

Highly Diastereo- and Enantioselective Synthesis of Spiro β -Lactams *via* Copper-Catalyzed Kinugasa/Aldol Cascade Reaction

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Supporting Information

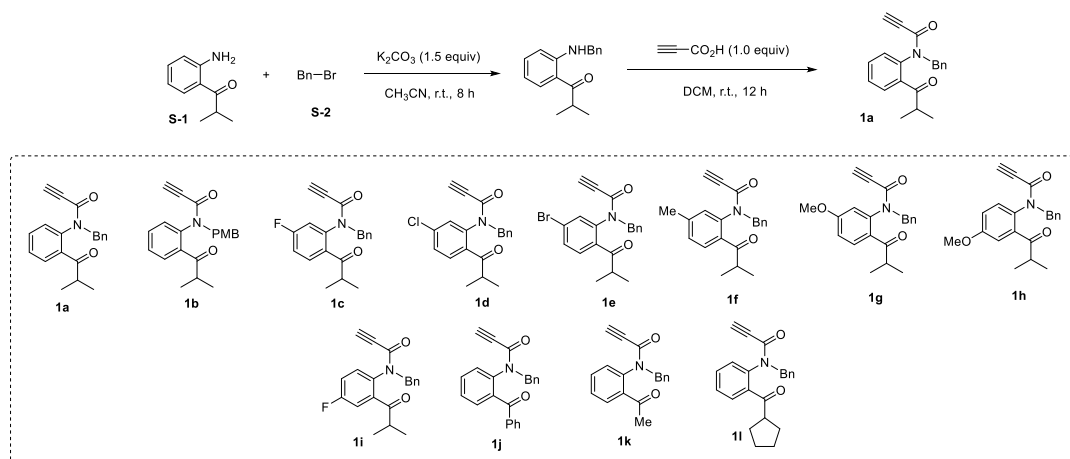
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I. General Remarks

^1H NMR and ^{13}C NMR spectra were recorded on a Bruker AV-400 or 500 MHz spectrometer. Chemical shifts (δ) are given in relative to tetramethylsilane (δ 0.00 ppm) in CDCl_3 . Coupling constants, J , were reported in hertz unit (Hz). High resolution mass spectra (HRMS) were obtained on a Q-STAR Elite ESI-LC-MS/MS Spectrometer. Chemical names were generated using Cambridge Soft. ChemDraw Ultra 16.0. Optical rotations were measured on a Perkin Elmer 341 polarimeter. Enantiomeric ratios were determined by chiral HPLC using a chiralpak AD-H (Amylose tris (3,5-dimethylphenylcarbamate) coated on $5\mu\text{m}$ silica-gel), chiralpak AS-H (Amylose tris-[(S)- α -methylbenzylcarbamate] coated on $5\mu\text{m}$ silica-gel) or chiralcel OD-H column (Cellulose tris (3,5-dimethylphenylcarbamate) coated on $5\mu\text{m}$ silica-gel) with hexane and *i*-PrOH as solvents. Commercially obtained reagents were used without further purification.

II. Synthesis of Substrates



A mixture of 1-(2-aminophenyl)-2-methylpropan-1-one **S-1** (5.0 mmol, 815 mg, 1.0 equiv) and K_2CO_3 (6.0 mmol, 0.83 g) in CH_3CN (10 mL) was stirred at room temperature, then benzyl bromide **S-2** (5.0 mmol, 850 mg, 1.0 equiv) was added by syringes. The reaction mixture was stirred for 8 h at room temperature. After the reaction was complete, water (20 mL) was added into the reaction mixture. The mixture was then extracted with ethyl acetate ($50\text{ mL} \times 3$) and further washed with brine and water. The organic layer was combined, dried over Na_2SO_4 , filtered, and concentrated in vacuo. The residue was directly used for the next step.

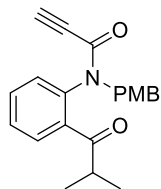
The above crude product (3 mmol, 1.0 equiv), propiolic acid (3.3 mmol, 1.1 equiv) and DCC (3.3 equiv) in DCM (15 mL) were stirred at room temperature for 12 hours. The mixture was filtrated and then removed solvent under the vacuum, the residue was purified by flash chromatography (ethyl acetate/petroleum ether = 1/5) to afford propiolamides **1a** as a white solid (580 mg, 38% yield in two steps).

^1H NMR (400 MHz, CDCl_3 , two rotamers) δ 7.72-7.63 (m, 1H), 7.43 (t, $J = 7.6$ Hz, 1H), 7.37-7.28 (m, 2H), 7.28-7.24 (m, 2H), 7.23-7.14 (m, 2H), 6.79&6.64 (2d, $J = 8.0$ Hz, 1H), 5.64 (d, $J = 14.8$ Hz, 1H), 4.10 (d, $J = 14.4$ Hz, 1H), 3.40-3.28 (m, 1H), 3.26&2.76 (2s, 1H), 1.17 (d, $J = 7.0$ Hz, 6H); ^{13}C NMR (100 MHz, CDCl_3 , two rotamers) δ 206.8, 206.1, 153.8, 152.9, 138.7, 137.4, 137.3, 136.6, 136.3, 136.2, 132.2, 131.7, 131.6, 130.2, 129.4, 129.2, 129.0, 129.0, 128.8, 128.6, 128.5, 128.3, 128.1, 127.8, 80.0, 76.5, 56.9, 52.8, 38.8, 38.6, 18.9, 18.8.

HRMS (ESI) calcd. for $C_{20}H_{20}NO_2^+$ (M+H) $^+$ 306.1489, found 306.1483.

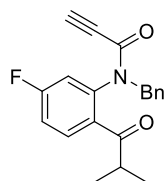
The propiolamides **1b~1l** and **4a~4b** were prepared according to similar procedure of **1a**.

N-(2-isobutyrylphenyl)-N-(4-methoxybenzyl)propiolamide (1b)



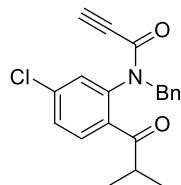
670.8 mg, 40%, white solid. 1H NMR (400 MHz, $CDCl_3$, two rotamers) δ 7.69-7.27 (m, 3H), 7.18-7.06 (m, 2H), 6.86-6.59 (m, 3H), 5.59 (d, J = 14.4 Hz, 1H), 4.03 (d, J = 14.4 Hz, 1H), 3.79&3.77 (d, J = 9.2 Hz, 3H), 3.37-3.28 (m, 1H), 3.26&2.75 (s, 1H), 1.17 (d, J = 6.8 Hz, 6H); ^{13}C NMR (100 MHz, $CDCl_3$, two rotamers) δ 206.3, 206.2, 159.4, 158.8, 152.8, 138.6, 137.5, 137.3, 136.8, 132.3, 131.6, 131.5, 130.8, 130.4, 130.1, 129.1, 128.9, 128.7, 128.4, 128.3, 128.2, 113.9, 113.8, 79.9, 79.8, 56.3, 55.3, 55.2, 52.1, 38.9, 38.7, 18.9, 18.9, 18.7. HRMS (ESI) calcd. for $C_{21}H_{22}NO_3^+$ (M+H) $^+$ 336.1594, found 336.1593.

N-benzyl-N-(5-fluoro-2-isobutyrylphenyl)propiolamide (1c)



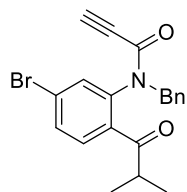
678.3 mg, 42%, white solid. 1H NMR (400 MHz, $CDCl_3$, two rotamers) δ 7.76-7.66 (m, 1H), 7.36-7.30 (m, 1H), 7.30-7.23 (m, 3H), 7.20-7.01 (m, 2H), 6.58-6.35 (2m, 1H), 5.63 (d, J = 14.4 Hz, 1H), 4.09 (d, J = 14.8 Hz, 1H), 3.38-3.28 (m, 1H), 3.27&2.80 (2s, 1H), 1.20-1.12 (m, 6H); ^{13}C NMR (100 MHz, $CDCl_3$, two rotamers) δ 205.2, 204.5, 163.4 (d, J = 253.0 Hz), 153.7, 152.6, 141.3, 141.2, 135.9, 133.4, 131.4 (d, J = 9.0 Hz), 130.8, 130.7, 129.3, 128.8, 128.6, 128.5, 128.3, 128.0, 119.7 (d, J = 22.0 Hz), 118.1, 117.9, 116.1 (d, J = 21.0 Hz), 115.4, 115.1, 80.3, 80.2, 76.2, 75.9, 56.7, 52.7, 38.6, 38.5, 18.88, 18.85. HRMS (ESI) calcd. for $C_{20}H_{18}FNO_2^+$ (M+H) $^+$ 324.1394, found 324.1391.

N-benzyl-N-(5-chloro-2-isobutyrylphenyl)propiolamide (1d)



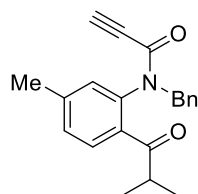
762.9 mg, 45%, white solid. 1H NMR (400 MHz, $CDCl_3$, two rotamers) δ 7.68-7.58 (m, 1H), 7.45-7.30 (m, 2H), 7.29-7.19 (m, 3H), 7.20-7.15 (m, 1H), 6.80&6.63 (2d, J = 2.2 Hz, 1H), 5.58 (d, J = 14.4 Hz, 1H), 4.10 (d, J = 14.4 Hz, 1H), 3.36-3.20 (m, 1H), 3.27&2.81 (2s, 1H), 1.20-1.09 (m, 6H); ^{13}C NMR (100 MHz, $CDCl_3$, two rotamers) δ 205.5, 204.8, 153.7, 152.6, 140.1, 138.8, 137.3, 137.2, 135.8, 135.7, 135.5, 134.9, 132.3, 130.6, 130.3, 129.8, 129.3, 129.2, 128.8, 128.64, 128.58, 128.5, 128.3, 128.0, 80.4, 80.3, 76.3, 75.9, 56.7, 52.7, 38.7, 38.6, 18.8, 18.7. HRMS (ESI) calcd. for $C_{20}H_{18}ClNO_2^+$ (M+H) $^+$ 340.1099, found 340.1099.

N-benzyl-N-(5-bromo-2-isobutyrylphenyl)propiolamide (1e)



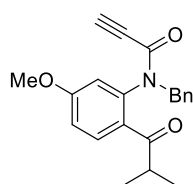
766.2 mg, 40%, white solid. ^1H NMR (400 MHz, CDCl_3 , two rotamers) δ 7.64-7.50 (m, 2H), 7.32-7.37 (m, 1H), 7.35-7.25 (m, 3H), 7.24-7.13 (m, 1H), 6.99&6.81 (2d, 1.9 Hz, 1H), 5.60 (d, J = 14.8 Hz, 1H), 4.13 (d, J = 14.4 Hz, 1H), 3.36-3.22 (m, 1H), 3.30&2.84 (2s, 1H), 1.20-1.15 (m, 6H); ^{13}C NMR (100 MHz, CDCl_3 , two rotamers) δ 205.7, 205.0, 153.7, 152.6, 140.0, 138.7, 136.0, 135.74, 135.69, 135.4, 135.2, 133.5, 132.1, 131.4, 130.4, 129.9, 129.4, 128.8, 128.7, 128.6, 128.3, 128.1, 125.3, 125.2, 80.4, 76.3, 75.9, 56.8, 52.8, 38.7, 38.6, 18.8, 18.7. HRMS (ESI) calcd. for $\text{C}_{20}\text{H}_{18}\text{BrNO}_2^+$ ($\text{M}+\text{H}$) $^+$ 384.0594, found 384.0590.

N-benzyl-N-(2-isobutyryl-5-methylphenyl)propiolamide (1f)



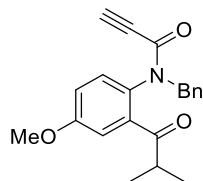
718.1 mg, 45%, white solid. ^1H NMR (400 MHz, CDCl_3 , two rotamers) δ 7.60 (t, J = 8.7 Hz, 1H), 7.34-7.26 (m, 2H), 7.25-7.13 (m, 4H), 6.61&6.44 (2d, J = 1.6 Hz, 1H), 5.60 (d, J = 14.4 Hz, 1H), 4.11 (d, J = 14.8 Hz, 1H), 3.40-3.29 (m, 1H), 3.23&2.74 (2s, 1H), 2.24&2.16 (2s, 3H), 1.19-1.12 (m, 6H); ^{13}C NMR (100 MHz, CDCl_3 , two rotamers) δ 205.4, 152.9, 142.6, 139.1, 136.43, 136.38, 133.9, 132.8, 131.1, 129.5, 129.4, 129.1, 128.9, 128.7, 128.5, 128.4, 128.0, 127.7, 79.8, 79.6, 76.6, 76.3, 52.8, 38.35, 38.26, 21.2, 21.1, 19.0, 18.9. HRMS (ESI) calcd. for $\text{C}_{21}\text{H}_{22}\text{NO}_2^+$ ($\text{M}+\text{H}$) $^+$ 320.1645, found 320.1642.

N-benzyl-N-(2-isobutyryl-5-methoxyphenyl)propiolamide (1g)



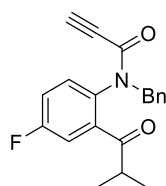
804.4 mg, 48%, white solid. ^1H NMR (400 MHz, CDCl_3 , two rotamers) δ 7.78-7.72 (m, 1H), 7.39-7.18 (m, 5H), 6.94&6.86 (2m, 1H), 6.27&6.11 (2d, J = 2.8 Hz, 1H), 5.71 (d, J = 14.4 Hz, 1H), 4.08 (d, J = 14.8 Hz, 1H), 3.64&3.56 (2s, 3H), 3.45-3.35 (m, 1H), 3.27&2.75 (2s, 1H), 1.22-1.14 (m, 6H); ^{13}C NMR (100 MHz, CDCl_3 , two rotamers) δ 204.7, 203.9, 162.0, 161.8, 153.7, 152.7, 141.3, 136.5, 131.3, 131.0, 129.5, 128.8, 128.63, 128.60, 128.5, 128.0, 127.7, 117.6, 115.9, 114.3, 113.8, 79.8, 79.4, 76.5, 76.3, 56.7, 55.5, 55.3, 52.5, 37.8, 37.7, 19.2, 19.1, 19.0. HRMS (ESI) calcd. for $\text{C}_{21}\text{H}_{22}\text{NO}_3^+$ ($\text{M}+\text{H}$) $^+$ 336.1594, found 336.1593.

N-benzyl-N-(2-isobutyryl-4-methoxyphenyl)propiolamide (1h)



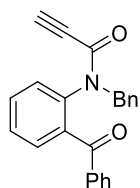
737.2 mg, 44%, white solid. ^1H NMR (400 MHz, CDCl_3 , two rotamers) δ 7.33-7.24 (m, 3H), 7.24-7.16 (m, 2H), 7.13 (m, 1H), 6.78 (m, 1H), 6.68&6.54 (2d, J = 8.8 Hz, 1H), 5.62 (d, J = 14.4 Hz, 1H), 4.05 (d, J = 14.4 Hz, 1H), 3.83&3.78 (2s, 3H), 3.34-3.26 (m, 1H), 3.25&2.79 (s, 1H), 1.17 (m, 6H); ^{13}C NMR (150 MHz, CDCl_3 , two rotamers) δ 206.1, 159.4, 153.3, 138.5, 136.3, 133.2, 131.2, 129.5, 128.7, 128.6, 128.5, 127.7, 115.8, 114.9, 80.0, 76.6, 55.6, 52.8, 38.9, 18.9, 18.7. HRMS (ESI) calcd. for $\text{C}_{21}\text{H}_{22}\text{NO}_3^+$ ($\text{M}+\text{H}$) $^+$ 336.1594, found 336.1591.

