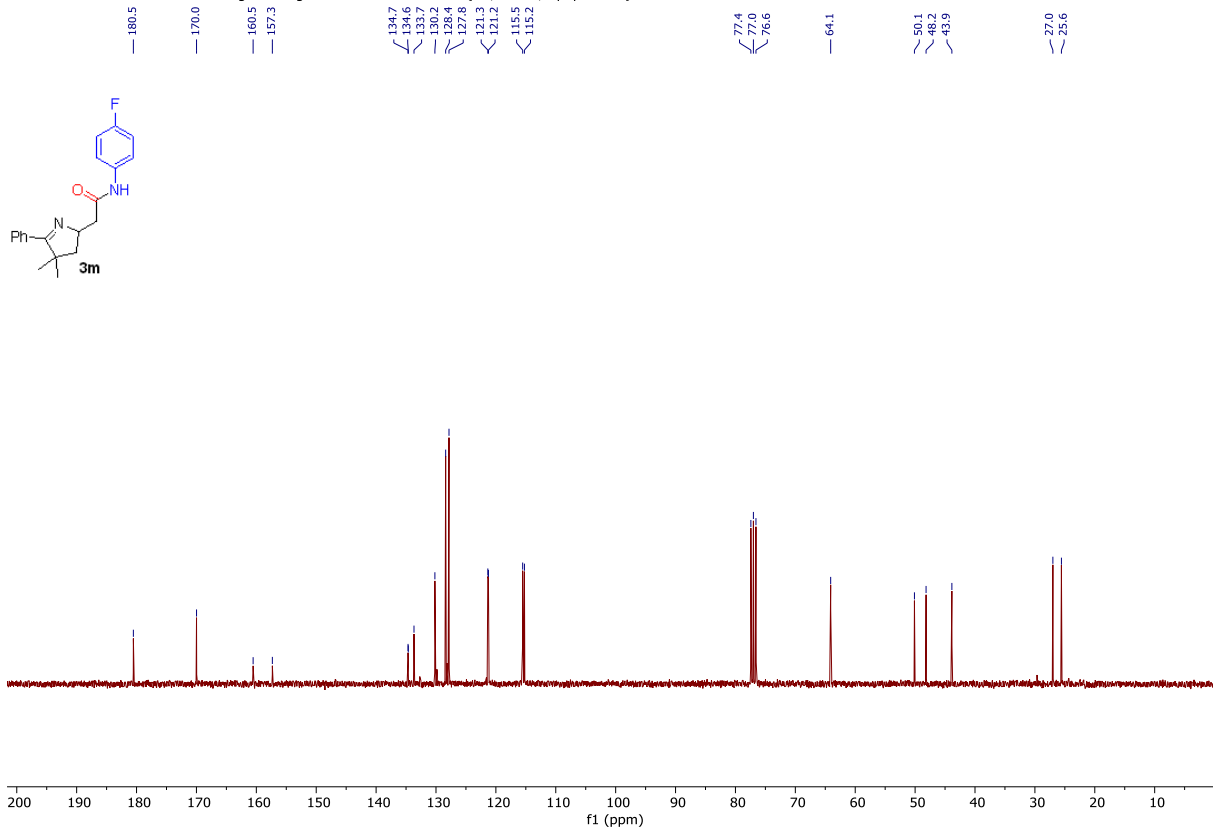
200417.f329.11.fid — Youcan Zhang YZhang-3-47 — C13CPD CDCl3 {C:\Bruker\TopSpin3.6.0} 2004 29 — 75.49MHz

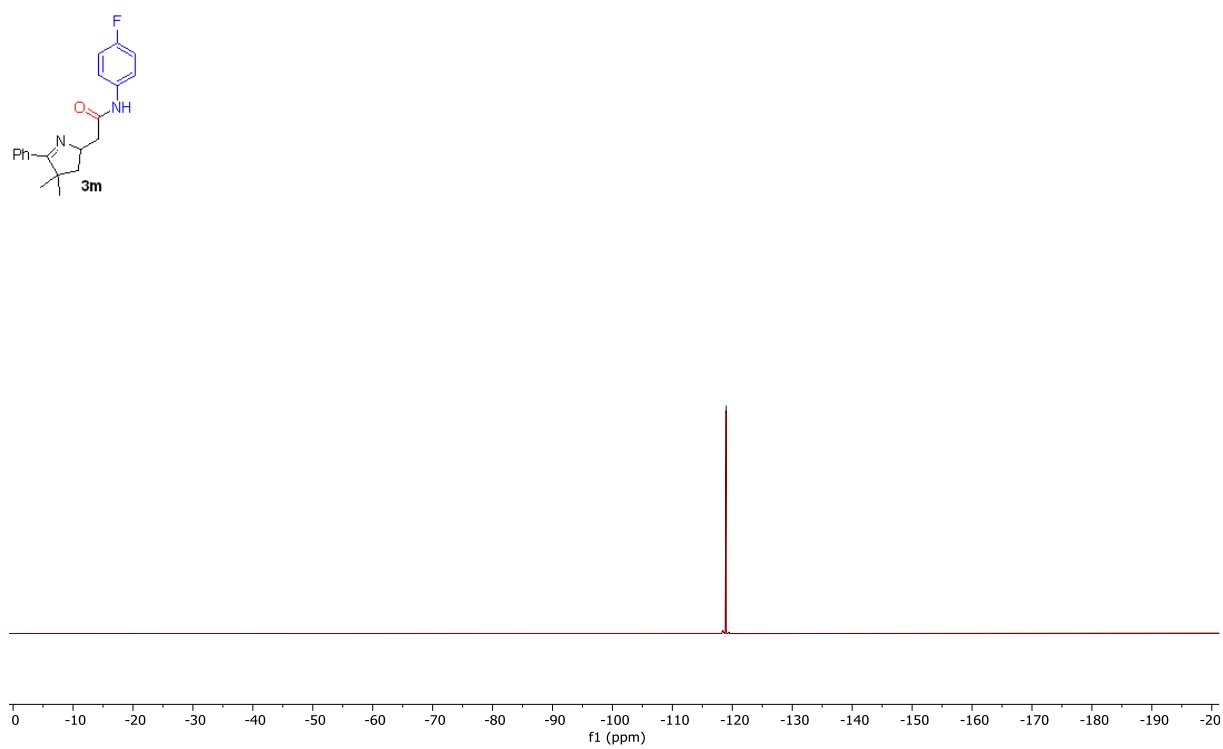


200409.f354.10.fid — Youcan Zhang YZhang-3-44 — PROTON CDCl3 {C:\Bruker\TopSpin3.6.0} 2004 54 — 300.20MHz

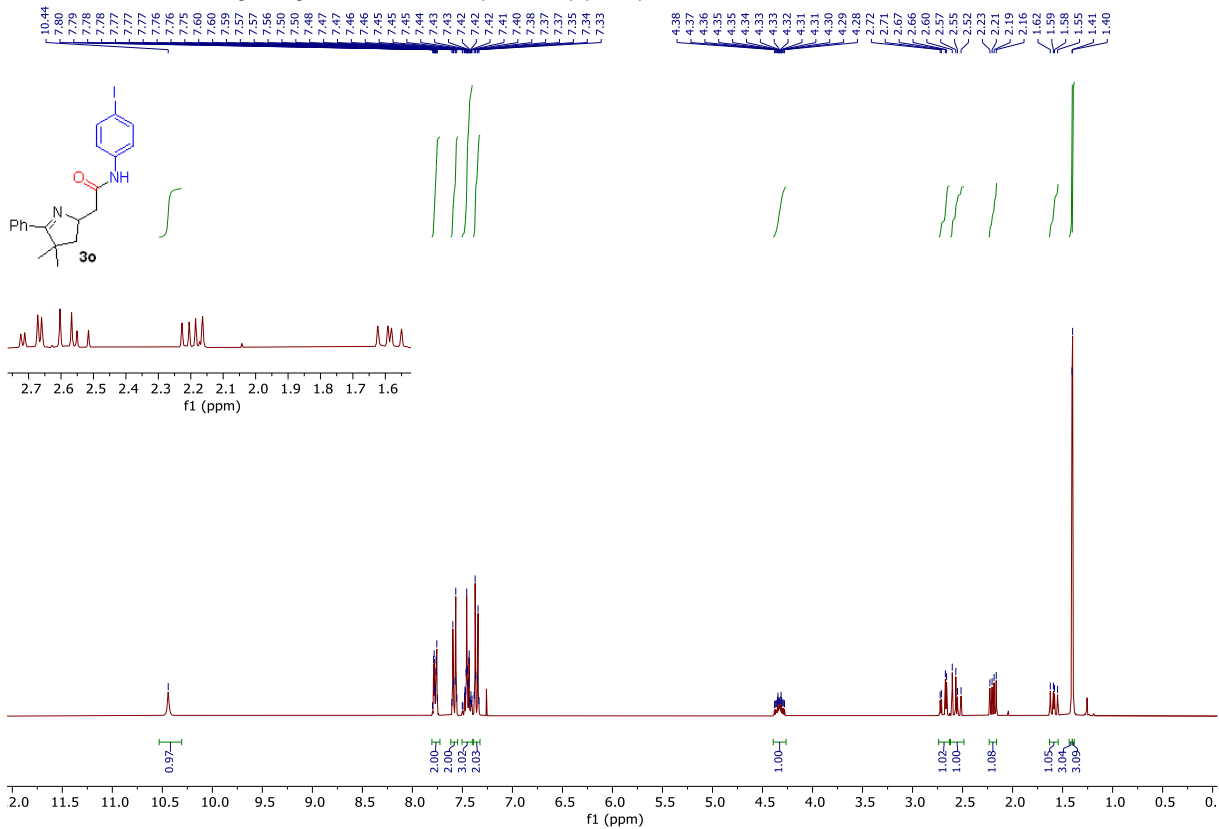


200409.f354.11.fid — Youcan Zhang YZhang-3-44 — C13CPD CDCl3 {C:\Bruker\TopSpin3.6.0} 2004 54 — 75.49MHz

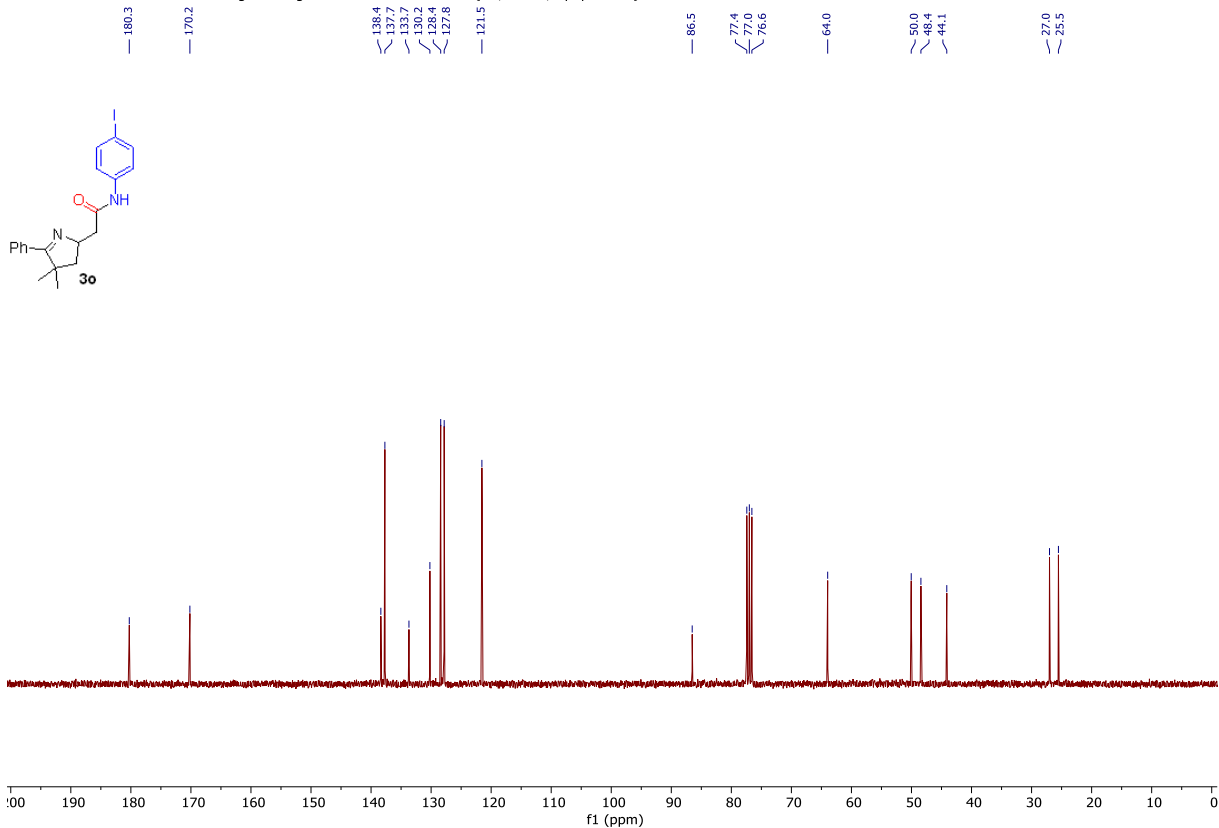




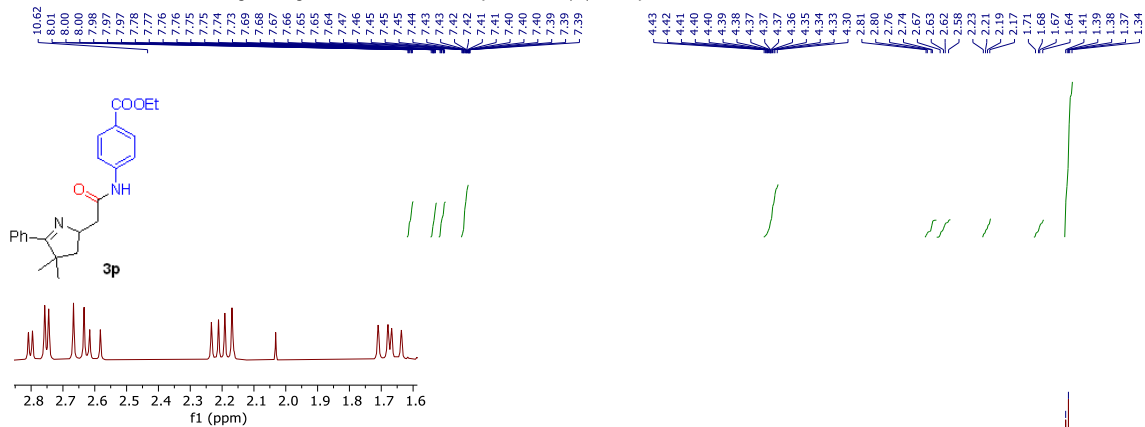
200424.f364.10.fid — Youcan Zhang YZhang-3-104 — PROTON CDCl3 {C:\Bruker\TopSpin3.6.0} 2004 4 — 300.20MHz



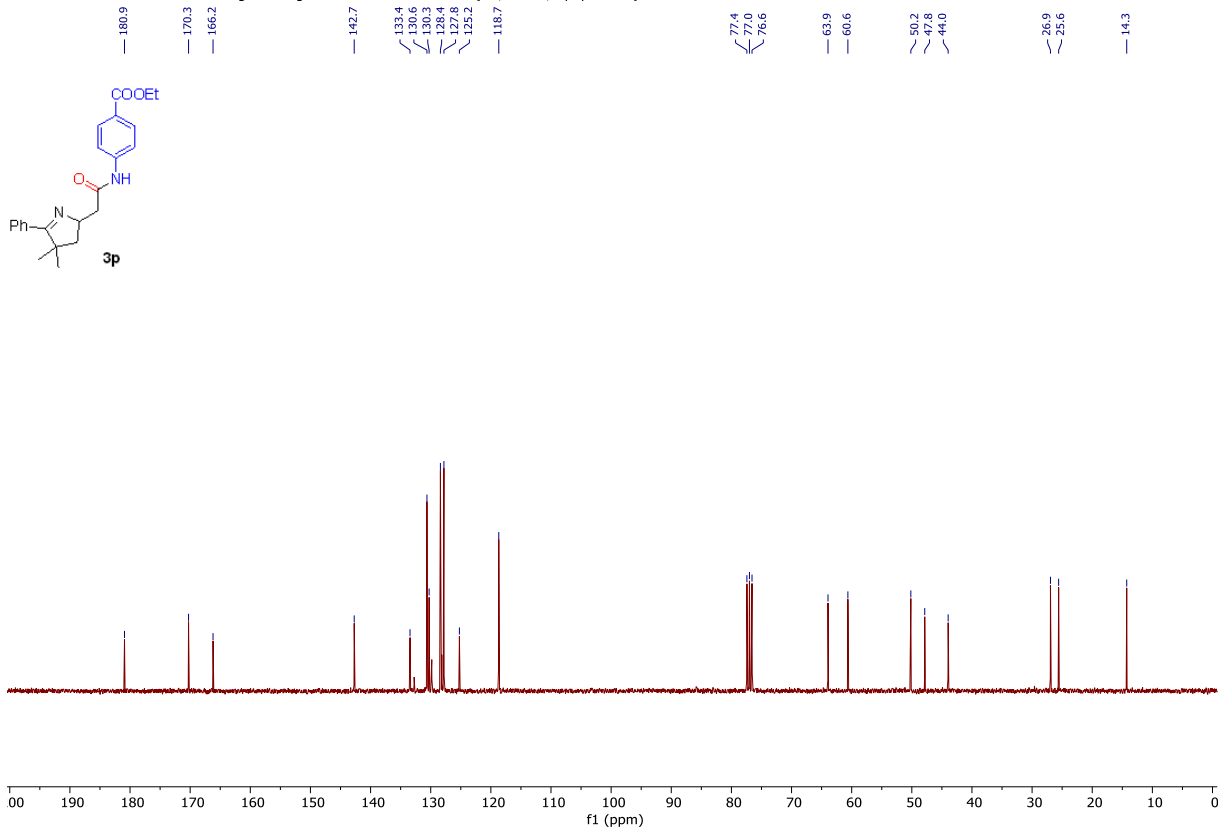
200424.f364.11.fid — Youcan Zhang YZhang-3-104 — C13CPD CDCl3 {C:\Bruker\TopSpin3.6.0} 2004 4 — 75.49MHz



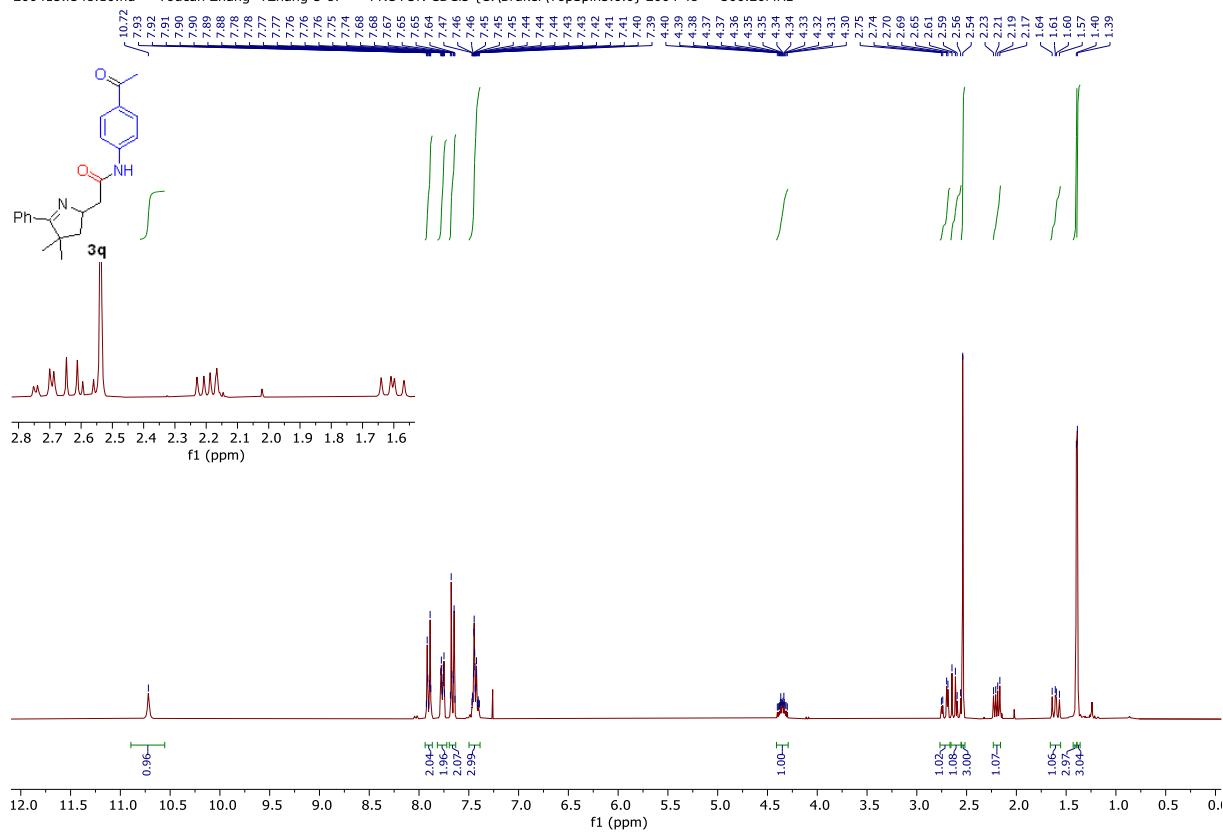
200422.f328.10.fid — Youcan Zhang YZhang-3-102 — PROTON CDCl3 {C:\Bruker\TopSpin3.6.0} 2004 28 — 300.20MHz



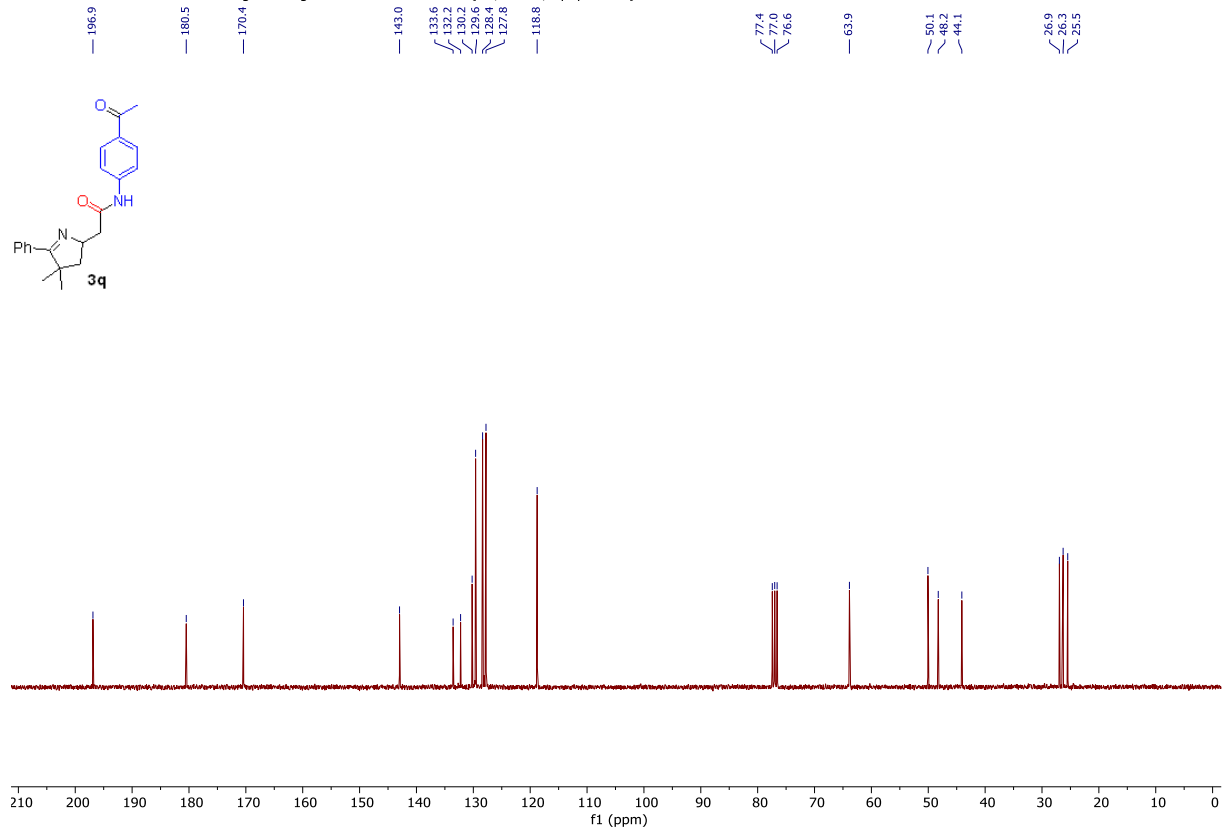
200422.f328.11.fid — Youcan Zhang YZhang-3-102 — C13CPD CDCl3 {C:\Bruker\TopSpin3.6.0} 2004 28 — 75.49MHz



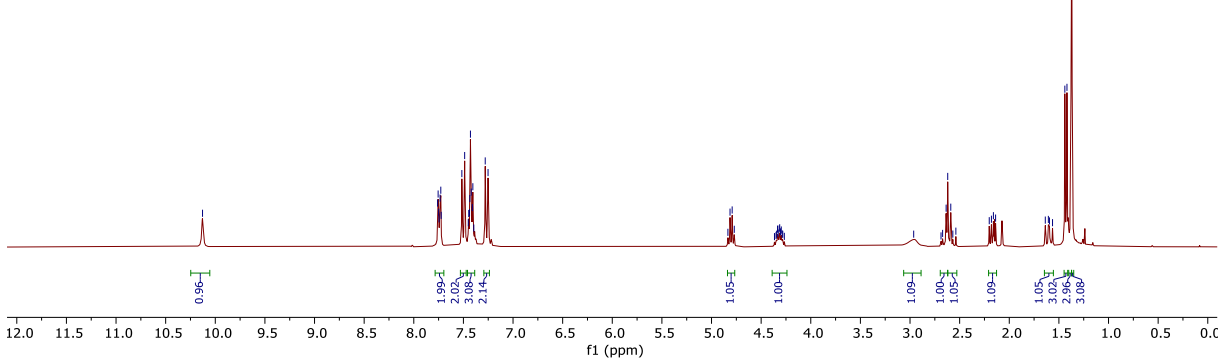
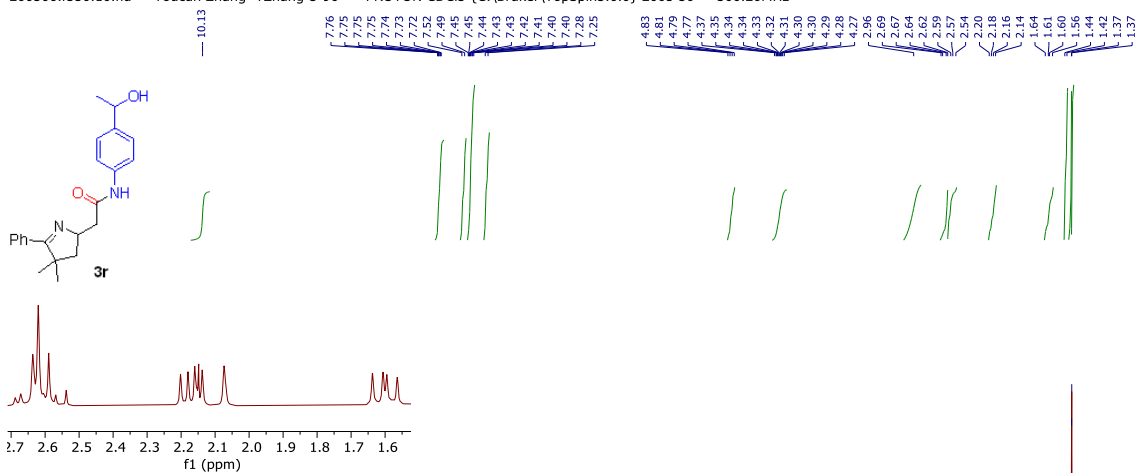
200415.f348.10.fid — Youcan Zhang YZhang-3-87 — PROTON CDCl3 {C:\Bruker\TopSpin3.6.0} 2004 48 — 300.20MHz



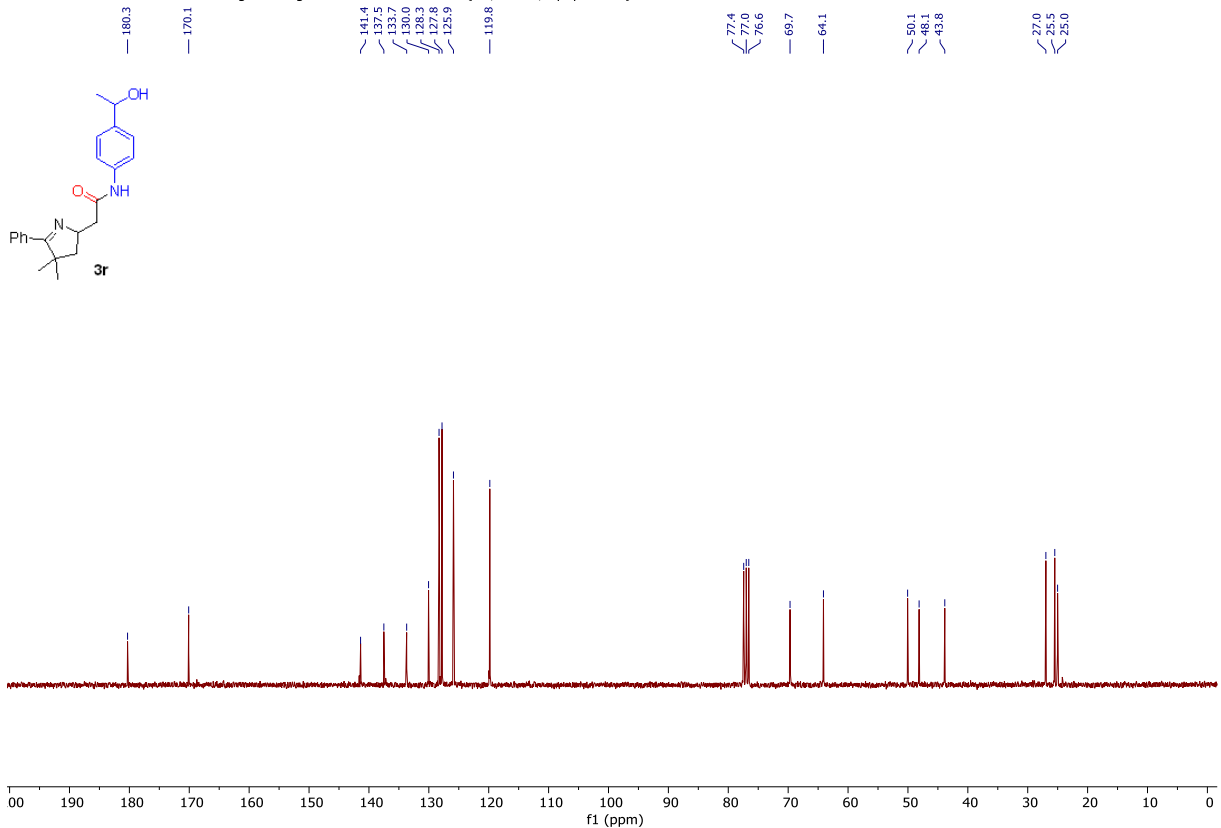
200415.f348.11.fid — Youcan Zhang YZhang-3-87 — C13CPD CDCl3 {C:\Bruker\TopSpin3.6.0} 2004 48 — 75.49MHz



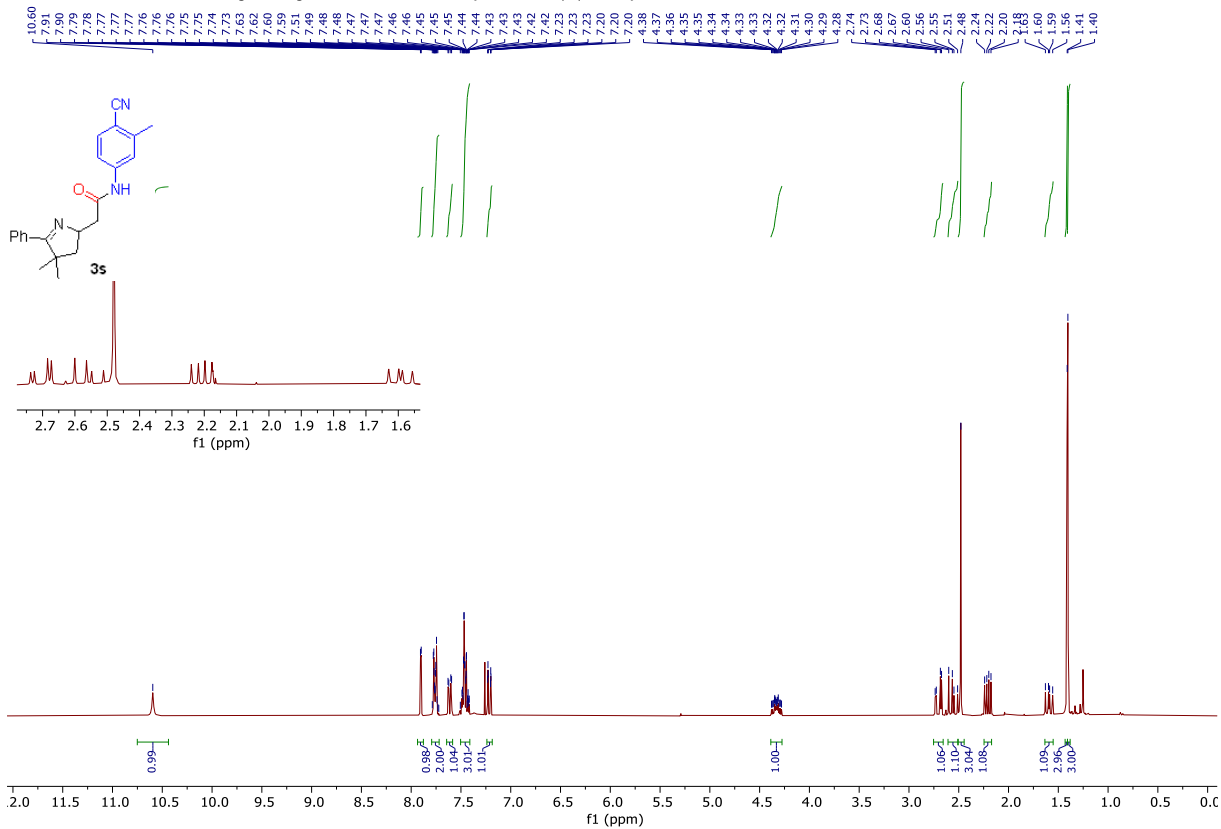
200506.f350.10.fid — Youcan Zhang YZhang-3-90 — PROTON CDCl3 {C:\Bruker\TopSpin3.6.0} 2005 50 — 300.20MHz



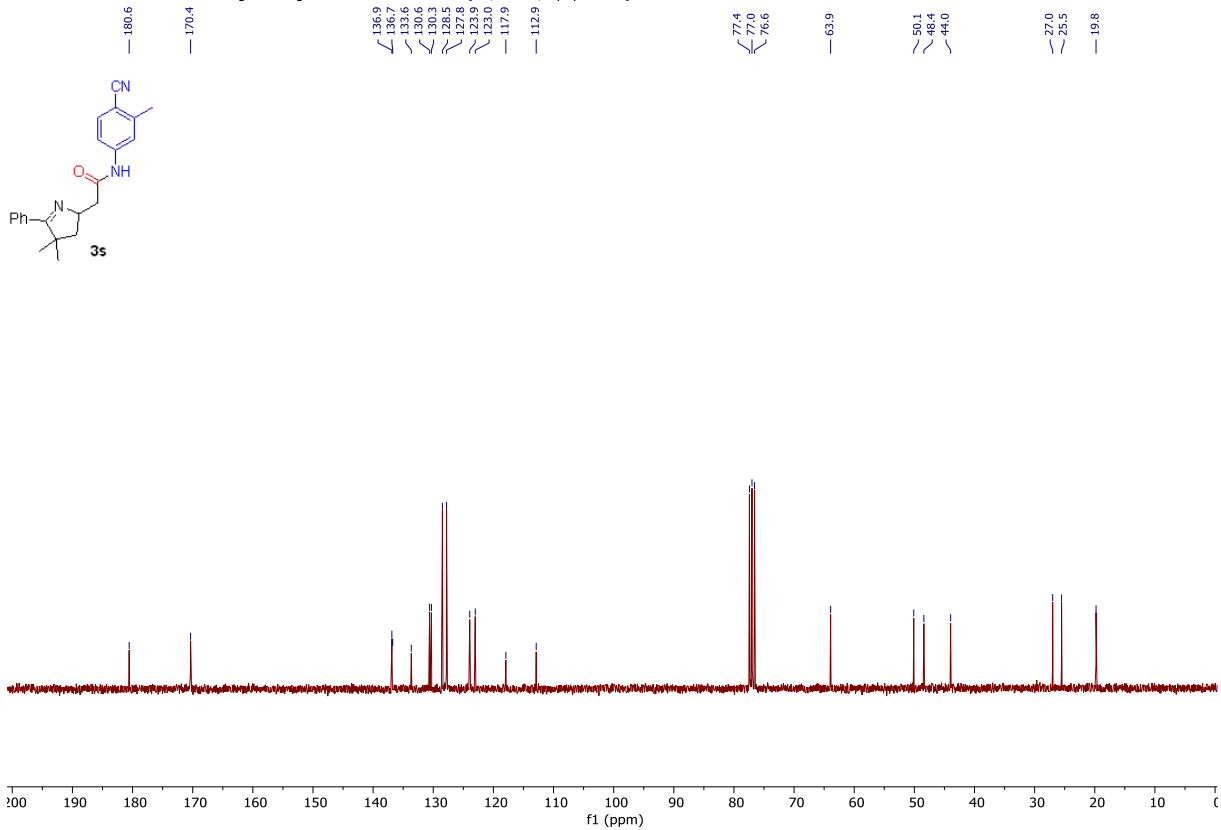
200506.f350.11.fid — Youcan Zhang YZhang-3-90 — C13CPD CDCl3 {C:\Bruker\TopSpin3.6.0} 2005 50 — 75.49MHz