N-benzyl-N-(4-fluoro-2-isobutyrylphenyl)propiolamide (1i)



694.6 mg, 43%, white solid. ^1H NMR (400 MHz, CDCl_3 , two rotamers) δ 7.39-7.29 (m, 2H), 7.26 (m, 3H), 7.17 (m, 1H), 7.01&6.95 (2m, 1H), 6.74&6.58 (2m, 1H), 5.64 (d, J = 14.4 Hz, 1H), 4.05 (d, J = 14.4 Hz, 1H), 3.33-3.21 (m, 1H), 2.28&2.81 (s, 1H), 1.18 (d, J = 6.8 Hz, 6H); ^{13}C NMR (100 MHz, CDCl_3 , two rotamers) δ 205.6, 204.9, 162.8, 162.0 (d, J = 250.0 Hz), 160.3, 153.9, 153.0, 139.2, 139.2, 138.5, 136.0, 135.9, 134.6, 134.6, 134.1 (d, J = 0.8 Hz), 133.1, 132.2, 132.1, 129.5, 128.7, 128.7, 128.6, 128.2, 127.9, 118.5, 118.33 (d, J = 2.2 Hz), 118.3, 116.2 (d, J = 2.4 Hz), 115.9, 115.7, 80.3, 80.3, 76.3, 76.0, 56.9, 52.7, 38.9, 38.7, 18.8, 18.7, 18.6. HRMS (ESI) calcd. for $\text{C}_{20}\text{H}_{18}\text{FNO}_2^+$ ($\text{M}+\text{H}$) $^+$ 324.1394, found 324.1391.

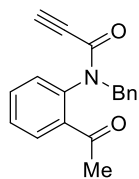
N-(2-benzoylphenyl)-N-benzylpropiolamide (1j)



847.8 mg, 50%, white solid. ^1H NMR (400 MHz, CDCl_3 , two rotamers) δ 7.81 (t, J = 8.3 Hz, 2H), 7.60 (t, J = 7.6 Hz, 1H), 7.49-7.37 (m, 5H), 7.33-7.29 (m, 1H), 7.24-7.15 (m, 4H), 6.97-6.78 (m, 1H), 5.47 (d, J = 14.4 Hz, 1H), 4.18 (d, J = 14.4 Hz, 1H), 3.12&2.83 (2s, 1H); ^{13}C NMR (100 MHz, CDCl_3 , two rotamers) δ 195.3, 153.0, 139.1, 137.9, 137.8, 137.1, 136.7, 136.3, 136.1, 133.6, 133.3, 131.7, 131.2, 131.1, 130.4, 130.3, 130.2, 130.0, 129.3, 129.2, 128.7, 128.5, 128.46, 128.41, 128.2, 128.0, 127.8, 127.5, 80.04, 80.01, 56.7, 52.7.

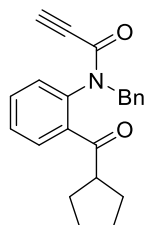
HRMS (ESI) calcd. for $\text{C}_{23}\text{H}_{18}\text{NO}_2^+$ ($\text{M}+\text{H}$) $^+$ 340.1332, found 340.1331.

N-(2-acetylphenyl)-N-benzylpropiolamide (1k)



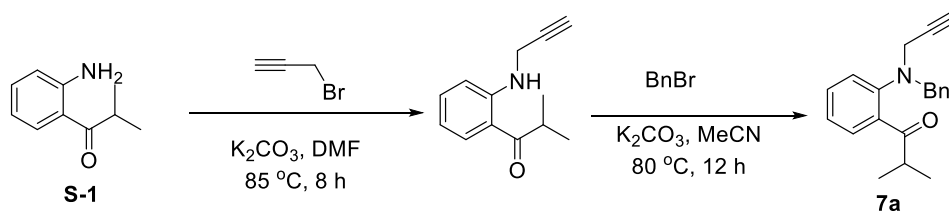
477.2 mg, 42%, white solid. ^1H NMR (400 MHz, CDCl_3 , two rotamers) δ 7.72&7.65 (2m, 1H), 7.46-7.30 (m, 2H), 7.21 (m, 3H), 7.13 (m, 2H), 6.83&6.68 (2d, J = 7.6 Hz, 1H), 5.41 (d, J = 14.4 Hz, 1H), 4.20 (d, J = 14.4 Hz, 1H), 3.29&2.76 (2s, 1H), 2.46&2.44 (2s, 3H); ^{13}C NMR (100 MHz, CDCl_3 , two rotamers) δ 199.6, 199.0, 176.0, 169.8, 161.6, 154.0, 153.0, 138.6, 137.2, 137.0, 136.4, 136.1, 136.0, 132.4, 132.2, 131.5, 129.9, 129.5, 129.4, 129.3, 129.1, 128.7, 128.6, 128.5, 128.3, 128.1, 127.8, 101.4, 83.1, 80.4, 79.9, 78.0, 77.6, 77.5, 77.3, 77.2, 77.0, 76.9, 76.3, 76.2, 59.3, 56.6, 52.7, 33.9, 33.3, 29.7, 29.2, 28.9, 25.0, 24.8, 24.2. HRMS (ESI) calcd. for $\text{C}_{18}\text{H}_{16}\text{NO}_2^+$ ($\text{M}+\text{H}$) $^+$ 278.1176, found 278.1174.

N-benzyl-N-(2-(cyclopentanecarbonyl)phenyl)propiolamide (11)



662.3 mg, 40%, white solid. ^1H NMR (400 MHz, CDCl_3 , two rotamers) δ 7.73&7.68 (2m, 1H), 7.45-7.40 (m, 1H), 7.36-7.27 (m, 2H), 7.26-7.21 (m, 3H), 7.20-7.15 (m, 1H), 6.79&6.63 (2m, 1H), 5.60 (d, J = 14.4 Hz, 1H), 4.11 (d, J = 14.4 Hz, 1H), 3.60-3.42 (m, 1H), 3.25&2.75 (2s, 1H), 1.94-1.82 (m, 4H), 1.73-1.53 (m, 4H); ^{13}C NMR (100 MHz, CDCl_3 , two rotamers) δ 205.5, 204.8, 153.8, 153.0, 138.7, 137.7, 137.3, 137.1, 136.34, 136.27, 131.9, 131.7, 131.6, 129.9, 129.5, 129.4, 129.0, 128.9, 128.6, 128.5, 128.3, 128.0, 127.8, 80.0, 79.9, 77.5, 77.3, 77.1, 76.8, 76.4, 76.2, 56.8, 52.8, 49.5, 49.4, 30.2, 30.1, 26.21, 26.18. HRMS (ESI) calcd. for $\text{C}_{22}\text{H}_{22}\text{NO}_2^+$ ($\text{M}+\text{H}$) $^+$ 332.1645, found 332.1636.

1-(2-(benzyl(prop-2-yn-1-yl)amino)phenyl)-2-methylpropan-1-one (7a)



A mixture of 1-(2-aminophenyl)-2-methylpropan-1-one **S-1** (5.0 mmol, 1.0 equiv), 3-bromoprop-1-yne (5.0 mmol, 1.0 equiv) and K_2CO_3 (0.83 g, 6.0 mmol) in DMF (10 mL) was stirred for 8 h at 85 °C. After the reaction was complete, water (20 mL) was added into the reaction mixture. The mixture was then extracted with ethyl acetate (50 mL $\times$ 3) and further washed with brine and water. The organic layer was combined, dried over Na_2SO_4 , filtered, and concentrated in vacuo. The residue was directly used for the next step.

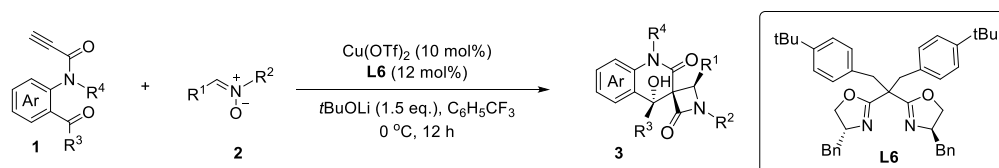
The above crude product, BnBr (1.02 g, 6 mmol) and K_2CO_3 (1.24 g, 9 mmol) in CH_3CN (15

mL) were stirred at 80 °C for 12 hours. The organic phase was removed in vacuum and the mixture was then extracted with ethyl acetate (50 mL × 3) and further washed with brine and water. The organic layer was combined, dried over Na₂SO₄, filtered, and concentrated in vacuo. The residue was purified by flash chromatography (ethyl acetate/petroleum ether = 1/100) to give the corresponding product **7a** (524 mg, 60% yield) as a yellow oil.

¹H NMR (400 MHz, CDCl₃) δ 7.45-7.40 (m, 1H), 7.37-7.30 (m, 7H), 7.20 -7.16 (m, 1H), 4.30 (s, 2H), 3.65 (d, *J* = 2.4 Hz, 2H), 3.64-3.59 (m, 1H), 2.29 (t, *J* = 2.4 Hz, 1H), 1.19 (d, *J* = 6.8 Hz, 6H); ¹³C NMR (100 MHz, CDCl₃) δ 212.2, 148.4, 137.3, 137.0, 130.5, 129.2, 128.5, 128.4, 127.6, 124.1, 122.6, 78.4, 73.9, 56.6, 43.5, 39.9, 18.9. HRMS (ESI) calcd. for C₂₀H₂₂NO⁺ (M+H)⁺ 292.1696, found 292.1690.

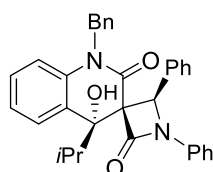
III. The Cascade Kinugasa/Aldol Reactions

General procedure for the reactions of *N*-(2-acylaryl)propiolamides with nitrones



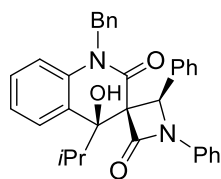
A mixture of propiolamide **1** (0.2 mmol, 1.0 equiv.), nitrone **2** (0.24 mmol, 1.2 equiv.), *t*BuOLi (0.30 mmol, 24 mg, 1.5 equiv.), Cu(OTf)₂ (0.02 mmol, 7.2 mg, 10 mol%) with chiral ligand **L6** (0.024 mmol, 15.0 mg, 12 mol%) in 2 mL C₆H₅CF₃ was stirred at 0 °C for 12 hours. After the reaction was complete (monitored by TLC), the solvent was removed in vacuum. Then H₂O (5.0 mL) and ethyl acetate (5.0 mL) were added into the mixture. The organic phase was separated, and the aqueous phase was extracted with ethyl acetate (5.0 mL × 3). The combined organic phase was washed with H₂O and brine, dried over Na₂SO₄. The solvent was removed under reduced pressure. The residue was purified by flash chromatography (ethyl acetate/petroleum ether = 1/3~1/5) to afford the desired products **3**.

(3*S*,4*R*,4'*R*)-1'-benzyl-4'-hydroxy-4'-isopropyl-1,4-diphenyl-1',4'-dihydro-2'*H*-spiro[azetidine-3,3'-quinoline]-2,2'-dione (**3aa**)



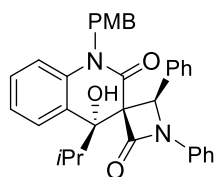
75.3 mg, 75%, white solid, ¹H NMR (400 MHz, CDCl₃) δ 7.65 (s, 1H), 7.25-6.98 (m, 12H), 6.97-6.45 (m, 5H), 5.42 (s, 1H), 4.77 (d, *J* = 16.0 Hz, 1H), 4.43 (d, *J* = 16.0 Hz, 1H), 2.58-2.53 (m, 2H), 1.11 (d, *J* = 6.4 Hz, 3H), 0.84 (d, *J* = 6.4 Hz, 3H); ¹³C NMR (100 MHz, CDCl₃) δ 165.9, 161.5, 138.1, 136.7, 136.4, 132.9, 128.9, 128.84, 128.76, 128.6, 128.4, 127.7, 126.9, 126.8, 126.6, 124.1, 123.5, 117.6, 116.2, 75.4, 60.3, 47.4, 36.2, 18.6, 17.4. HRMS (ESI) calcd. for C₃₃H₃₁N₂O₃⁺ (M+H)⁺ 503.2329, found 503.2321. HPLC (AD-H, *n*-hexane/*i*-PrOH = 80:20, flow rate=1.0 mL/min, I=254 nm) τ_{major} = 14.2 min, τ_{minor} = 12.5 min; [α]_D²⁵ 36.4 (c 1.0, CHCl₃, 97.5:2.5 er).

(3S,4R,4'S)-1'-benzyl-4'-hydroxy-4'-isopropyl-1,4-diphenyl-1',4'-dihydro-2'H-spiro[azetidine-3,3'-quinoline]-2,2'-dione (3aa')



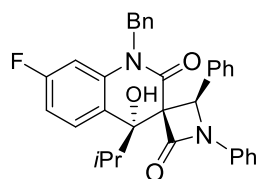
^1H NMR (400 MHz, CDCl_3) δ 7.47-7.45 (m, 1H), 7.38 (d, J = 8.6 Hz, 2H), 7.35-7.28 (m, 4H), 7.27-7.17 (m, 9H), 7.15-7.05 (m, 2H), 6.91-6.83 (m, 1H), 5.73 (s, 1H), 5.50 (d, J = 16.4 Hz, 1H), 4.52 (d, J = 16.4 Hz, 1H), 2.62-2.55 (m, 1H), 2.37 (s, 1H), 1.07 (d, J = 6.8 Hz, 3H), 0.80 (d, J = 6.8 Hz, 3H); ^{13}C NMR (150 MHz, CDCl_3) δ 163.9, 162.1, 138.2, 136.4, 136.0, 133.8, 132.9, 129.9, 129.6, 129.1, 128.8, 128.2, 127.1, 126.6, 126.4, 126.0, 124.6, 123.3, 117.9, 117.8, 115.7, 73.7, 58.8, 46.8, 37.1, 17.7, 17.0. HRMS (ESI) calcd. for $\text{C}_{33}\text{H}_{30}\text{N}_2\text{NaO}_3^+$ ($\text{M}+\text{Na}$) $^+$ 525.2149, found 525.2144. HPLC (AD-H, *n*-hexane/*i*-PrOH = 90:10, flow rate=1.0 mL/min, I=254 nm) τ_{major} = 11.6min, τ_{minor} = 13.1 min; $[\alpha]_{\text{D}}^{25}$ 76.3 (c 1.0, CHCl_3 , 95.5:4.5 er).

(3S,4R,4'R)-4'-hydroxy-4'-isopropyl-1'-(4-methoxybenzyl)-1,4-diphenyl-1',4'-dihydro-2'H-spiro[azetidine-3,3'-quinoline]-2,2'-dione (3ba)



80.6 mg, 76%, white solid, ^1H NMR (400 MHz, CDCl_3) δ 7.67-7.61 (m, 1H), 7.32-7.26 (m, 1H), 7.26-6.98 (m, 10H), 6.68-6.61 (m, 3H), 6.55-6.49 (m, 2H), 5.41 (s, 1H), 4.64 (d, J = 15.6 Hz, 1H), 4.40 (d, J = 15.6 Hz, 1H), 3.74 (s, 3H), 2.65 (s, 1H), 2.57-2.49 (m, 1H), 1.09 (d, J = 6.8 Hz, 3H), 0.81 (d, J = 6.8 Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 165.9, 161.6, 158.4, 138.0, 136.7, 132.9, 128.9, 128.8, 128.7, 128.5, 128.4, 128.1, 127.8, 127.6, 126.8, 124.1, 123.5, 117.6, 116.2, 113.9, 75.3, 60.3, 55.2, 46.6, 36.2, 18.6, 17.4. HRMS (ESI) calcd. for $\text{C}_{34}\text{H}_{33}\text{N}_2\text{O}_4^+$ ($\text{M}+\text{H}$) $^+$ 533.2435, found 533.2432. HPLC (IC-H, *n*-hexane/*i*-PrOH = 80:20, flow rate=1.0 mL/min, I=254 nm) τ_{major} = 10.2 min, τ_{minor} = 64.4 min; $[\alpha]_{\text{D}}^{25}$ 157.4 (c 1.0, CHCl_3 , 95:5 er).