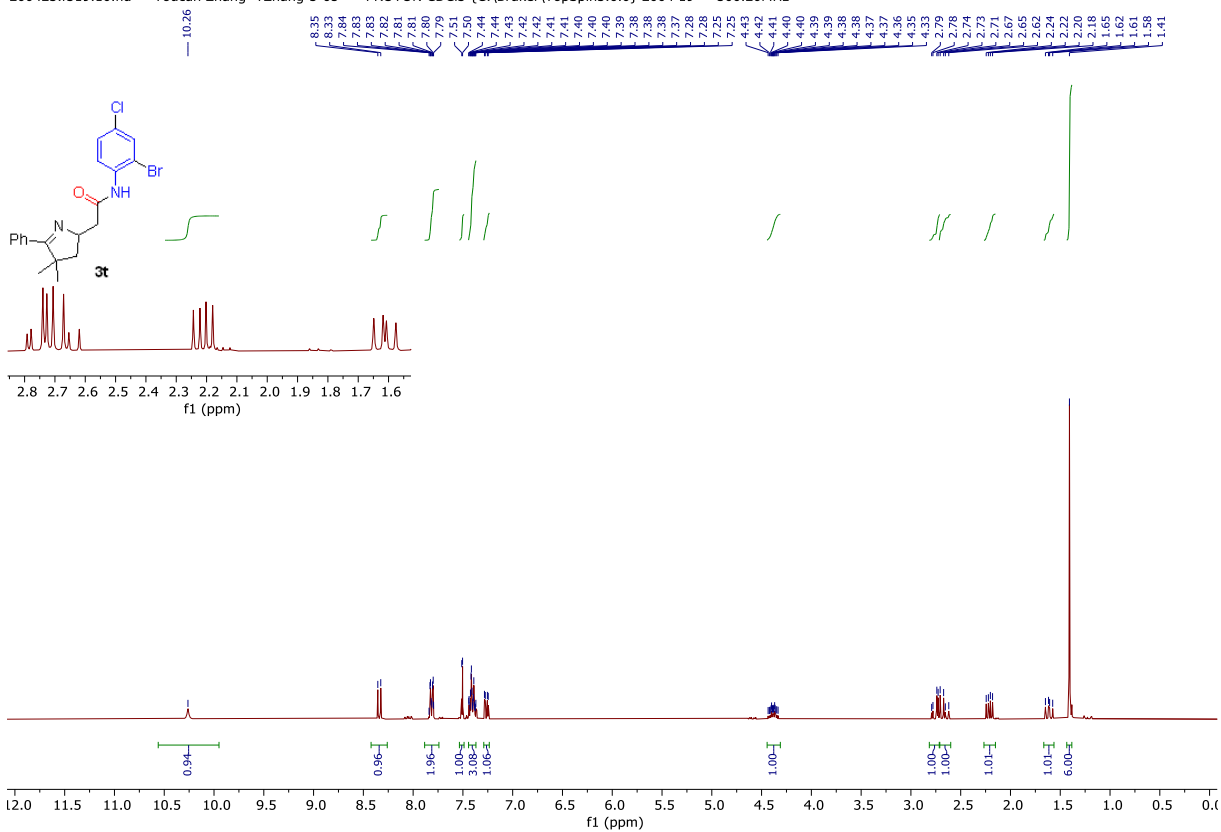
200409.f355.10.fid — Youcan Zhang YZhang-3-43 — PROTON CDCl3 {C:\Bruker\TopSpin3.6.0} 2004 55 — 300.20MHz



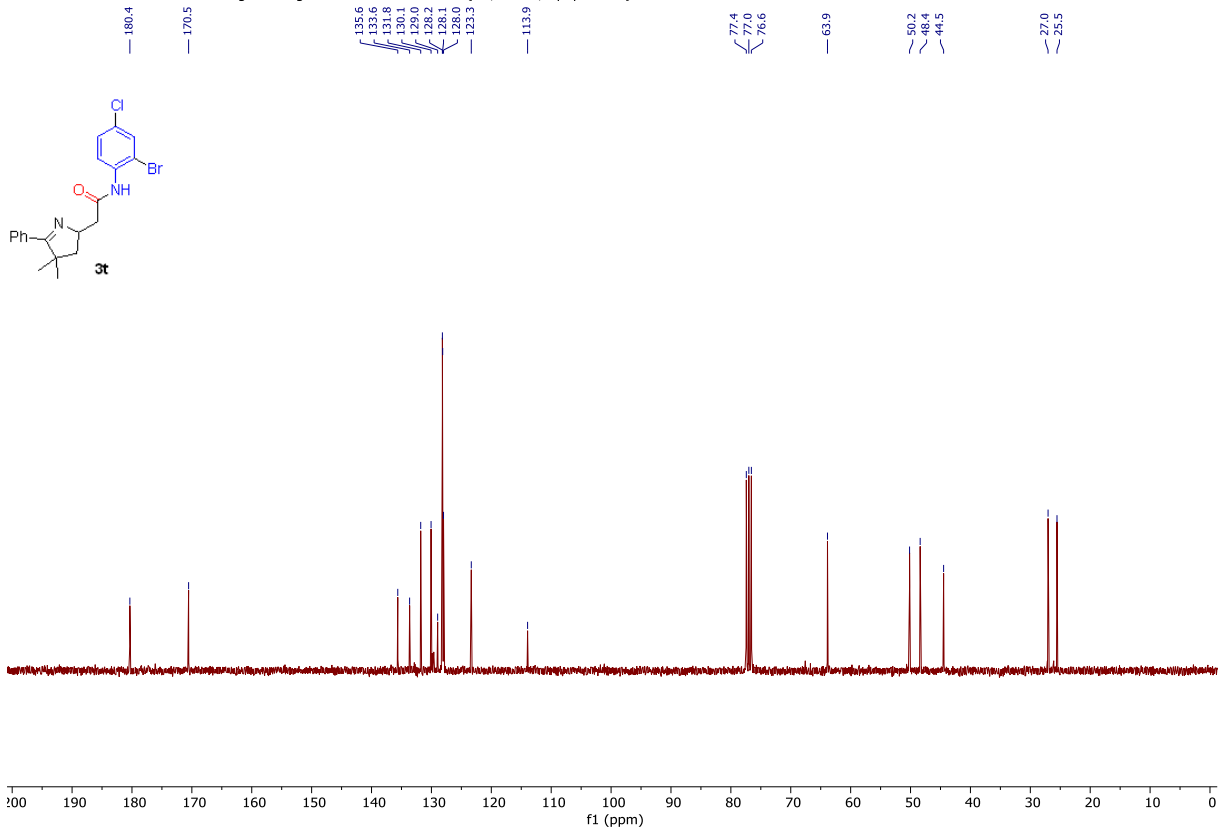
200409.f355.11.fid — Youcan Zhang YZhang-3-43 — C13CPD CDCl3 {C:\Bruker\TopSpin3.6.0} 2004 55 — 75.49MHz



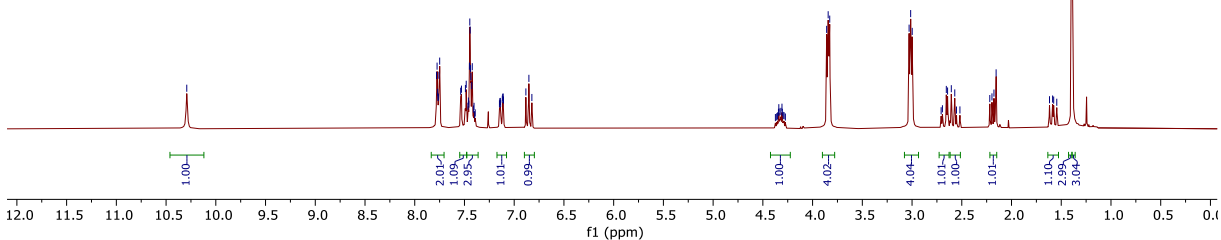
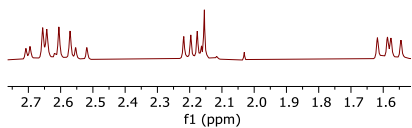
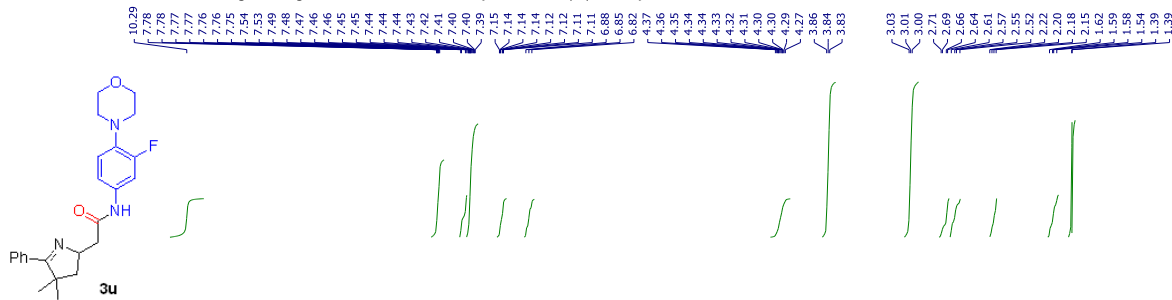
200423.f319.10.fid — Youcan Zhang YZhang-3-65 — PROTON CDCl3 {C:\Bruker\TopSpin3.6.0} 2004 19 — 300.20MHz



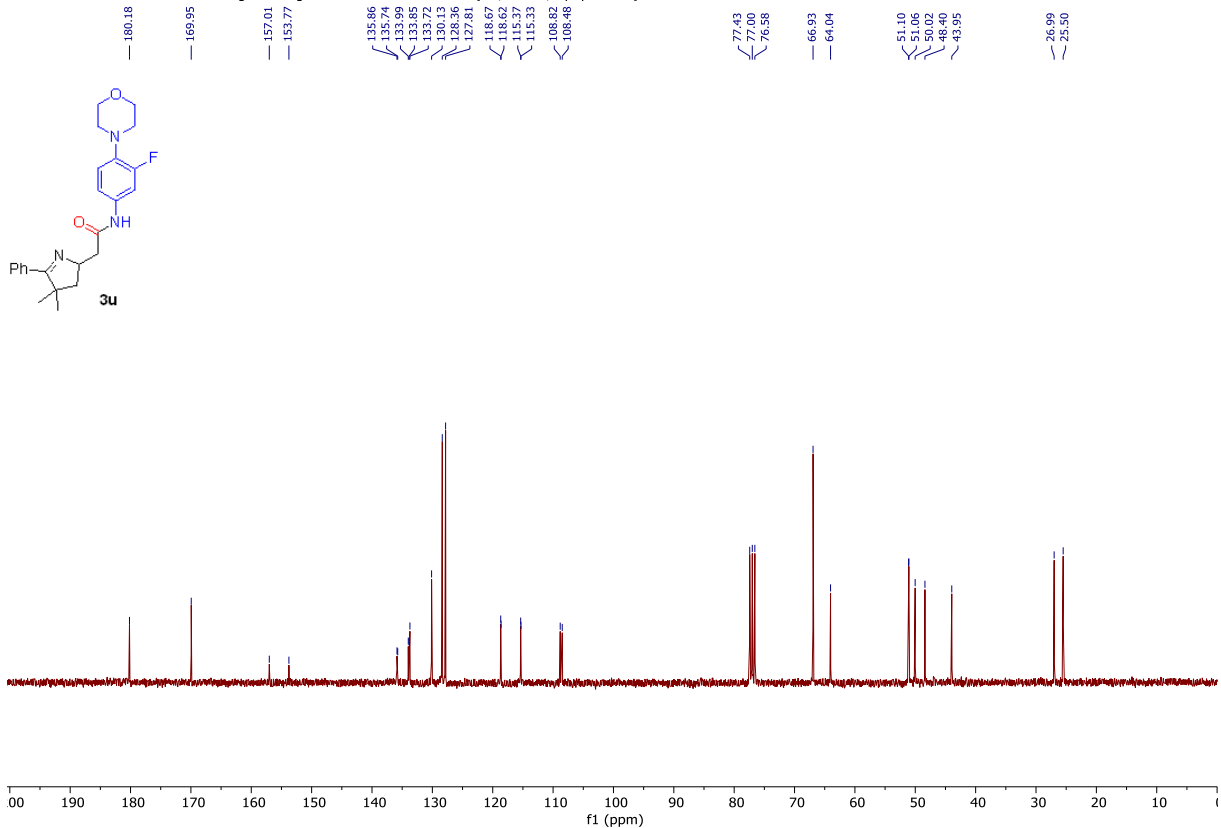
200423.f319.11.fid — Youcan Zhang YZhang-3-65 — C13CPD CDCl3 {C:\Bruker\TopSpin3.6.0} 2004 19 — 75.49MHz

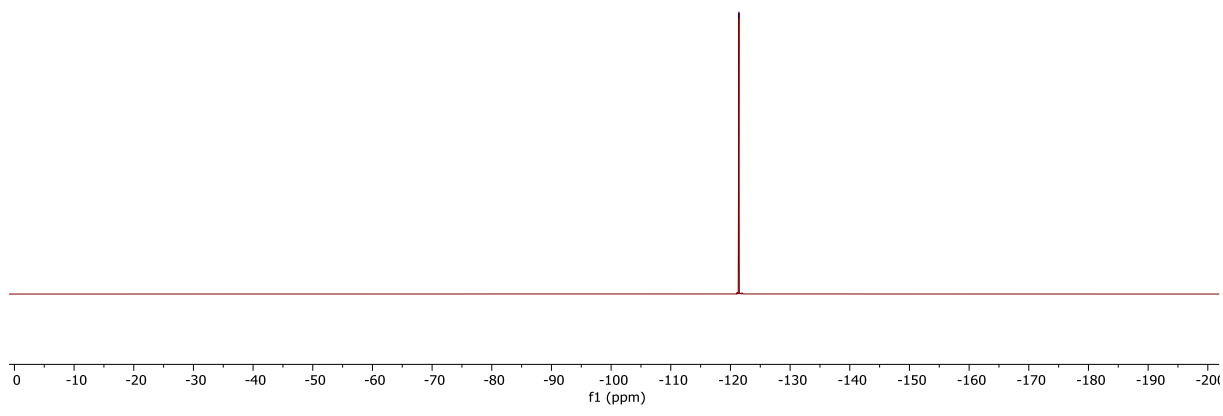
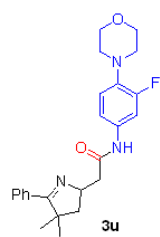


200424.f365.10.fid — Youcan Zhang YZhang-3-109 — PROTON CDCl3 {C:\Bruker\TopSpin3.6.0} 2004 5 — 300.20MHz

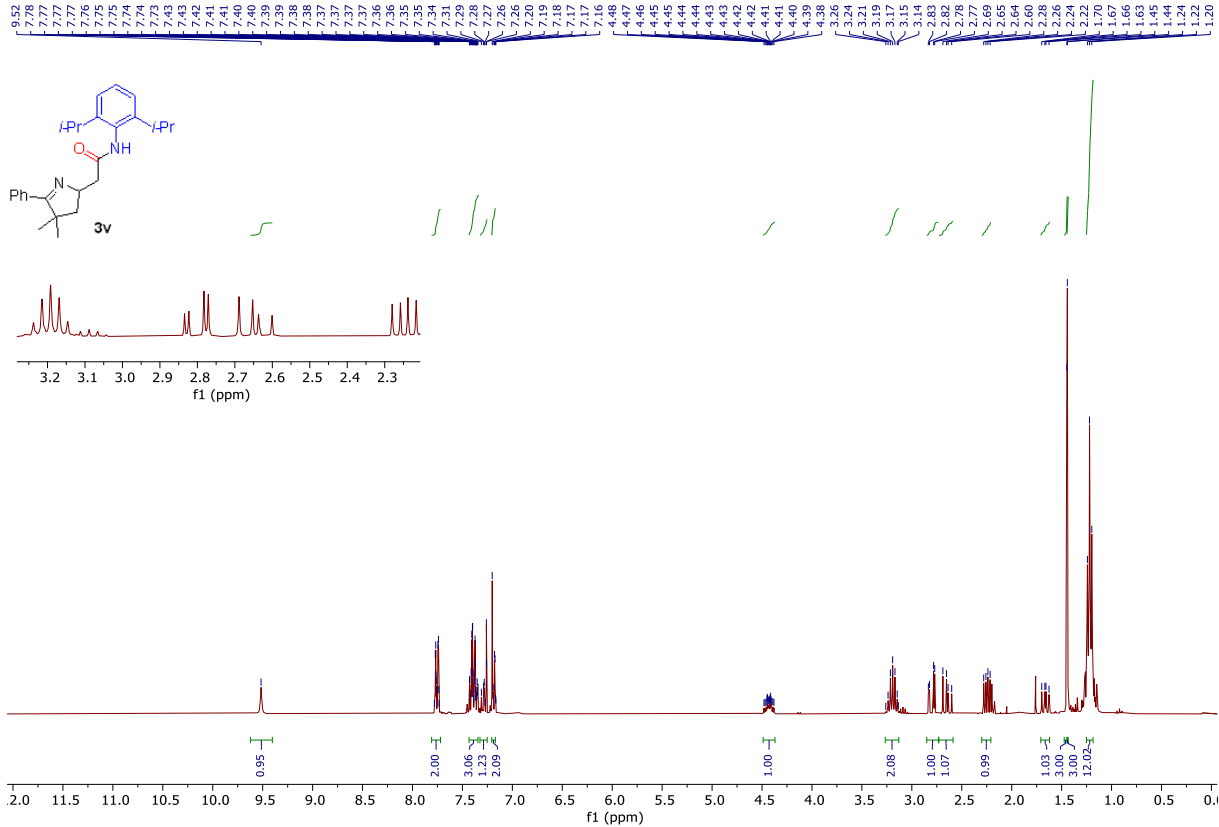


200424.f365.11.fid — Youcan Zhang YZhang-3-109 — C13CPD CDCl3 {C:\Bruker\TopSpin3.6.0} 2004 5 — 75.49MHz

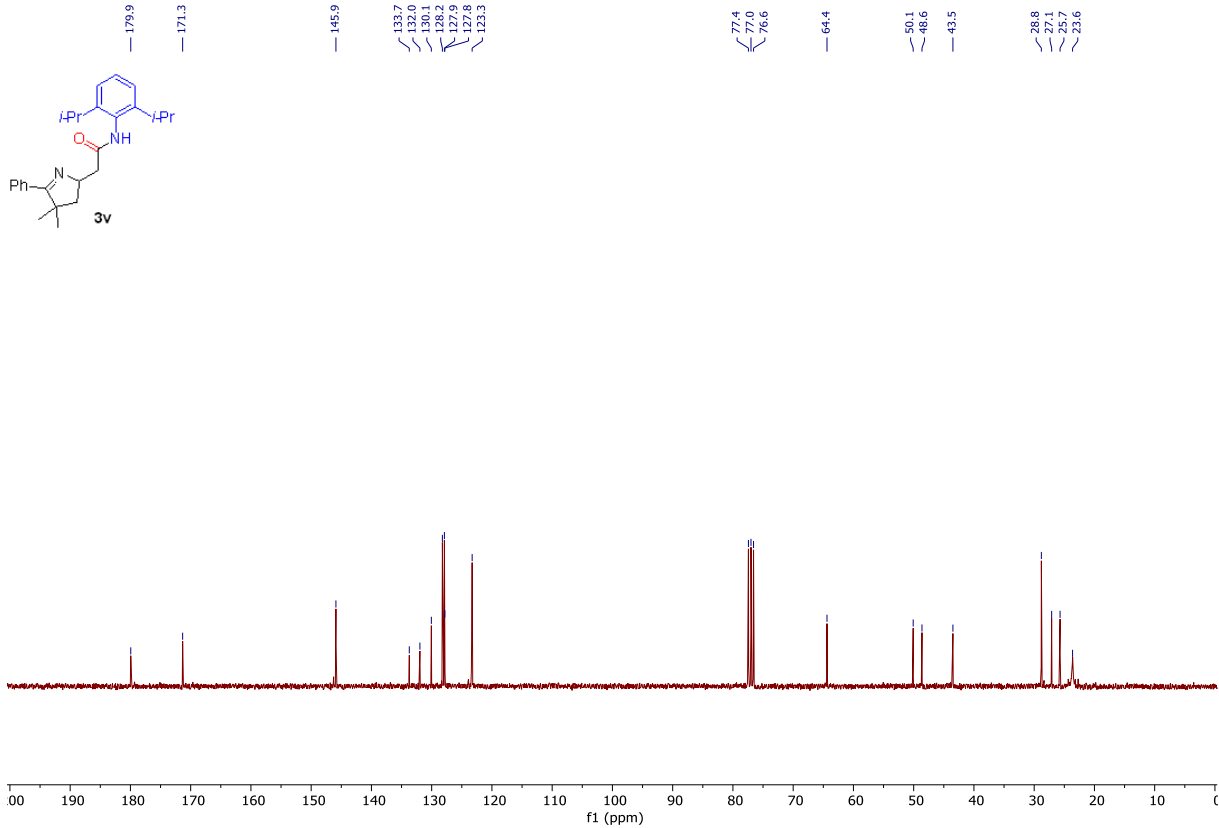




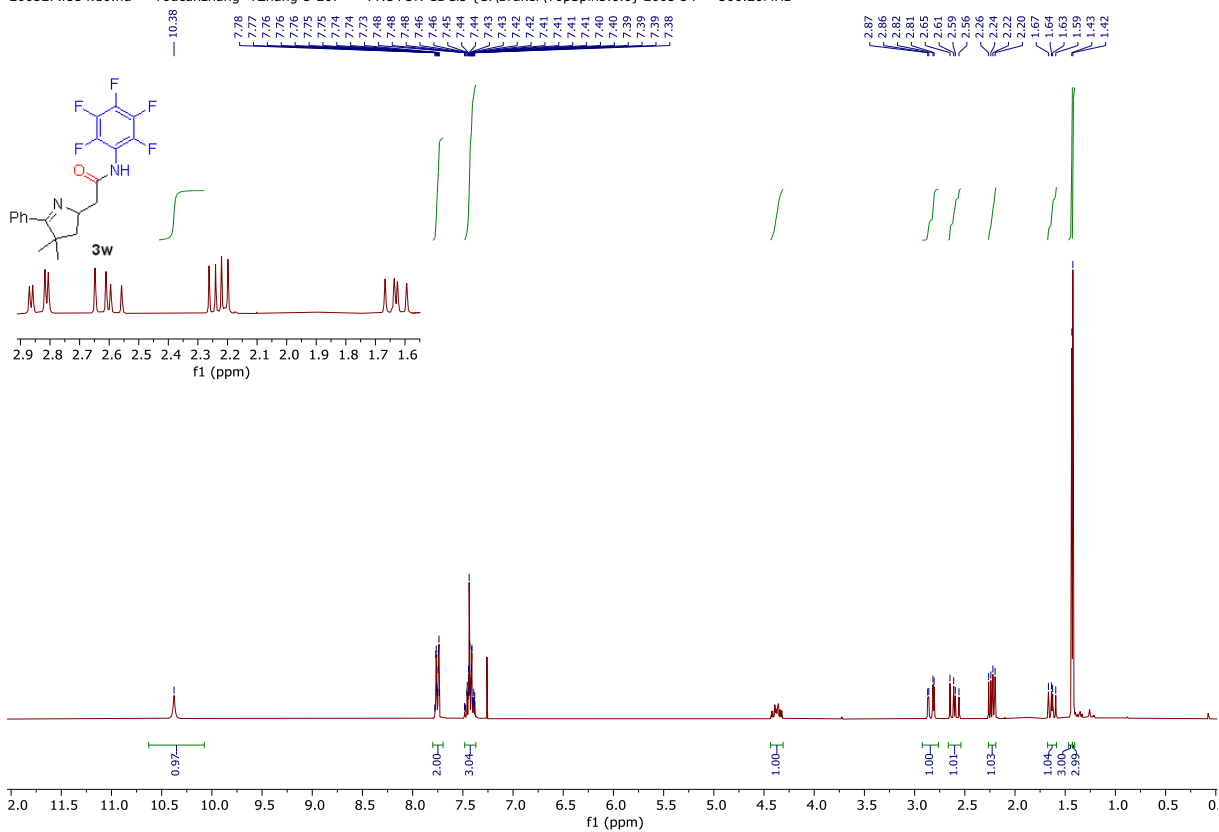
200508.f356.10.fid — Youcan Zhang YZhang-3-139 — PROTON CDCl3 {C:\Bruker\TopSpin3.6.0} 2005 56 — 300.20MHz



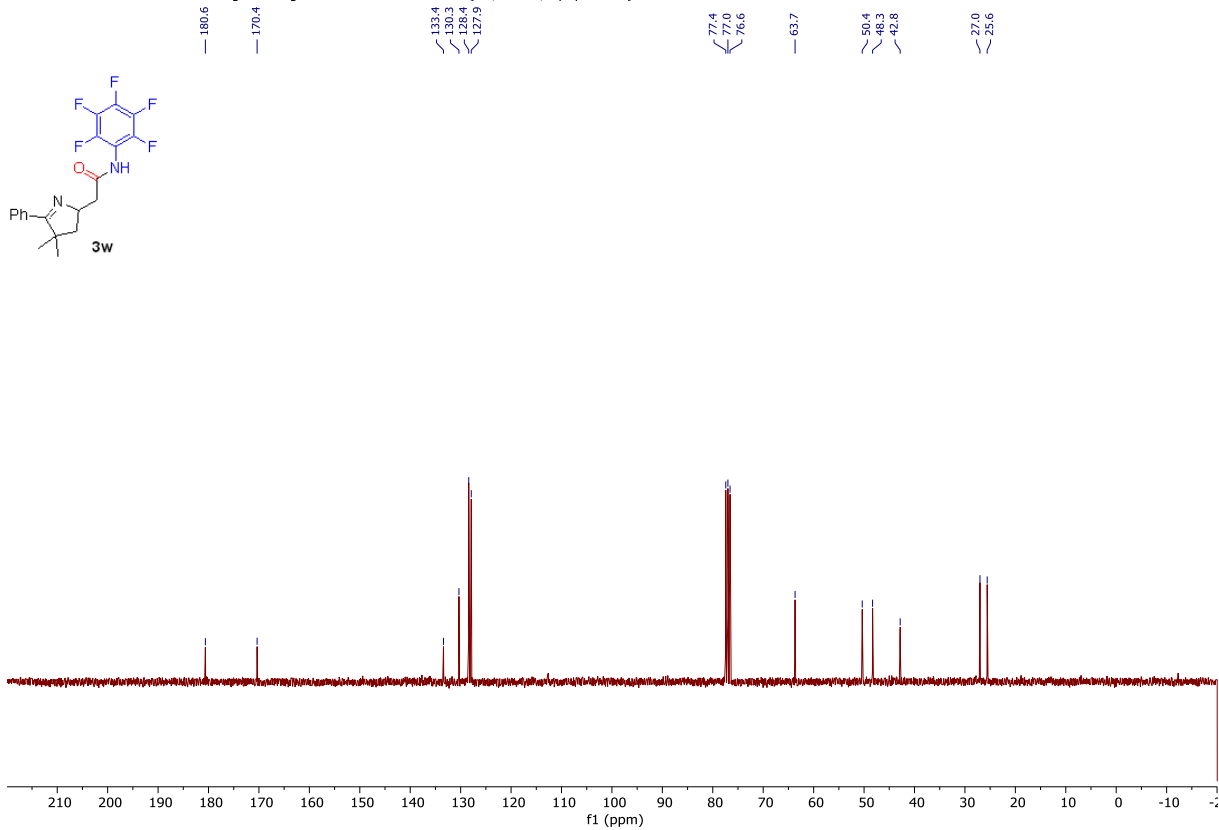
200508.f356.11.fid — Youcan Zhang YZhang-3-139 — C13CPD CDCl3 {C:\Bruker\TopSpin3.6.0} 2005 56 — 75.49MHz

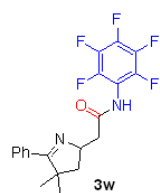


200527.f334.10.fid — Youcanzhang YZhang-3-207 — PROTON CDCl3 {C:\Bruker\TopSpin3.6.0} 2005 34 — 300.20MHz

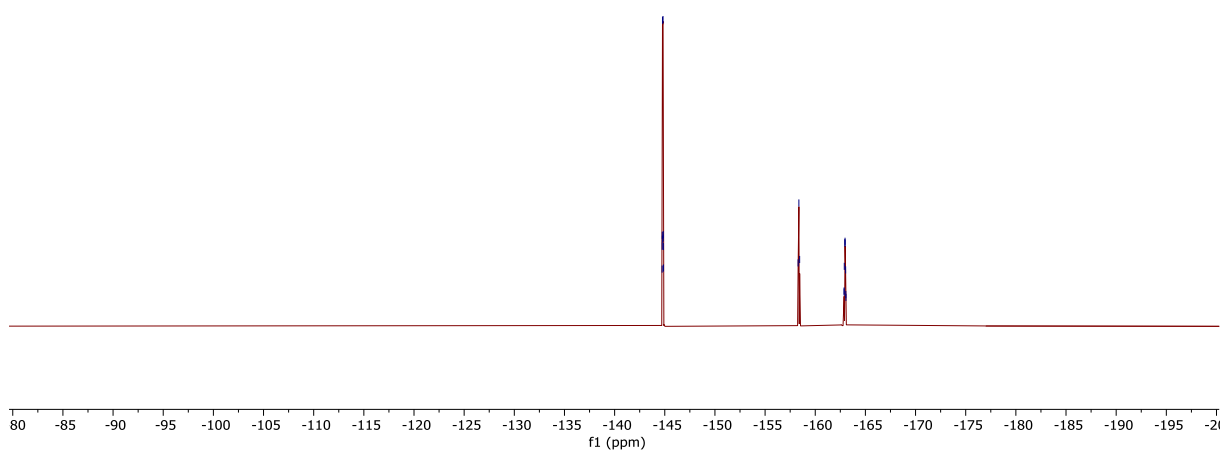


200527.f334.11.fid — Youcanzhang YZhang-3-207 — C13CPD CDCl3 {C:\Bruker\TopSpin3.6.0} 2005 34 — 75.49MHz

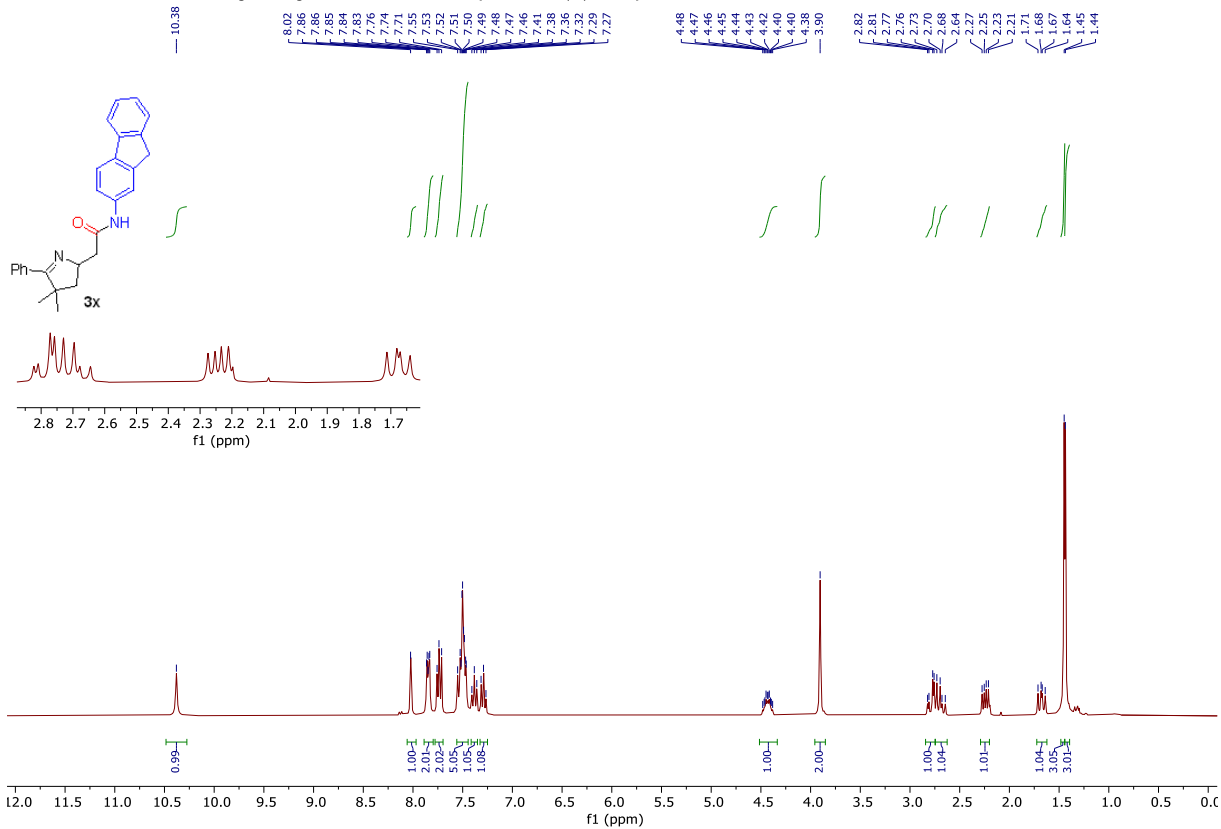




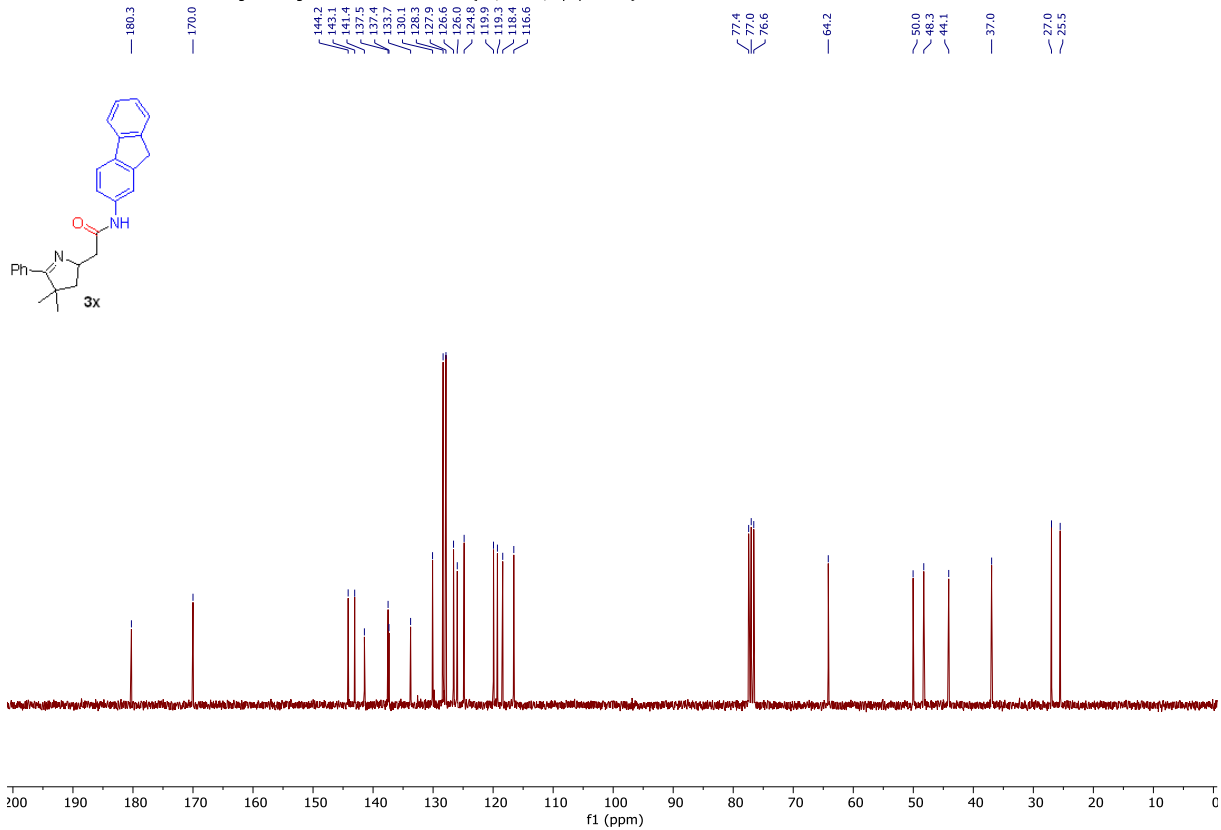
144.7
144.8
144.8
144.8
144.8
144.8
144.8
144.9
158.3
158.4
158.4
162.9
162.9
163.0
163.0
163.0
163.0
163.1