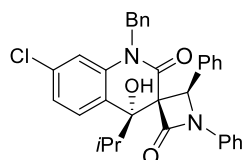
(3S,4R,4'R)-1'-benzyl-7'-fluoro-4'-hydroxy-4'-isopropyl-1,4-diphenyl-1',4'-dihydro-2'H-spiro[azetidine-3,3'-quinoline]-2,2'-dione (3ca)



70.7 mg, 75%, white solid, ^1H NMR (400 MHz, CDCl_3) δ 7.64-7.60 (m, 1H), 7.31 (t, J = 7.4 Hz, 1H), 7.25-6.69 (m, 13H), 6.55 (d, J = 7.1 Hz, 2H), 6.38-6.35 (m, 1H), 5.45 (s, 1H), 4.64 (d, J = 16.0 Hz, 1H), 4.41 (d, J = 16.4 Hz, 1H), 2.75 (s, 1H), 2.61-2.54 (m, 1H), 1.06 (d, J = 6.8 Hz, 3H), 0.83 (d, J = 6.8 Hz,

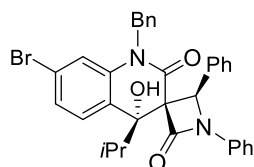
3H); ^{13}C NMR (100 MHz, CDCl_3) δ 166.1, 162.8 (d, $J = 244.0$ Hz), 161.3, 139.6, 139.5, 136.6, 135.7, 132.7, 128.9, 128.7, 128.6, 128.5, 127.6, 127.1, 126.7, 124.2, 123.2, 117.6, 109.9 (d, $J = 21.0$ Hz), 103.8 (d, $J = 27.0$ Hz), 75.2, 60.3, 47.4, 36.4, 18.6, 17.3; ^{19}F NMR (376 MHz, CDCl_3) δ -111.7. HRMS (ESI) calcd. for $\text{C}_{33}\text{H}_{30}\text{FN}_2\text{O}_3^+$ ($\text{M}+\text{H}$) $^+$ 521.2235, found 521.2233. HPLC (AD-H, *n*-hexane/*i*-PrOH = 80:20, flow rate=1.0 mL/min, I=254 nm) $\tau_{\text{major}} = 12.7$ min, $\tau_{\text{minor}} = 9.0$ min; $[\alpha]_{\text{D}}^{25}$ 129.4 (c 1.0, CHCl_3 , 96:4 er).

(3S,4R,4'R)-1'-benzyl-7'-chloro-4'-hydroxy-4'-isopropyl-1,4-diphenyl-1',4'-dihydro-2'H-spiro[azetidine-3,3'-quinoline]-2,2'-dione (3da)



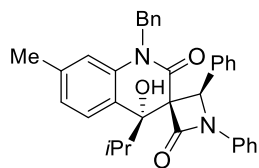
78.3 mg, 73%, white solid, ^1H NMR (400 MHz, CDCl_3) δ 7.58 (d, $J = 8.3$ Hz, 1H), 7.36-7.28 (m, 1H), 7.26-7.08 (m, 10H), 7.06-6.99 (m, 1H), 6.80 (s, 2H), 6.63 (d, $J = 1.6$ Hz, 1H), 6.61-6.50 (m, 2H), 5.43 (s, 1H), 4.60 (d, $J = 15.6$ Hz, 1H), 4.45 (d, $J = 16.0$ Hz, 1H), 2.59-2.50 (m, 2H), 1.07 (d, $J = 6.8$ Hz, 3H), 0.81 (d, $J = 6.8$ Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 165.9, 161.1, 139.1, 136.6, 135.7, 134.5, 132.6, 129.0, 128.7, 128.5, 128.2, 127.6, 127.2, 126.7, 126.1, 124.3, 123.4, 117.6, 116.2, 75.1, 60.3, 47.2, 36.3, 18.6, 17.2. HRMS (ESI) calcd. for $\text{C}_{33}\text{H}_{30}\text{ClN}_2\text{O}_3^+$ ($\text{M}+\text{H}$) $^+$ 537.1939, found 537.1937. HPLC (AD-H, *n*-hexane/*i*-PrOH = 80:20, flow rate=1.0 mL/min, I=254 nm) $\tau_{\text{major}} = 10.9$ min, $\tau_{\text{minor}} = 8.2$ min; $[\alpha]_{\text{D}}^{25}$ 131.6 (c 1.0, CHCl_3 , 97.5:2.5 er).

(3S,4R,4'R)-1'-benzyl-7'-bromo-4'-hydroxy-4'-isopropyl-1,4-diphenyl-1',4'-dihydro-2'H-spiro[azetidine-3,3'-quinoline]-2,2'-dione (3ea)



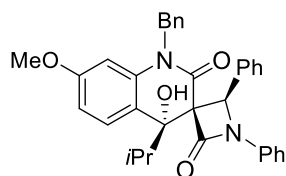
83.5 mg, 72%, white solid, ^1H NMR (400 MHz, CDCl_3) δ 7.59-7.27 (m, 4H), 7.25-7.21 (m, 2H), 7.20-7.15 (m, 4H), 7.14-7.10 (m, 3H), 7.05-6.97 (m, 1H), 6.78 (d, $J = 1.6$ Hz, 2H), 6.63-6.56 (m, 2H), 5.42 (s, 1H), 4.58 (d, $J = 16.0$ Hz, 1H), 4.46 (d, $J = 16.0$ Hz, 1H), 2.76 (d, $J = 11.6$ Hz, 1H), 2.57-2.50 (m, 1H), 1.07 (d, $J = 6.8$ Hz, 3H), 0.81 (d, $J = 6.4$ Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 165.9, 161.1, 139.2, 136.6, 135.6, 132.6, 129.0, 129.0, 128.7, 128.6, 128.5, 127.6, 127.2, 126.8, 126.8, 126.4, 124.3, 122.4, 119.1, 117.6, 75.1, 60.2, 47.2, 36.1, 18.6, 17.3. HRMS (ESI) calcd. for $\text{C}_{33}\text{H}_{30}\text{BrN}_2\text{O}_3^+$ ($\text{M}+\text{H}$) $^+$ 581.1434, found 581.1434, HPLC (AD-H, *n*-hexane/*i*-PrOH = 80:20, flow rate=1.0 mL/min, I=254 nm) $\tau_{\text{major}} = 10.3$ min, $\tau_{\text{minor}} = 8.3$ min; $[\alpha]_{\text{D}}^{25}$ 143.8 (c 1.0, CHCl_3 , 98:2 er).

(3S,4R,4'R)-1'-benzyl-4'-hydroxy-4'-isopropyl-7'-methyl-1,4-diphenyl-1',4'-dihydro-2'H-spiro[azetidine-3,3'-quinoline]-2,2'-dione (3fa)



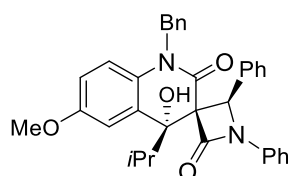
72.3 mg, 70%, white solid, ^1H NMR (400 MHz, CDCl_3) δ 7.49 (d, J = 7.8 Hz, 1H), 7.27 (d, J = 8.4 Hz, 2H), 7.24-7.13 (m, 4H), 7.13-7.07 (m, 5H), 7.03-6.99 (m, 2H), 6.83-6.63 (m, 1H), 6.55 (d, J = 7.2 Hz, 2H), 6.44 (s, 1H), 5.43 (s, 1H), 4.70 (d, J = 16.0 Hz, 1H), 4.42 (d, J = 16.0 Hz, 1H), 2.56-2.49 (m, 1H), 2.44 (s, 1H), 2.26 (s, 3H), 1.07 (d, J = 6.8 Hz, 3H), 0.82 (d, J = 6.8 Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 166.0, 161.6, 138.8, 138.0, 136.8, 136.5, 133.0, 128.9, 128.7, 128.5, 128.4, 127.7, 126.8, 126.7, 126.7, 124.7, 124.2, 124.1, 117.6, 116.8, 75.5, 60.3, 47.4, 36.3, 21.5, 18.6, 17.3. HRMS (ESI) calcd. for $\text{C}_{34}\text{H}_{33}\text{N}_2\text{O}_3^+$ ($\text{M}+\text{H}$) $^+$ 517.2486, found 517.2484. HPLC (AD-H, *n*-hexane/*i*-PrOH = 80:20, flow rate=1.0 mL/min, I=254 nm) τ_{major} = 15.6 min, τ_{minor} = 9.4 min; $[\alpha]_{\text{D}}^{25}$ 80.8 (c 1.0, CHCl_3 , 97:3 er).

(3S,4R,4'R)-1'-benzyl-4'-hydroxy-4'-isopropyl-7'-methoxy-1,4-diphenyl-1',4'-dihydro-2'H-spiro[azetidine-3,3'-quinoline]-2,2'-dione (3ga)



72.3 mg, 68%, white solid, ^1H NMR (400 MHz, CDCl_3) δ 7.52 (d, J = 8.5 Hz, 1H), 7.36-7.24 (m, 4H), 7.24-7.20 (m, 2H), 7.16 (t, J = 7.6 Hz, 2H), 7.13-6.98 (m, 4H), 6.80 (s, 1H), 6.73-6.70 (m, 1H), 6.57-6.54 (m, 2H), 6.20 (d, J = 2.0 Hz, 1H), 5.47 (s, 1H), 4.71 (d, J = 16.0 Hz, 1H), 4.38 (d, J = 16.0 Hz, 1H), 3.69 (s, 3H), 2.57-2.51 (m, 1H), 2.31 (s, 1H), 1.05 (d, J = 6.8 Hz, 3H), 0.84 (d, J = 6.8 Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 166.2, 161.6, 160.0, 139.2, 136.8, 136.4, 132.9, 128.9, 128.8, 128.6, 128.4, 128.0, 127.7, 126.9, 126.7, 124.1, 119.4, 117.6, 107.8, 103.1, 75.5, 60.4, 55.3, 47.4, 36.7, 18.6, 17.3. HRMS (ESI) calcd. for $\text{C}_{34}\text{H}_{33}\text{N}_2\text{O}_4^+$ ($\text{M}+\text{H}$) $^+$ 533.2435, found 533.2438. HPLC (AD-H, *n*-hexane/*i*-PrOH = 80:20, flow rate=1.0 mL/min, I=254 nm) τ_{major} = 14.2 min, τ_{minor} = 11.5 min; $[\alpha]_{\text{D}}^{25}$ 95.4 (c 1.0, CHCl_3 , 96.5:3.5 er).

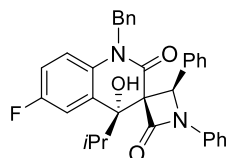
(3S,4R,4'R)-1'-benzyl-4'-hydroxy-4'-isopropyl-6'-methoxy-1,4-diphenyl-1',4'-dihydro-2'H-spiro[azetidine-3,3'-quinoline]-2,2'-dione (3ha)



74.5 mg, 79%, white solid, ^1H NMR (400 MHz, CDCl_3) δ 7.30 (d, J = 7.4 Hz, 1H), 7.27-7.15 (m, 7H), 7.13-7.06 (m, 4H), 7.05-6.97 (m, 1H), 6.74-6.71 (m, 2H), 6.55-6.44 (m, 3H), 5.40 (s, 1H), 4.79 (d, J = 15.6 Hz, 1H), 4.36 (d, J = 16.0 Hz, 1H), 3.86 (s, 3H), 2.57-2.52 (m, 1H), 2.49 (s, 1H), 1.12 (d, J = 6.8 Hz, 3H), 0.84 (d, J = 6.8 Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 166.0, 161.6, 138.8, 138.0, 136.8, 136.5, 133.0, 128.9, 128.7, 128.5, 128.4, 127.7, 126.8, 126.7, 126.7, 124.7, 124.2, 124.1, 117.6, 116.8,

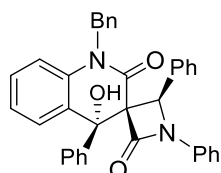
75.5, 60.3, 47.4, 36.3, 21.5, 18.6, 17.3. HRMS (ESI) calcd. for $C_{34}H_{33}N_2O_4^+$ ($M+H$) $^+$ 533.2435, found 533.2432. HPLC (AD-H, *n*-hexane/*i*-PrOH = 80:20, flow rate=1.0 mL/min, I=254 nm) τ_{major} = 17.2 min, τ_{minor} = 11.1 min; $[\alpha]_D^{25}$ 126.8 (c 1.0, CHCl₃, 97.5:2.5 er).

(3S,4R,4'R)-1'-benzyl-6'-fluoro-4'-hydroxy-4'-isopropyl-1,4-diphenyl-1',4'-dihydro-2'H-spiro[azetidine-3,3'-quinoline]-2,2'-dione (3ia)



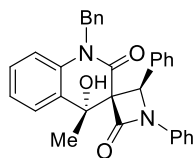
77.0 mg, 74%, white solid, ^1H NMR (400 MHz, CDCl₃) δ 7.44-7.28 (m, 2H), 7.26-7.08 (m, 9H), 7.07-6.61 (m, 4H), 6.58-6.43 (m, 3H), 5.42 (s, 1H), 4.81 (d, J = 16.4 Hz, 1H), 4.37 (d, J = 16.0 Hz, 1H), 2.82 (s, 1H), 2.61-2.54 (m, 1H), 1.11 (d, J = 6.8 Hz, 3H), 0.85 (d, J = 6.8 Hz, 3H); ^{13}C NMR (100 MHz, CDCl₃) δ 165.7, 161.2, 159.1 (d, J = 243.0 Hz), 136.6, 136.1, 134.3, 134.2, 132.8, 130.4 (d, J = 7.0 Hz), 129.0, 128.9, 128.7, 128.5, 127.7, 127.0, 126.5, 124.2, 117.6, 115.3 (d, J = 23.0 Hz), 114.2 (d, J = 24.0 Hz), 77.4, 77.3, 77.1, 76.8, 76.5, 75.0, 60.2, 47.8, 36.1, 18.6, 17.4; ^{19}F NMR (376 MHz, CDCl₃) δ -118.3. HRMS (ESI) calcd. for $C_{33}H_{30}FN_2O_3^+$ ($M+H$) $^+$ 521.2235, found 521.2235. HPLC (IC-H, *n*-hexane/*i*-PrOH = 80:20, flow rate=1.0 mL/min, I=254 nm) τ_{major} = 6.4 min, τ_{minor} = 25.1 min; $[\alpha]_D^{25}$ 160.3 (c 1.0, CHCl₃, 96:4 er).

(3S,4R,4'R)-1'-benzyl-4'-hydroxy-1,4,4'-triphenyl-1',4'-dihydro-2'H-spiro[azetidine-3,3'-quinoline]-2,2'-dione (3ja)



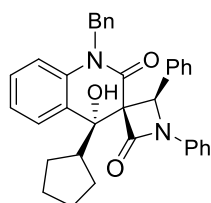
75.1 mg, 70%, white solid, ^1H NMR (400 MHz, CDCl₃) δ 8.03-8.01 (m, 1H), 7.85-7.72 (m, 2H), 7.54-7.31 (m, 5H), 7.30-7.26 (m, 2H), 7.26-7.18 (m, 3H), 7.14 (t, J = 7.6 Hz, 2H), 7.08-7.03 (m, 1H), 6.99 (t, J = 7.4 Hz, 1H), 6.87 (t, J = 7.6 Hz, 2H), 6.69 (d, J = 15.6 Hz, 2H), 6.47-6.44 (m, 1H), 6.19 (d, J = 7.6 Hz, 2H), 5.35 (s, 1H), 4.93 (d, J = 16.4 Hz, 1H), 3.93 (d, J = 16.0 Hz, 1H), 2.94 (s, 1H), 1.65 (s, 1H); ^{13}C NMR (100 MHz, CDCl₃) δ 165.7, 161.4, 140.3, 136.9, 136.6, 135.8, 132.8, 131.7, 129.0, 128.8, 128.7, 128.6, 128.3, 128.3, 127.5, 126.7, 126.4, 124.4, 124.3, 123.9, 117.7, 116.5, 75.9, 75.2, 60.6, 44.6. HRMS (ESI) calcd. for $C_{36}H_{29}N_2O_3^+$ ($M+H$) $^+$ 537.2173, found 537.2170. HPLC (AD-H, *n*-hexane/*i*-PrOH = 80:20, flow rate=1.0 mL/min, I=254 nm) τ_{major} = 19.4 min, τ_{minor} = 17.3 min; $[\alpha]_D^{25}$ 70.8 (c 1.0, CHCl₃, 95:5 er).