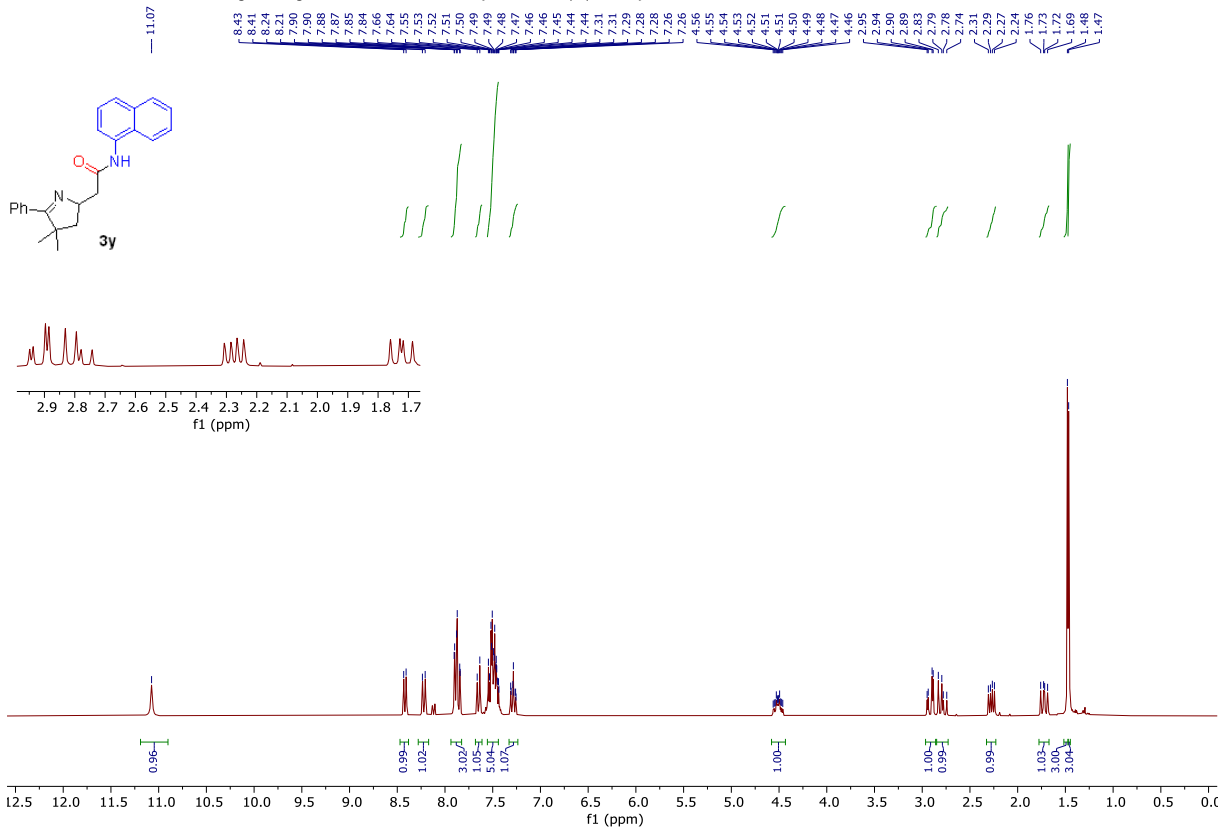
200415.f344.10.fid — Youcan Zhang YZhang-3-5-2 — PROTON CDCl3 {C:\Bruker\TopSpin3.6.0} 2004 44 — 300.20MHz



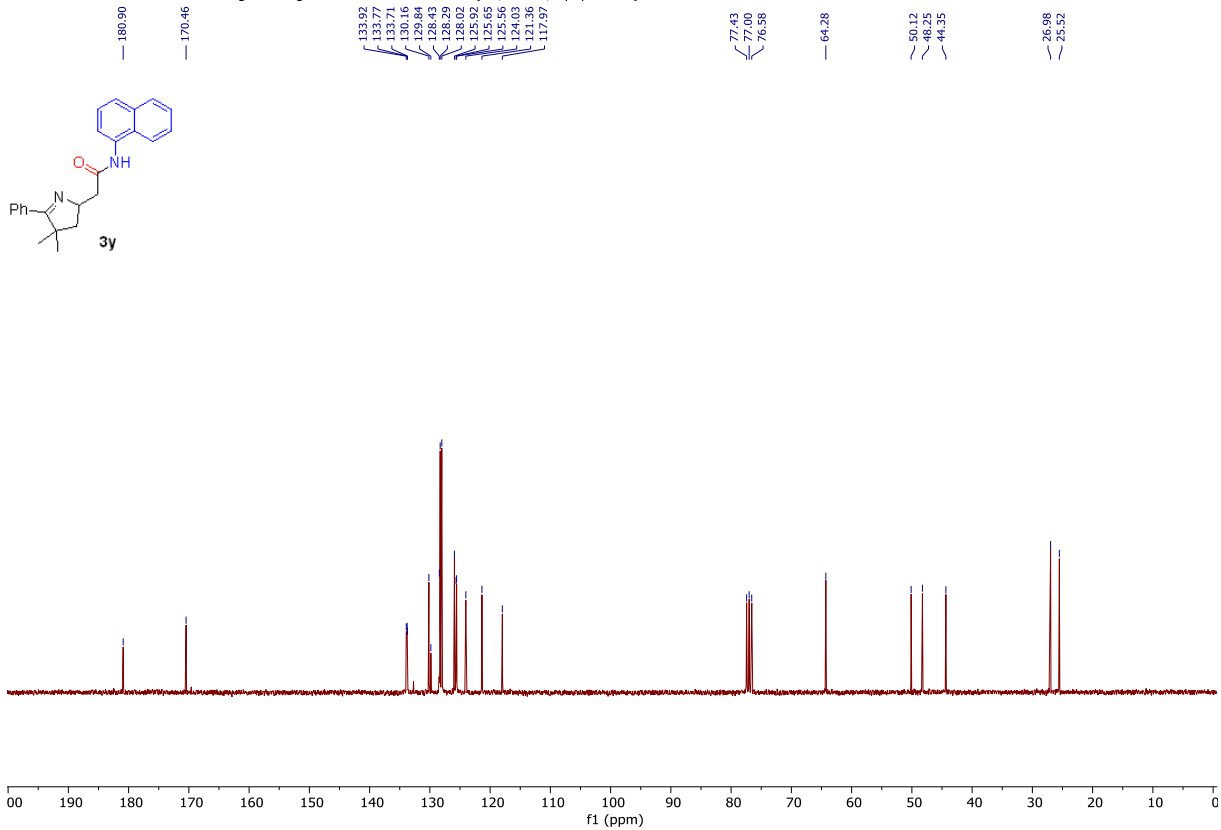
200415.f344.11.fid — Youcan Zhang YZhang-3-5-2 — C13CPD CDCl3 {C:\Bruker\TopSpin3.6.0} 2004 44 — 75.49MHz



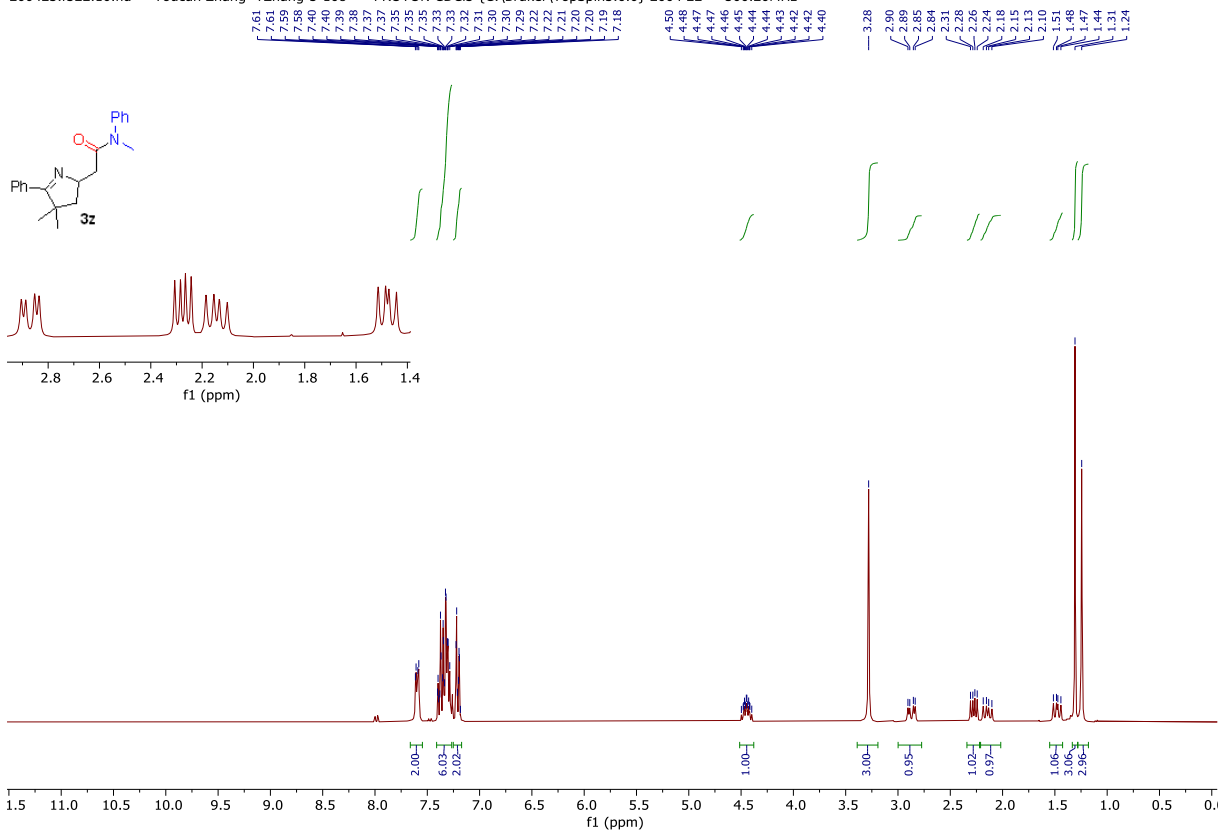
200424.f362.10.fid — Youcan Zhang YZhang-3-101 — PROTON CDCl3 {C:\Bruker\TopSpin3.6.0} 2004 2 — 300.20MHz



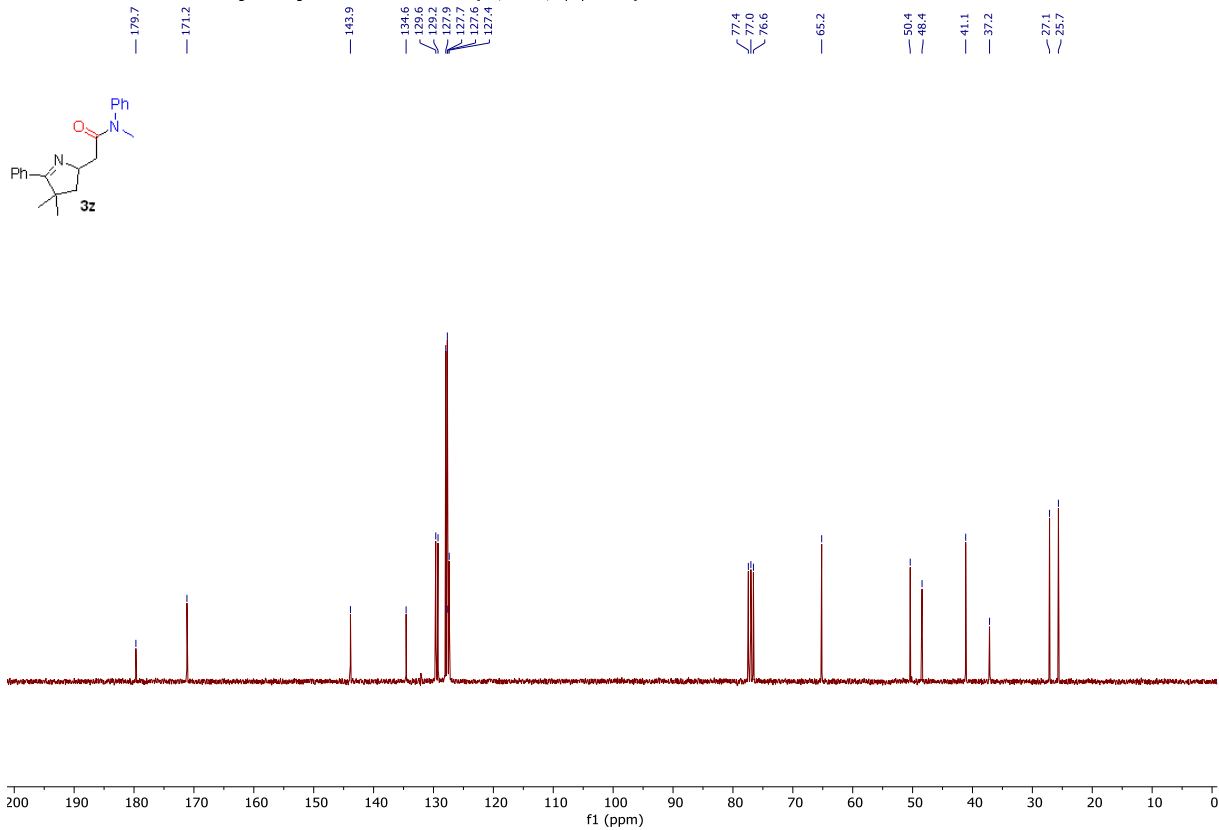
200424.f362.11.fid — Youcan Zhang YZhang-3-101 — C13CPD CDCl3 {C:\Bruker\TopSpin3.6.0} 2004 2 — 75.49MHz



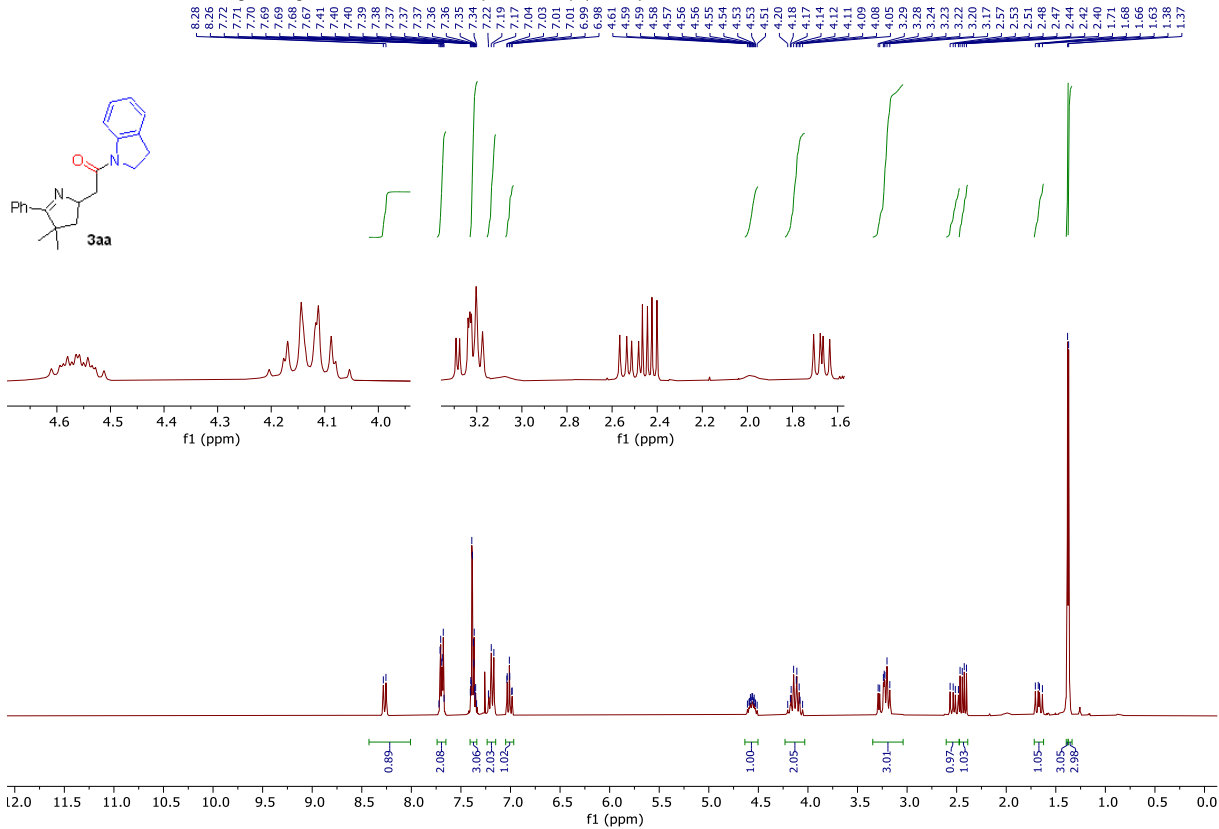
200423.f322.10.fid — Youcan Zhang YZhang-3-108 — PROTON CDCl3 {C:\Bruker\TopSpin3.6.0} 2004 22 — 300.20MHz



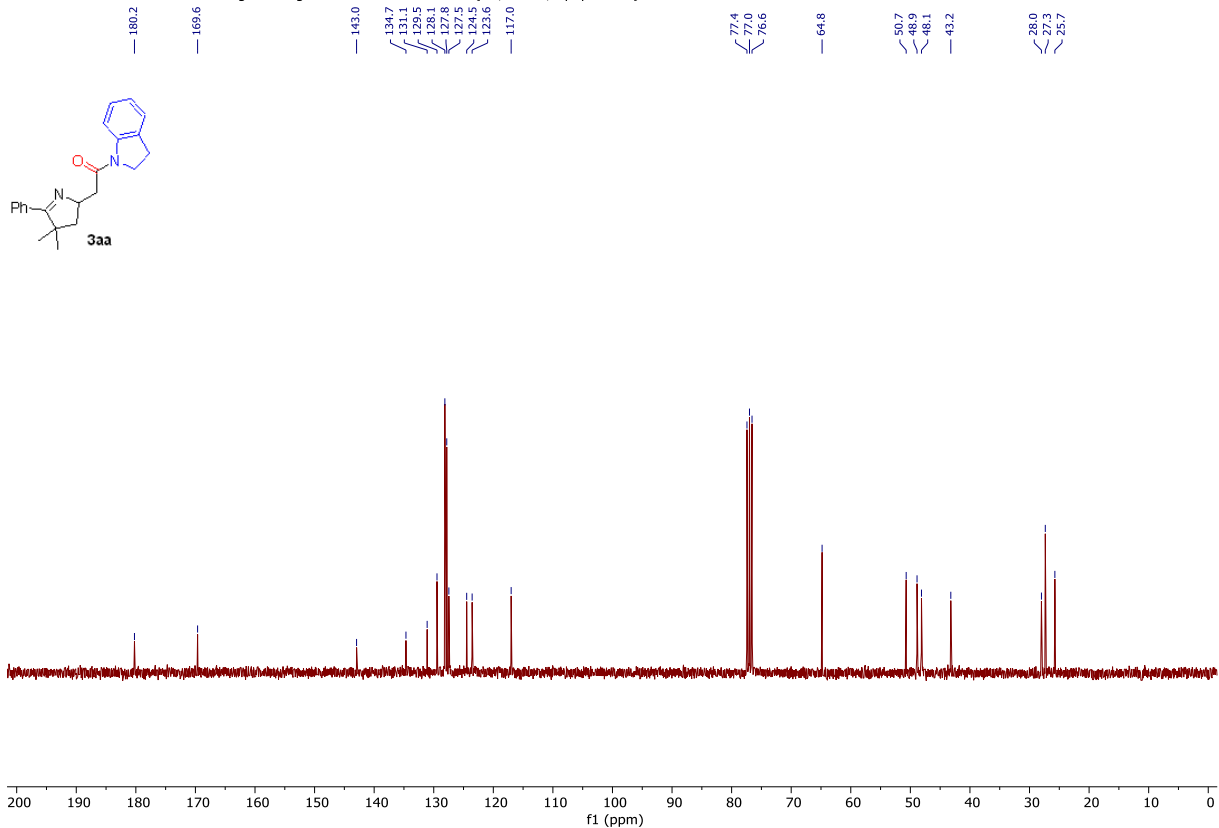
200423.f322.11.fid — Youcan Zhang YZhang-3-108 — C13CPD CDCl3 {C:\Bruker\TopSpin3.6.0} 2004 22 — 75.49MHz



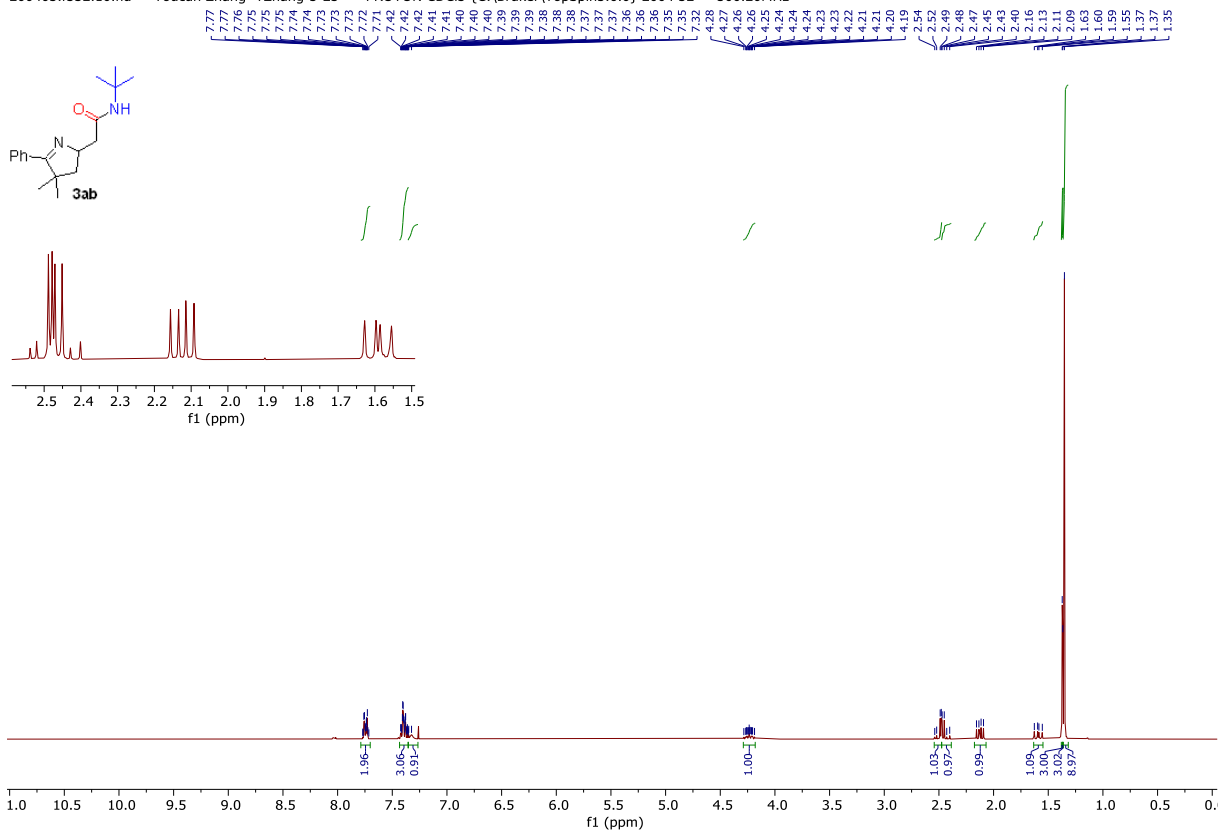
200423.f323.10.fid — Youcan Zhang YZhang-3-105 — PROTON CDCl3 {C:\Bruker\TopSpin3.6.0} 2004 23 — 300.20MHz



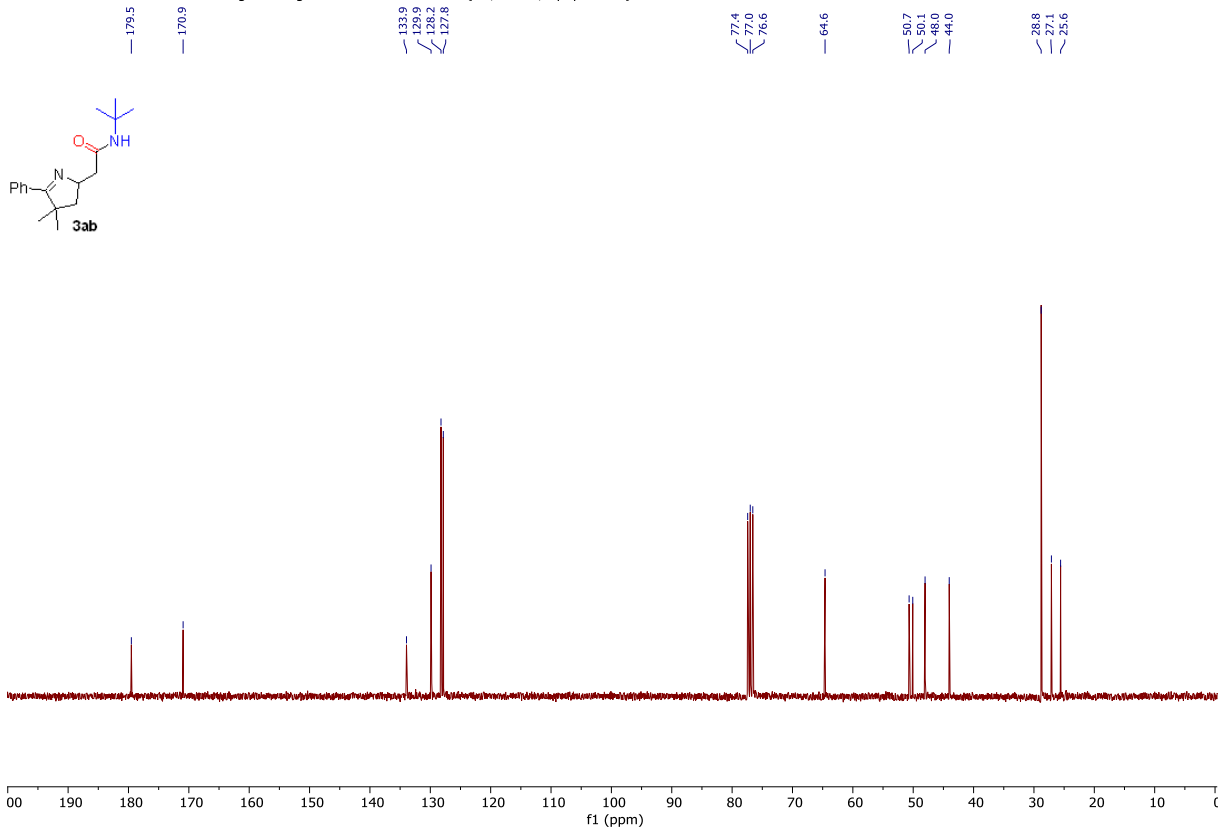
200423.f323.11.fid — Youcan Zhang YZhang-3-105 — C13CPD CDCl3 {C:\Bruker\TopSpin3.6.0} 2004 23 — 75.49MHz



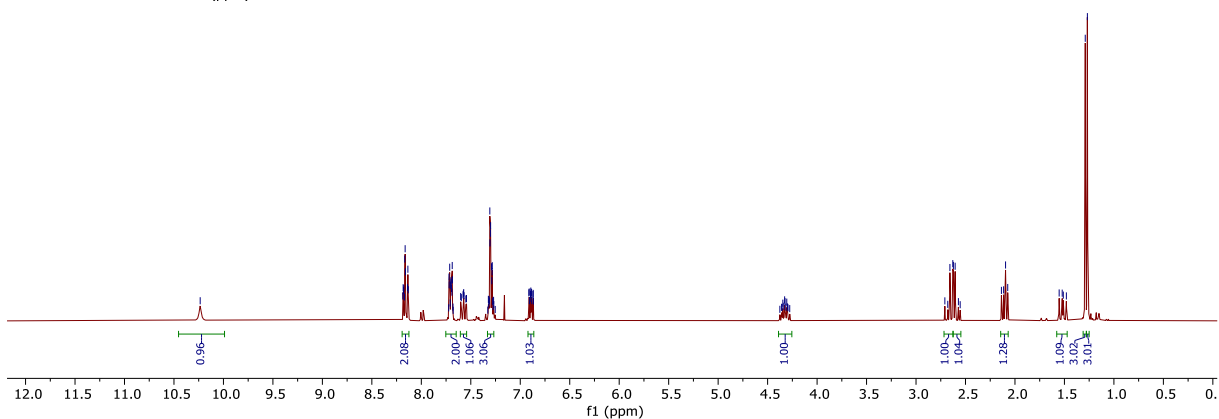
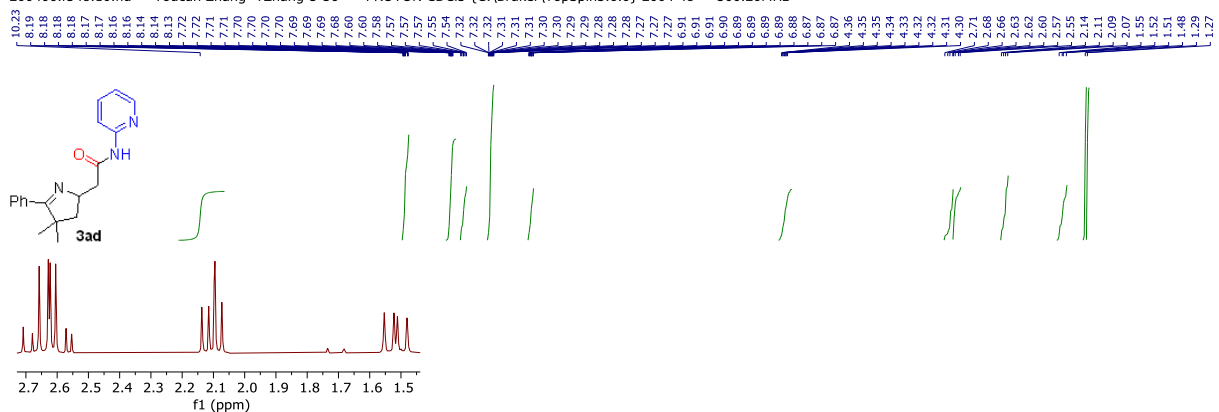
200403.f332.10.fid — Youcan Zhang YZhang-3-23 — PROTON CDCl3 {C:\Bruker\TopSpin3.6.0} 2004 32 — 300.20MHz



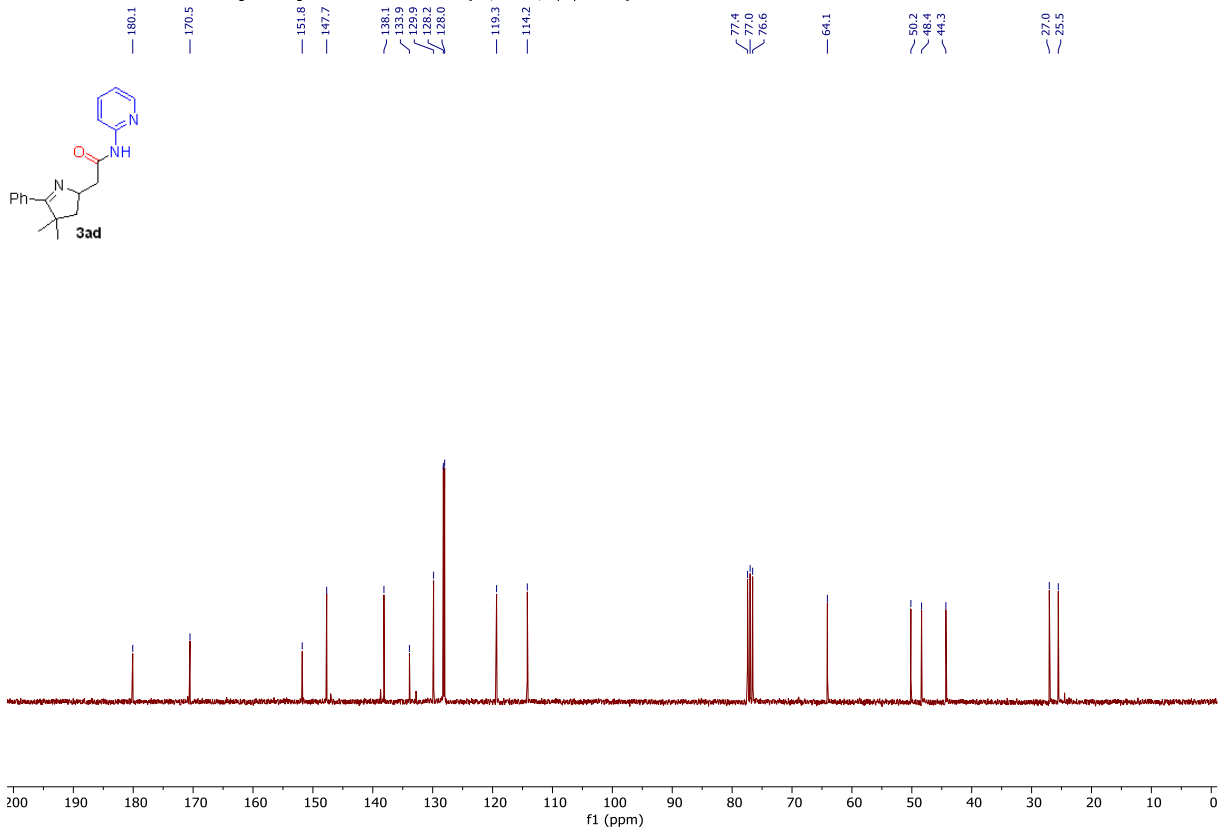
200403.f332.11.fid — Youcan Zhang YZhang-3-23 — C13CPD CDCl3 {C:\Bruker\TopSpin3.6.0} 2004 32 — 75.49MHz



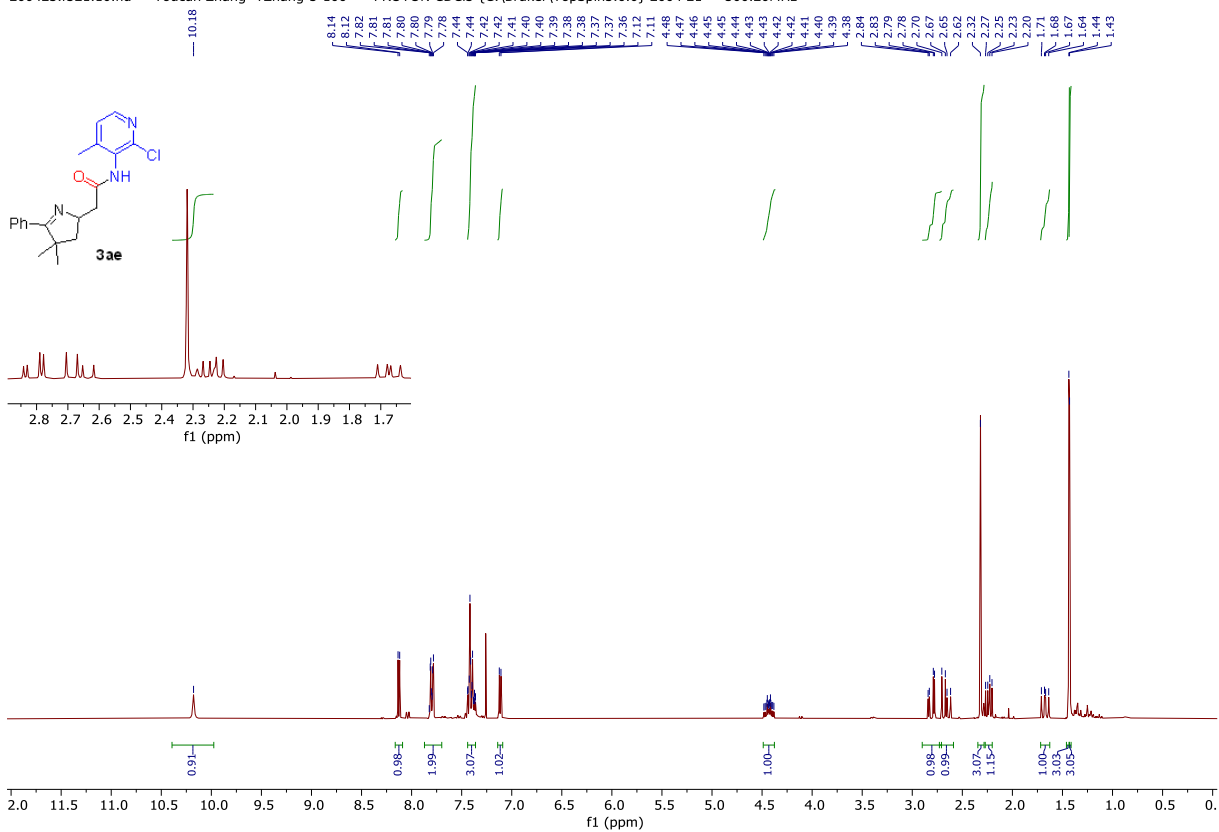
200406.f348.10.fid — Youcan Zhang YZhang-3-36 — PROTON CDCl3 {C:\Bruker\TopSpin3.6.0} 2004 48 — 300.20MHz



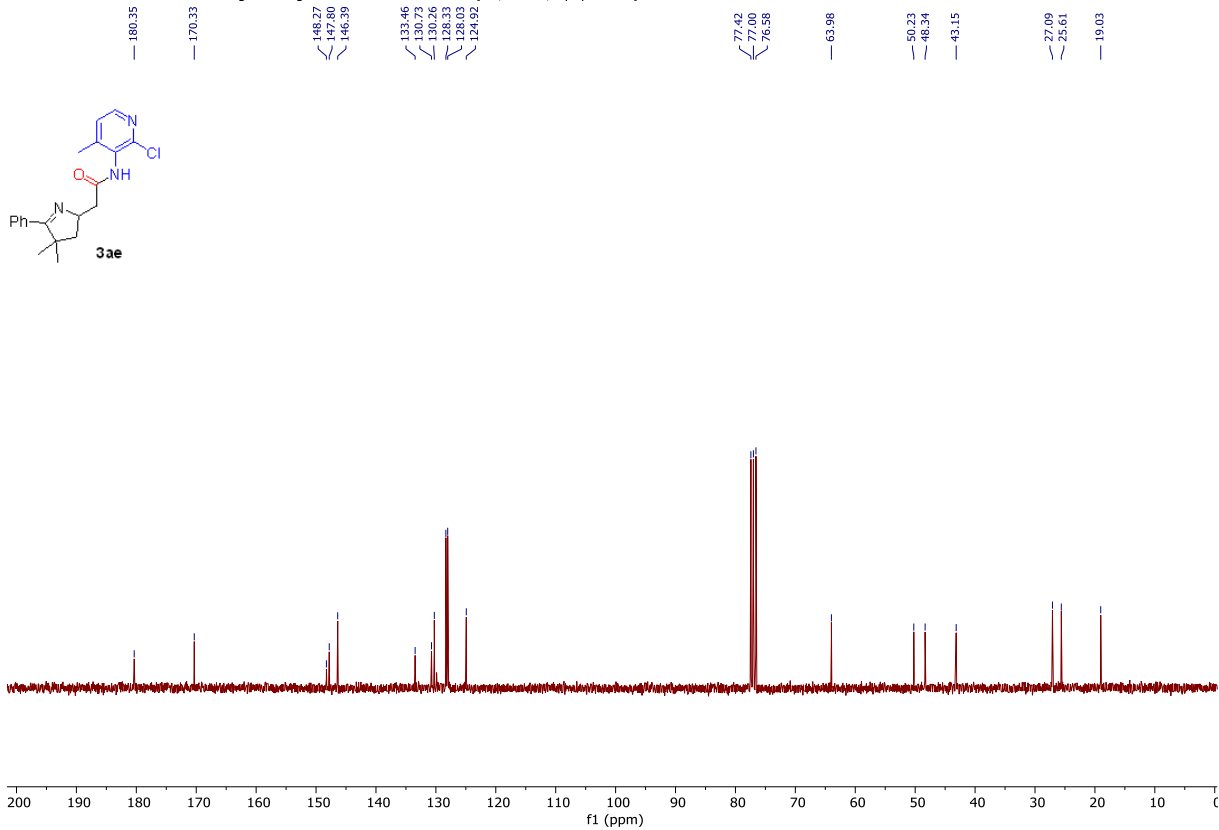
200406.f348.11.fid — Youcan Zhang YZhang-3-36 — C13CPD CDCl3 {C:\Bruker\TopSpin3.6.0} 2004 48 — 75.49MHz



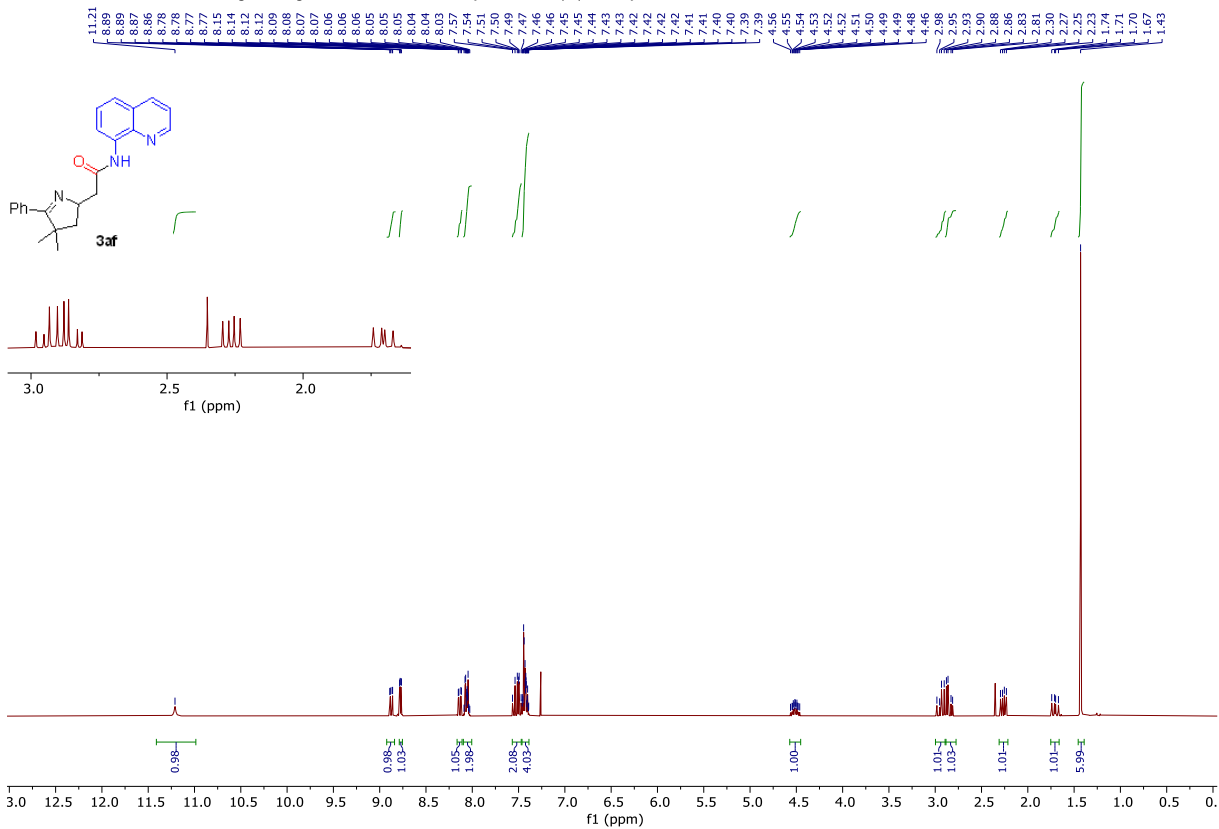
200423.f321.10.fid — Youcan Zhang YZhang-3-106 — PROTON CDCl3 {C:\Bruker\TopSpin3.6.0} 2004 21 — 300.20MHz



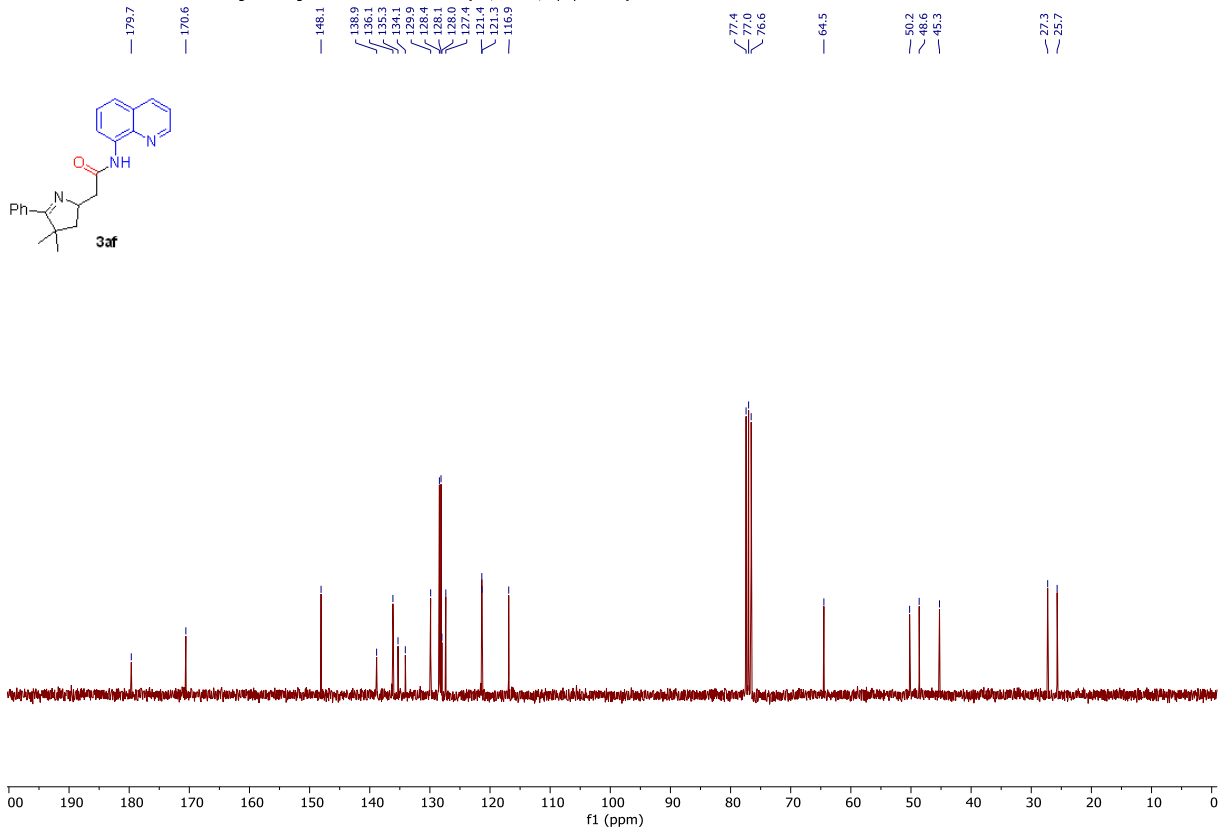
200423.f321.11.fid — Youcan Zhang YZhang-3-106 — C13CPD CDCl3 {C:\Bruker\TopSpin3.6.0} 2004 21 — 75.49MHz



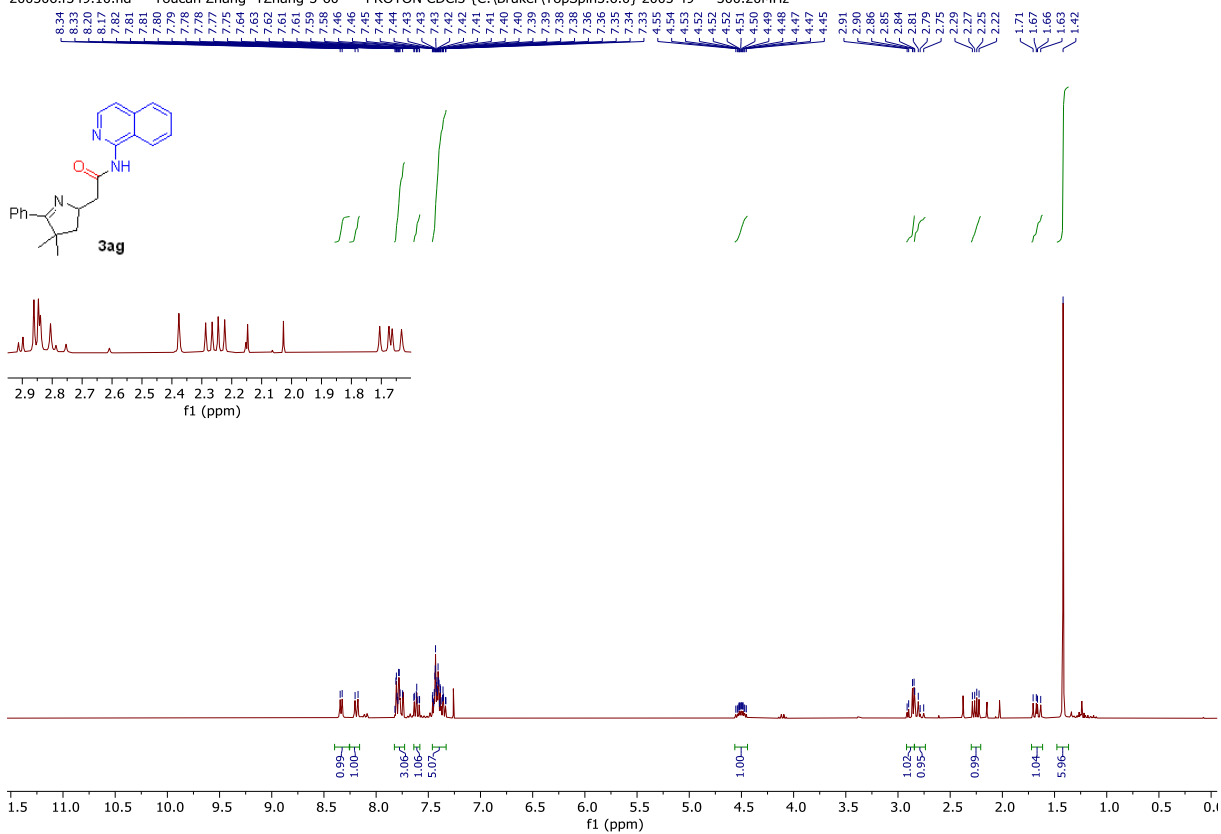
200423.f318.10.fid — Youcan Zhang YZhang-3-63 — PROTON CDCl3 {C:\Bruker\TopSpin3.6.0} 2004 18 — 300.20MHz



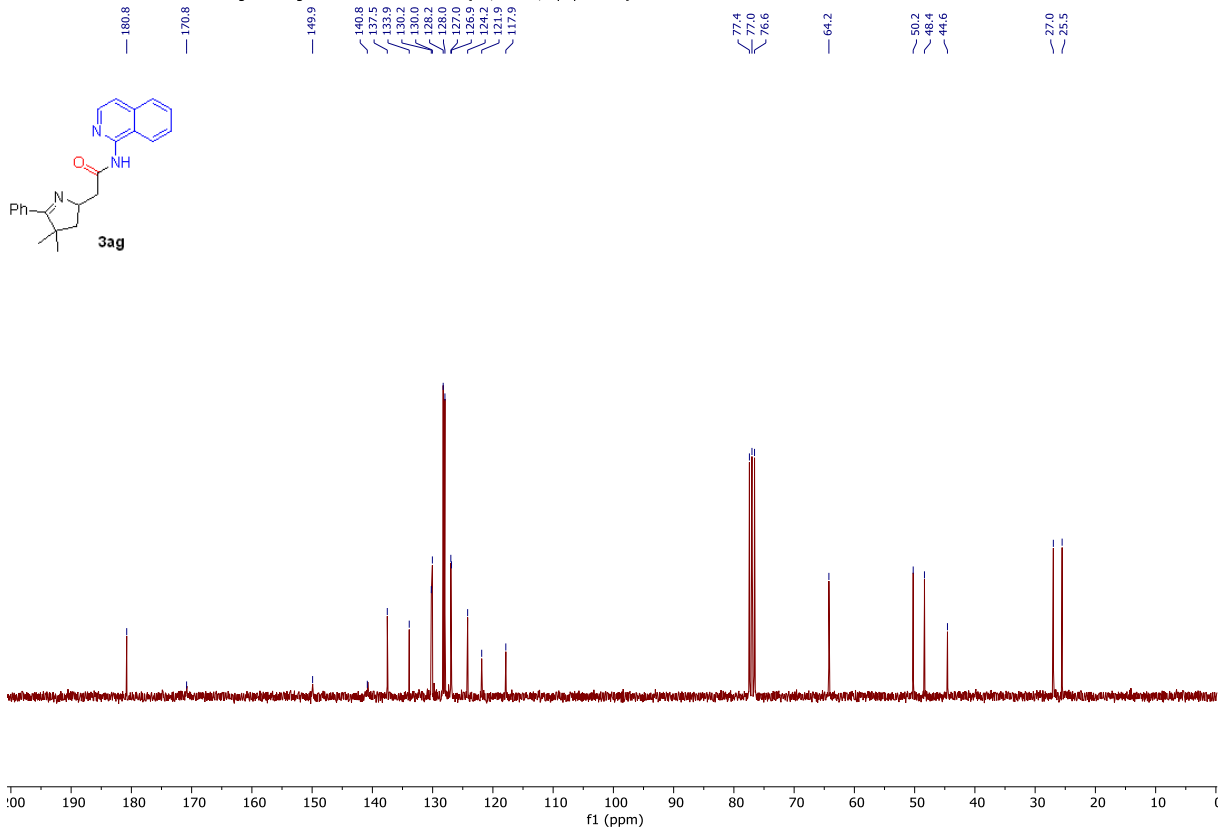
200423.f318.11.fid — Youcan Zhang YZhang-3-63 — C13CPD CDCl3 {C:\Bruker\TopSpin3.6.0} 2004 18 — 75.49MHz



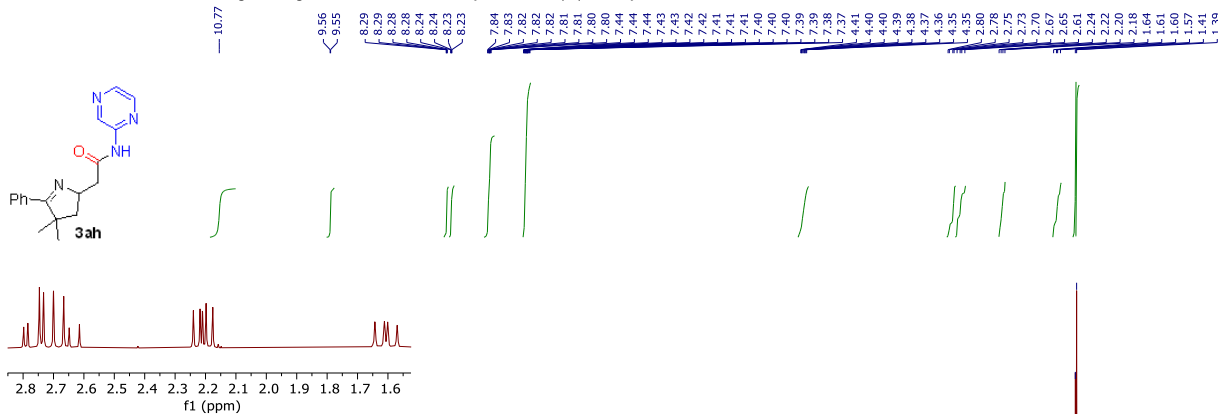
200506.f349.10.fid — Youcan Zhang YZhang-3-60 — PROTON CDCl3 {C:\Bruker\TopSpin3.6.0} 2005 49 — 300.20MHz



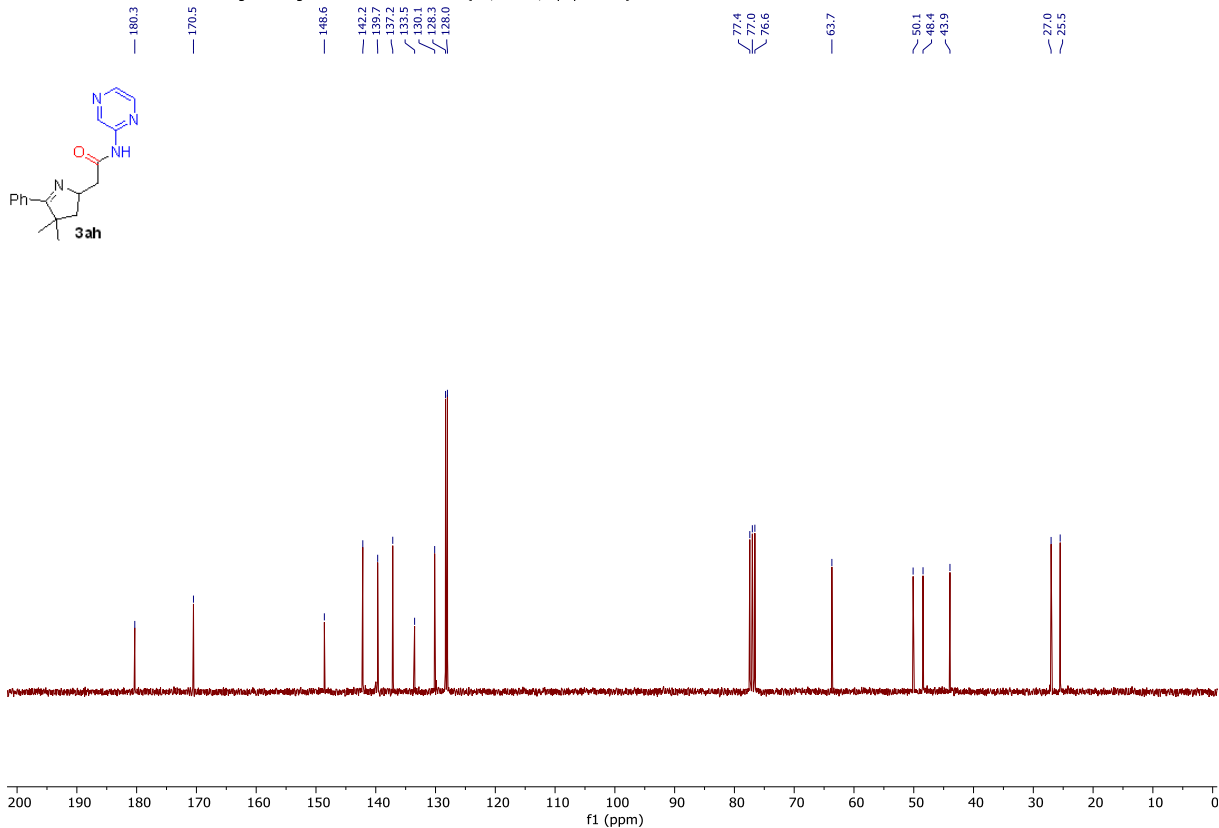
200506.f349.11.fid — Youcan Zhang YZhang-3-60 — C13CPD CDCl3 {C:\Bruker\TopSpin3.6.0} 2005 49 — 75.49MHz



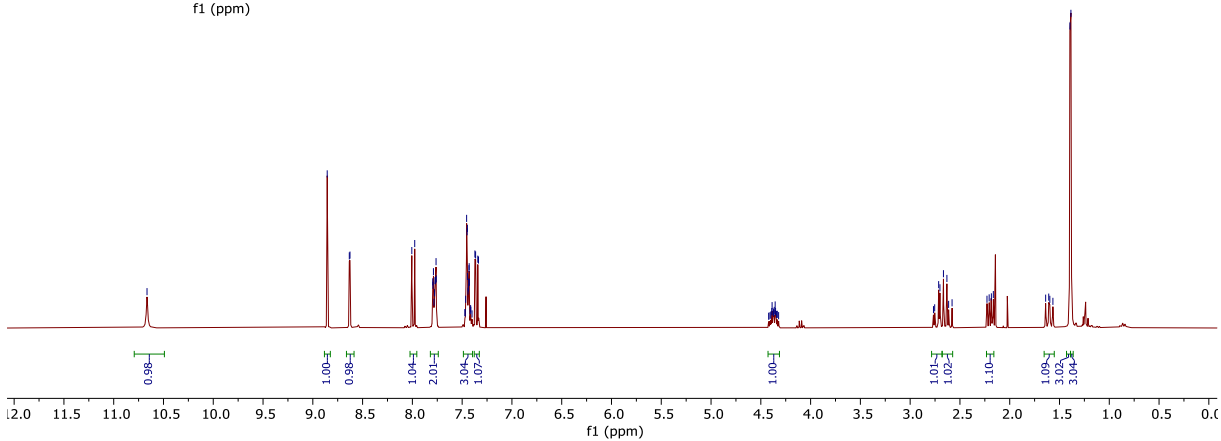
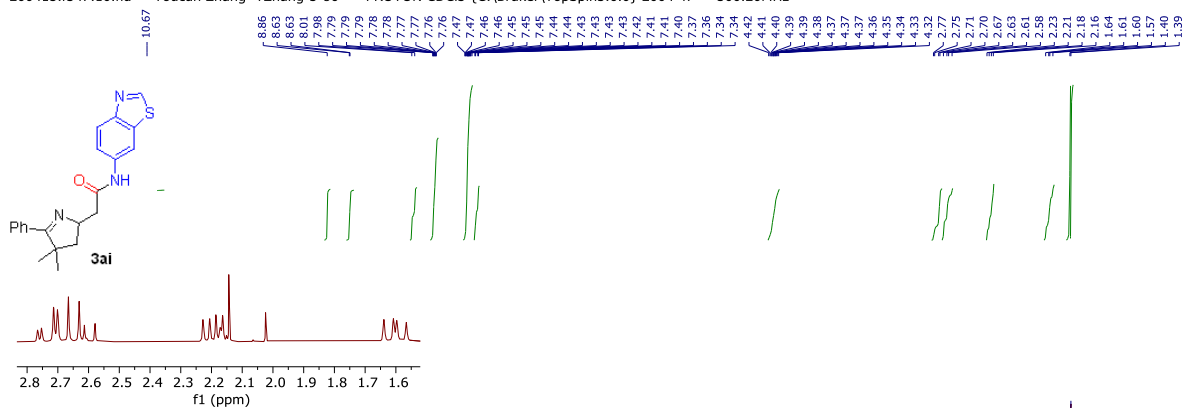
200421.f344.10.fid — Youcan Zhang YZhang-3-62 — PROTON CDCl3 {C:\Bruker\TopSpin3.6.0} 2004 44 — 300.20MHz



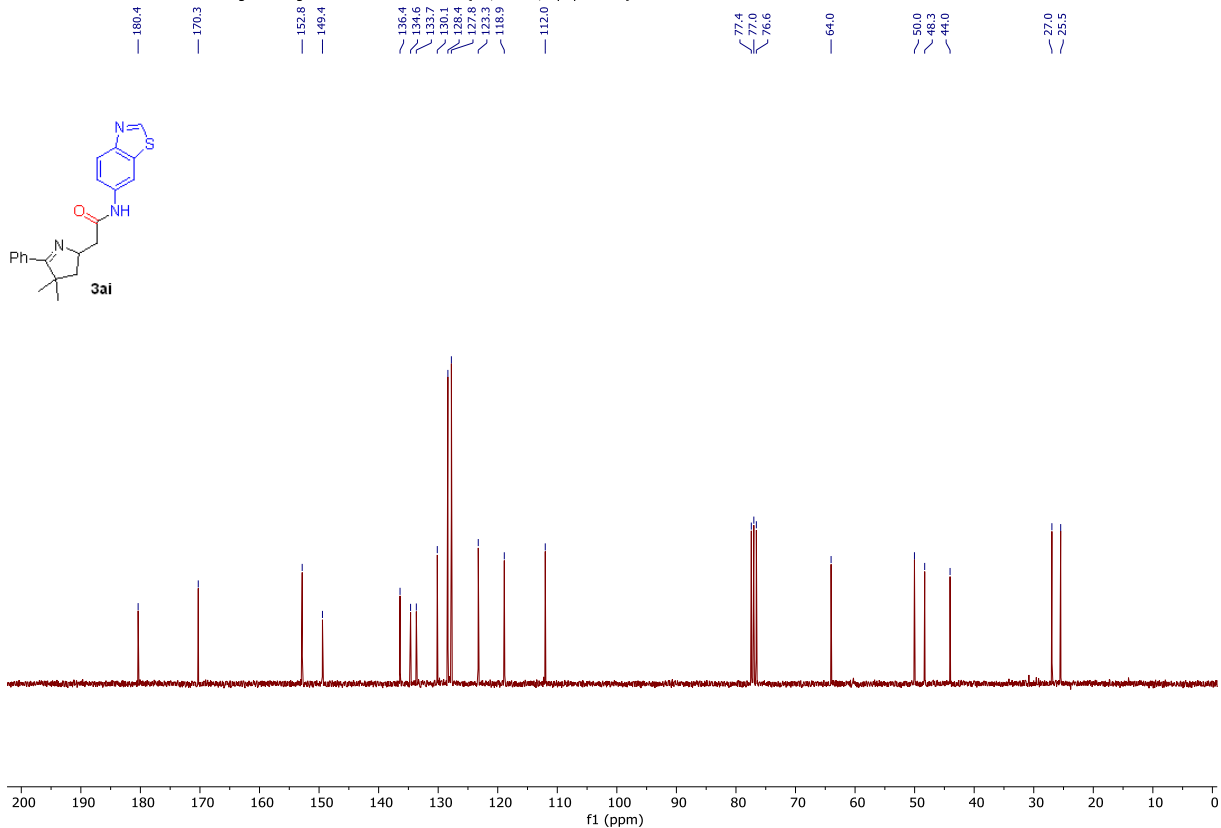
200421.f344.11.fid — Youcan Zhang YZhang-3-62 — C13CPD CDCl3 {C:\Bruker\TopSpin3.6.0} 2004 44 — 75.49MHz

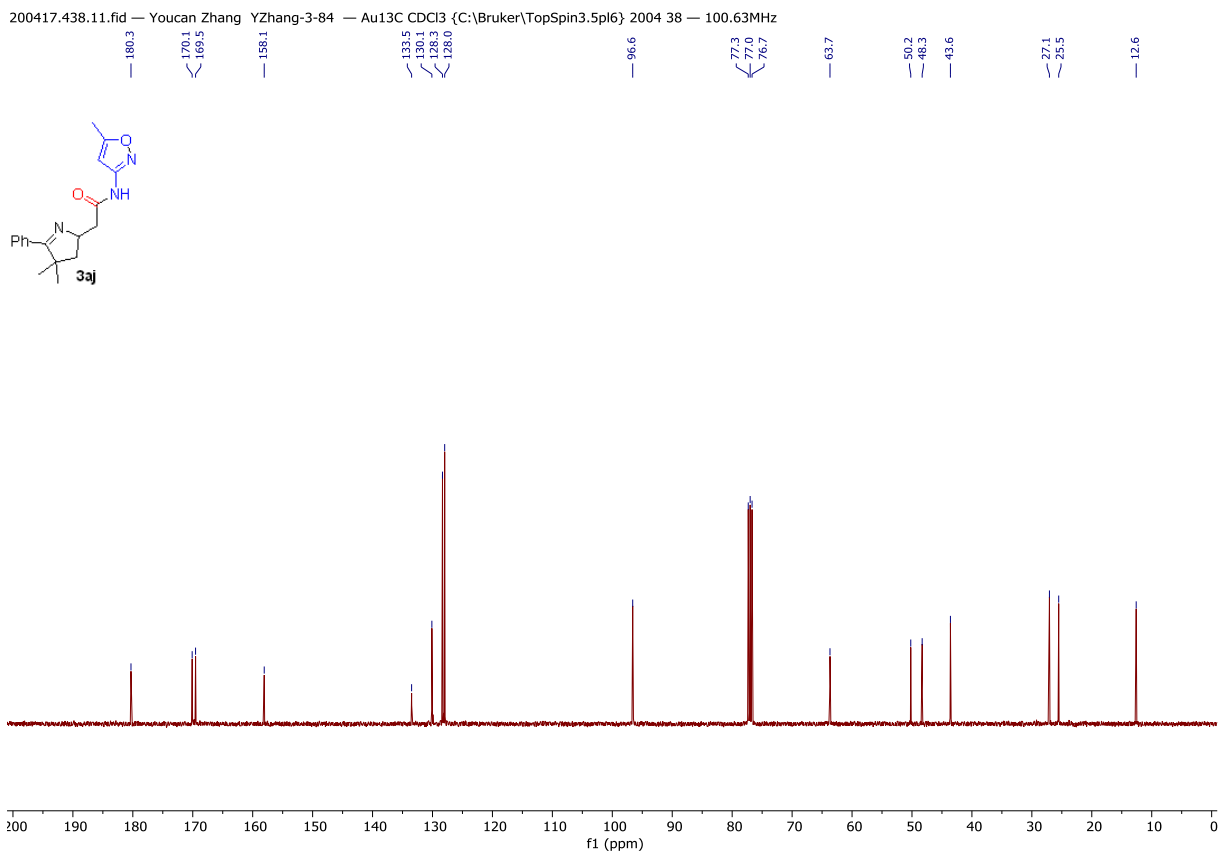
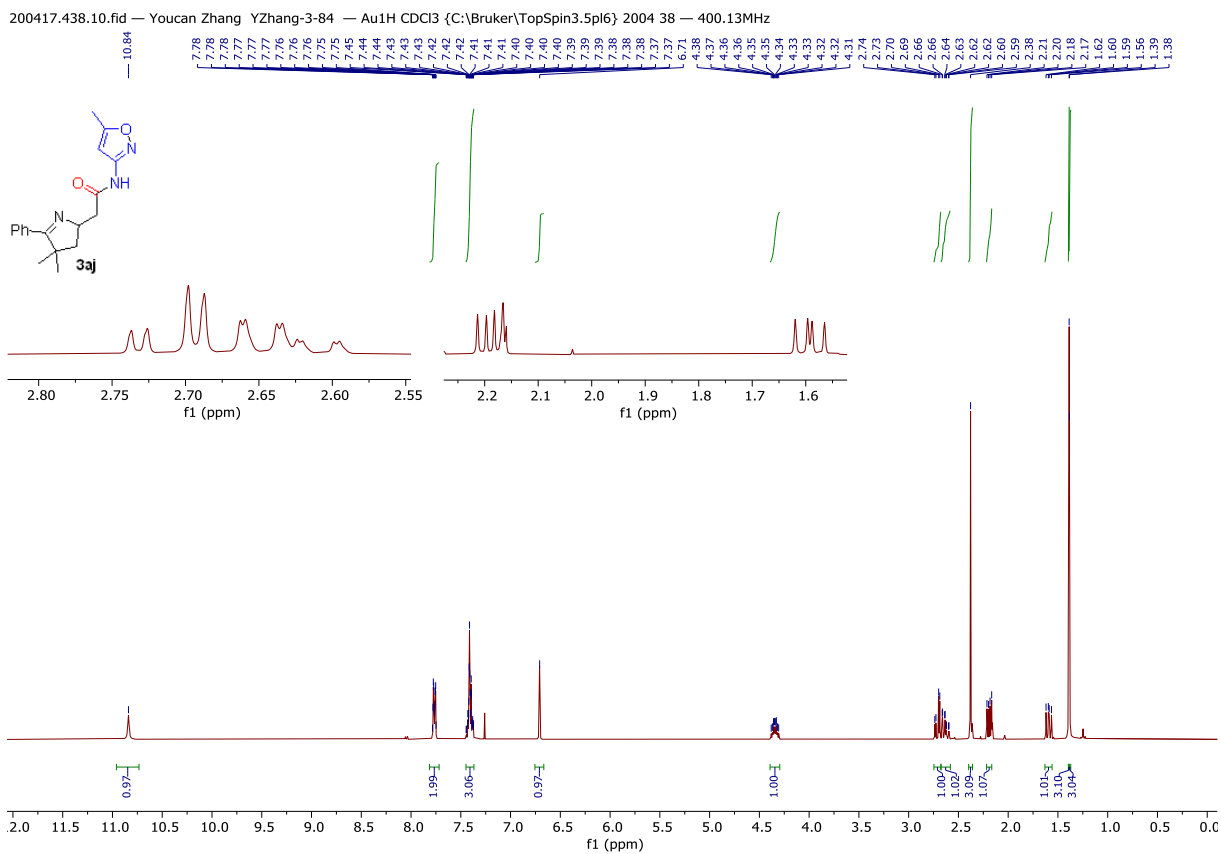


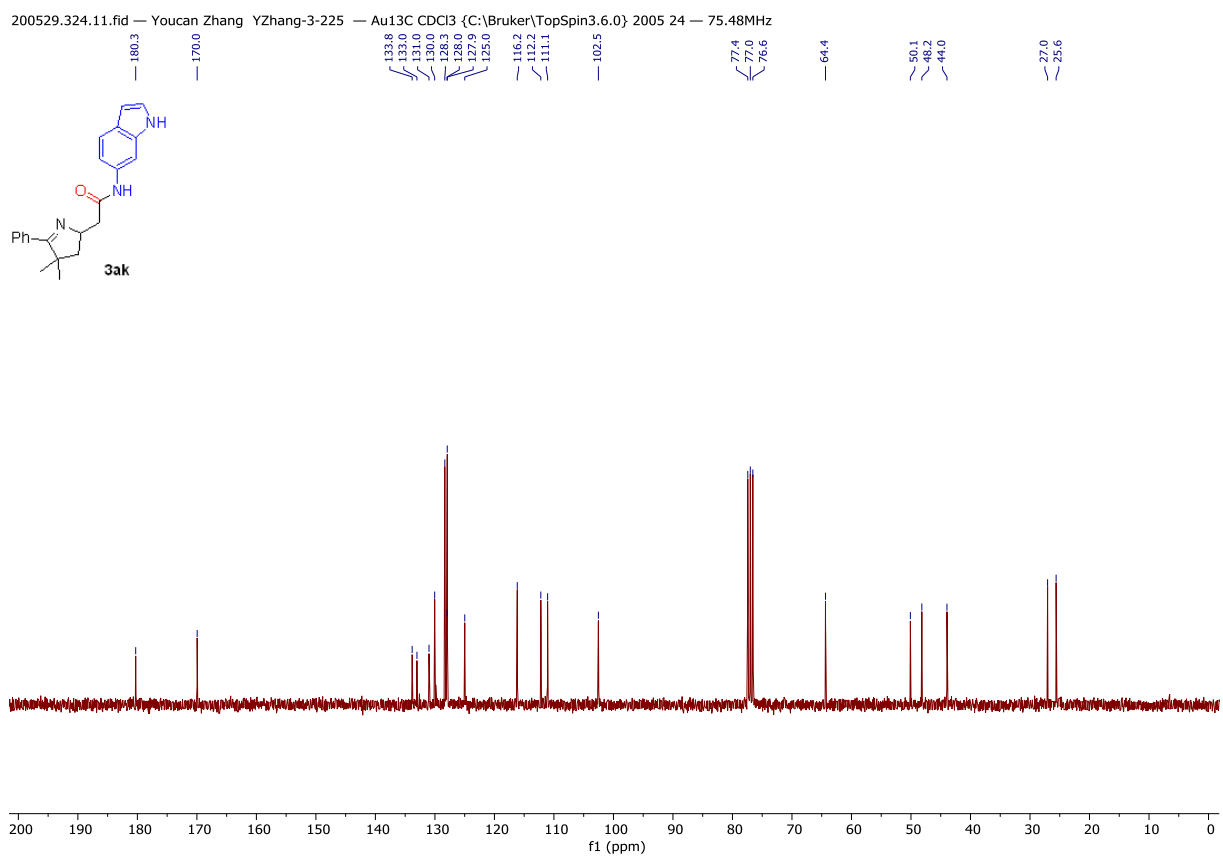
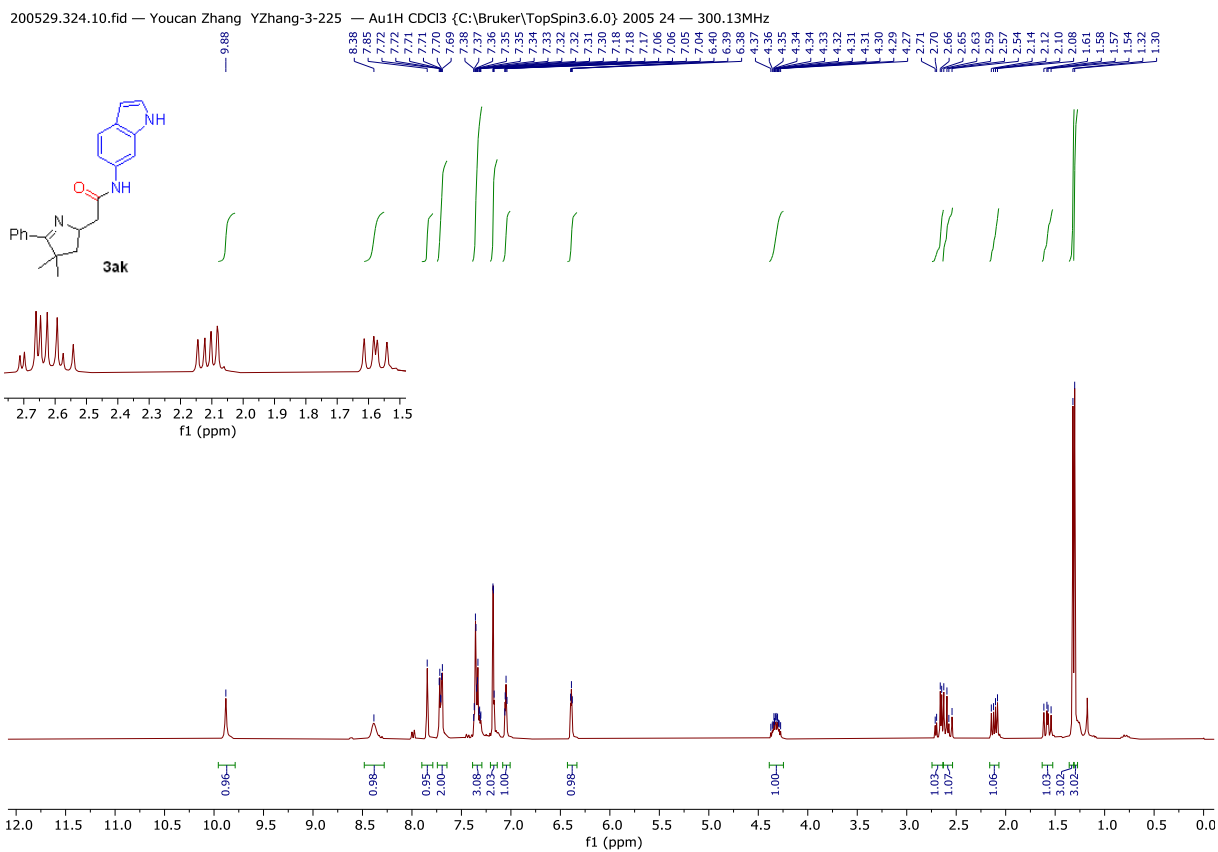
200415.f347.10.fid — Youcan Zhang YZhang-3-86 — PROTON CDCl3 {C:\Bruker\TopSpin3.6.0} 2004 47 — 300.20MHz