(3S,4R,4'R)-1'-benzyl-4'-hydroxy-4'-methyl-1,4-diphenyl-1',4'-dihydro-2'H-spiro[azetidine-3,3'-quinoline]-2,2'-dione (3ka)



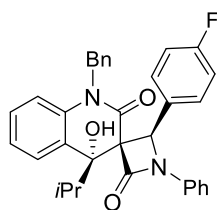
46.7 mg, 49%, white solid, ^1H NMR (400 MHz, CDCl_3) δ 7.77-7.71 (m, 1H), 7.35-7.27 (m, 2H), 7.24-6.99 (m, 10H), 6.86-6.55 (m, 5H), 5.32 (s, 1H), 4.74 (d, J = 16.0 Hz, 1H), 4.62 (d, J = 16.0 Hz, 1H), 2.87 (s, 1H), 1.81 (s, 3H); ^{13}C NMR (150 MHz, CDCl_3) δ 165.3, 162.3, 136.8, 136.7, 136.3, 132.9, 131.6, 129.0, 128.8, 128.8, 128.6, 128.5, 127.3, 126.9, 126.5, 124.3, 124.2, 124.0, 117.6, 116.1, 74.8, 71.4, 59.8, 46.6, 26.1. HRMS (ESI) calcd. for $\text{C}_{31}\text{H}_{26}\text{N}_2\text{NaO}_3^+$ ($\text{M}+\text{Na}$) $^+$ 497.1836, found 497.1823. HPLC (IC-H, *n*-hexane/*i*-PrOH = 80:20, flow rate=1.0 mL/min, I=254 nm) τ_{major} = 10.7 min, τ_{minor} = 41.0 min; $[\alpha]_{\text{D}}^{25}$ 156.4 (c 1.0, CHCl_3 , 95:5 er).

(3S,4R,4'R)-1'-benzyl-4'-cyclopentyl-4'-hydroxy-1,4-diphenyl-1',4'-dihydro-2'H-spiro[azetidine-3,3'-quinoline]-2,2'-dione (3la)



51.7 mg, 49%, white solid, ^1H NMR (400 MHz, CDCl_3) δ 7.70-7.62 (m, 1H), 7.33-7.28 (m, 1H), 7.27-7.17 (m, 6H), 7.17-7.06 (m, 5H), 7.03 (t, J = 7.2 Hz, 1H), 6.74 (s, 2H), 6.65-6.60 (m, 1H), 6.58-6.49 (m, 2H), 5.37 (d, J = 2.0 Hz, 1H), 4.88 (d, J = 15.6 Hz, 1H), 4.37 (d, J = 16.0 Hz, 1H), 2.80-2.70 (m, 1H), 2.56 (s, 1H), 2.11-1.97 (m, 1H), 1.75 (s, 1H), 1.65-1.48 (m, 4H), 1.40-1.22 (m, 1H), 0.95-0.85 (m, 1H); ^{13}C NMR (100 MHz, CDCl_3) δ 165.6, 161.7, 138.3, 136.8, 136.4, 133.0, 128.9, 128.84, 128.78, 128.55, 128.50, 128.3, 127.6, 126.9, 126.6, 126.4, 124.1, 123.7, 117.6, 116.3, 75.6, 75.5, 60.1, 47.7, 47.6, 28.6, 26.7, 24.7, 23.7. HRMS (ESI) calcd. for $\text{C}_{35}\text{H}_{32}\text{N}_2\text{NaO}_3^+$ ($\text{M}+\text{Na}$) $^+$ 551.2305, found 551.2294. HPLC (IC-H, *n*-hexane/*i*-PrOH = 90:10, flow rate=1.0 mL/min, I=254 nm) τ_{major} = 11.0 min, τ_{minor} = 40.3 min; $[\alpha]_{\text{D}}^{25}$ 69.0 (c 1.0, CHCl_3 , 93.5:6.5 er).

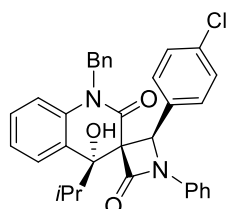
(2R,3S,4'R)-1'-benzyl-2-(4-fluorophenyl)-4'-hydroxy-4'-isopropyl-1-phenyl-1',4'-dihydro-2'H-spiro[azetidine-3,3'-quinoline]-2',4-dione (3ab)



78.0 mg, 75%, white solid, ^1H NMR (400 MHz, CDCl_3) δ 7.70-7.57 (m, 1H), 7.38-7.10 (m, 10H), 7.04 (t, J = 6.7 Hz, 1H), 6.82 (t, J = 8.4 Hz, 2H), 6.76-6.62 (m, 2H), 6.57 (d, J = 6.9 Hz, 2H), 5.41 (s, 1H), 4.92 (d, J = 15.8 Hz, 1H), 4.39 (d, J = 15.9 Hz, 1H), 2.58-2.51 (m, 1H), 2.43 (s, 1H), 1.09 (d, J = 6.8 Hz, 3H), 0.84 (d, J = 6.9 Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 165.8, 163.1 (d, J = 243.0 Hz), 161.3, 138.1, 136.5, 136.3, 129.5 (d, J = 8.0 Hz), 129.01, 128.97, 128.8 (d, J = 2.0 Hz), 128.5, 127.7, 127.1,

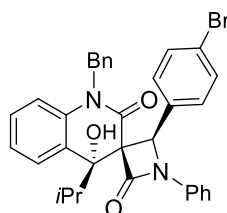
126.8, 126.6, 124.3, 123.7, 117.5, 116.2, 115.6 (d, $J = 21.0$ Hz), 75.3, 59.6, 47.8, 36.2, 18.6, 17.3; ^{19}F NMR (376 MHz, CDCl_3) δ -112.4. HRMS (ESI) calcd. for $\text{C}_{33}\text{H}_{30}\text{FN}_2\text{O}_3^+$ ($\text{M}+\text{H}$) $^+$ 521.2235, found 521.2232. HPLC (AD-H, n -hexane/ i -PrOH = 80:20, flow rate=1.0 mL/min, I=254 nm) $\tau_{\text{major}} = 13.5$ min, $\tau_{\text{minor}} = 7.5$ min; $[\alpha]_{\text{D}}^{25}$ 122.8 (c 1.0, CHCl_3 , 97:3 er).

(2R,3S,4'R)-1'-benzyl-2-(4-chlorophenyl)-4'-hydroxy-4'-isopropyl-1-phenyl-1',4'-dihydro-2'H-spiro[azetidine-3,3'-quinoline]-2',4-dione (3ac)



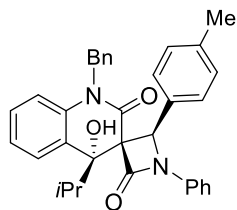
75.1 mg, 70%, white solid, ^1H NMR (400 MHz, CDCl_3) δ 7.67-7.60 (m, 1H), 7.25-7.15 (m, 9H), 7.10 (d, $J = 8.2$ Hz, 3H), 7.07-7.02 (m, 1H), 6.72-6.49 (m, 4H), 5.41 (s, 1H), 4.99 (d, $J = 15.6$ Hz, 1H), 4.35 (d, $J = 16.0$ Hz, 1H), 2.59-2.52 (m, 1H), 2.49 (s, 1H), 1.09 (d, $J = 6.8$ Hz, 3H), 0.85 (d, $J = 6.8$ Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ = 165.7, 161.2, 138.2, 136.5, 136.3, 134.7, 131.7, 129.1, 129.0, 128.8, 128.6, 127.6, 127.1, 126.9, 126.5, 124.3, 123.8, 117.5, 116.3, 75.3, 59.6, 48.1, 36.3, 18.6, 17.4. HRMS (ESI) calcd. for $\text{C}_{33}\text{H}_{30}\text{ClN}_2\text{O}_3^+$ ($\text{M}+\text{H}$) $^+$ 537.1939, found 537.1935. HPLC (AD-H, n -hexane/ i -PrOH = 80:20, flow rate=1.0 mL/min, I=254 nm) $\tau_{\text{major}} = 12.2$ min, $\tau_{\text{minor}} = 7.2$ min; $[\alpha]_{\text{D}}^{25}$ 75.2 (c 1.0, CHCl_3 , 96.5:3.5 er).

(2R,3S,4'R)-1'-benzyl-2-(4-bromophenyl)-4'-hydroxy-4'-isopropyl-1-phenyl-1',4'-dihydro-2'H-spiro[azetidine-3,3'-quinoline]-2',4-dione (3ad)



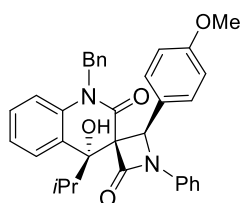
90.5 mg, 78%, white solid, ^1H NMR (400 MHz, CDCl_3) δ 7.64-7.62 (m, 1H), 7.33-7.23 (m, 3H), 7.23-7.16 (m, 4H), 7.14-7.07 (m, 3H), 7.06-6.98 (m, 1H), 6.74-6.38 (m, 6H), 5.39 (s, 1H), 4.99 (d, $J = 16.0$ Hz, 1H), 4.35 (d, $J = 16.0$ Hz, 1H), 3.75 (s, 3H), 2.59-2.52 (m, 1H), 2.39 (s, 1H), 1.09 (d, $J = 6.8$ Hz, 3H), 0.85 (d, $J = 6.8$ Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 166.0, 161.5, 159.9, 138.3, 136.8, 136.5, 129.0, 128.9, 128.8, 128.4, 127.7, 126.9, 126.7, 126.6, 124.8, 124.1, 123.5, 117.6, 116.3, 113.9, 75.2, 60.0, 55.1, 47.8, 36.3, 18.6, 17.3. HRMS (ESI) calcd. for $\text{C}_{33}\text{H}_{30}\text{BrN}_2\text{O}_3^+$ ($\text{M}+\text{H}$) $^+$ 581.1434, found 581.1429. HPLC (AD-H, n -hexane/ i -PrOH = 80:20, flow rate=1.0 mL/min, I=254 nm) $\tau_{\text{major}} = 7.9$ min, $\tau_{\text{minor}} = 13.0$ min; $[\alpha]_{\text{D}}^{25}$ 110.2 (c 1.0, CHCl_3 , 96:4 er).

(3S,4R,4'R)-1'-benzyl-4'-hydroxy-4'-isopropyl-1-phenyl-4-(p-tolyl)-1',4'-dihydro-2'H-spiro[azetidine-3,3'-quinoline]-2,2'-dione (3ae)



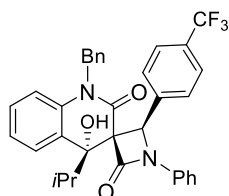
82.6 mg, 80%, white solid, ^1H NMR (400 MHz, CDCl_3) δ 7.69-7.57 (m, 1H), 7.34-6.97 (m, 11H), 6.93 (d, $J = 7.6$ Hz, 2H), 6.72-6.52 (m, 4H), 5.39 (s, 1H), 4.89 (d, $J = 15.6$ Hz, 1H), 4.37 (d, $J = 16.0$ Hz, 1H), 2.60-2.50 (m, 1H), 2.45 (s, 1H), 2.32 (s, 3H), 1.10 (d, $J = 6.8$ Hz, 3H), 0.84 (d, $J = 6.8$ Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 166.0, 161.5, 138.3, 138.2, 136.8, 136.5, 129.9, 129.2, 128.9, 128.8, 128.3, 127.9, 127.6, 126.8, 126.7, 126.7, 124.0, 123.5, 117.6, 116.3, 75.2, 60.2, 47.7, 36.2, 21.4, 18.6, 17.4. HRMS (ESI) calcd. for $\text{C}_{34}\text{H}_{33}\text{N}_2\text{O}_3^+$ ($\text{M}+\text{H}$) $^+$ 517.2486, found 517.2485. HPLC (AD-H, n -hexane/ i -PrOH = 90:10, flow rate=1.0 mL/min, I=254 nm) $\tau_{\text{major}} = 24.9$ min, $\tau_{\text{minor}} = 14.3$ min; $[\alpha]_{\text{D}}^{25}$ 110.4 (c 1.0, CHCl_3 , 96:4 er).

(2R,3S,4'R)-1'-benzyl-4'-hydroxy-4'-isopropyl-2-(4-methoxyphenyl)-1-phenyl-1',4'-dihydro-2'H-spiro[azetidine-3,3'-quinoline]-2',4-dione (3af)



77.7 mg, 73%, white solid, ^1H NMR (400 MHz, CDCl_3) δ 7.64-7.62 (m, 1H), 7.27 (d, $J = 1.6$ Hz, 1H), 7.26-7.17 (m, 5H), 7.15-6.98 (m, 4H), 6.95-6.62 (m, 4H), 6.61-6.34 (m, 3H), 5.39 (s, 1H), 4.99 (d, $J = 16.0$ Hz, 1H), 4.35 (d, $J = 16.0$ Hz, 1H), 3.75 (s, 3H), 2.59-2.52 (m, 1H), 2.39 (s, 1H), 1.09 (d, $J = 6.8$ Hz, 3H), 0.85 (d, $J = 6.8$ Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 166.0, 161.5, 159.9, 138.3, 136.8, 136.5, 129.0, 128.9, 128.8, 128.4, 127.7, 126.9, 126.7, 126.6, 124.8, 124.1, 123.5, 117.6, 116.3, 113.9, 75.2, 60.0, 55.1, 47.8, 36.3, 18.6, 17.3. HRMS (ESI) calcd. for $\text{C}_{34}\text{H}_{33}\text{N}_2\text{O}_4^+$ ($\text{M}+\text{H}$) $^+$ 533.2435, found 533.2433. HPLC (AD-H, n -hexane/ i -PrOH = 80:20, flow rate=1.0 mL/min, I=230 nm) $\tau_{\text{major}} = 12.4$ min, $\tau_{\text{minor}} = 8.9$ min; $[\alpha]_{\text{D}}^{25}$ 132.6 (c 1.0, CHCl_3 , 97:3 er).

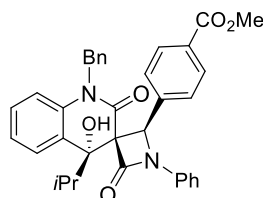
(3S,4R,4'R)-1'-benzyl-4'-hydroxy-4'-isopropyl-1-phenyl-4-(4-(trifluoromethyl)phenyl)-1',4'-dihydro-2'H-spiro[azetidine-3,3'-quinoline]-2,2'-dione (3ag)



92.3 mg, 81%, white solid, ^1H NMR (400 MHz, CDCl_3) δ 7.71-7.65 (m, 1H), 7.41 (d, $J = 8.4$ Hz, 2H), 7.31-7.22 (m, 7H), 7.18-7.04 (m, 4H), 6.96-6.77 (m, 1H), 6.75-6.63 (m, 3H), 5.49 (s, 1H), 4.74 (d, $J = 15.6$ Hz, 1H), 4.47 (d, $J = 16.0$ Hz, 1H), 2.61-2.52 (m, 2H), 1.13 (d, $J = 6.8$ Hz, 3H), 0.85 (d, $J = 6.8$ Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 165.6, 161.1, 137.9, 137.3, 136.4, 136.2, 131.0, 130.7, 129.1, 129.1, 128.5, 128.1, 127.7, 127.3, 126.9, 126.8, 125.3 (q, $J = 4.0$ Hz), 125.2, 124.5, 123.8, 117.5, 116.3, 75.5,

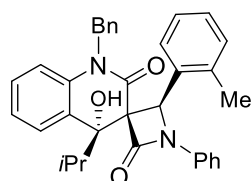
59.7, 47.5, 36.1, 18.6, 17.3; ^{19}F NMR (376 MHz, CDCl_3) δ -62.3. HRMS (ESI) calcd. for $\text{C}_{34}\text{H}_{30}\text{F}_3\text{N}_2\text{O}_3^+$ ($\text{M}+\text{H}$) $^+$ 571.2203, found 571.2200. HPLC (AD-H, *n*-hexane/*i*-PrOH = 80:20, flow rate=1.0 mL/min, I=254 nm) τ_{major} = 7.5 min, τ_{minor} = 6.0 min; $[\alpha]_{\text{D}}^{25}$ 94.8 (c 1.0, CHCl_3 , 96.5:3.5 er).