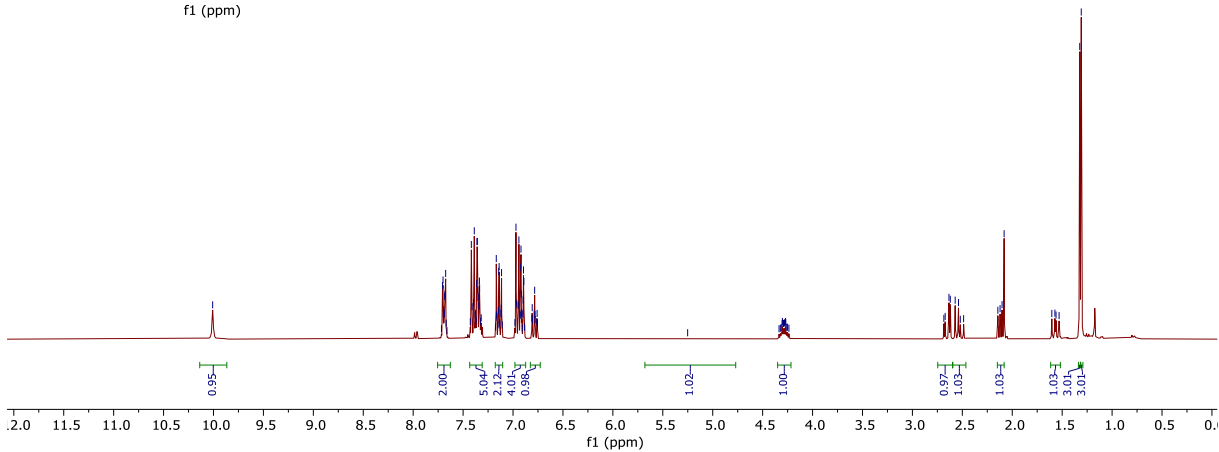
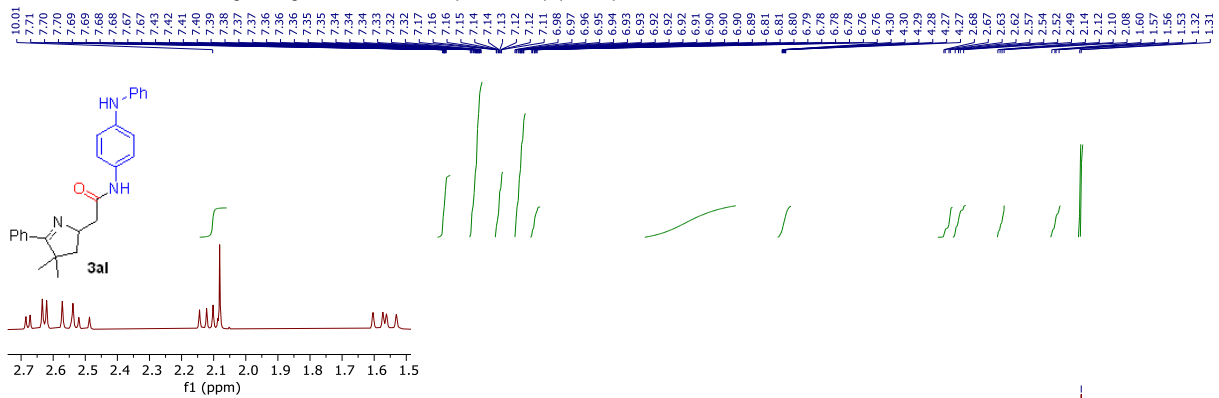
200415.f347.11.fid — Youcan Zhang YZhang-3-86 — C13CPD CDCl3 {C:\Bruker\TopSpin3.6.0} 2004 47 — 75.49MHz



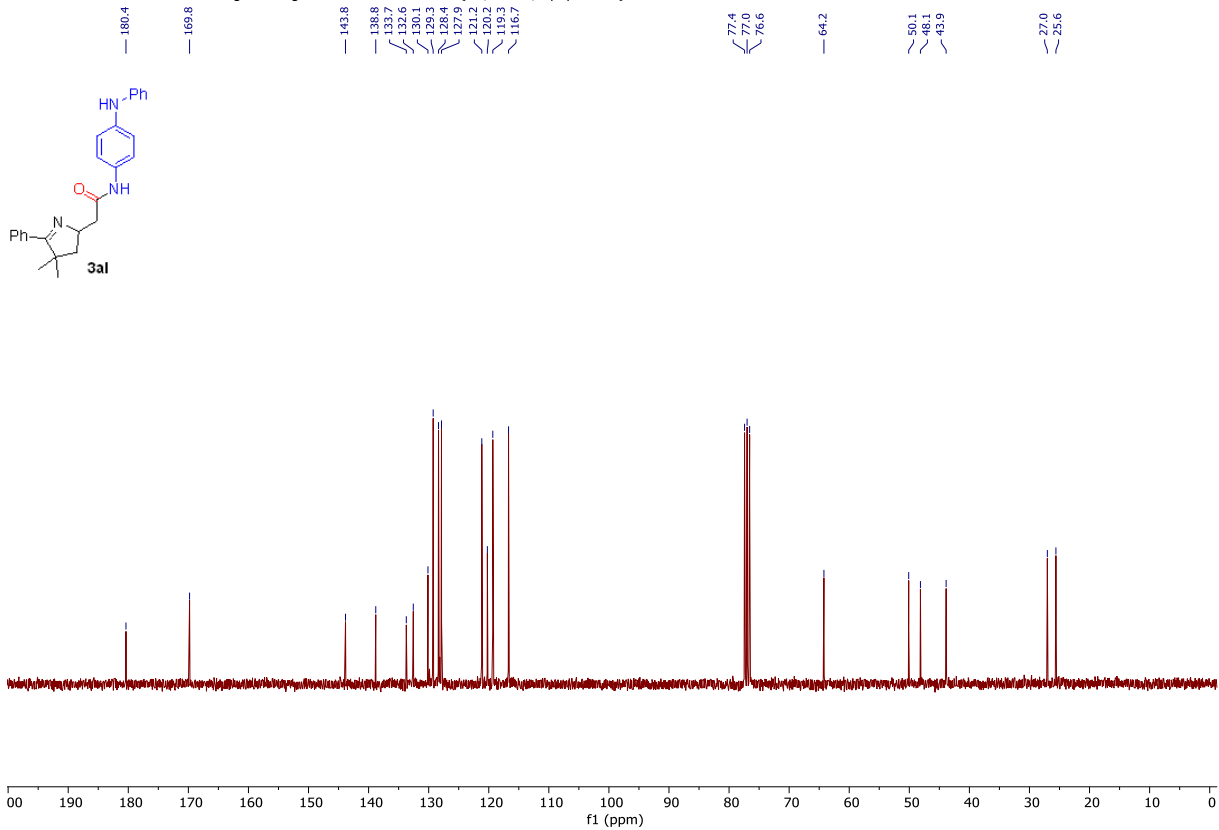


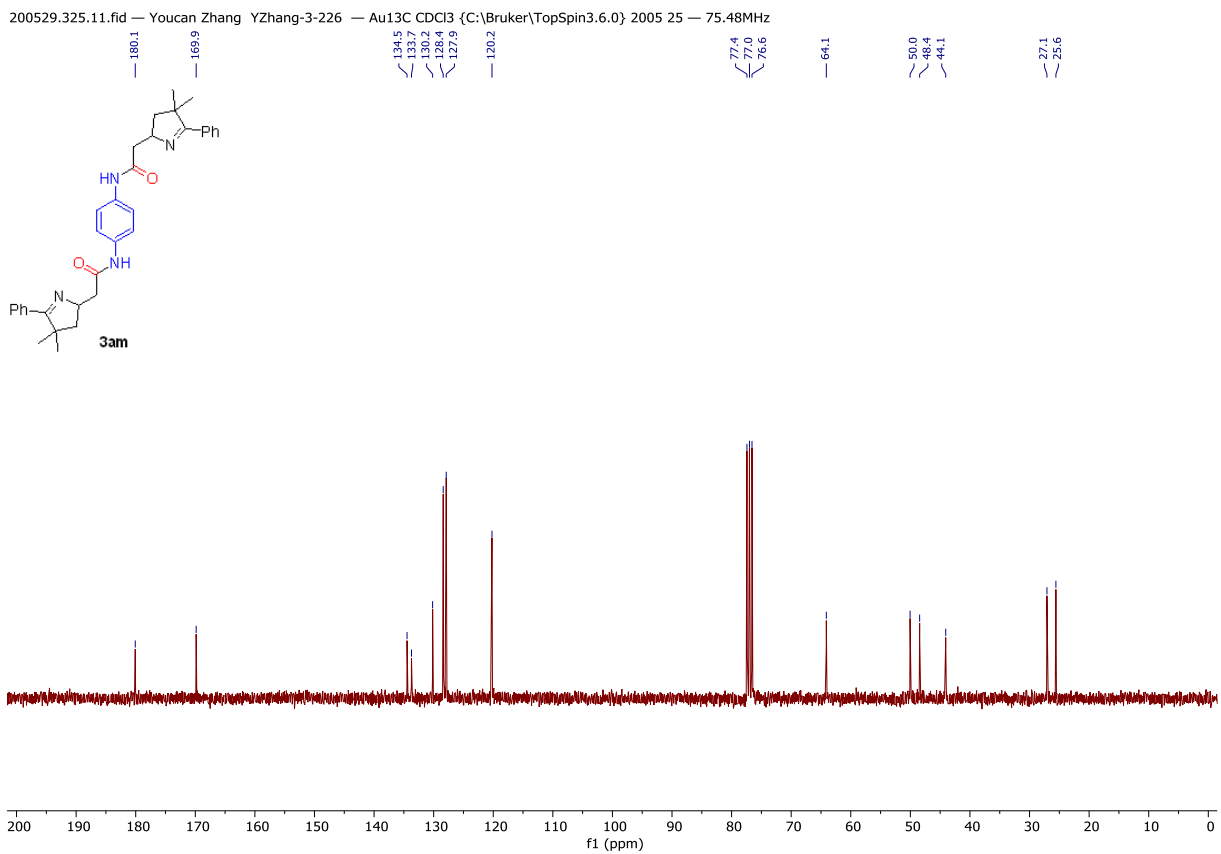
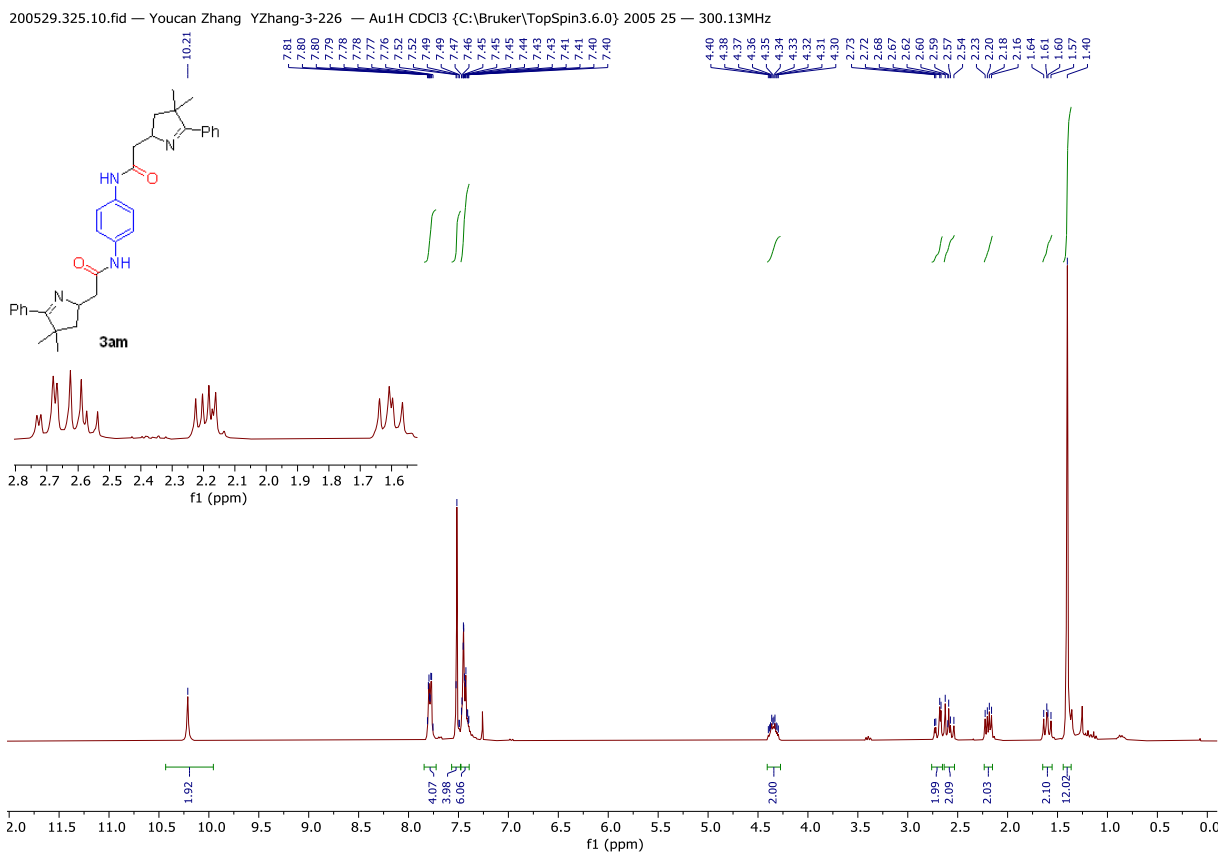


200526.316.10.fid — Youcan Zhang YZhang-3-208 — Au1H CDCl3 {C:\Bruker\TopSpin3.6.0} 2005 16 — 300.13MHz

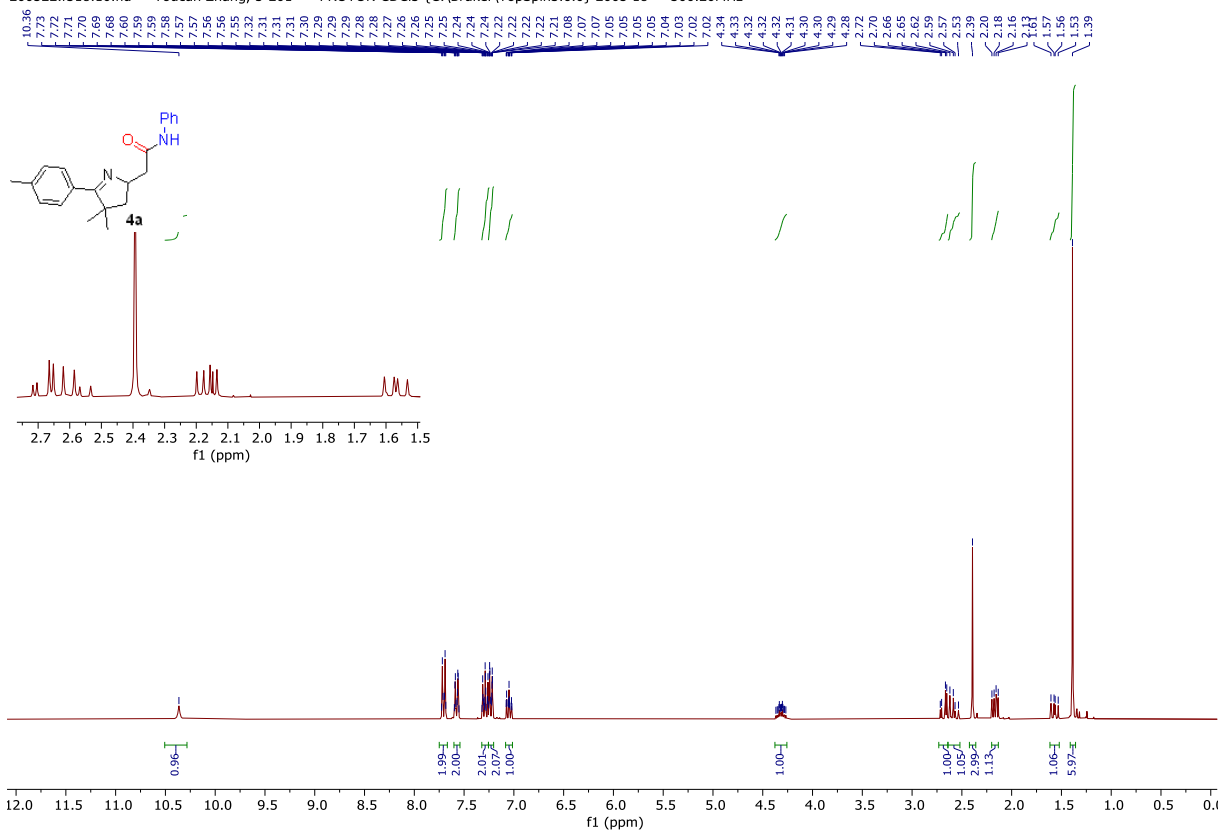


200526.316.11.fid — Youcan Zhang YZhang-3-208 — Au13C CDCl3 {C:\Bruker\TopSpin3.6.0} 2005 16 — 75.48MHz

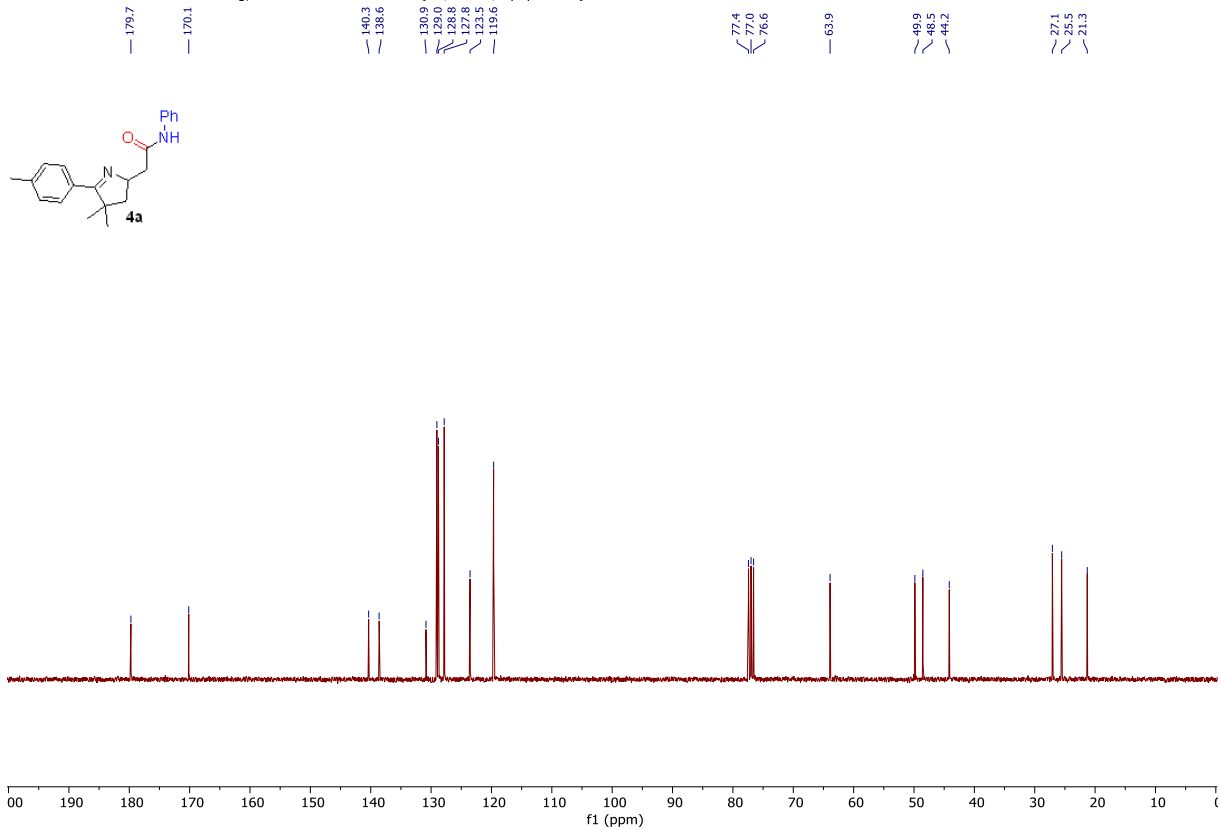




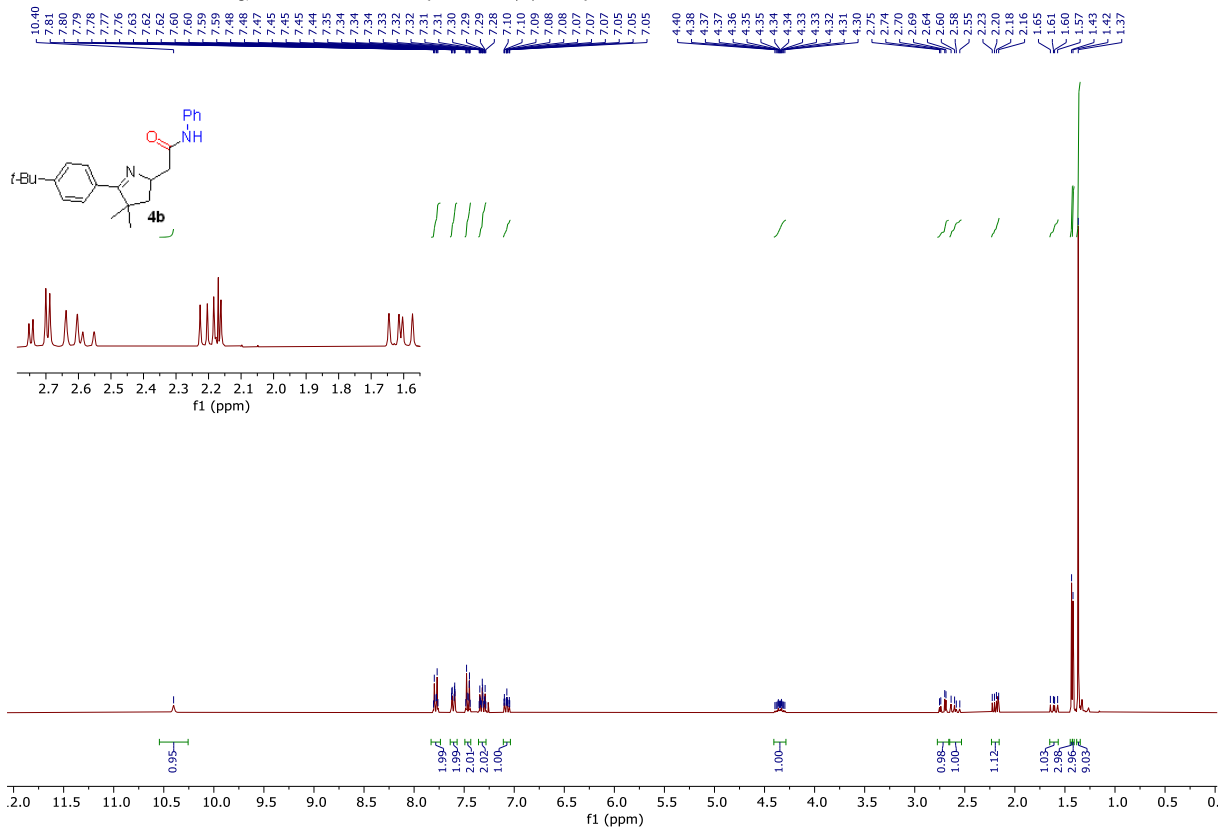
200522.f318.10.fid — Youcan Zhang, 3-201 — PROTON CDCl3 {C:\Bruker\TopSpin3.6.0} 2005 18 — 300.20MHz



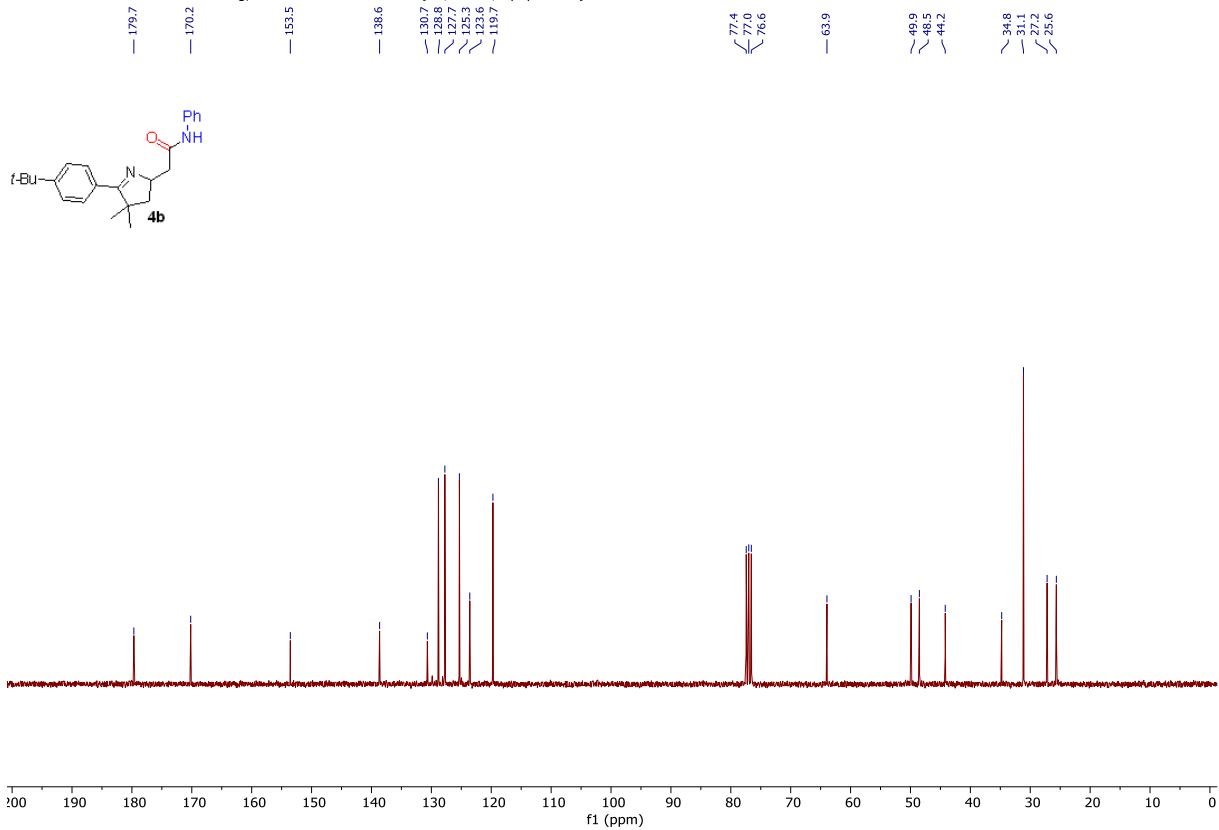
200522.f318.11.fid — Youcan Zhang, 3-201 — C13CPD CDCl3 {C:\Bruker\TopSpin3.6.0} 2005 18 — 75.49MHz

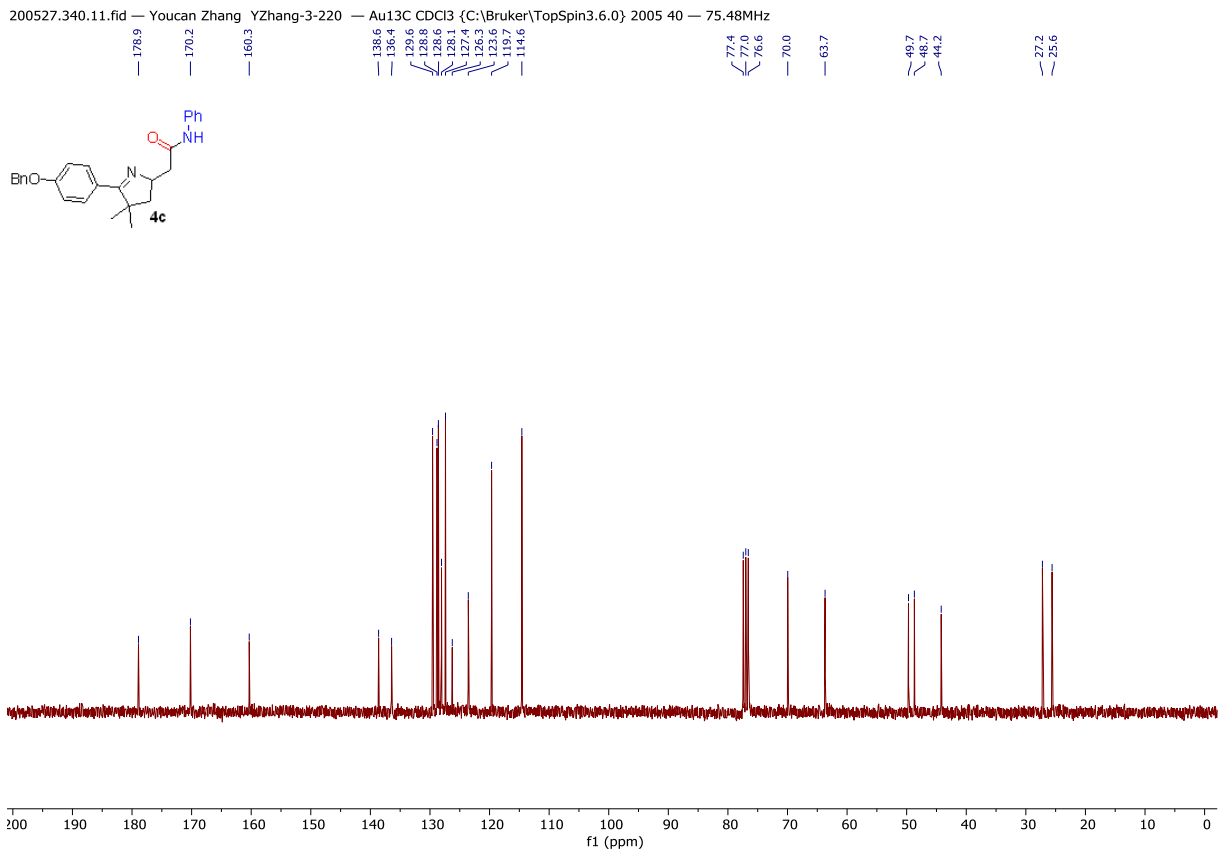
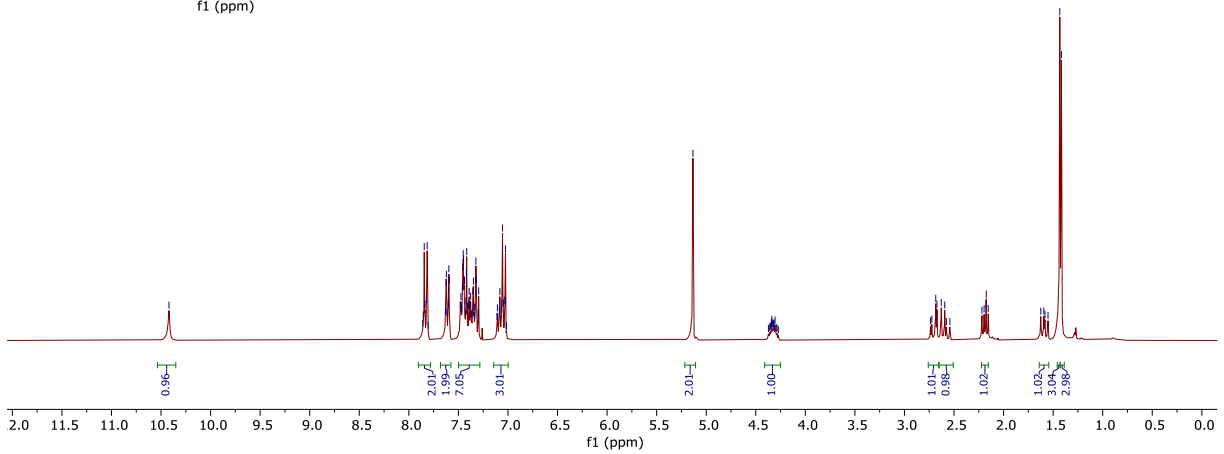
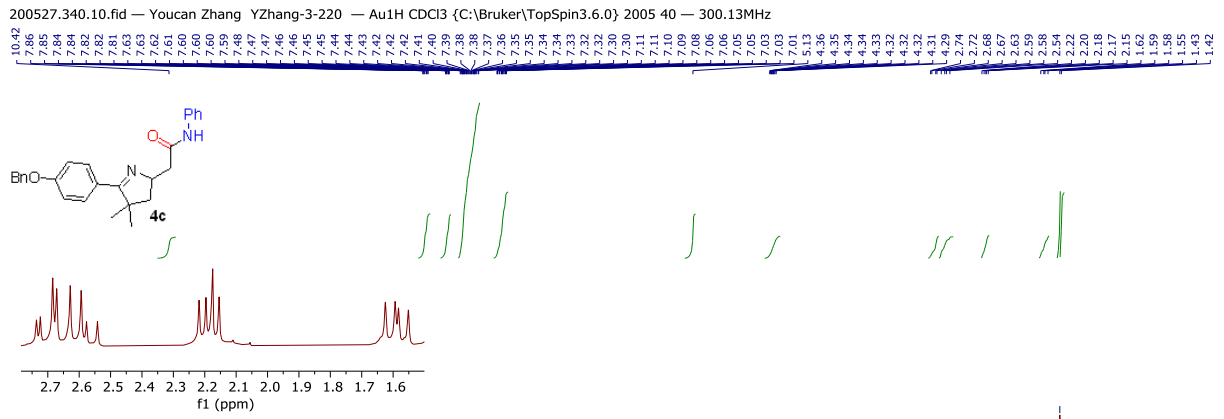


200522.f319.10.fid — Youcan Zhang, 3-202 — PROTON CDCl3 {C:\Bruker\TopSpin3.6.0} 2005 19 — 300.20MHz

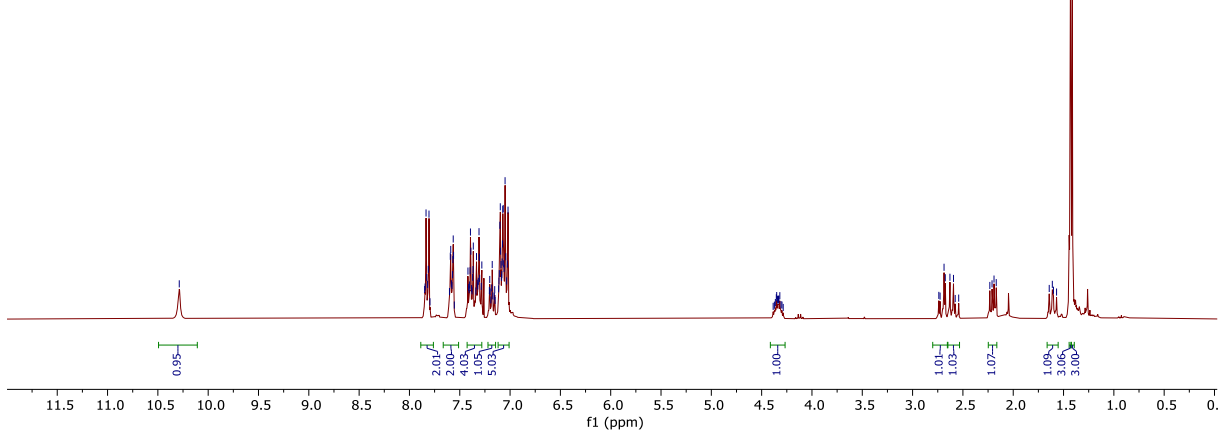
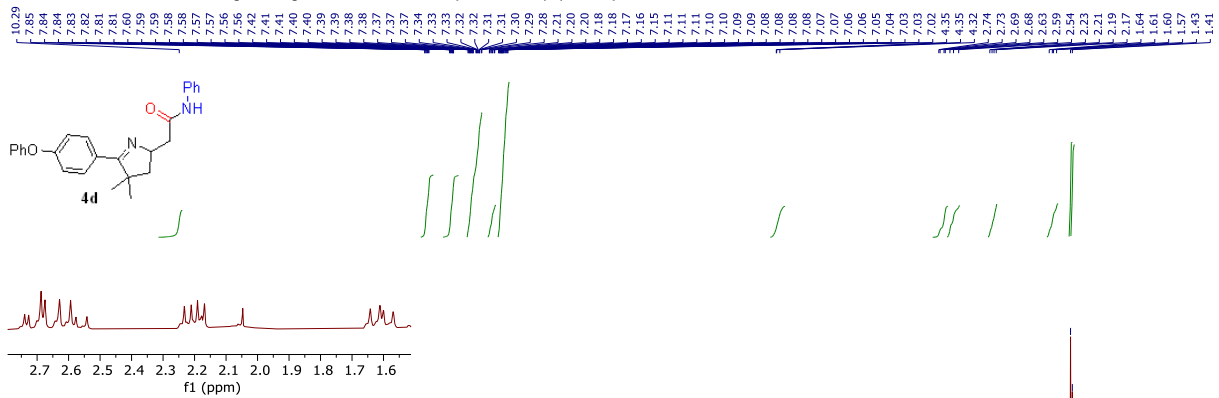