Methyl 4-((3*S*,4*R*,4'*R*)-1'-benzyl-4'-hydroxy-4'-isopropyl-2,2'-dioxo-1-phenyl-1',4'-dihydro-2'H-spiro[azetidine-3,3'-quinolin]-4-yl)benzoate (3ah)



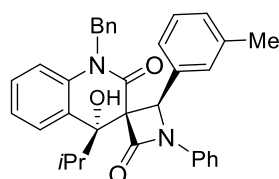
84.0 mg, 75%, white solid, ^1H NMR (400 MHz, CDCl_3) δ 7.76 (d, J = 8.4 Hz, 2H), 7.71-7.60 (m, 1H), 7.30-7.12 (m, 7H), 7.12-7.06 (m, 1H), 7.06-6.97 (m, 3H), 6.94-6.72 (m, 1H), 6.72-6.66 (m, 1H), 6.66-6.57 (m, 2H), 5.46 (s, 1H), 4.76 (d, J = 15.6 Hz, 1H), 4.39 (d, J = 16.0 Hz, 1H), 3.89 (s, 3H), 2.88 (s, 1H), 2.59-2.52 (m, 1H), 1.09 (d, J = 6.8 Hz, 3H), 0.83 (d, J = 6.8 Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 166.7, 165.7, 161.2, 138.2, 138.0, 136.5, 136.3, 130.5, 129.6, 129.0, 128.4, 127.8, 127.7, 127.1, 127.0, 127.0, 124.3, 123.8, 117.5, 116.3, 76.7, 75.6, 59.8, 52.2, 47.6, 36.1, 18.6, 17.4. HRMS (ESI) calcd. for $\text{C}_{35}\text{H}_{33}\text{N}_2\text{O}_5^+$ ($\text{M}+\text{H}$) $^+$ 561.2384, found 561.2382. HPLC (AD-H, *n*-hexane/*i*-PrOH = 80:20, flow rate=1.0 mL/min, I=254 nm) τ_{major} = 14.3 min, τ_{minor} = 11.5 min; $[\alpha]_{\text{D}}^{25}$ 120.2 (c 1.0, CHCl_3 , 97.5:2.5 er).

(3*S*,4*R*,4'*R*)-1'-benzyl-4'-hydroxy-4'-isopropyl-1-phenyl-4-(*o*-tolyl)-1',4'-dihydro-2'H-spiro[azetidine-3,3'-quinoline]-2,2'-dione (3ai)



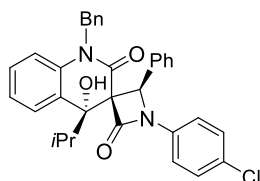
61.9 mg, 60%, white solid, ^1H NMR (400 MHz, CDCl_3) δ 7.68-7.58 (m, 1H), 7.48-7.34 (m, 1H), 7.23 (dd, J = 7.5, 1.4 Hz, 1H), 7.19 (d, J = 4.3 Hz, 4H), 7.17-7.13 (m, 2H), 7.13-7.09 (m, 1H), 7.08-7.05 (m, 3H), 7.04-6.98 (m, 2H), 6.66-6.58 (m, 1H), 6.37-6.29 (m, 2H), 5.85 (s, 1H), 5.22 (d, J = 16.0 Hz, 1H), 4.19 (d, J = 16.4 Hz, 1H), 2.78-2.70 (m, 1H), 2.67 (s, 1H), 1.41 (s, 3H), 1.00 (d, J = 6.8 Hz, 3H), 0.93 (d, J = 6.8 Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 165.7, 162.0, 138.8, 137.2, 136.53, 136.50, 130.5, 130.4, 129.2, 128.9, 128.73, 128.69, 128.6, 127.6, 126.8, 126.7, 126.4, 126.0, 124.1, 123.6, 117.6, 116.3, 75.3, 56.6, 48.3, 37.2, 18.6, 17.5, 17.4. HRMS (ESI) calcd. for $\text{C}_{34}\text{H}_{33}\text{N}_2\text{O}_3^+$ ($\text{M}+\text{H}$) $^+$ 517.2486, found 517.2482. HPLC (IC-H, *n*-hexane/*i*-PrOH = 80:20, flow rate=1.0 mL/min, I=254 nm) τ_{major} = 7.2 min, τ_{minor} = 38.6 min; $[\alpha]_{\text{D}}^{25}$ 55.8 (c 1.0, CHCl_3 , 99.5:0.5 er).

(3*S*,4*R*,4'*R*)-1'-benzyl-4'-hydroxy-4'-isopropyl-1-phenyl-4-(*m*-tolyl)-1',4'-dihydro-2'H-spiro[azetidine-3,3'-quinoline]-2,2'-dione (3aj)



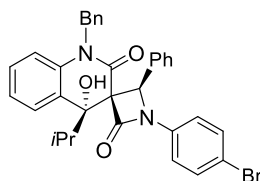
85.7 mg, 83%, white solid, ^1H NMR (400 MHz, CDCl_3) δ 7.65-7.63 (m, 1H), 7.29-7.26 (m, 3H), 7.23-7.16 (m, 4H), 7.16-7.06 (m, 4H), 7.06-6.98 (m, 2H), 6.73-6.40 (m, 4H), 5.37 (s, 1H), 4.84 (d, $J = 16.0$ Hz, 1H), 4.39 (d, $J = 16.0$ Hz, 1H), 2.57-2.50 (m, 1H), 2.42 (s, 1H), 2.07 (s, 3H), 1.11 (d, $J = 7.2$ Hz, 3H), 0.84 (d, $J = 6.8$ Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 165.9, 161.5, 138.3, 138.0, 136.9, 136.5, 132.8, 129.5, 128.9, 128.7, 128.5, 128.3, 128.0, 126.9, 126.7, 126.6, 124.1, 123.6, 117.6, 116.2, 75.3, 60.3, 47.7, 36.1, 21.2, 18.6, 17.4. HRMS (ESI) calcd. for $\text{C}_{34}\text{H}_{33}\text{N}_2\text{O}_3^+$ ($\text{M}+\text{H}$) $^+$ 517.2486, found 517.2485. HPLC (AD-H, *n*-hexane/*i*-PrOH = 90:10, flow rate=1.0 mL/min, I=254 nm) $\tau_{\text{major}} = 16.0$ min, $\tau_{\text{minor}} = 22.9$ min; $[\alpha]_{\text{D}}^{25} 118.6$ (c 1.0, CHCl_3 , 95:5 er).

(3S,4R,4'R)-1'-benzyl-1-(4-chlorophenyl)-4'-hydroxy-4'-isopropyl-4-phenyl-1',4'-dihydro-2'H-spiro[azetidine-3,3'-quinoline]-2,2'-dione (3ak)



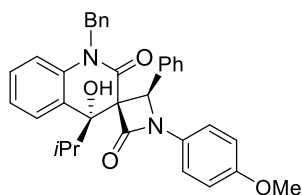
75.2 mg, 70%, white solid, ^1H NMR (400 MHz, CDCl_3) δ 7.66-7.63 (m, 1H), 7.30 (t, $J = 7.4$ Hz, 1H), 7.24-7.05 (m, 11H), 7.03-6.40 (m, 5H), 5.40 (s, 1H), 4.76 (d, $J = 16.0$ Hz, 1H), 4.42 (d, $J = 16.0$ Hz, 1H), 2.60-2.52 (m, 2H), 1.11 (d, $J = 6.8$ Hz, 3H), 0.84 (d, $J = 6.8$ Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 165.7, 161.4, 138.0, 136.3, 135.2, 132.5, 129.2, 129.0, 128.9, 128.9, 128.6, 128.5, 127.7, 127.6, 126.9, 126.8, 126.6, 123.6, 118.8, 116.3, 75.7, 60.5, 47.4, 36.1, 18.6, 17.3. HRMS (ESI) calcd. for $\text{C}_{33}\text{H}_{30}\text{ClN}_2\text{O}_3^+$ ($\text{M}+\text{H}$) $^+$ 537.1939, found 537.1935. HPLC (AD-H, *n*-hexane/*i*-PrOH = 80:20, flow rate=1.0 mL/min, I=254 nm) $\tau_{\text{major}} = 25.3$ min, $\tau_{\text{minor}} = 16.2$ min; $[\alpha]_{\text{D}}^{25} 106.4$ (c 1.0, CHCl_3 , 94:6 er).

(3S,4R,4'R)-1'-benzyl-1-(4-bromophenyl)-4'-hydroxy-4'-isopropyl-4-phenyl-1',4'-dihydro-2'H-spiro[azetidine-3,3'-quinoline]-2,2'-dione (3al)



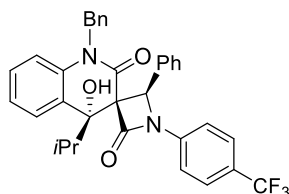
84.7 mg, 73%, white solid, ^1H NMR (400 MHz, CDCl_3) δ 7.66-7.63 (m, 1H), 7.35-7.27 (m, 3H), 7.25-6.43 (m, 14H), 5.40 (s, 1H), 4.77 (d, $J = 16.0$ Hz, 1H), 4.41 (d, $J = 16.0$ Hz, 1H), 2.68 (s, 1H), 2.59-2.52 (m, 1H), 1.10 (d, $J = 6.8$ Hz, 3H), 0.83 (d, $J = 6.8$ Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 165.7, 161.5, 138.0, 136.3, 135.6, 132.4, 131.9, 129.0, 128.9, 128.6, 128.5, 127.6, 126.9, 126.8, 126.6, 123.6, 119.1, 116.9, 116.3, 75.7, 60.5, 47.5, 36.2, 18.6, 17.3. HRMS (ESI) calcd. for $\text{C}_{33}\text{H}_{30}\text{BrN}_2\text{O}_3^+$ ($\text{M}+\text{H}$) $^+$ 581.1434, found 581.1430. HPLC (AD-H, *n*-hexane/*i*-PrOH = 80:20, flow rate=1.0 mL/min, I=254 nm) $\tau_{\text{major}} = 18.4$ min, $\tau_{\text{minor}} = 32.8$ min; $[\alpha]_{\text{D}}^{25} 130.0$ (c 1.0, CHCl_3 , 94.5:5.5 er).

(3S,4R,4'R)-1'-benzyl-4'-hydroxy-4'-isopropyl-1-(4-methoxyphenyl)-4-phenyl-1',4'-dihydro-2'H-spiro[azetidine-3,3'-quinoline]-2,2'-dione (3am)



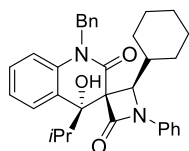
85.1 mg, 80%, white solid, ^1H NMR (400 MHz, CDCl_3) δ 7.65-7.63 (m, 1H), 7.29 (d, J = 7.3 Hz, 1H), 7.22-7.16 (m, 4H), 7.15-7.02 (m, 5H), 6.81-6.69 (m, 3H), 6.62-6.51 (m, 4H), 5.38 (s, 1H), 4.78 (d, J = 15.6 Hz, 1H), 4.41 (d, J = 16.0 Hz, 1H), 3.72 (s, 3H), 2.61-2.51 (m, 1H), 2.49 (s, 1H), 1.10 (d, J = 6.8 Hz, 3H), 0.83 (d, J = 6.8 Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 166.0, 160.8, 156.1, 138.1, 136.5, 133.0, 130.3, 128.8, 128.7, 128.5, 128.4, 127.9, 127.7, 126.8, 126.7, 126.6, 123.5, 118.9, 116.2, 114.2, 75.4, 60.4, 55.4, 47.4, 36.2, 18.6, 17.4. HRMS (ESI) calcd. for $\text{C}_{34}\text{H}_{33}\text{N}_2\text{O}_4^+$ ($\text{M}+\text{H}$) $^+$ 533.2435, found 533.2430. HPLC (AD-H, *n*-hexane/*i*-PrOH = 80:20, flow rate=1.0 mL/min, I=230 nm) τ_{major} = 38.1 min, τ_{minor} = 21.4 min; $[\alpha]_{\text{D}}^{25}$ 154.8 (c 1.0, CHCl_3 , 93.5:6.5 er).

(3S,4R,4'R)-1'-benzyl-4'-hydroxy-4'-isopropyl-4-phenyl-1-(4-(trifluoromethyl)phenyl)-1',4'-dihydro-2'H-spiro[azetidine-3,3'-quinoline]-2,2'-dione (3an)



83.2 mg, 73%, white solid, ^1H NMR (400 MHz, CDCl_3) δ 7.65-7.62 (m, 1H), 7.46 (d, J = 8.5 Hz, 2H), 7.36-7.29 (m, 3H), 7.26 (s, 1H), 7.23-7.19 (m, 2H), 7.19-7.06 (m, 5H), 6.66-6.60 (dd, J = 5.9, 3.4 Hz, 1H), 6.57-6.48 (m, 2H), 5.44 (s, 1H), 4.76 (d, J = 16.0 Hz, 1H), 4.43 (d, J = 16.0 Hz, 1H), 2.57-2.49 (m, 1H), 2.44 (s, 1H), 1.11 (d, J = 6.8 Hz, 3H), 0.84 (d, J = 6.8 Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 165.5, 161.9, 139.4, 137.9, 136.2, 132.3, 129.1, 129.0, 128.6, 127.62, 127.56, 127.2, 126.9, 126.7, 126.6, 126.5, 126.3 (q, J = 3.0 Hz), 123.7, 121.2 (q, J = 293.0 Hz), 117.4, 116.3, 75.9, 60.6, 47.5, 36.1, 18.6, 17.3; ^{19}F NMR (376 MHz, CDCl_3) δ -62.2. HRMS (ESI) calcd. for $\text{C}_{34}\text{H}_{30}\text{F}_3\text{N}_2\text{O}_3^+$ ($\text{M}+\text{H}$) $^+$ 571.2203, found 571.2198. HPLC (AD-H, *n*-hexane/*i*-PrOH = 80:20, flow rate=1.0 mL/min, I=254 nm) τ_{major} = 26.4 min, τ_{minor} = 16.0 min; $[\alpha]_{\text{D}}^{25}$ 115.8 (c 1.0, CHCl_3 , 95:5 er).

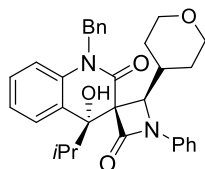
(2R,3S,4'R)-1'-benzyl-2-cyclohexyl-4'-hydroxy-4'-isopropyl-1-phenyl-1',4'-dihydro-2'H-spiro[azetidine-3,3'-quinoline]-2',4-dione (3ao)



56.9 mg, 56%, white solid, ^1H NMR (400 MHz, CDCl_3) δ 7.55-7.52 (m, 1H), 7.48-7.46 (m, 2H), 7.41-7.36 (m, 2H), 7.35-7.26 (m, 5H), 7.25-7.03 (m, 4H), 5.40 (d, J = 15.6 Hz, 1H), 4.75 (d, J = 15.6 Hz, 1H), 4.39 (d, J = 7.2 Hz, 1H), 2.53-2.46 (m, 1H), 2.11 (s, 1H), 1.81-1.11 (m, 11H), 0.90-0.84 (m, 6H); ^{13}C NMR (100 MHz, CDCl_3) δ 167.2, 162.8, 138.6, 137.7, 137.1, 129.0, 128.84, 128.78, 128.2, 127.6, 127.3, 127.0, 124.7, 123.6, 119.6, 115.7, 71.5, 62.3, 48.4, 38.6, 37.0, 31.2, 30.6, 25.8, 18.7, 17.3. HRMS (ESI) calcd. for $\text{C}_{33}\text{H}_{36}\text{N}_2\text{NaO}_3^+$ ($\text{M}+\text{Na}$) $^+$ 531.2618, found 531.2614. HPLC (AD-H, *n*-hexane/*i*-PrOH = 80:20, flow rate=1.0 mL/min, I=254 nm) τ_{major} = 14.2 min, τ_{minor} = 12.5 min; $[\alpha]_{\text{D}}^{25}$ 36.4 (c 1.0, CHCl_3 , 97.5:2.5 er).

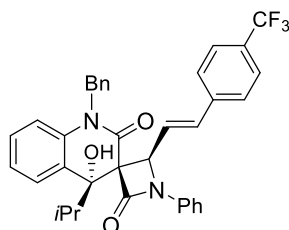
er). HPLC (AD-H, *n*-hexane/*i*-PrOH = 80:20, flow rate=1.0 ml/min, I=254 nm) $\tau_{\text{major}} = 5.7$ min, $\tau_{\text{minor}} = 13.2$ min; $[\alpha]_{\text{D}}^{25} 148.8$ (c 1.0, CHCl₃, 95:5 er).