200522.f319.11.fid — Youcan Zhang, 3-202 — C13CPD CDCl3 {C:\Bruker\TopSpin3.6.0} 2005 19 — 75.49MHz

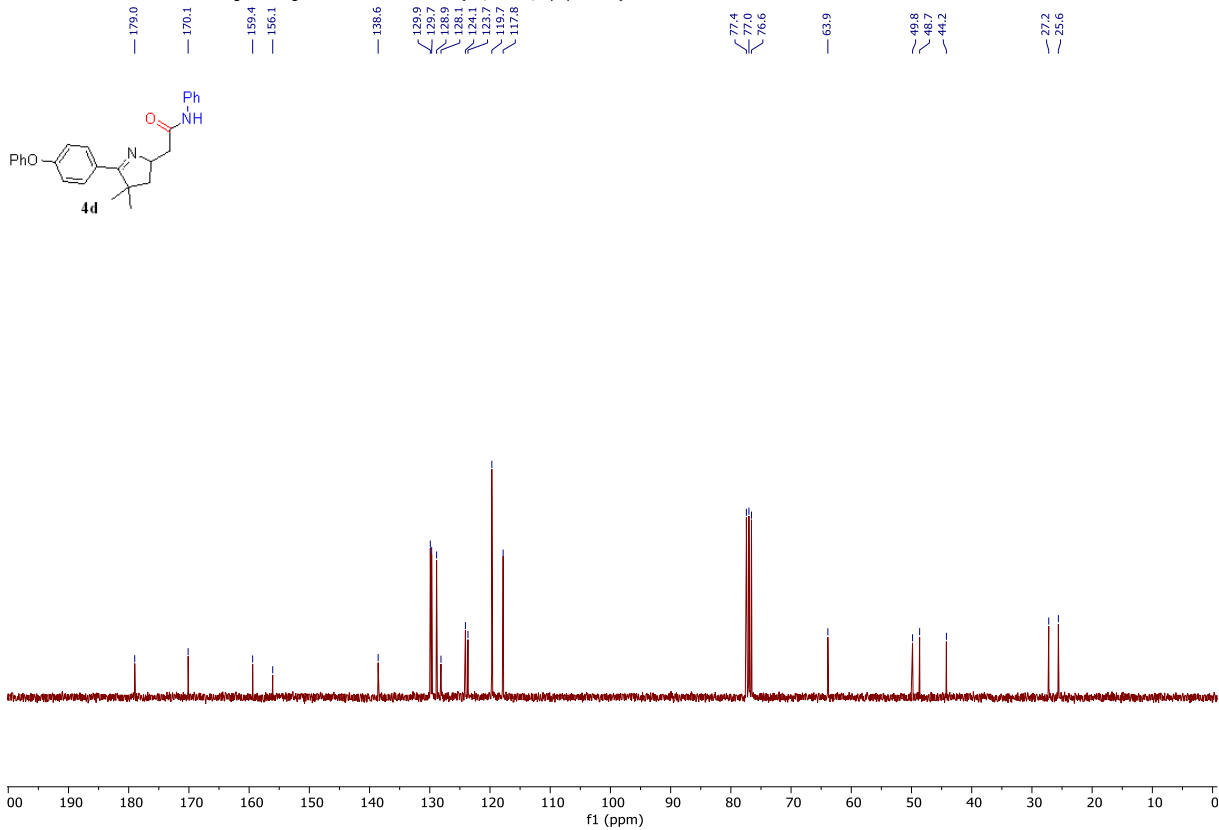




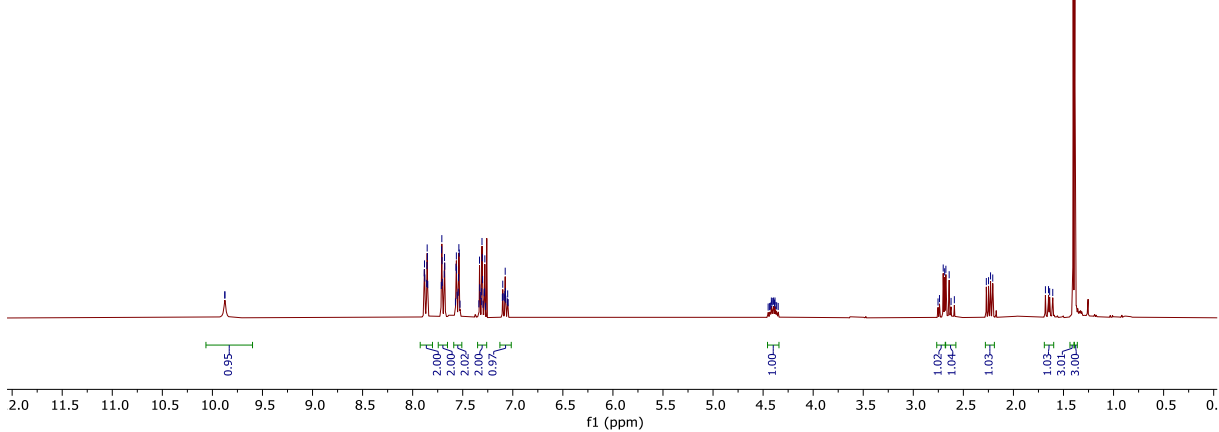
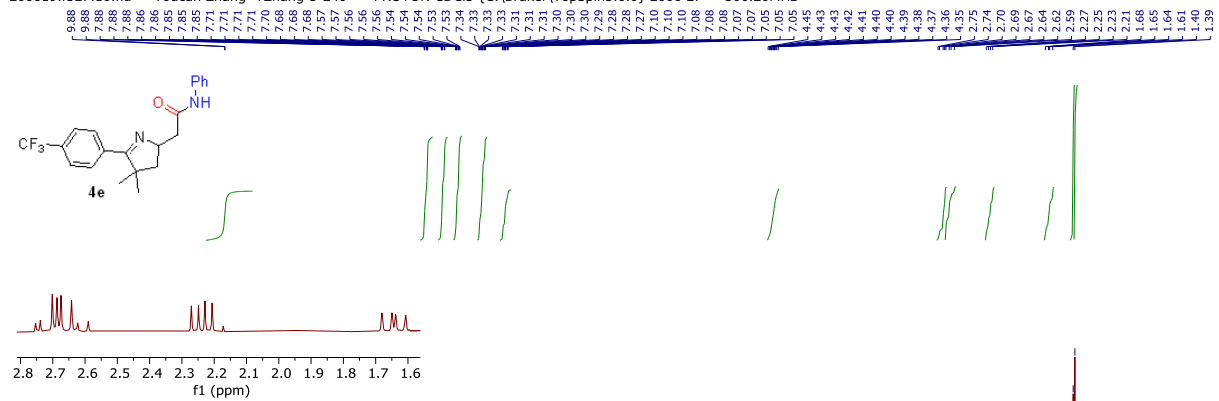
200618.326.10.fid — Youcan Zhang YZhang-3-242 — Au1H CDCl3 {C:\Bruker\TopSpin3.6.0} 2006 26 — 300.13MHz



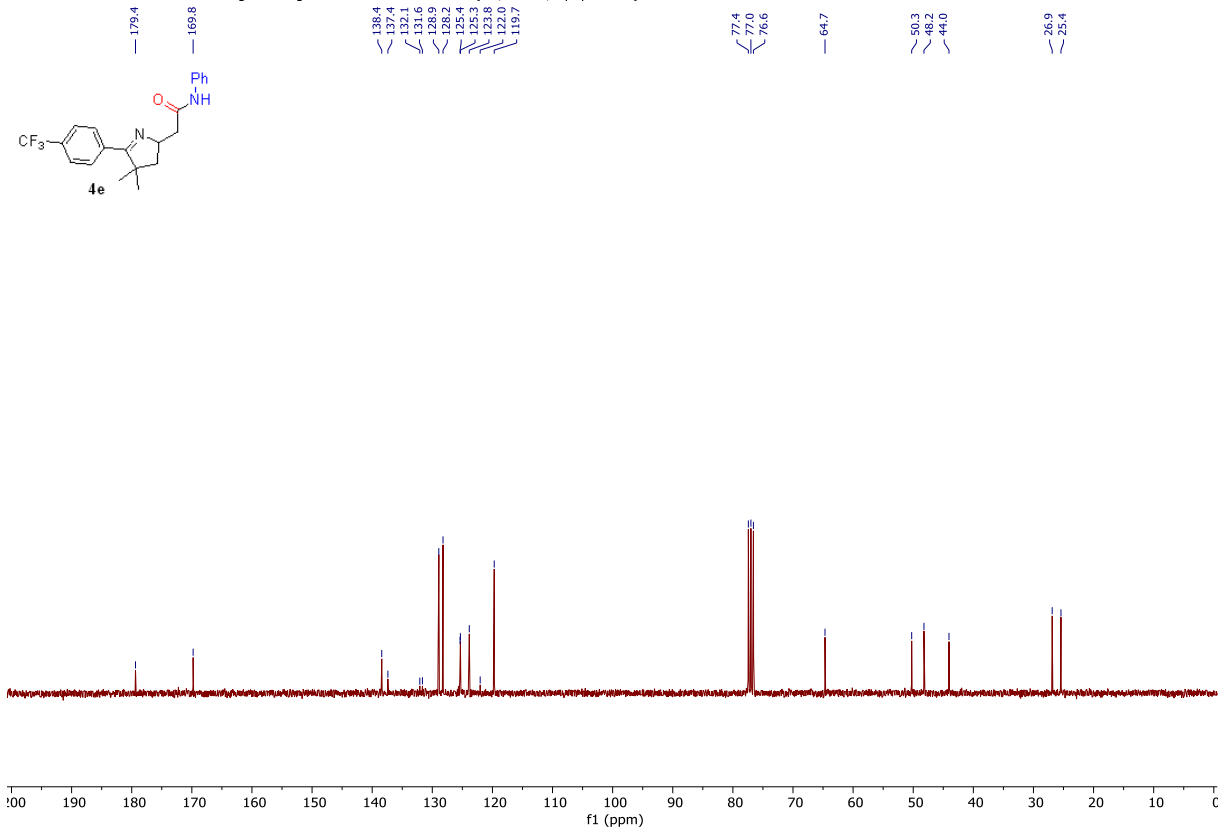
200618.326.11.fid — Youcan Zhang YZhang-3-242 — Au13C CDCl3 {C:\Bruker\TopSpin3.6.0} 2006 26 — 75.48MHz

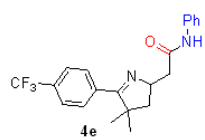


200619.f327.10.fid — Youcan Zhang YZhang-3-240 — PROTON CDCl3 {C:\Bruker\TopSpin3.6.0} 2006 27 — 300.20MHz

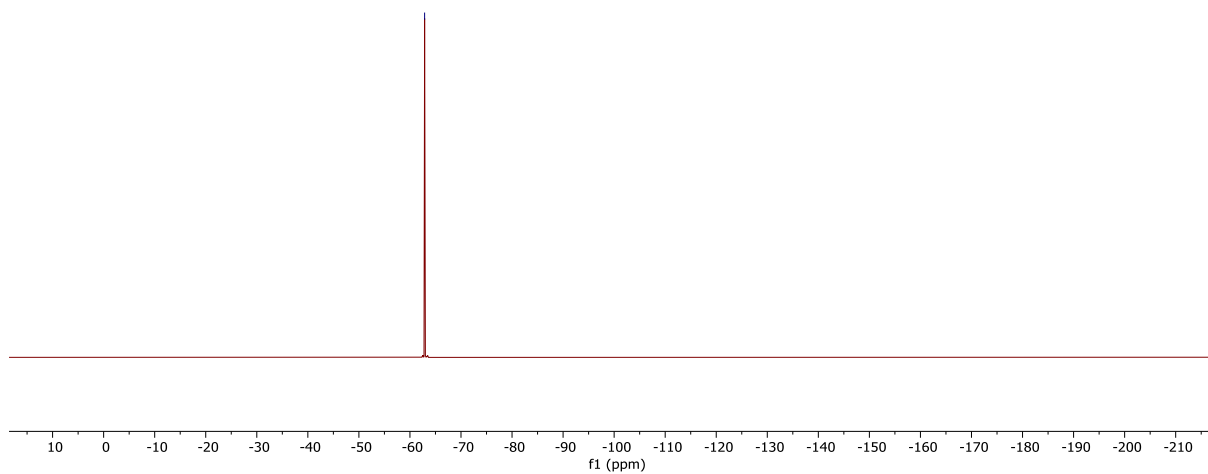


200619.f327.11.fid — Youcan Zhang YZhang-3-240 — C13CPD CDCl3 {C:\Bruker\TopSpin3.6.0} 2006 27 — 75.49MHz

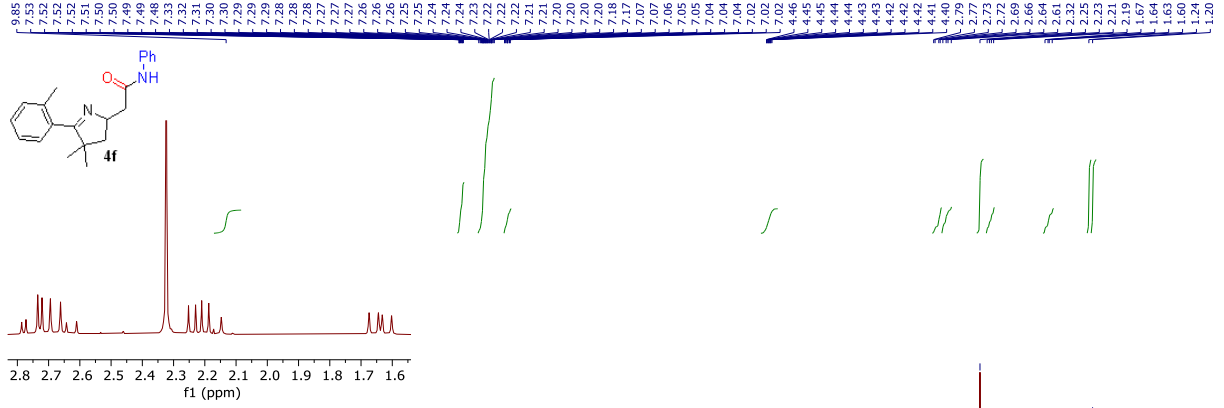




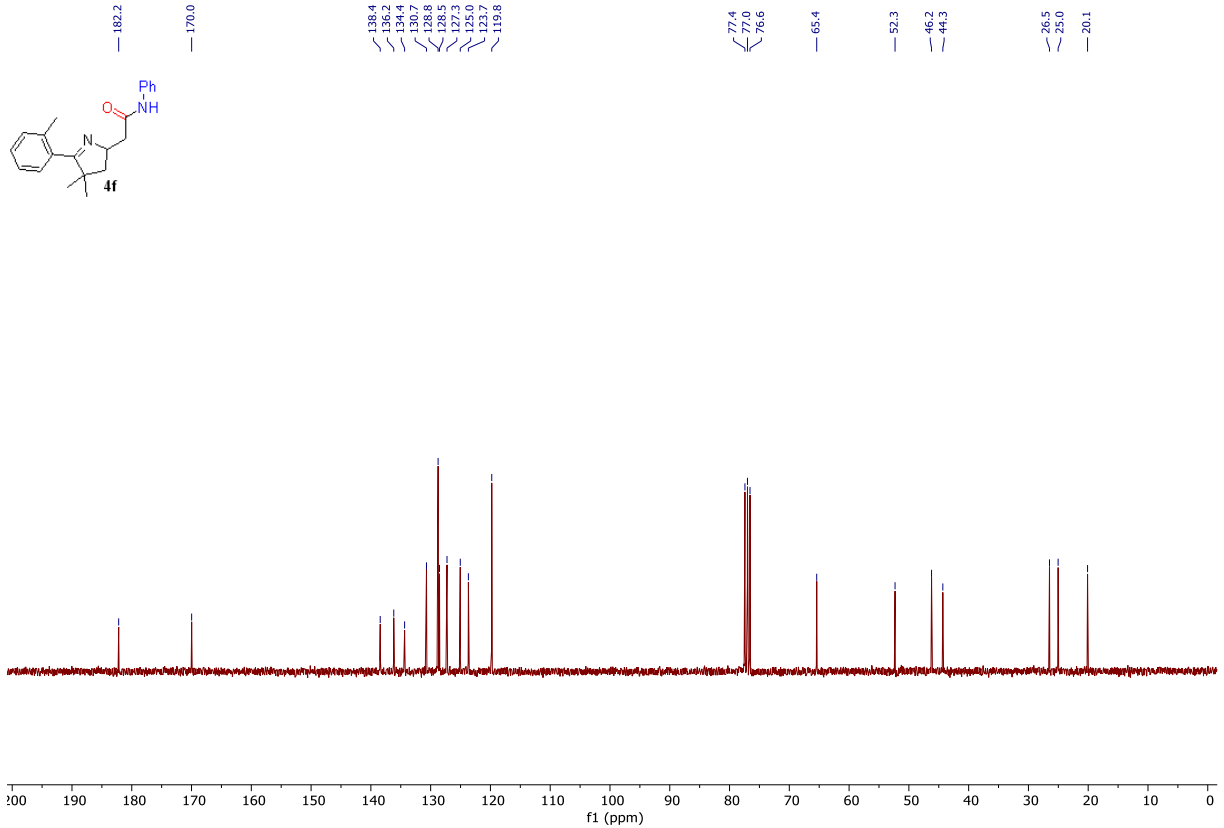
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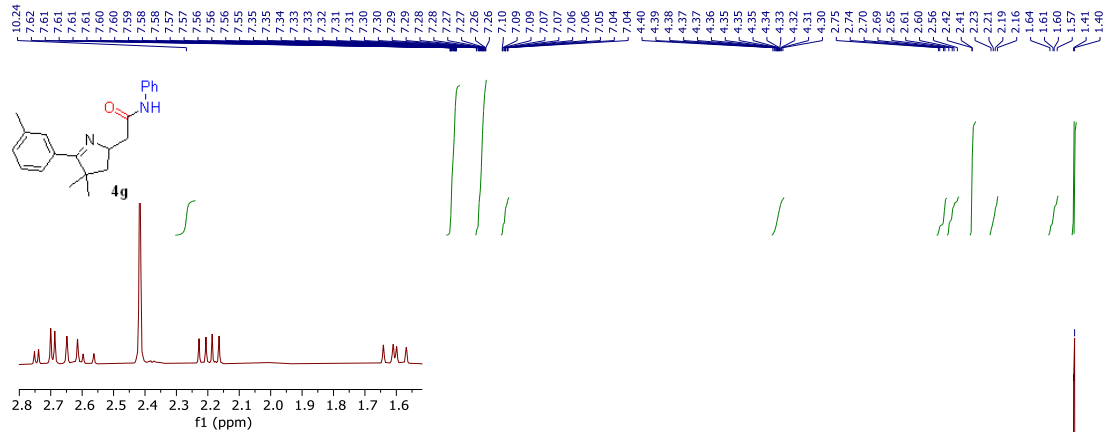
200612.f333.10.fid — Zhang/ Y Zhang-3-233 — PROTON CDCl3 {C:\Bruker\TopSpin3.6.0} 2006 33 — 300.20MHz



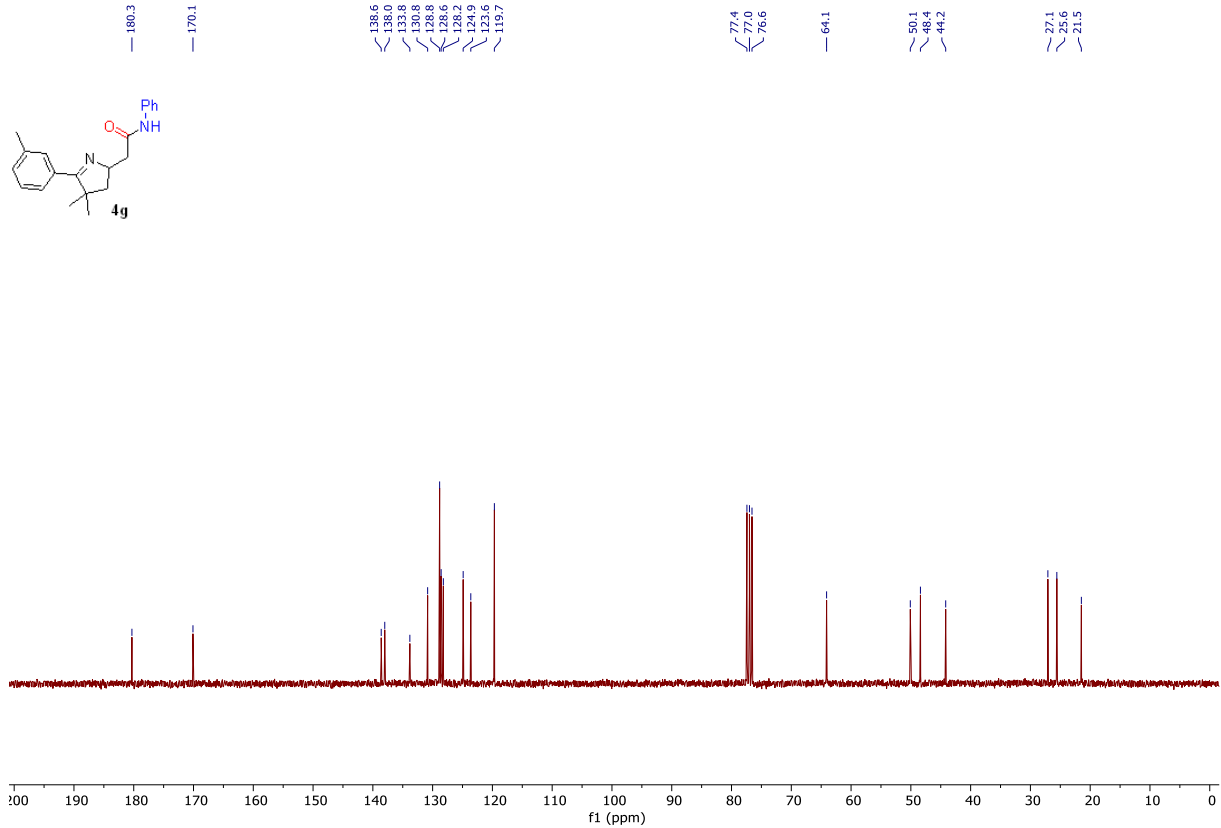
200612.f333.11.fid — Zhang/ Y Zhang-3-233 — C13CPD CDCl3 {C:\Bruker\TopSpin3.6.0} 2006 33 — 75.49MHz



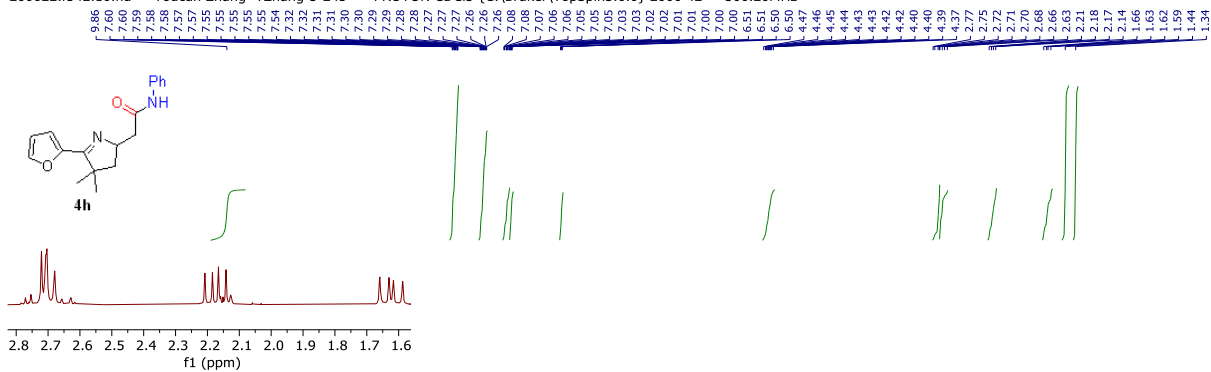
200623.f308.10.fid — Zhang/ Y Zhang-3-25-1 — PROTON CDCl3 {C:\Bruker\TopSpin3.6.0} 2006 8 — 300.20MHz



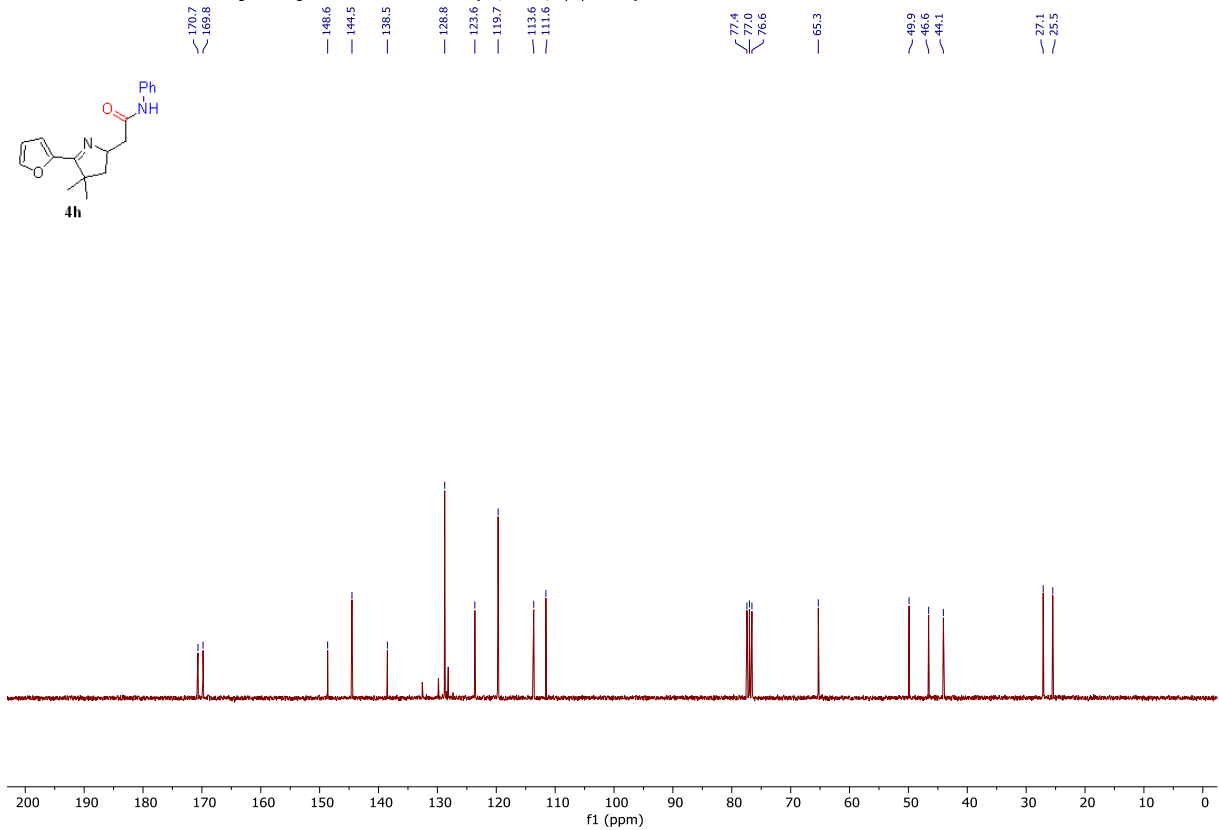
200623.f308.11.fid — Zhang/ Y Zhang-3-25-1 — C13CPD CDCl3 {C:\Bruker\TopSpin3.6.0} 2006 8 — 75.49MHz



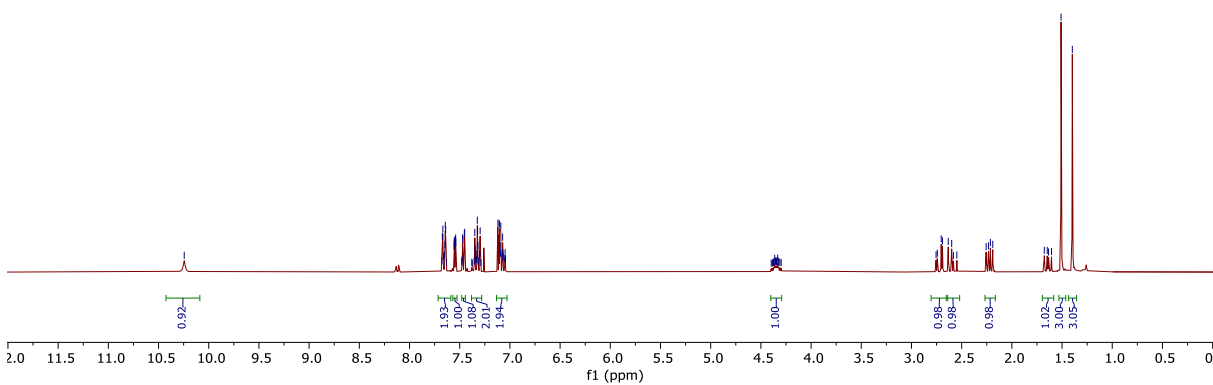
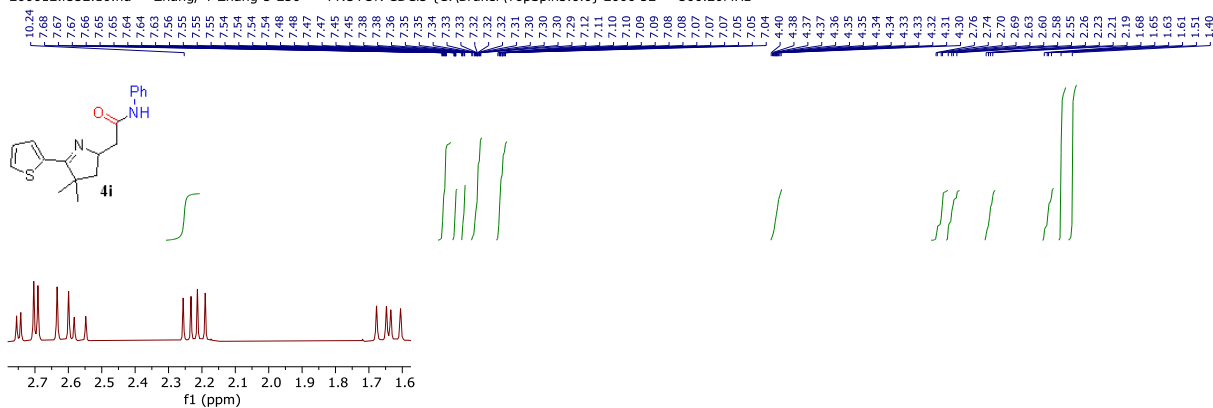
200622.f342.10.fid — Youcan Zhang YZhang-3-245 — PROTON CDCl3 {C:\Bruker\TopSpin3.6.0} 2006 42 — 300.20MHz



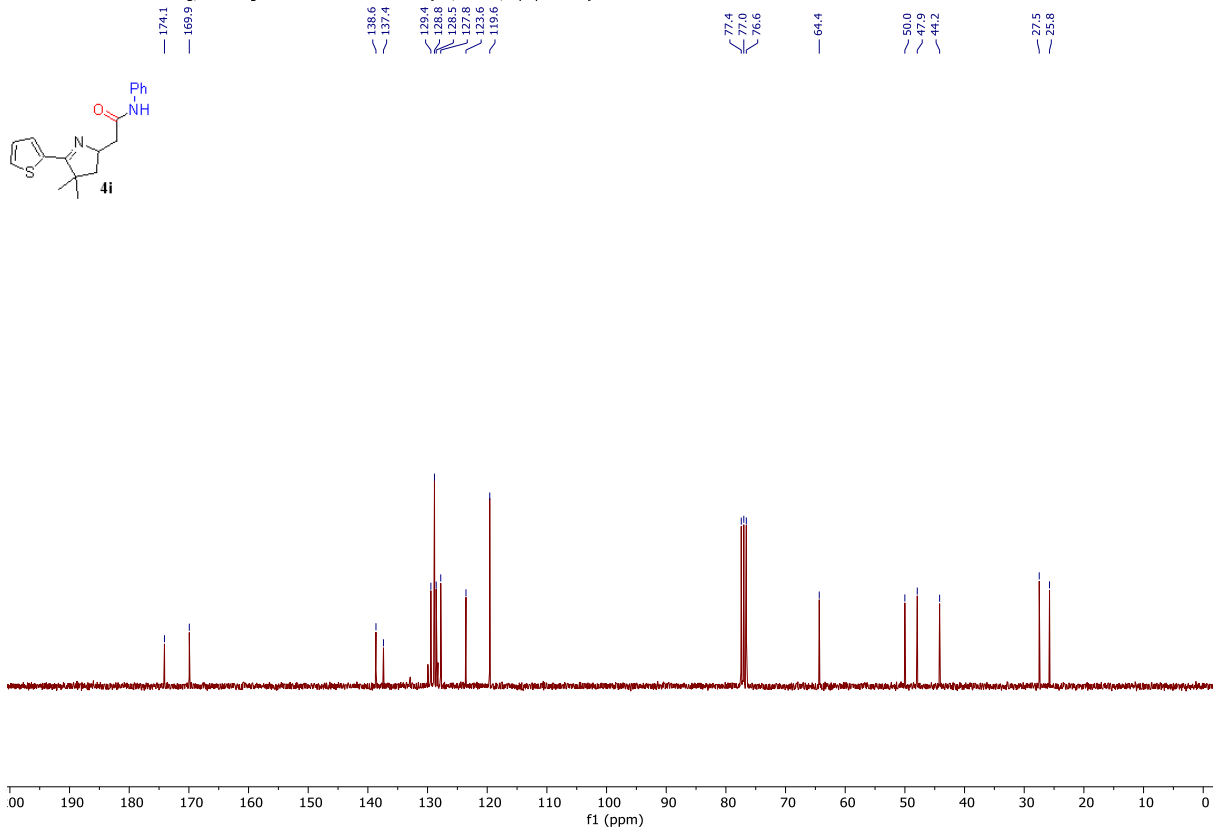
200622.f342.11.fid — Youcan Zhang YZhang-3-245 — C13CPD CDCl3 {C:\Bruker\TopSpin3.6.0} 2006 42 — 75.49MHz



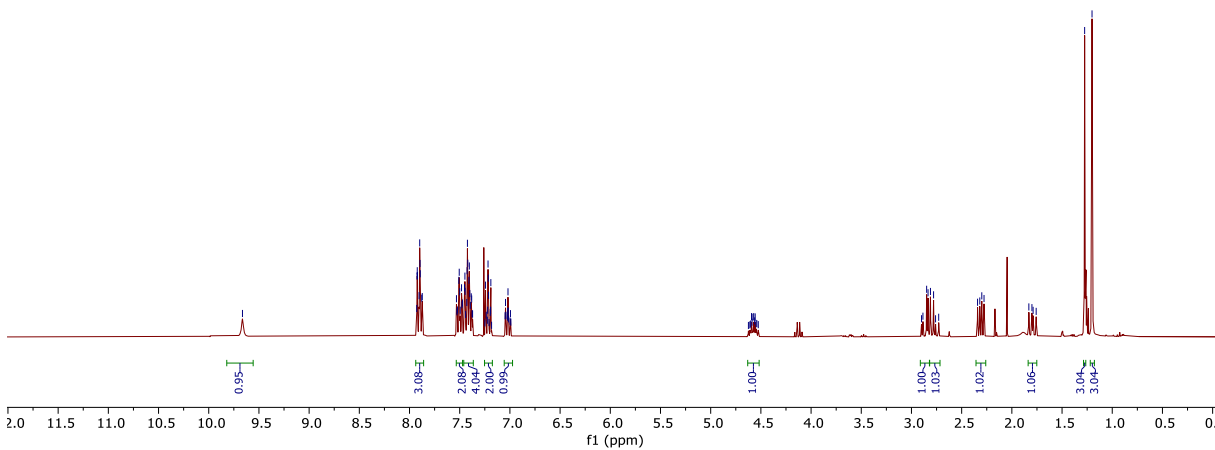
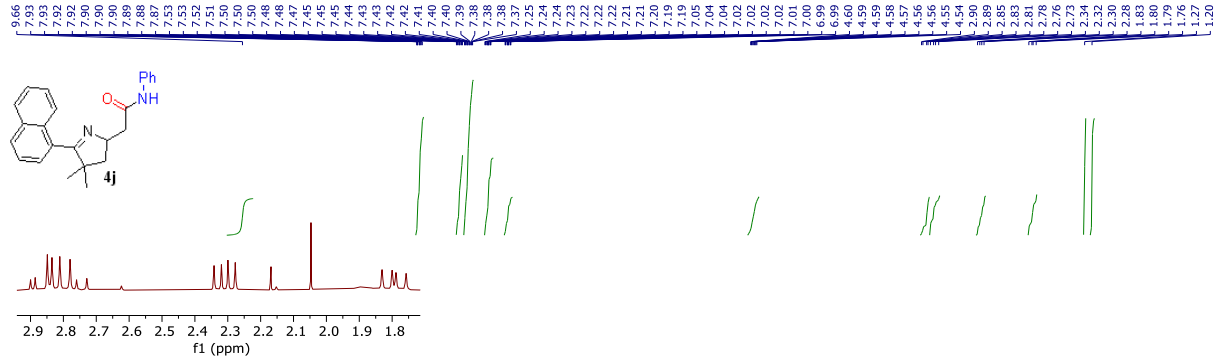
200612.f332.10.fid — Zhang/ Y Zhang-3-230 — PROTON CDCl3 {C:\Bruker\TopSpin3.6.0} 2006 32 — 300.20MHz