(3S,4R,4'R)-1'-benzyl-4'-hydroxy-4'-isopropyl-1-phenyl-4-(tetrahydro-2H-pyran-4-yl)-1',4'-dihydro-2'H-spiro[azetidine-3,3'-quinoline]-2,2'-dione (3ap)



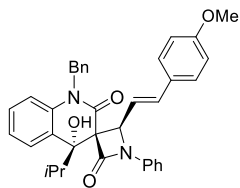
55.1 mg, 54%, white solid, ¹H NMR (400 MHz, CDCl₃) δ 7.58-7.45 (m, 3H), 7.42-7.27 (m, 8H), 7.20-7.08 (m, 3H), 5.46 (d, *J* = 15.2 Hz, 1H), 4.65 (d, *J* = 15.6 Hz, 1H), 4.42 (d, *J* = 7.6 Hz, 1H), 3.71-3.62 (m, 1H), 3.55-3.45 (m, 1H), 3.10-3.00 (m, 1H), 2.95-2.85 (m, 1H), 2.54-2.45 (m, 1H), 2.37 (s, 1H), 1.98-1.87 (m, 1H), 1.14-1.35 (m, 1H), 1.28-1.15 (m, 1H), 1.05-0.97 (m, 1H), 0.86 (t, *J* = 6.4 Hz, 6H), 0.78-0.68 (m, 1H); ¹³C NMR (100 MHz, CDCl₃) δ 167.1, 162.6, 138.5, 137.3, 137.0, 129.2, 129.0, 128.9, 128.4, 127.8, 127.6, 126.8, 125.0, 123.8, 119.8, 115.6, 71.5, 67.5, 67.1, 61.4, 48.6, 37.1, 36.2, 30.6, 30.4, 18.6, 17.3. HRMS (ESI) calcd. for C₃₂H₃₅N₂O₄⁺ (M+H)⁺ 511.2591, found 511.2594. HPLC (AD-H, *n*-hexane/*i*-PrOH = 80:20, flow rate=1.0 mL/min, I=254 nm) $\tau_{\text{major}} = 8.4$ min, $\tau_{\text{minor}} = 31.9$ min; $[\alpha]_{\text{D}}^{25} 93.6$ (c 1.0, CHCl₃, 93.5:6.5 er).

(3S,4R,4'R)-1'-benzyl-4'-hydroxy-4'-isopropyl-1-phenyl-4-((E)-4-(trifluoromethyl)styryl)-1',4'-dihydro-2'H-spiro[azetidine-3,3'-quinoline]-2,2'-dione (3aq)



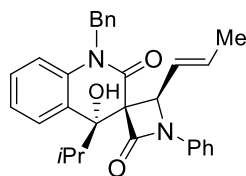
The reaction was performed at room temperature. 75.1 mg, 63%, white solid, ¹H NMR (400 MHz, CDCl₃) δ 7.67-7.58 (m, 1H), 7.49 (d, *J* = 8.4 Hz, 2H), 7.41 (d, *J* = 8.0 Hz, 2H), 7.29-7.21 (m, 4H), 7.18-7.12 (m, 4H), 7.09-7.01 (m, 2H), 6.90-6.78 (m, 3H), 6.24-6.04 (m, 2H), 5.24 (d, *J* = 16.0 Hz, 1H), 4.98 (d, *J* = 7.6 Hz, 1H), 4.65 (d, *J* = 15.6 Hz, 1H), 2.54-2.48 (m, 1H), 2.39 (s, 1H), 1.10 (d, *J* = 6.8 Hz, 3H), 0.85 (d, *J* = 6.8 Hz, 3H); ¹³C NMR (101 MHz, CDCl₃) δ 166.3, 160.7, 138.9, 138.1, 137.3, 136.5, 135.3, 130.0, 129.1, 128.8, 128.4, 127.7, 127.2, 127.2, 127.0, 126.9, 126.5, 126.3, 125.6 (q, *J* = 3.0 Hz), 125.4, 124.3, 123.7, 117.2, 116.1, 77.2, 76.5, 74.1, 58.7, 48.0, 36.1, 18.5, 17.2. HRMS (ESI) calcd. for C₃₆H₃₁F₃N₂O₃⁺ (M+H)⁺ 597.2360, found 597.2354. HPLC (AD-H, *n*-hexane/*i*-PrOH = 80:20, flow rate=1.0 mL/min, I=254 nm) $\tau_{\text{major}} = 14.2$ min, $\tau_{\text{minor}} = 10.8$ min; $[\alpha]_{\text{D}}^{25} 73.4$ (c 1.0, CHCl₃, 94.5:5.5 er).

(2R,3S,4'R)-1'-benzyl-4'-hydroxy-4'-isopropyl-2-((E)-4-methoxystyryl)-1-phenyl-1',4'-dihydro-2'H-spiro[azetidine-3,3'-quinoline]-2',4'-dione (3ar)



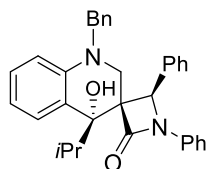
The reaction was performed at room temperature. 68.1 mg, 61%, white solid, ^1H NMR (400 MHz, CDCl_3) δ 7.61 (d, $J = 4.8$ Hz, 1H), 7.47 (d, $J = 7.6$ Hz, 2H), 7.28-7.07 (m, 10H), 6.92 (t, $J = 7.2$ Hz, 2H), 6.82 (d, $J = 6.8$ Hz, 3H), 6.11 (d, $J = 16.0$ Hz, 1H), 6.05-5.93 (m, 1H), 5.24 (d, $J = 15.6$ Hz, 1H), 4.97 (d, $J = 8.4$ Hz, 1H), 4.76 (d, $J = 15.6$ Hz, 1H), 3.84 (s, 3H), 2.63-2.50 (m, 1H), 2.39 (s, 1H), 1.10 (d, $J = 6.4$ Hz, 3H), 0.87 (d, $J = 6.4$ Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 166.5, 160.9, 159.8, 138.0, 137.4, 136.5, 136.4, 128.9, 128.7, 128.5, 128.4, 128.2, 127.0, 126.9, 126.8, 124.1, 123.5, 120.8, 117.3, 116.1, 114.0, 76.5, 73.9, 59.3, 55.4, 47.7, 36.2, 18.4, 17.2. HRMS (ESI) calcd. for $\text{C}_{36}\text{H}_{35}\text{N}_2\text{O}_3^+$ ($\text{M}+\text{H}$) $^+$ 559.2591, found 559.2582. HPLC (AD-H, *n*-hexane/*i*-PrOH = 80:20, flow rate=1.0 mL/min, I=254 nm) τ_{major} = 23.3 min, τ_{minor} = 18.9 min; $[\alpha]_{\text{D}}^{25}$ 120.6 (c 1.0, CHCl_3 , 92.5:7.5 er).

(3S,4R,4'R)-1'-benzyl-4'-hydroxy-4'-isopropyl-1-phenyl-4-((E)-prop-1-en-1-yl)-1',4'-dihydro-2'H-spiro[azetidine-3,3'-quinoline]-2,2'-dione (3as)



The reaction was performed at room temperature. 62.5 mg, 67%, white solid, ^1H NMR (400 MHz, CDCl_3) δ 7.60-7.52 (m, 1H), 7.47-7.27 (m, 9H), 7.25-7.21 (m, 1H), 7.16 (t, $J = 7.6$ Hz, 1H), 7.08 (t, $J = 7.2$ Hz, 1H), 6.96 (d, $J = 8.0$ Hz, 1H), 5.52-5.26 (m, 3H), 4.77 (d, $J = 8.4$ Hz, 1H), 4.67 (d, $J = 16.0$ Hz, 1H), 2.56-2.49 (m, 1H), 2.34 (s, 1H), 1.51 (d, $J = 6.0$ Hz, 3H), 1.08 (d, $J = 6.8$ Hz, 3H), 0.86 (d, $J = 6.8$ Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 166.6, 160.9, 138.2, 137.1, 134.0, 128.8, 128.7, 127.4, 127.3, 126.8, 125.1, 117.4, 115.7, 77.2, 76.4, 73.2, 58.9, 48.0, 36.1, 18.4, 18.0, 17.2. HRMS (ESI) calcd. for $\text{C}_{30}\text{H}_{31}\text{N}_2\text{O}_3^+$ ($\text{M}+\text{H}$) $^+$ 467.2329, found 467.2328. HPLC (IC-H, *n*-hexane/*i*-PrOH = 80:20, flow rate=1.0 mL/min, I=254 nm) τ_{major} = 8.1 min, τ_{minor} = 16.2 min; $[\alpha]_{\text{D}}^{25}$ 125.4 (c 1.0, CHCl_3 , 91.5:8.5 er).

(3S,4R,4'R)-1'-benzyl-4'-hydroxy-4'-isopropyl-1,4-diphenyl-1',4'-dihydro-2'H-spiro[azetidine-3,3'-quinolin]-2-one (8aa)

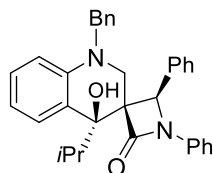


The product was synthesized according to the standard procedure as **3aa**.

39.2 mg, 41%, white solid. ^1H NMR (400 MHz, CDCl_3) δ 7.50 (dd, $J = 7.6, 1.2$ Hz, 1H), 7.30-7.26 (m, 2H), 7.24-7.10 (m, 10H), 7.03-6.98 (m, 1H), 6.85 (t, $J = 7.6$ Hz, 1H), 6.75-6.73 (m, 2H), 6.29 (d, $J = 8.4$ Hz, 1H), 4.97 (s, 1H), 4.00 (d, $J = 16.0$ Hz, 1H), 3.58 (d, $J = 12.4$ Hz, 1H), 3.41 (d, $J = 15.6$ Hz, 1H), 3.15 (d, $J = 12.4$ Hz, 1H), 2.34-2.26 (m, 1H), 2.23 (s, 1H), 1.38 (d, $J = 6.8$ Hz, 3H), 0.78 (d, $J = 6.8$ Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 165.7, 144.1, 137.7, 136.7, 134.1, 128.9, 128.6, 128.1, 128.1, 128.0,

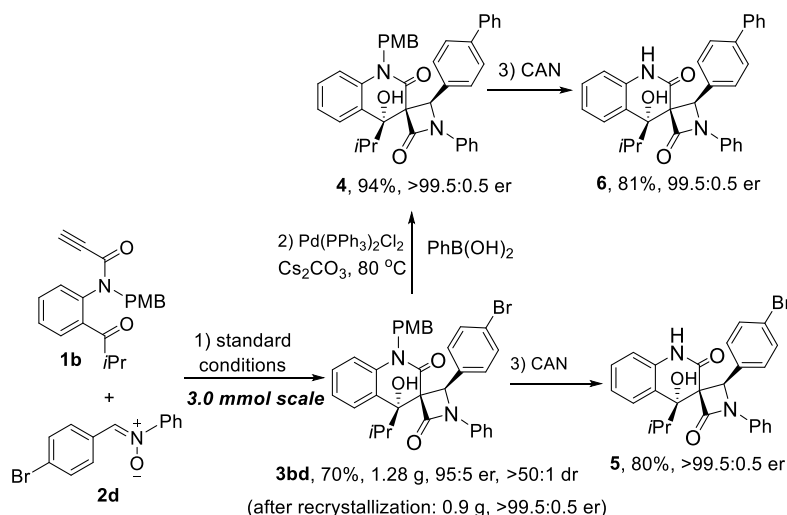
126.9, 126.8, 117.6, 116.4, 112.0, 76.8, 67.9, 61.3, 54.6, 47.7, 32.9, 18.5, 17.2. HRMS (ESI) calcd. for $C_{33}H_{33}N_2O_2^+ (M+H)^+$ 489.2537, found 489.2532. HPLC (AD-H, *n*-hexane/*i*-PrOH = 80:20, flow rate=1.0 mL/min, I=254 nm) τ_{major} = 8.6 min, τ_{minor} = 5.7 min; $[\alpha]_D^{25}$ 103.4 (c 1.0, CHCl₃, 92.5:7.5 er).

(3*S*,4*R*,4'*S*)-1'-benzyl-4'-hydroxy-4'-isopropyl-1,4-diphenyl-1',4'-dihydro-2'H-spiro[azetidine-3,3'-quinolin]-2-one(8aa')



The product was isolated in the synthesis of **8aa** by silica gel column chromatography (ethyl acetate/petroleum ether = 1:5). 26.7 mg, 27%, white solid, 1H NMR (400 MHz, CDCl₃) δ 7.39-7.29 (m, 8H), 7.25-7.16 (m, 7H), 7.14-7.06 (m, 1H), 7.00 (t, *J* = 7.6 Hz, 1H), 6.47 (d, *J* = 8.0 Hz, 1H), 5.62 (s, 1H), 4.54 (d, *J* = 17.2 Hz, 1H), 4.34 (d, *J* = 17.6 Hz, 1H), 3.46 (d, *J* = 12.8 Hz, 1H), 3.02 (d, *J* = 12.8 Hz, 1H), 2.36-2.29 (m, 1H), 2.16 (s, 1H), 1.22 (d, *J* = 6.8 Hz, 3H), 0.78 (d, *J* = 6.8 Hz, 3H); ^{13}C NMR (100 MHz, CDCl₃) δ 167.6, 143.7, 137.3, 137.0, 128.9, 128.8, 128.7, 128.6, 128.5, 127.9, 126.8, 126.4, 125.1, 124.5, 123.8, 117.4, 116.0, 110.8, 74.9, 66.2, 59.7, 54.0, 49.6, 35.1, 18.7, 18.3. HRMS (ESI) calcd. for $C_{33}H_{33}N_2O_2^+ (M+H)^+$ 489.2537, found 489.2532. HPLC (IC-H, *n*-hexane/*i*-PrOH = 80:20, flow rate=1.0 mL/min, I=254 nm) τ_{major} = 5.9 min, τ_{minor} = 4.9 min; $[\alpha]_D^{25}$ 78.6 (c 1.0, CHCl₃, 93.5:6.5 er).

IV. Synthetic Transformations



Gram synthesis of 3bd: A mixture of Cu(OTf)₂ (0.30 mmol, 105 mg, 10 mol%) with (4*S*,4'*S*)-**L6** (**L6**, 0.36 mmol, 219 mg, 12 mol%) in dry C₆H₅CF₃ (20 mL) was stirred at room temperature for 2 h under the atmosphere of argon. Then, corresponding propiolamide **1b** (3.0 mmol, 1.0 equiv.), nitron **2d** (3.6 mmol, 1.2 equiv.), *t*BuOLi (4.5 mmol, 0.36 g, 1.5 equiv.) and dry C₆H₅CF₃ (5 mL) were added to the mixture at 0 °C and the reaction mixture was stirred at this temperature for 12 hours. After the reaction was complete (monitored by TLC), the solvent was removed in vacuum. Then H₂O (50.0 mL) and ethyl acetate (50.0 mL) were added into the mixture. The organic phase was separated, and the aqueous phase was extracted with ethyl acetate (50.0 mL $\times$ 3). The combined

organic phase was washed with H₂O and brine, dried over Na₂SO₄. The solvent was removed under reduced pressure. The residue was purified by flash chromatography (ethyl acetate/petroleum ether = 1:4) to afford the desired products **3bd** in 70% yield with 95:5 er. The e.r. value of **3bd** was increased to 99.5:0.5 after single recrystallization in ethyl acetate and petroleum ether.

¹H NMR (400 MHz, CDCl₃) δ 7.67-7.59 (m, 1H), 7.38-7.11 (m, 9H), 7.08-7.00 (m, 1H), 6.99-6.32 (m, 7H), 5.38 (s, 1H), 4.97 (d, *J* = 15.6 Hz, 1H), 4.25 (d, *J* = 15.6 Hz, 1H), 3.79 (s, 3H), 2.58-2.48 (m, 1H), 2.45 (s, 1H), 1.07 (d, *J* = 6.8 Hz, 3H), 0.84 (d, *J* = 6.8 Hz, 3H); ¹³C NMR (100 MHz, CDCl₃) δ 165.6, 161.3, 158.6, 138.3, 136.4, 132.3, 131.7, 129.4, 129.0, 128.3, 127.8, 126.8, 124.3, 123.7, 122.9, 117.5, 116.4, 114.0, 75.2, 59.6, 55.3, 47.6, 36.3, 18.6, 17.3. HRMS (ESI) calcd. for C₃₄H₃₂BrN₂O₄⁺ (M+H)⁺ 611.1540, found 611.1540. HPLC (AD-H, *n*-hexane/*i*-PrOH = 80:20, flow rate=1.0 mL/min, I=254 nm) τ_{major} = 15.8 min, τ_{minor} = 10.2 min; [α]_D²⁵ 106.0 (c 1.0, CHCl₃, 99.5:0.5 er).