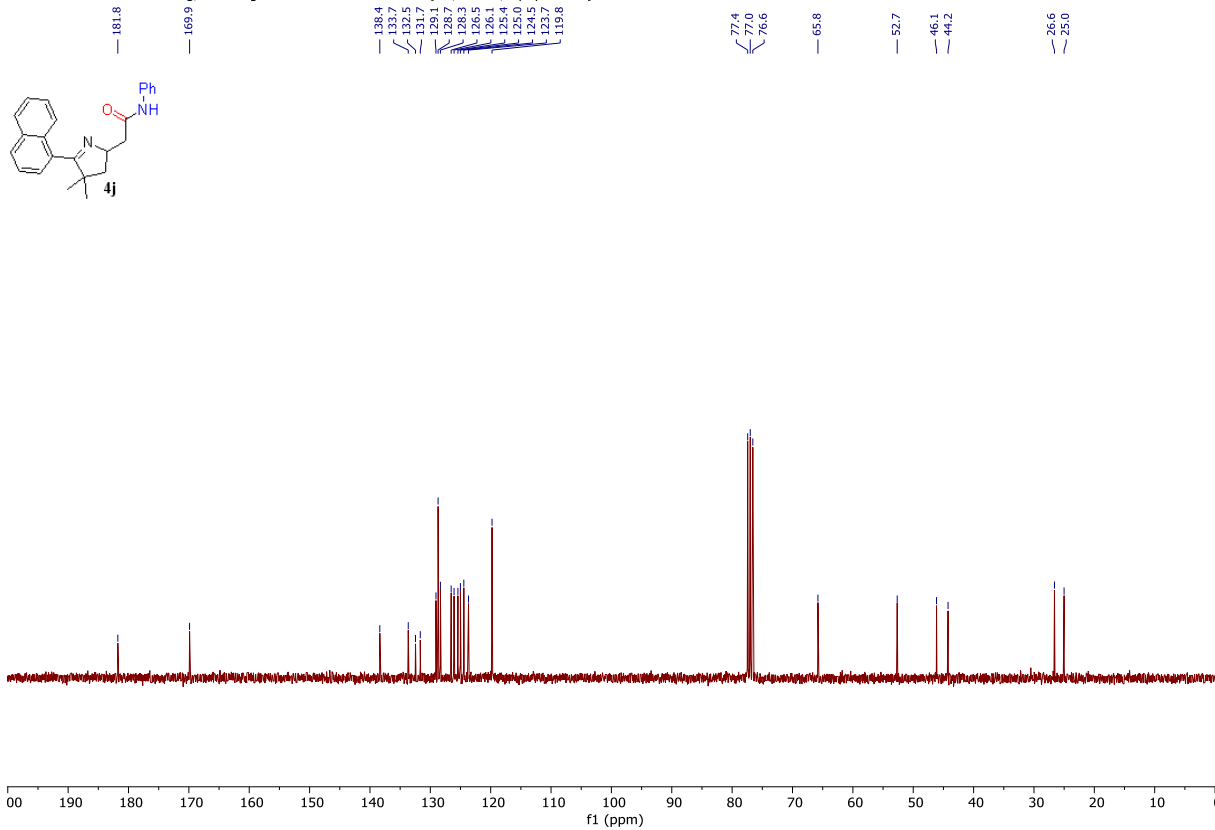
200612.f332.11.fid — Zhang/ Y Zhang-3-230 — C13CPD CDCl3 {C:\Bruker\TopSpin3.6.0} 2006 32 — 75.49MHz



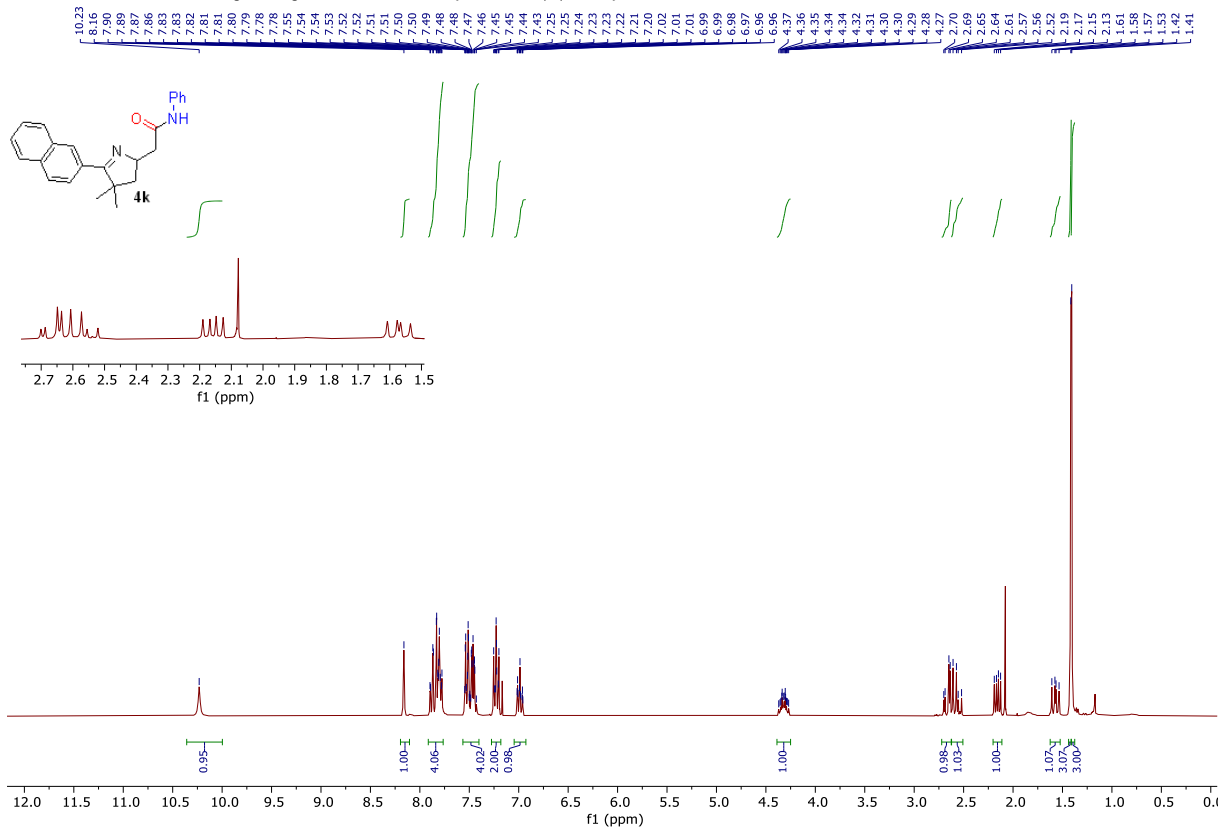
200612.f331.10.fid — Zhang/ Y Zhang-3-232 — PROTON CDCl3 {C:\Bruker\TopSpin3.6.0} 2006 31 — 300.20MHz



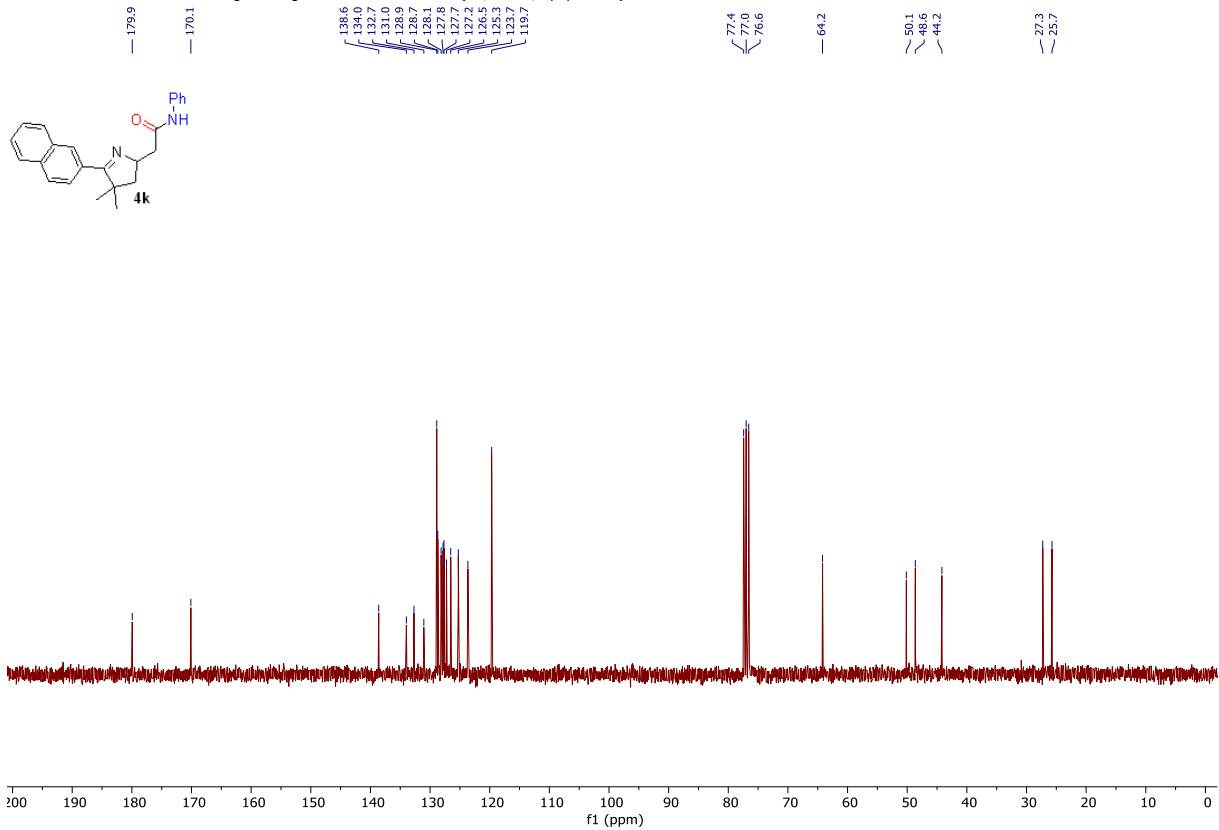
200612.f331.11.fid — Zhang/ Y Zhang-3-232 — C13CPD CDCl3 {C:\Bruker\TopSpin3.6.0} 2006 31 — 75.49MHz



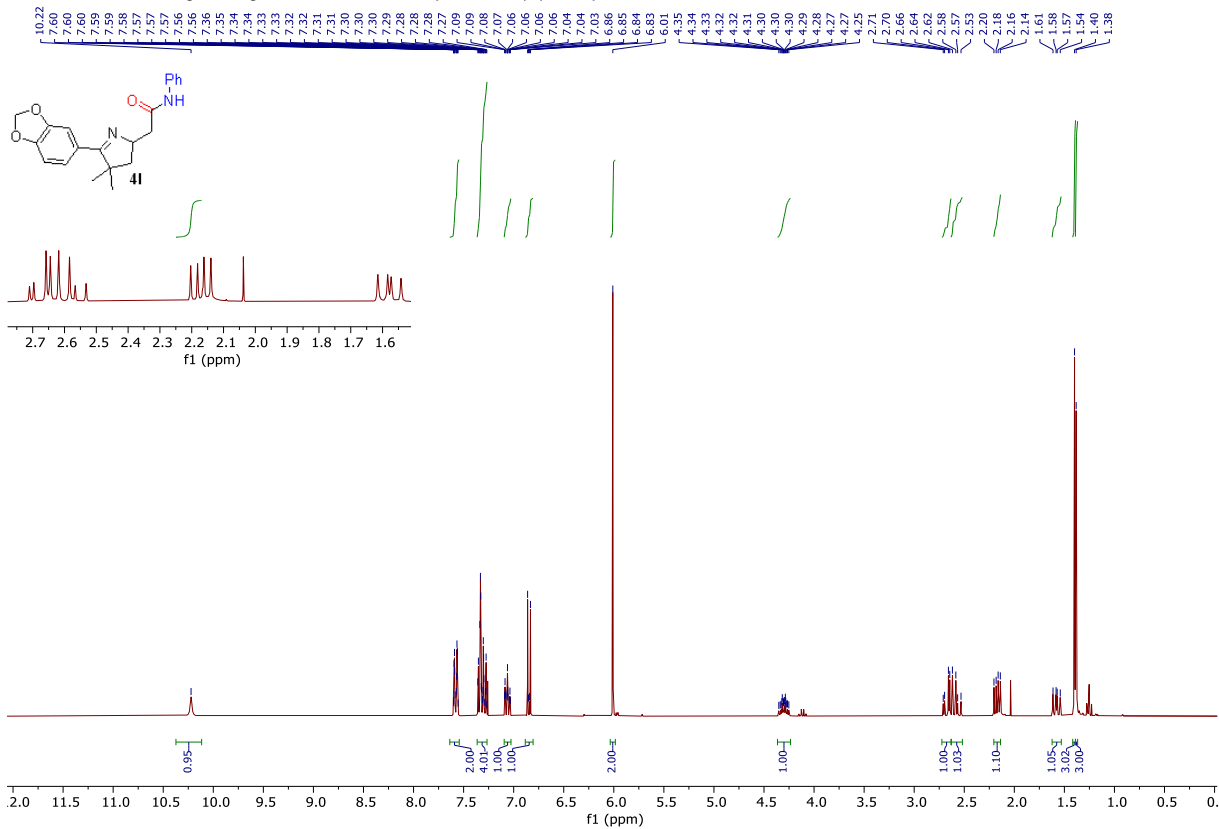
200527.341.10.fid — Youcan Zhang YZhang-3-221 — Au1H CDCl3 {C:\Bruker\TopSpin3.6.0} 2005 41 — 300.13MHz



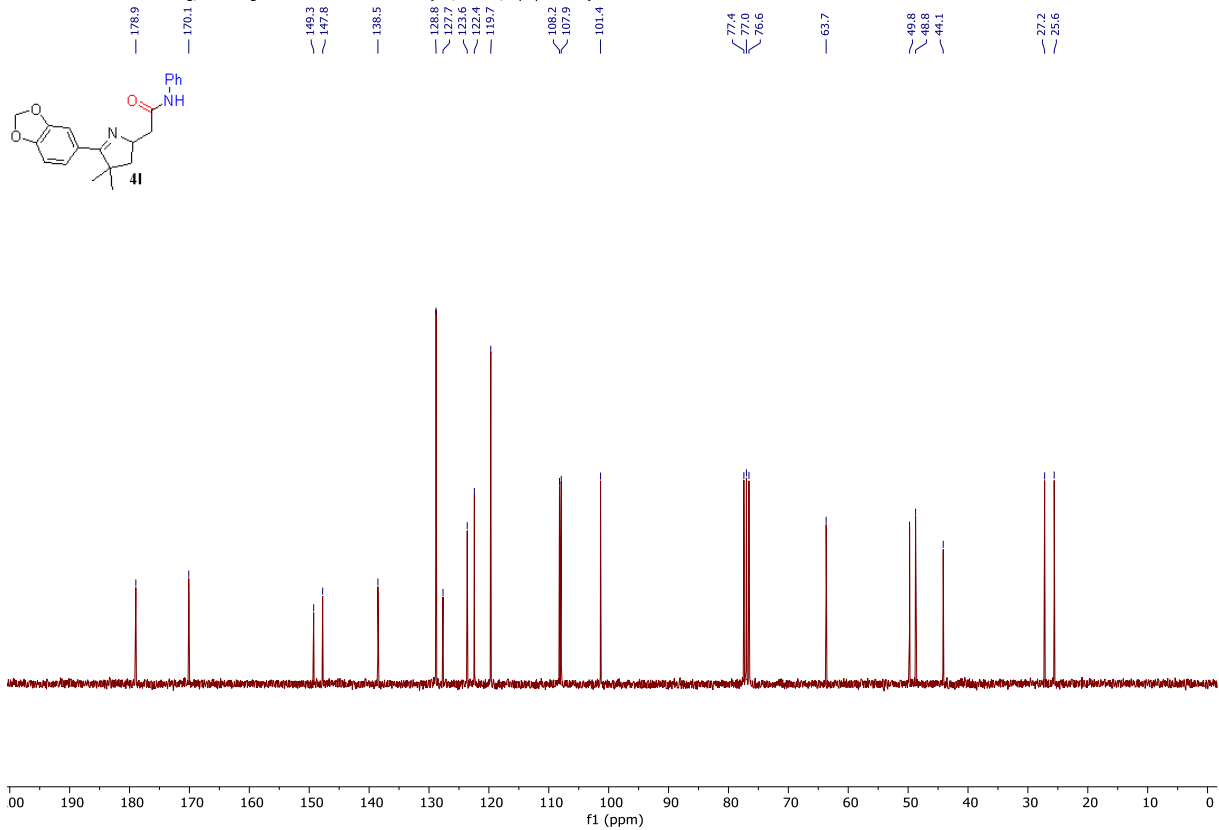
200527.341.11.fid — Youcan Zhang YZhang-3-221 — Au13C CDCl3 {C:\Bruker\TopSpin3.6.0} 2005 41 — 75.48MHz



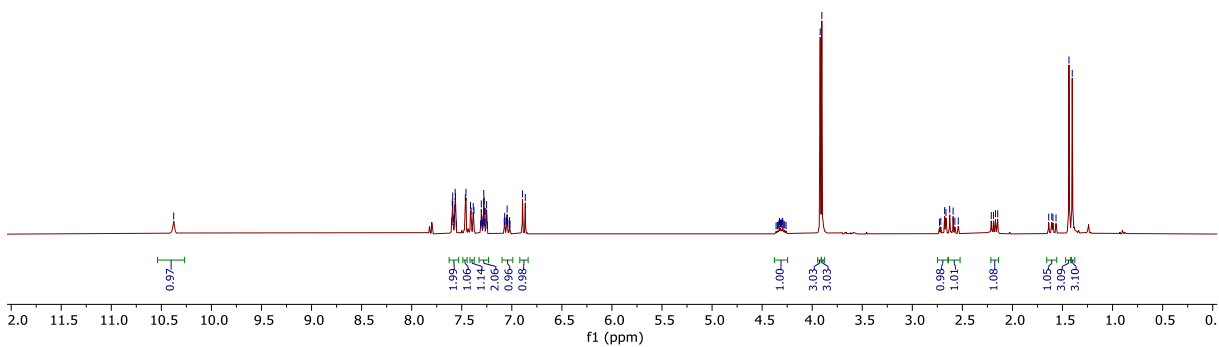
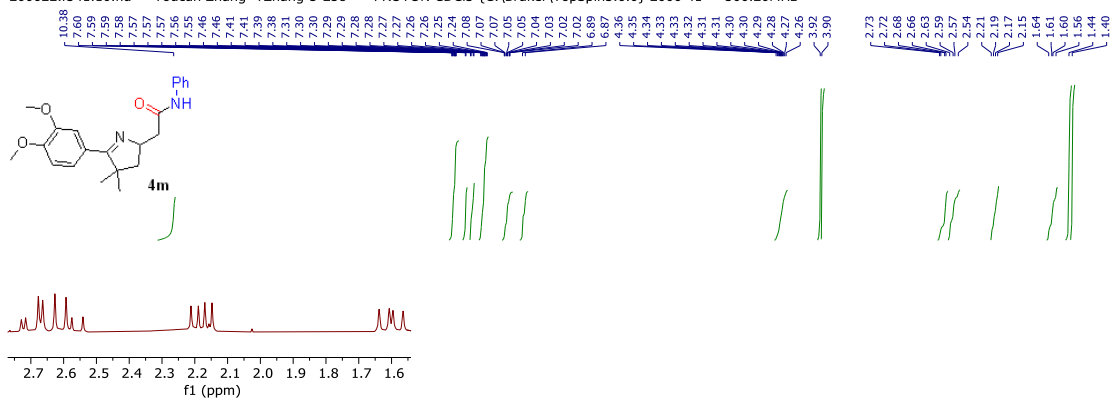
200612.f330.10.fid — Zhang/ Y Zhang-3-229 — PROTON CDCl3 {C:\Bruker\TopSpin3.6.0} 2006 30 — 300.20MHz



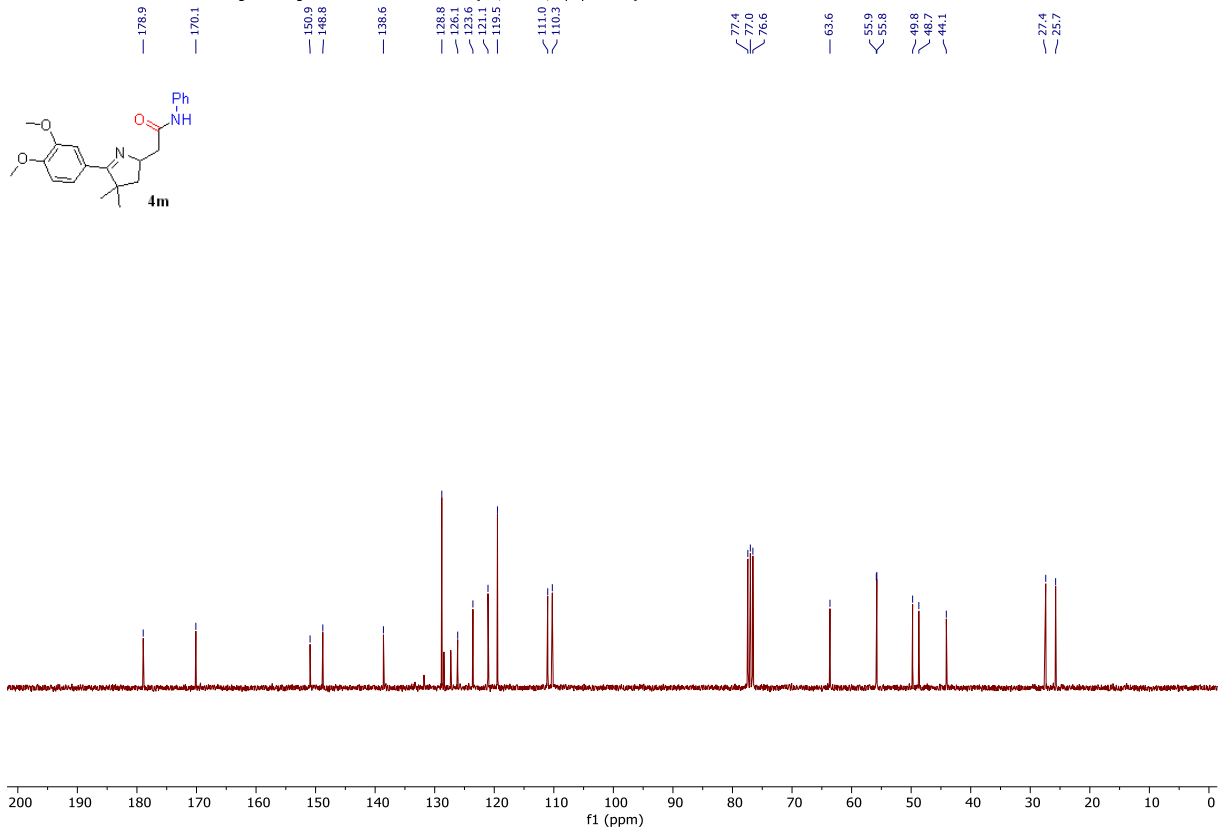
200612.f330.11.fid — Zhang/ Y Zhang-3-229 — C13CPD CDCl3 {C:\Bruker\TopSpin3.6.0} 2006 30 — 75.49MHz



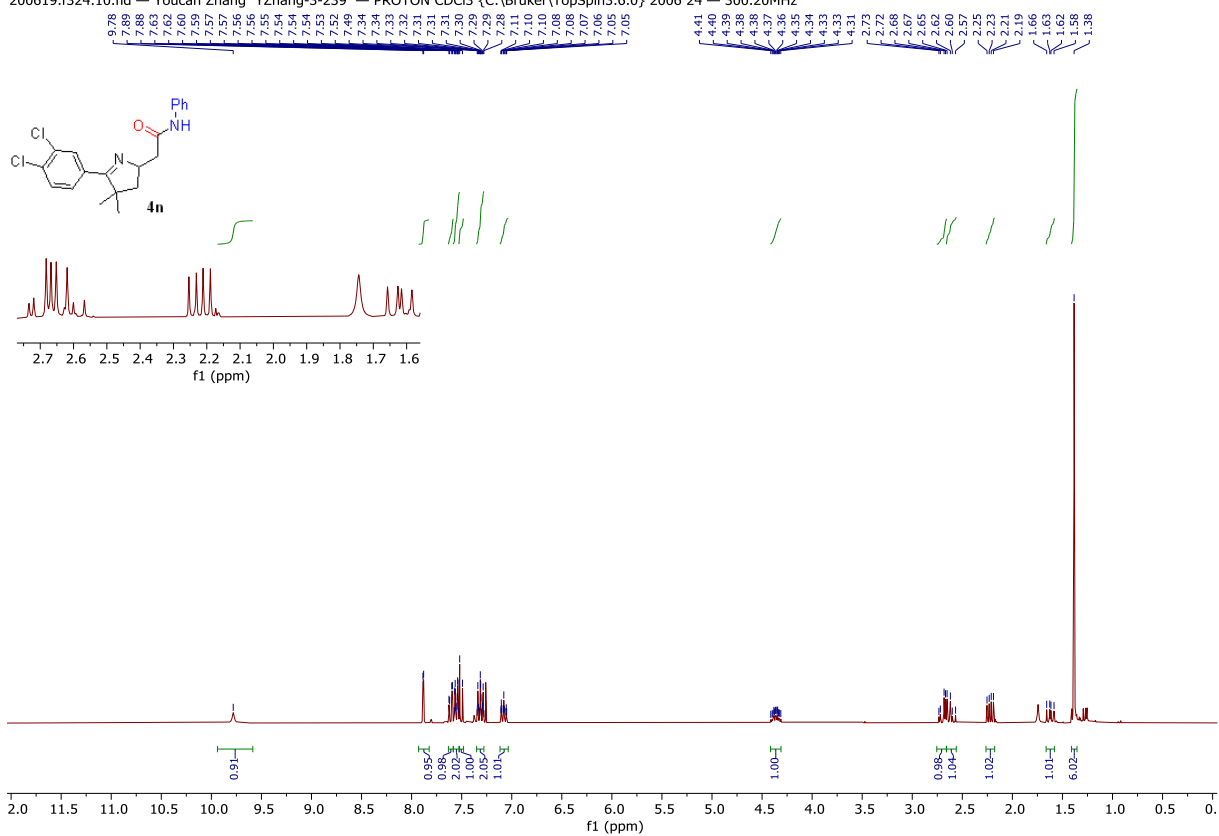
200622.f341.10.fid — Youcan Zhang YZhang-3-238 — PROTON CDCl3 {C:\Bruker\TopSpin3.6.0} 2006 41 — 300.20MHz



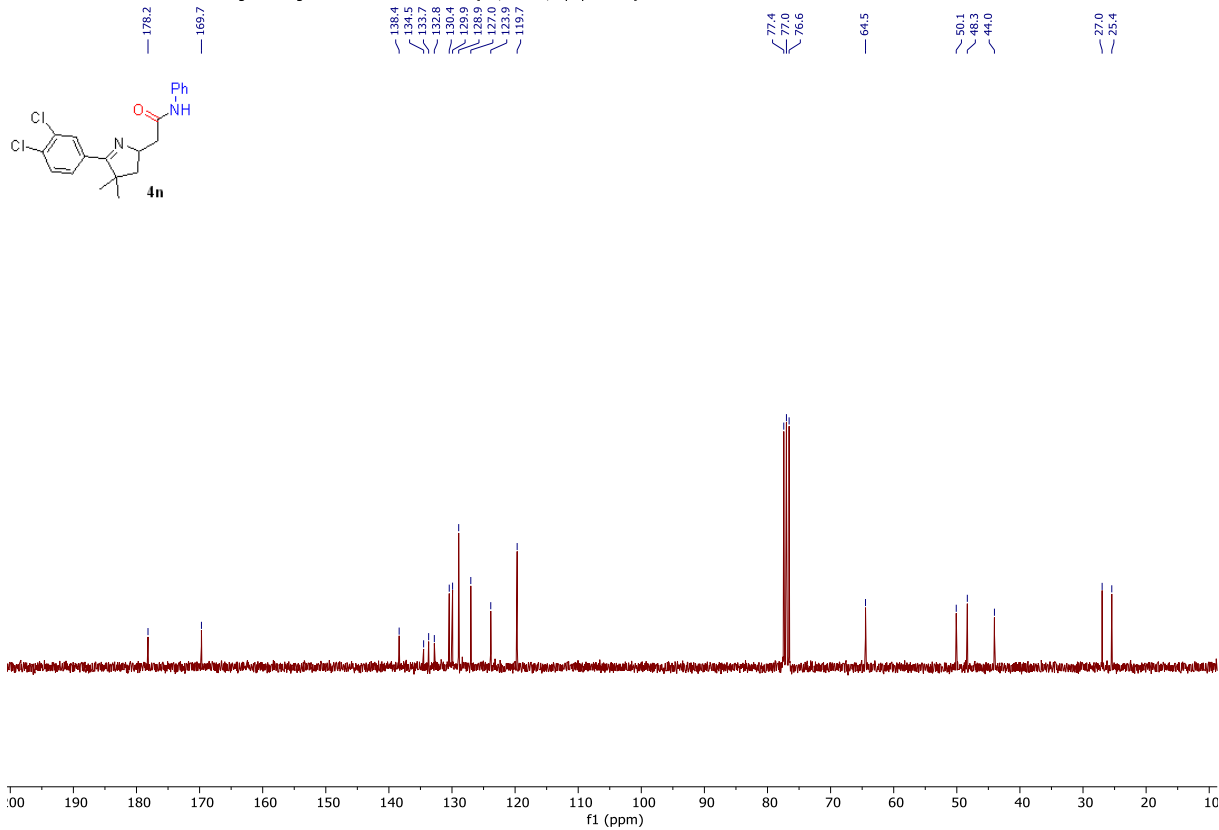
200622.f341.11.fid — Youcan Zhang YZhang-3-238 — C13CPD CDCl3 {C:\Bruker\TopSpin3.6.0} 2006 41 — 75.49MHz



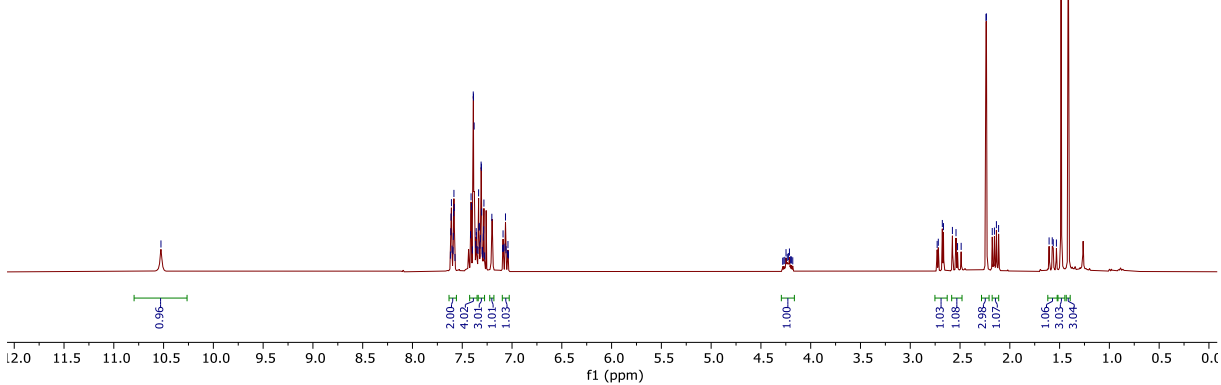
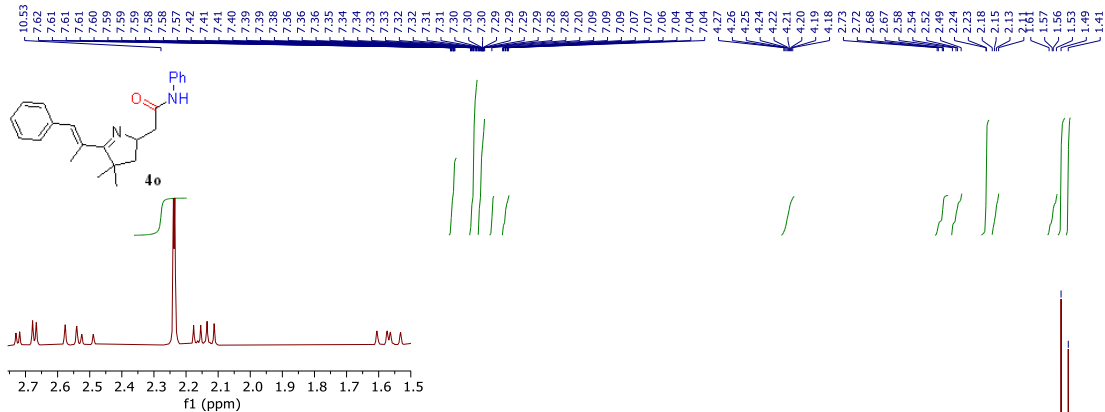
200619.f324.10.fid — Youcan Zhang YZhang-3-239 — PROTON CDCl3 {C:\Bruker\TopSpin3.6.0} 2006 24 — 300.20MHz



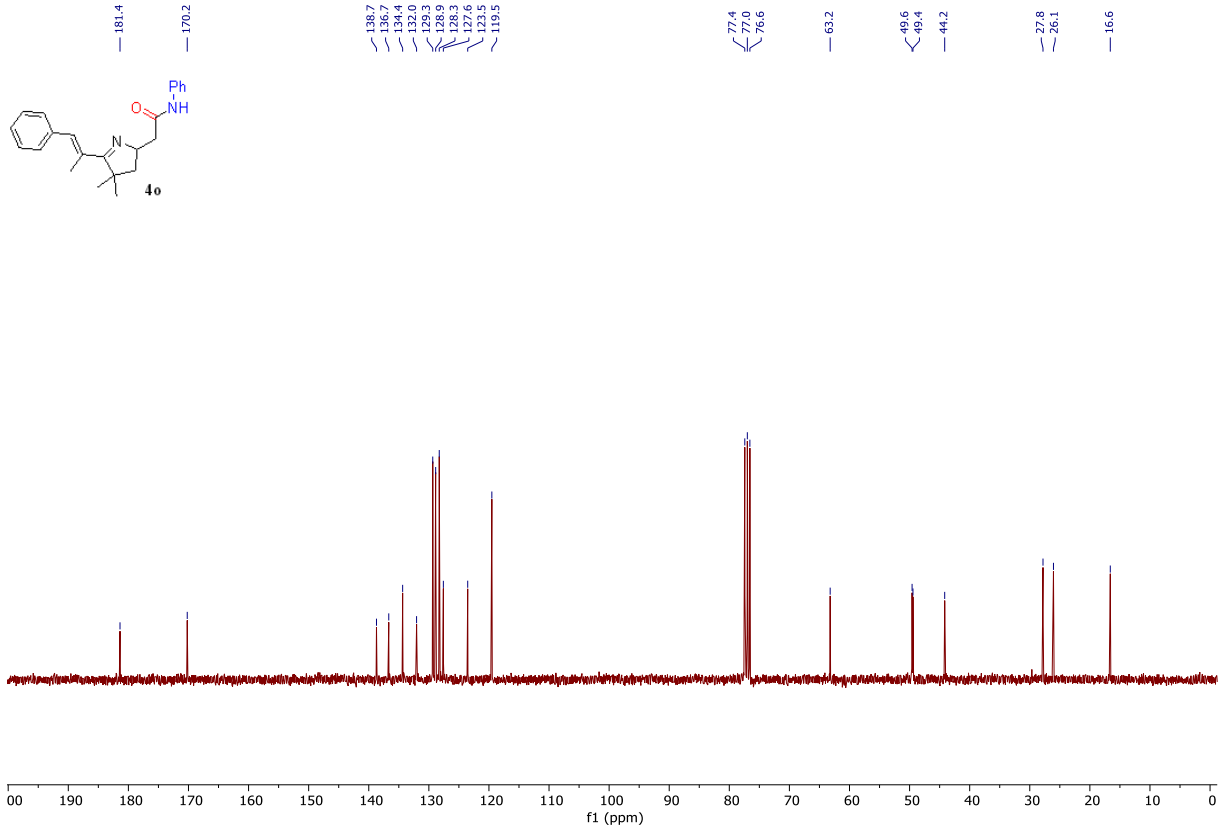
200619.f324.11.fid — Youcan Zhang YZhang-3-239 — C13CPD CDCl3 {C:\Bruker\TopSpin3.6.0} 2006 24 — 75.49MHz



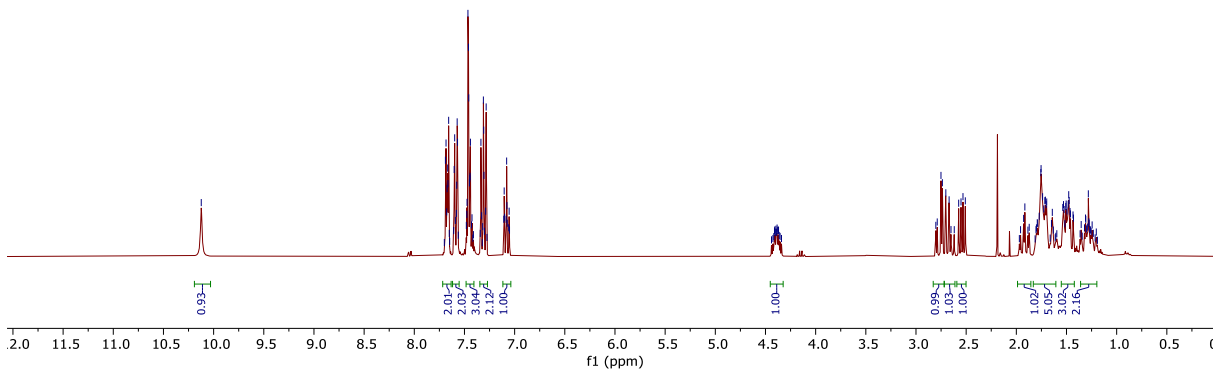
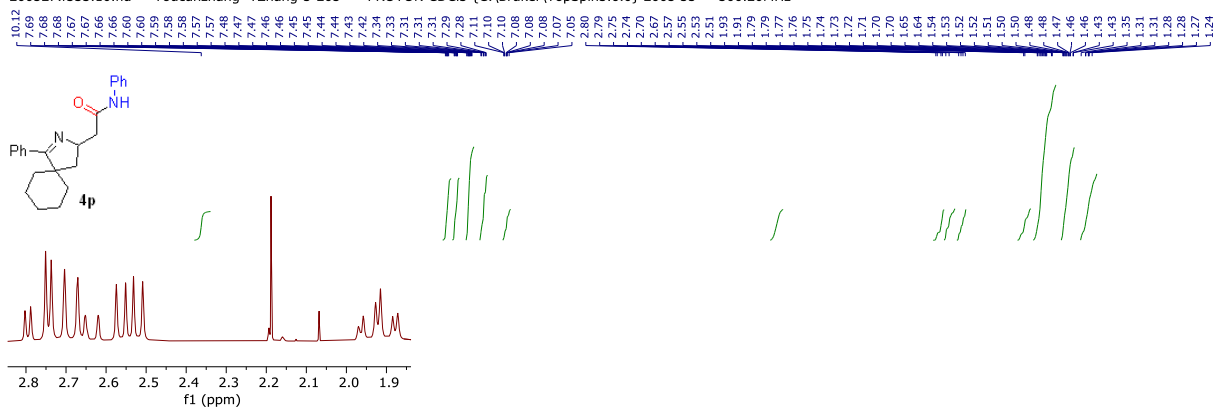
200622.f343.10.fid — Youcan Zhang YZhang-3-241 — PROTON CDCl3 {C:\Bruker\TopSpin3.6.0} 2006 43 — 300.20MHz