Synthesis of 4: A mixture of **3bd** (0.2 mmol, 121 mg), Pd(Cl)₂PPh₂ (0.02 mmol, 15.4 mg, 10 mol%), and Cs₂CO₃ (0.6 mmol, 195 mg, 3 equiv.) in Dioxane/H₂O=1:1 (2.2 mL) was stirred in 40 °C for 8 hours under the argon atmosphere. After the reaction was completed, the mixture was concentrated in vacuum and then loaded on silica column (ethyl acetate/petroleum ether = 1:3) to afford the title compound **4** as a white solid in 94% yield (114.4 mg), with 99.5:0.5 er.

¹H NMR (400 MHz, DMSO-*d*₆) δ 7.77-7.69 (m, 2H), 7.65-7.55 (m, 3H), 7.46 (t, *J* = 7.7 Hz, 2H), 7.41-7.32 (m, 2H), 7.30 (d, *J* = 7.3 Hz, 2H), 7.28-7.20 (m, 4H), 7.07 (t, *J* = 7.3 Hz, 1H), 6.84-6.61 (m, 3H), 6.44-6.32 (m, 4H), 6.10 (s, 1H), 5.61 (s, 1H), 4.86 (d, *J* = 15.9 Hz, 1H), 4.25 (d, *J* = 16.3 Hz, 1H), 3.26 (s, 3H), 2.48-2.40 (m, 1H), 0.92 (d, *J* = 6.7 Hz, 3H), 0.75 (d, *J* = 6.8 Hz, 3H); ¹³C NMR (100 MHz, DMSO-*d*₆) δ 166.3, 161.9, 158.2, 140.3, 139.3, 138.4, 137.1, 133.0, 129.6, 129.5, 129.2, 128.9, 128.6, 128.5, 128.2, 127.7, 127.5, 126.9, 126.7, 124.4, 123.7, 117.5, 116.4, 114.0, 76.3, 75.3, 59.5, 54.8, 35.8, 18.7, 18.0. HRMS (ESI) calcd. for C₄₀H₃₇N₂O₄⁺ (M+H)⁺ 609.2748, found 609.2743. HPLC (AD-H, *n*-hexane/*i*-PrOH = 80:20, flow rate=1.0 mL/min, I=254 nm) τ_{major} = 19.0 min, τ_{minor} = 8.2 min; [α]_D²⁵ 90.6 (c 1.0, CHCl₃, 99.5:0.5 er).

Synthesis of 5: A mixture of **3bd** (0.2 mmol, 121 mg), Ce(NH₄)₂(NO₃)₆ (0.6 mmol, 329 mg, 3.0 equiv.) in DCM (2 mL) was stirred in room temperature for 12 hours. After the reaction was completed, the mixture was quenched with H₂O and extracted with ethyl acetate, dried over Na₂SO₄. The organic phase was concentrated in vacuum and the residue was loaded on silica column (ethyl acetate/petroleum ether = 1:5) to afford the title compound **5** as a white solid in 80% yield (78.4 mg) and with 99.5:0.5 er.

¹H NMR (400 MHz, DMSO-*d*₆) δ 9.99 (s, 1H), 7.52-7.48 (m, 1H), 7.37 (d, *J* = 8.8 Hz, 2H), 7.30 (t, *J* = 7.9 Hz, 2H), 7.28-7.24 (m, 1H), 7.23-7.17 (m, 2H), 7.15-7.10 (m, 1H), 7.07 (t, *J* = 7.3 Hz, 1H), 6.63-6.50 (m, 3H), 5.97 (s, 1H), 5.55 (s, 1H), 2.45-2.40 (m, 1H), 0.89 (d, *J* = 6.8 Hz, 3H), 0.79 (d, *J* = 6.8 Hz, 3H); ¹³C NMR (100 MHz, DMSO-*d*₆) δ 166.4, 161.9, 137.0, 136.2, 133.3, 131.3, 129.8, 129.7, 129.2, 127.8, 125.9, 124.4, 122.6, 122.1, 117.4, 115.7, 76.9, 75.5, 58.9, 36.2, 18.7, 17.9. HRMS (ESI) calcd. for C₂₆H₂₄BrN₂O₃⁺ (M+H)⁺ 491.0965, found 491.0965. HPLC (AD-H, *n*-hexane/*i*-PrOH = 90:10, flow rate=1.0 mL/min, I=254 nm) τ_{major} = 29.6 min, τ_{minor} = 8.3 min; [α]_D²⁵ 74.6 (c 1.0, CHCl₃, 99.5:0.5 er).

Synthesis of 6: A mixture of **4** (0.2 mmol, 121 mg), Ce(NH₄)₂(NO₃)₆ (0.6 mmol, 329 mg, 3.0 equiv.) in DCM (2 mL) was stirred in room temperature for 12 hours. After the reaction was completed, the

mixture was quenched with H₂O and extracted with ethyl acetate, dried over Na₂SO₄. The organic phase was concentrated in vacuum and the residue was loaded on silica column (ethyl acetate/petroleum ether = 1:2) to afford the title compound **6** as a white solid in 81% yield (79.1 mg) with 99.5:0.5 er.

¹H NMR (400 MHz, CDCl₃) δ 7.62 (d, *J* = 7.7 Hz, 1H), 7.52 (d, *J* = 7.9 Hz, 2H), 7.45-7.28 (m, 6H), 7.25 (d, *J* = 11.2 Hz, 4H), 7.13-6.97 (m, 2H), 6.92-6.63 (m, 2H), 6.43 (d, *J* = 8.0 Hz, 1H), 5.51 (s, 1H), 2.65-2.53 (m, 1H), 2.41 (s, 1H), 1.06 (d, *J* = 6.8 Hz, 3H), 0.91 (d, *J* = 6.8 Hz, 3H); ¹³C NMR (150 MHz, CDCl₃) δ 166.2, 161.1, 141.3, 140.2, 136.7, 134.6, 131.51, 131.49, 129.2, 129.0, 128.8, 127.8, 127.5, 127.0, 126.7, 125.3, 124.3, 123.4, 117.6, 115.6, 75.1, 60.0, 36.9, 18.6, 17.3, 17.3. HRMS (ESI) calcd. for C₃₂H₂₈N₂NaO₃⁺ (M+Na)⁺ 511.1992, found 511.1975. HPLC (AD-H, *n*-hexane/*i*-PrOH = 80:20, flow rate=1.0 mL/min, I=254 nm) τ_{major} = 8.0 min, τ_{minor} = 5.4 min; [α]_D²⁵ 88.6 (c 1.0, CHCl₃, 99.5:0.5 er).

V. Epimerization of **3aa'** to **3aa**

A mixture of **3aa'** (0.1 mmol, 1.0 equiv., 95.5:4.5 er), *t*BuOLi (12 mg, 0.15mmol, 1.5 equiv.) in PhCF₃ (1 mL) was stirred at 0 °C for 12 hours. The solvent was removed in vacuum. Then H₂O (5.0 mL) and ethyl acetate (5.0 mL) were added into the mixture. The organic phase was separated, and the aqueous phase was extracted with ethyl acetate (5.0 mL × 3). The combined organic phase was washed with H₂O and brine, dried over Na₂SO₄. The solvent was removed under reduced pressure. The residue was purified by flash chromatography to afford **3aa** (0.098mmol, 49.2mg, 95.5:4.5er). At room temperature, the transformation was completed in 2 hours.

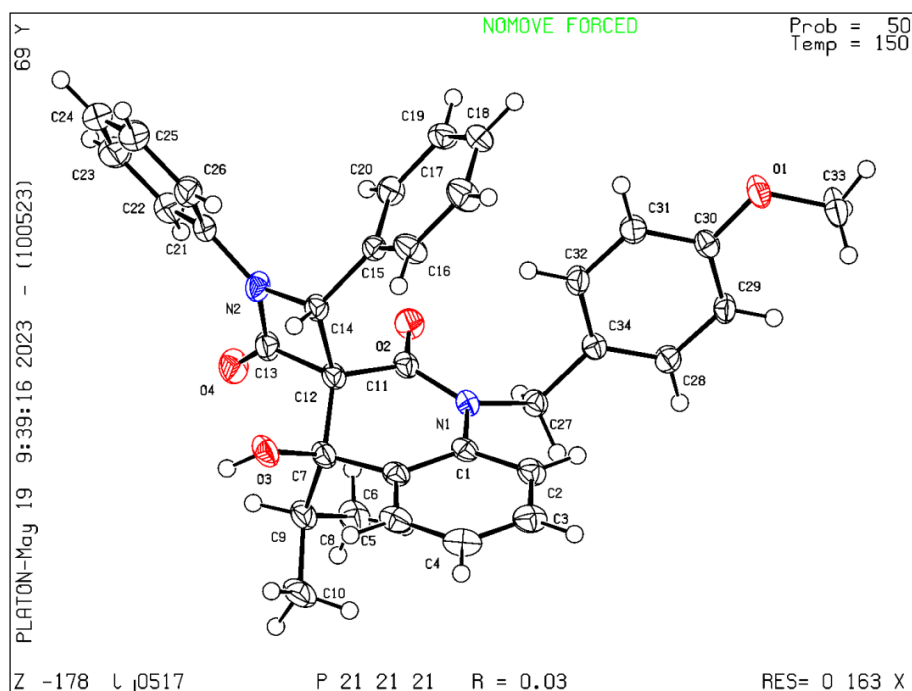
VI. X-Ray Crystallographic Data of **3ba** and **3ba'**

X-Ray Crystallographic Data of **3ba**

Compounds **3ba** were collected at 100 K on a Rigaku Oxford Diffraction Supernova Dual Source, Cu at Zero equipped with an AtlasS2 CCD using Cu Kα radiation. The data were collected and processed using CrysAlisPro22.

The chiral **3ba** was completely dissolved in ethyl acetate (0.3 mL). Hexanes (1.0 mL) was added slowly to the solution at room temperature. The solvent diffused slowly, and the single crystal was obtained after two days. The structure in Figure S1 showed the absolute configuration of **3ba** is (2R,3S,4'R). The CCDC number is 2267696. These details can be obtained free of charge via www.ccdc.com.ac.uk/data_request/cif from the Cambridge Crystallographic Data Centre.

Figure S1. Thermal Ellipsoid Plot for **3ba (30% probability level)**



Crystal Data for 3ba

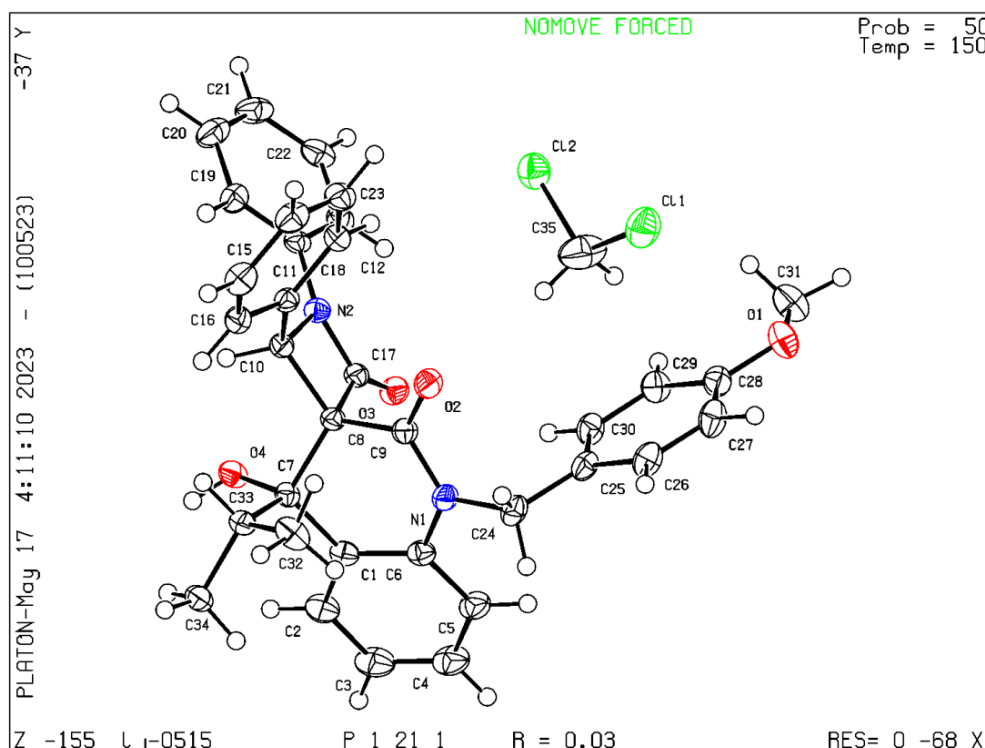
Identification code	LJ0517
Empirical formula	C ₃₄ H ₃₂ N ₂ O ₄
Formula weight	532.61
Temperature/K	150.00(10)
Crystal system	orthorhombic
Space group	P2 ₁ 2 ₁ 2 ₁
a/Å	6.87031(10)
b/Å	18.6297(3)
c/Å	21.5547(3)
α/°	90
β/°	90
γ/°	90
Volume/Å ³	2758.83(7)
Z	4
ρ _{calc} /cm ³	1.282
μ/mm ⁻¹	0.673
F(000)	1128.0
Crystal size/mm ³	0.16 × 0.13 × 0.11
Radiation	Cu Kα (λ = 1.54184)
2θ range for data collection/°	6.27 to 147.916
Index ranges	-8 ≤ h ≤ 5, -19 ≤ k ≤ 22, -26 ≤ l ≤ 24
Reflections collected	16646
Independent reflections	5482 [R _{int} = 0.0285, R _{sigma} = 0.0297]
Data/restraints/parameters	5482/0/366
Goodness-of-fit on F ²	1.051
Final R indexes [I ≥ 2σ (I)]	R ₁ = 0.0317, wR ₂ = 0.0781
Final R indexes [all data]	R ₁ = 0.0358, wR ₂ = 0.0799
Largest diff. peak/hole / e Å ⁻³	0.17/-0.14
Flack/Hooft parameter	0.09(8)/0.08(8)

X-Ray Crystallographic Data of 3ba'

Compounds **3ba'** were collected at 100 K on a Rigaku Oxford Diffraction Supernova Dual Source, Cu at Zero equipped with an AtlasS2 CCD using Cu K α radiation. The data were collected and processed using CrysAlisPro22.

The chiral **3ba'** was completely dissolved in DCM (0.3 mL). Hexanes (1.0 mL) was added slowly to the solution at room temperature. The solvent diffused slowly, and the single crystal was obtained after two days. The structure in Figure S2 showed the absolute configuration of **3ba'** is (2R,3S,4'R). The CCDC number is 2267697. These details can be obtained free of charge via www.ccdc.com.ac.uk/data_request/cif from the Cambridge Crystallographic Data Centre.