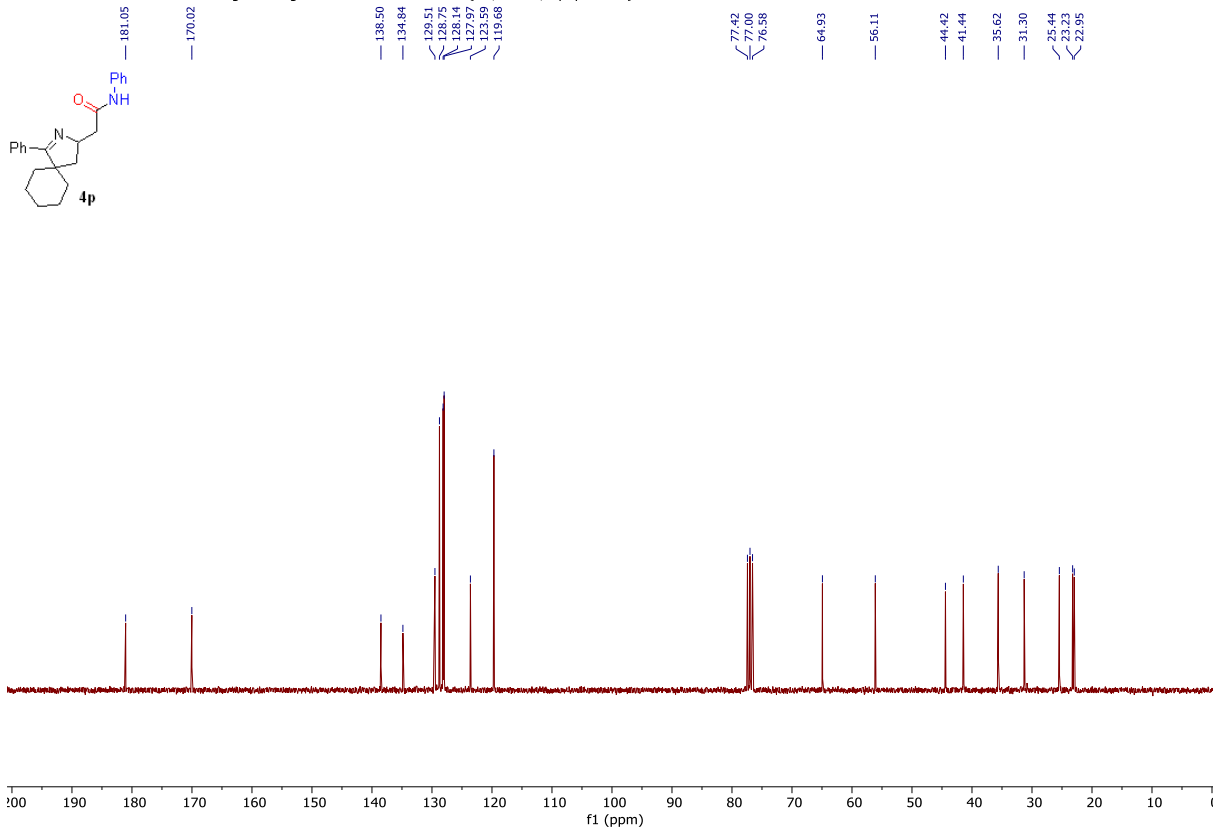
200622.f343.11.fid — Youcan Zhang YZhang-3-241 — C13CPD CDCl3 {C:\Bruker\TopSpin3.6.0} 2006 43 — 75.49MHz



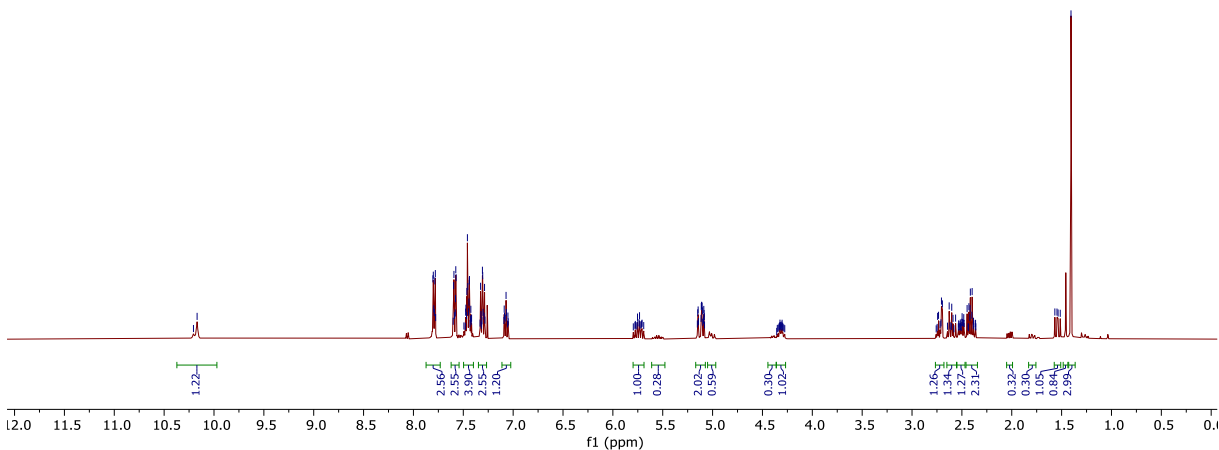
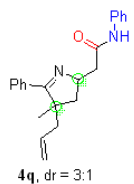
200527.f333.10.fid — Youcanzhang YZhang-3-205 — PROTON CDCl3 {C:\Bruker\TopSpin3.6.0} 2005 33 — 300.20MHz



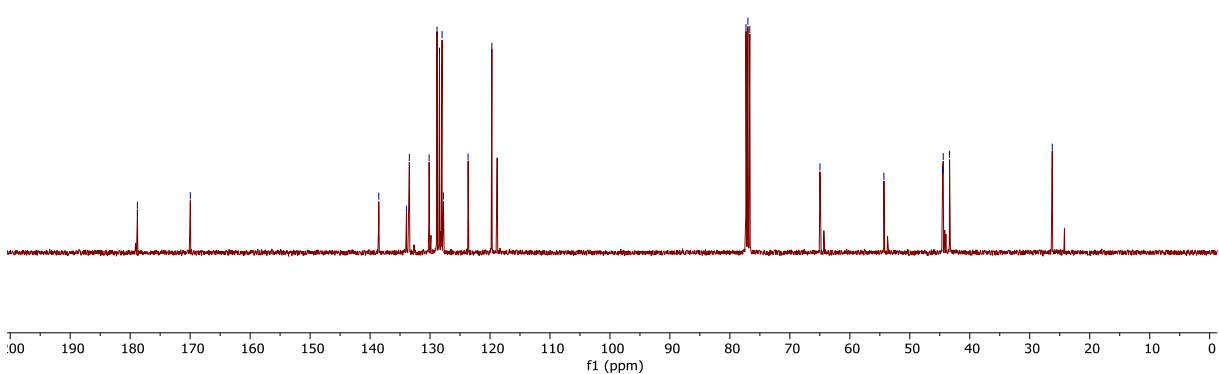
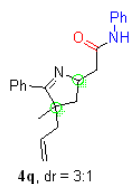
200527.f333.11.fid — Youcanzhang YZhang-3-205 — C13CPD CDCl3 {C:\Bruker\TopSpin3.6.0} 2005 33 — 75.49MHz



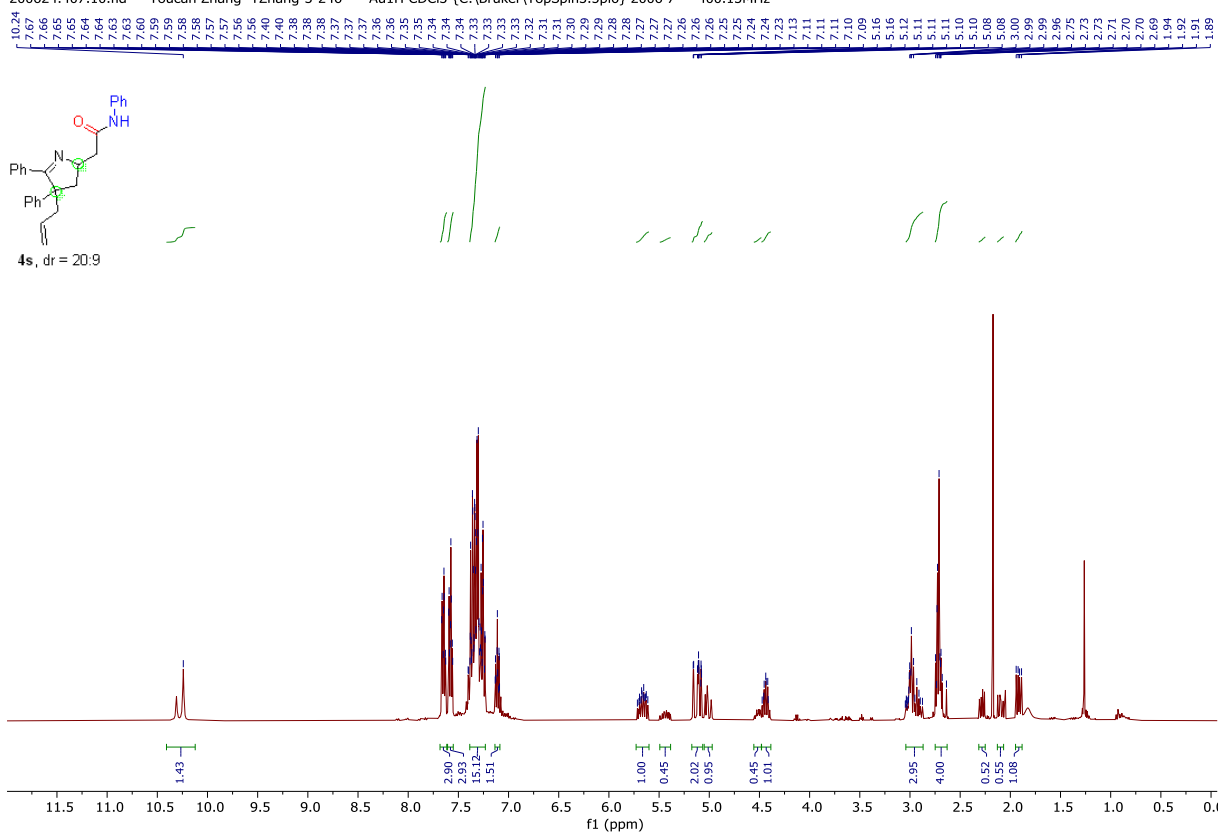
200504.404.10.fid — Youcan Zhang YZhang-3-141 — Au1H CDCl3 {C:\Bruker\TopSpin3.5pl6} 2005 4 — 400.13MHz



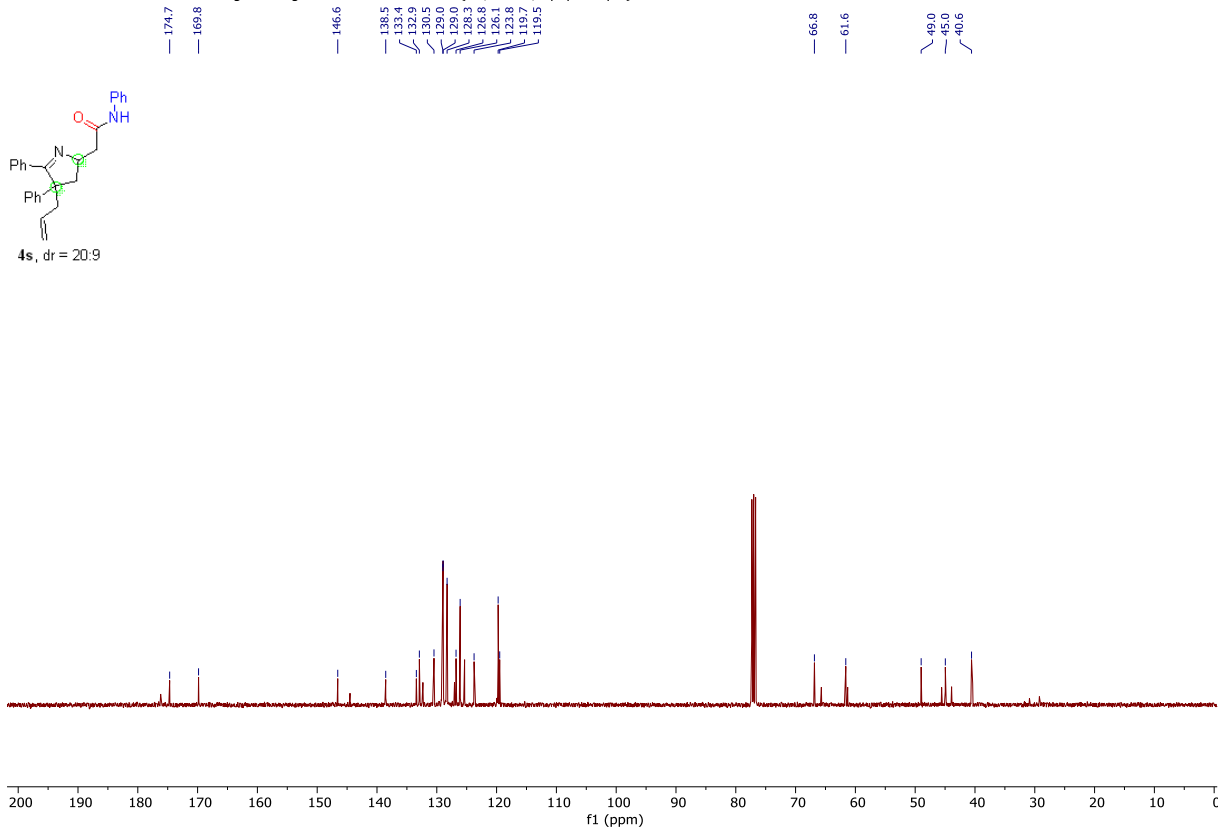
200504.404.11.fid — Youcan Zhang YZhang-3-141 — Au13C CDCl3 {C:\Bruker\TopSpin3.5pl6} 2005 4 — 100.63MHz



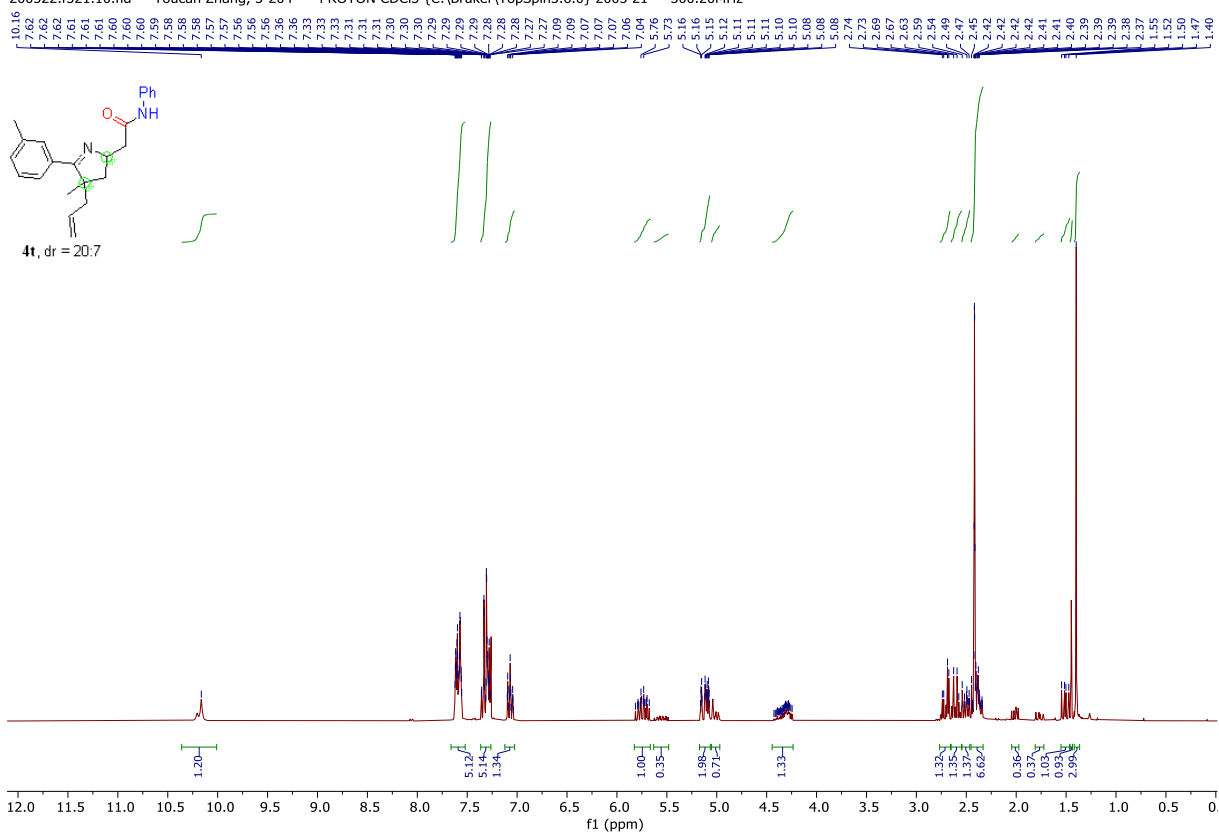
200624.407.10.fid — Youcan Zhang YZhang-3-246 — Au1H CDCl3 {C:\Bruker\TopSpin3.5pl6} 2006 7 — 400.13MHz



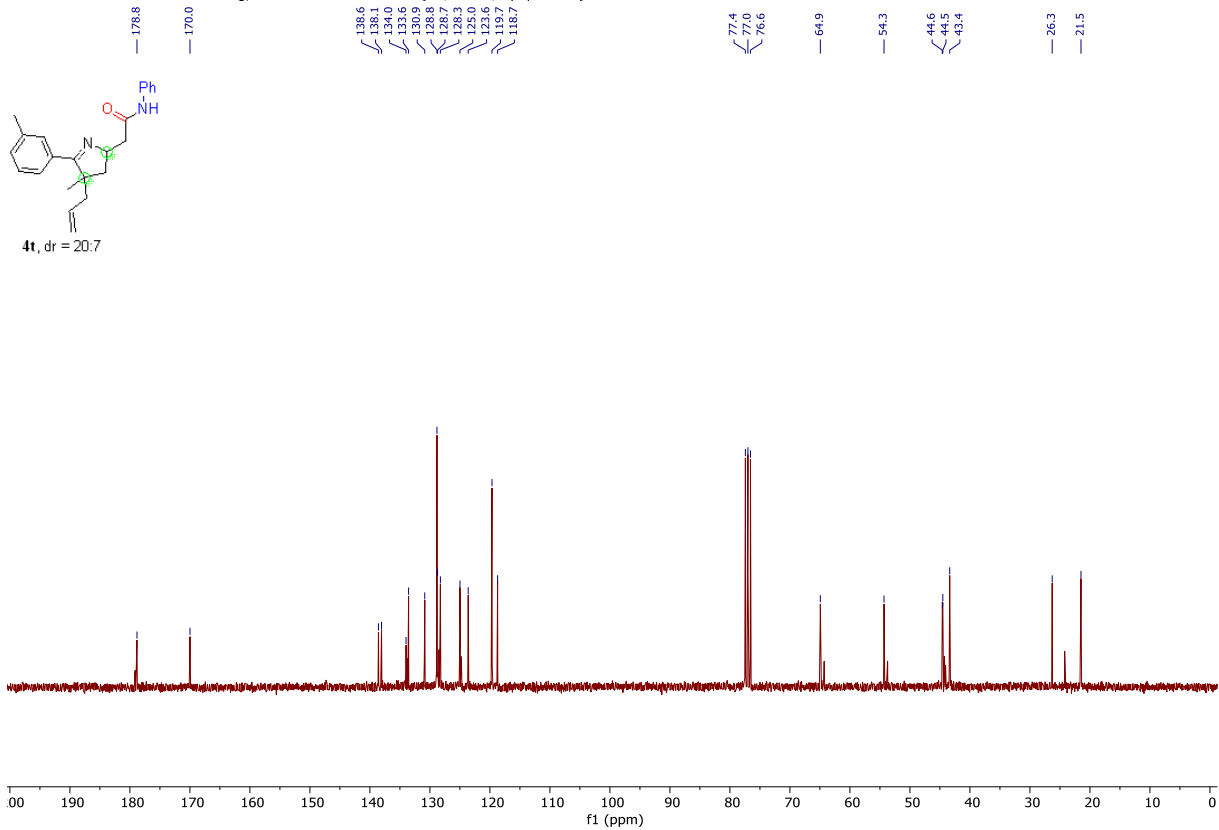
200624.407.11.fid — Youcan Zhang YZhang-3-246 — Au13C CDCl3 {C:\Bruker\TopSpin3.5pl6} 2006 7 — 100.63MHz

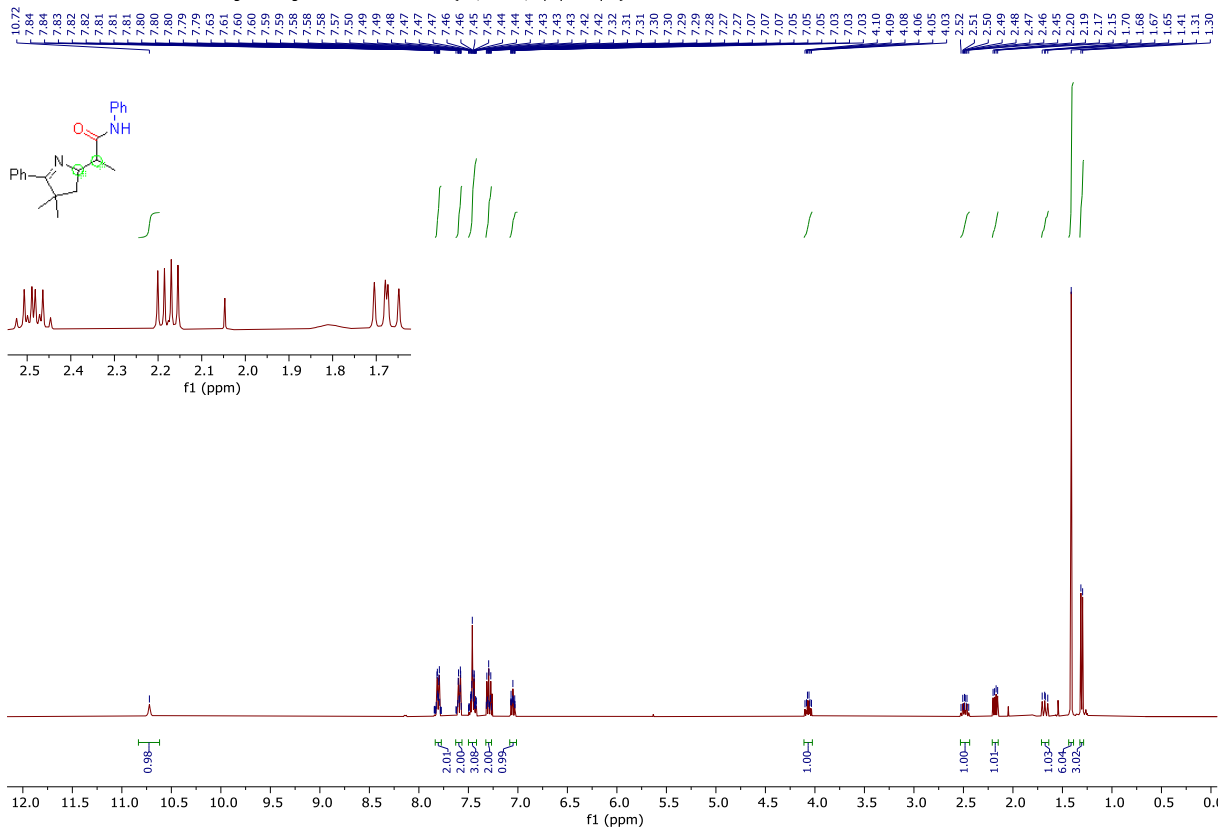
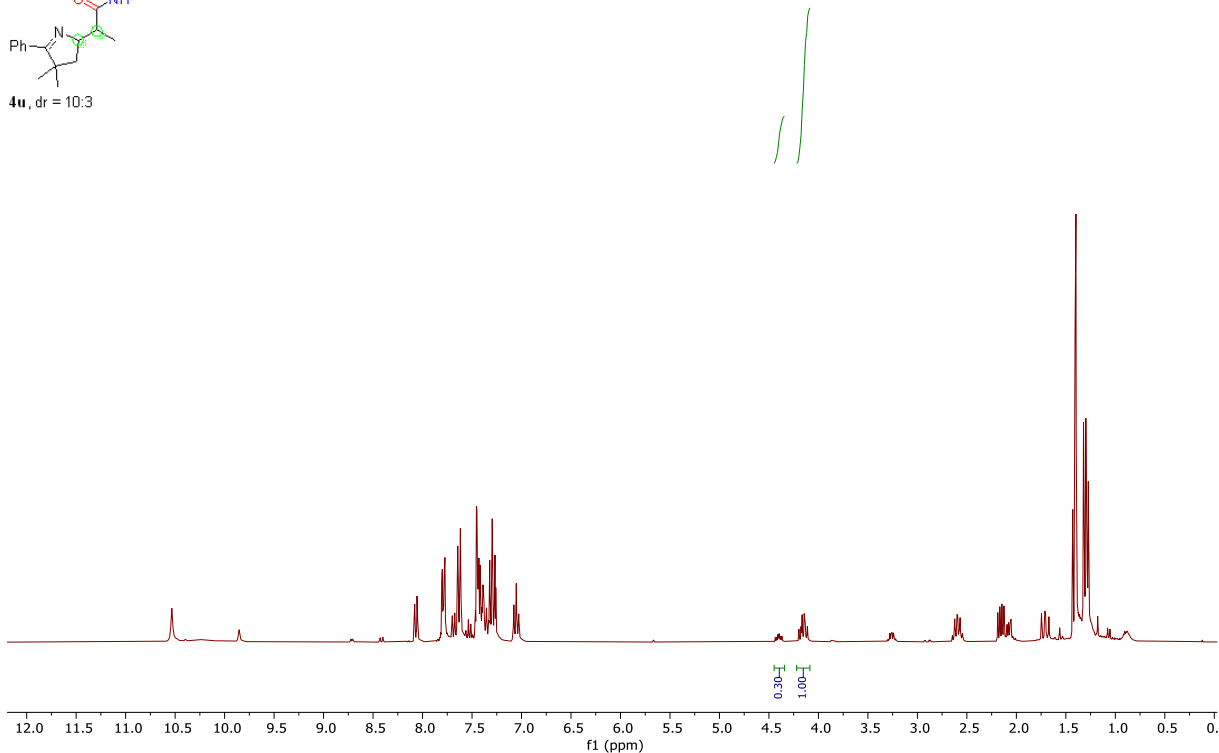
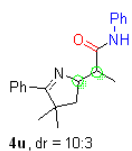


200522.f321.10.fid — Youcan Zhang, 3-204 — PROTON CDCl3 {C:\Bruker\TopSpin3.6.0} 2005 21 — 300.20MHz

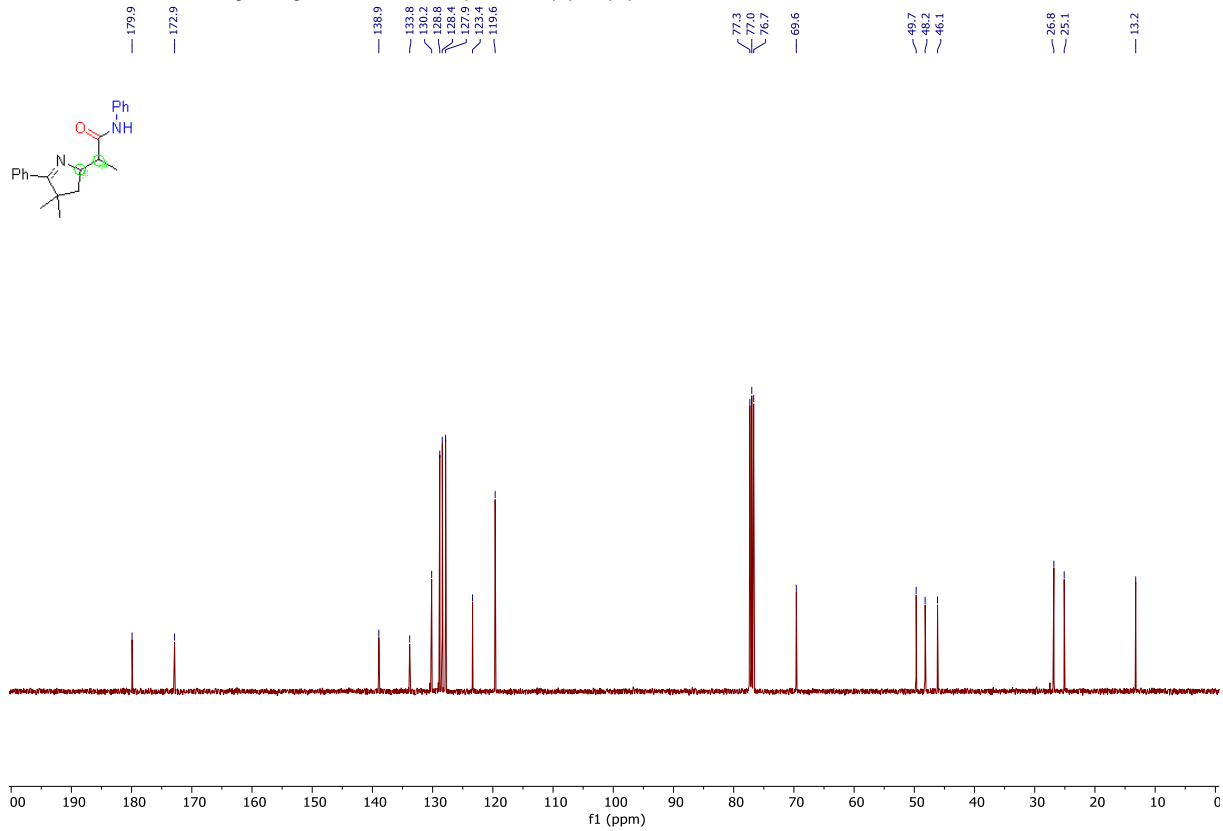


200522.f321.11.fid — Youcan Zhang, 3-204 — C13CPD CDCl3 {C:\Bruker\TopSpin3.6.0} 2005 21 — 75.49MHz

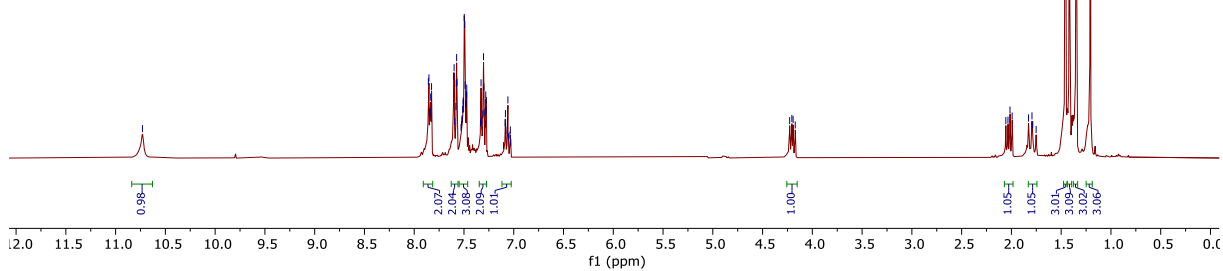
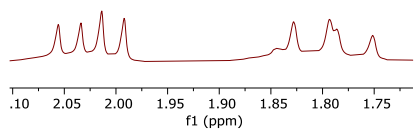
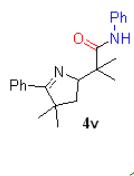




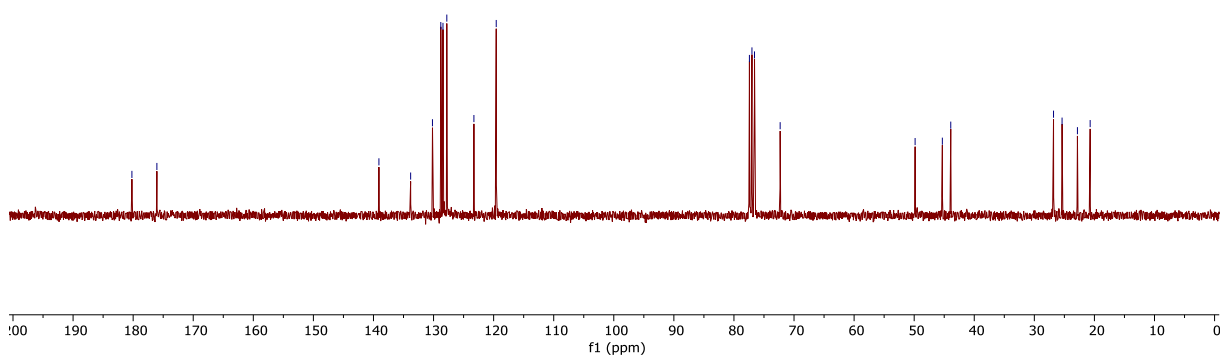
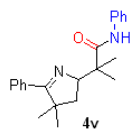
200603.406.11.fid — Youcan Zhang YZhang-3-224 — Au13C CDCl3 {C:\Bruker\TopSpin3.5pl6} 2006 6 — 100.63MHz



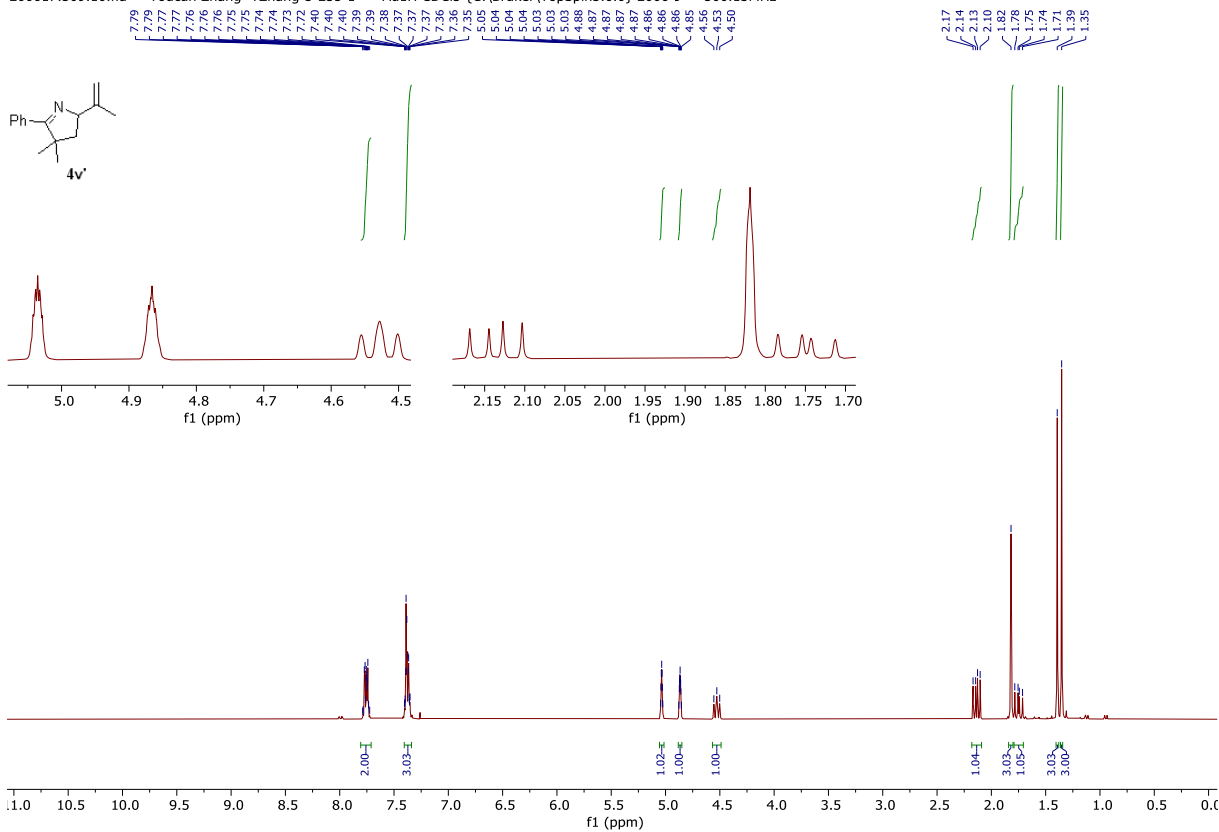
200617.310.10.fid — Youcan Zhang YZhang-3-235-2 — Au1H CDCl3 {C:\Bruker\TopSpin3.6.0} 2006 10 — 300.13MHz



200617.310.11.fid — Youcan Zhang YZhang-3-235-2 — Au13C CDCl3 {C:\Bruker\TopSpin3.6.0} 2006 10 — 75.48MHz



200617.309.10.fid — Youcan Zhang YZhang-3-235-1 — Au1H CDCl3 {C:\Bruker\TopSpin3.6.0} 2006 9 — 300.13MHz



200617.309.11.fid — Youcan Zhang YZhang-3-235-1 — Au13C CDCl3 {C:\Bruker\TopSpin3.6.0} 2006 9 — 75.48MHz