Figure S2. Thermal Ellipsoid Plot for 3ba' (30% probability level)

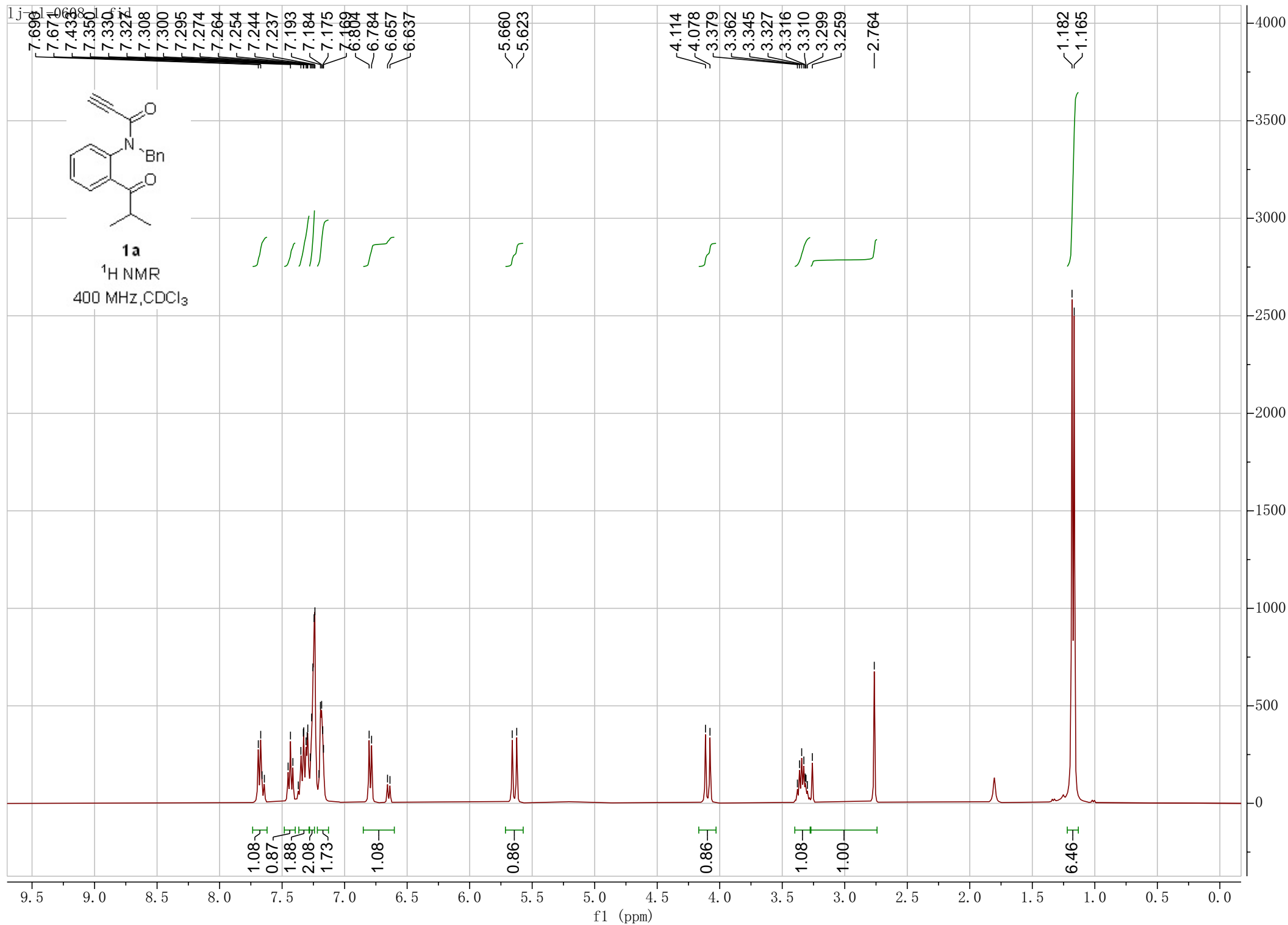


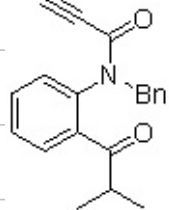
Crystal data and structure refinement for LJ-0515.

Identification code	LJ-0515
Empirical formula	C ₃₅ H ₃₄ Cl ₂ N ₂ O ₄
Formula weight	617.54
Temperature/K	149.99(10)
Crystal system	monoclinic
Space group	P2 ₁
a/Å	12.9975(2)
b/Å	8.1026(2)
c/Å	14.7406(3)
α /°	90
β /°	103.744(2)
γ /°	90
Volume/Å ³	1507.93(5)

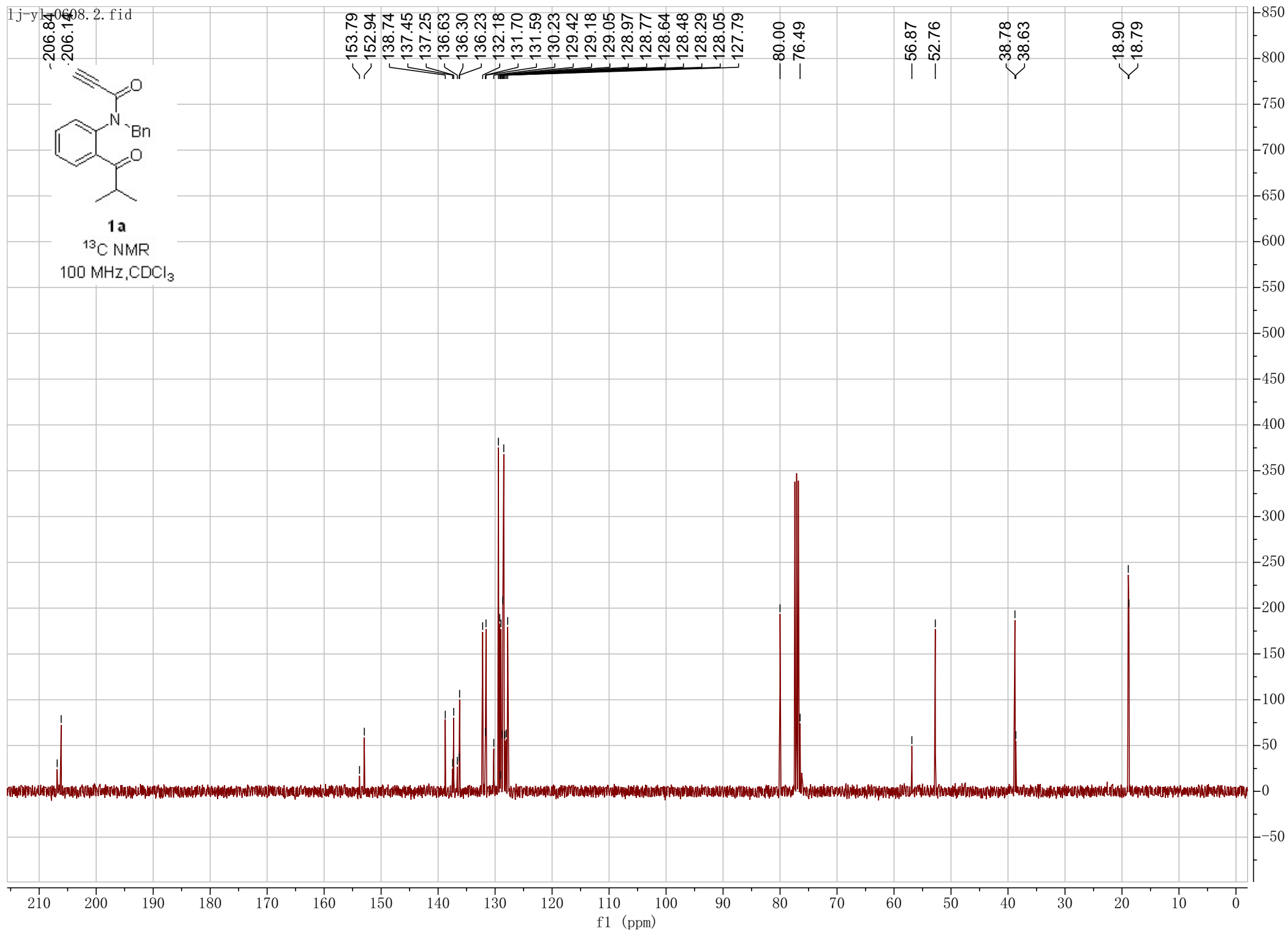
Z	2
$\rho_{\text{calc}}/\text{g}/\text{cm}^3$	1.360
μ/mm^{-1}	2.283
F(000)	648.0
Crystal size/ mm^3	$0.15 \times 0.14 \times 0.11$
Radiation	Cu K α ($\lambda = 1.54184$)
2 Θ range for data collection/ $^\circ$	6.172 to 148.21
Index ranges	$-16 \leq h \leq 16, -9 \leq k \leq 9, -18 \leq l \leq 18$
Reflections collected	14476
Independent reflections	5721 [$R_{\text{int}} = 0.0342, R_{\text{sigma}} = 0.0386$]
Data/restraints/parameters	5721/1/392
Goodness-of-fit on F^2	1.066
Final R indexes [$I \geq 2\sigma(I)$]	$R_1 = 0.0334, wR_2 = 0.0825$
Final R indexes [all data]	$R_1 = 0.0357, wR_2 = 0.0837$
Largest diff. peak/hole / $e \text{ \AA}^{-3}$	0.16/-0.25
Flack/Hooft parameter	-0.008(9)/-0.005(6)

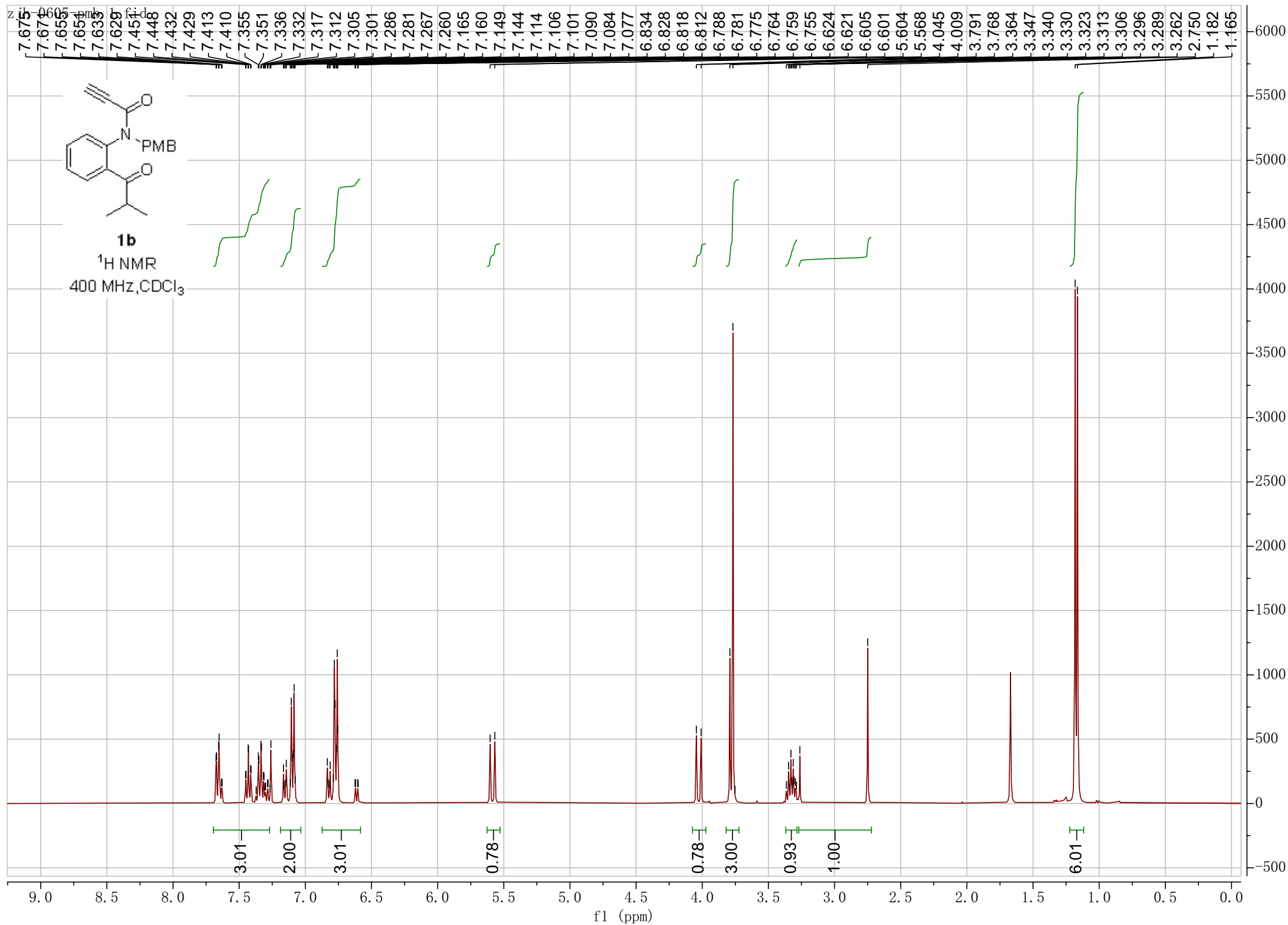
VII. NMR and HPLC Spectra

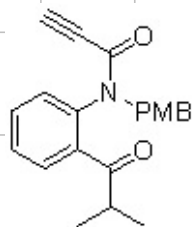


**1a**

^{13}C NMR
100 MHz, CDCl_3

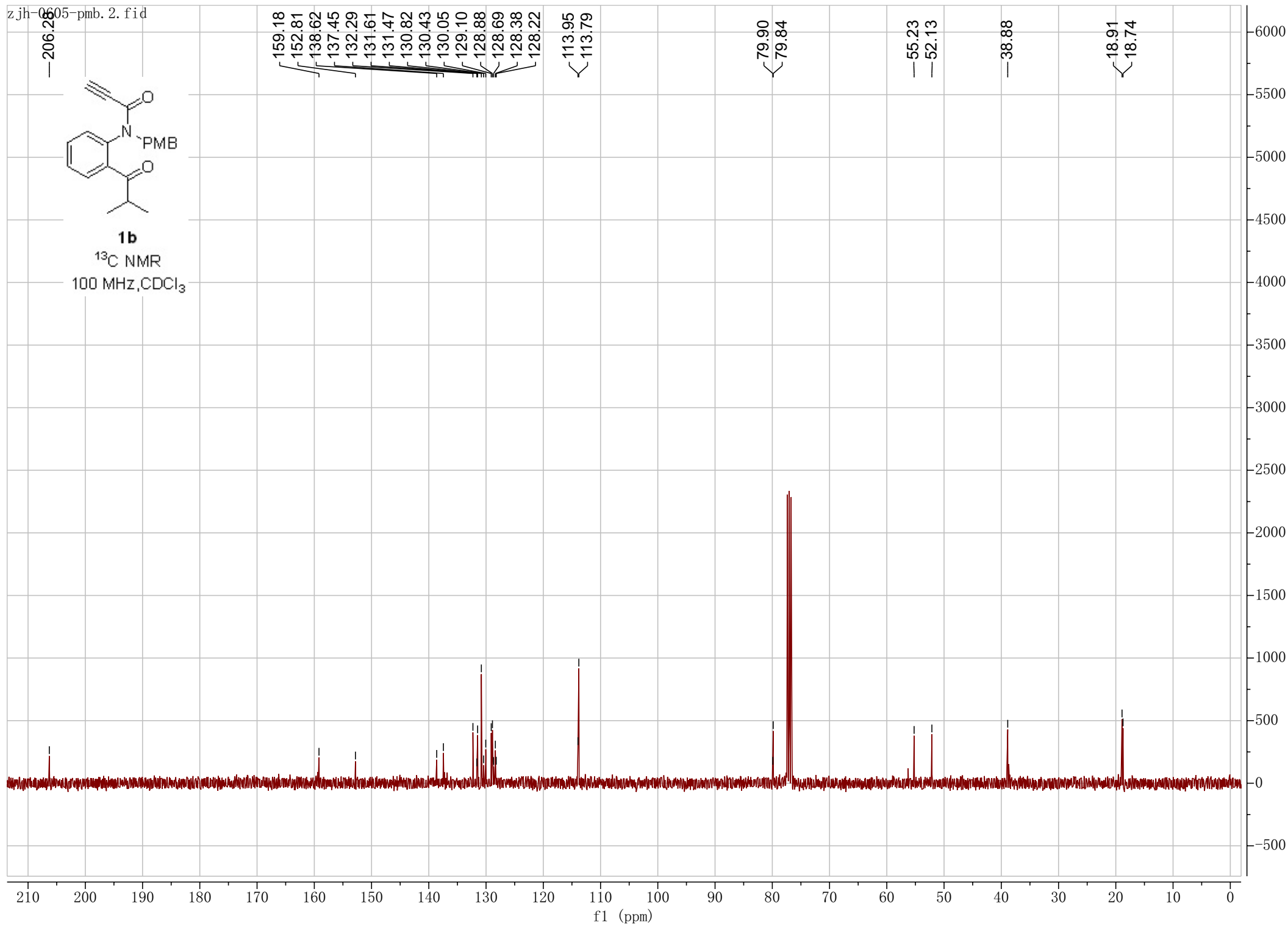


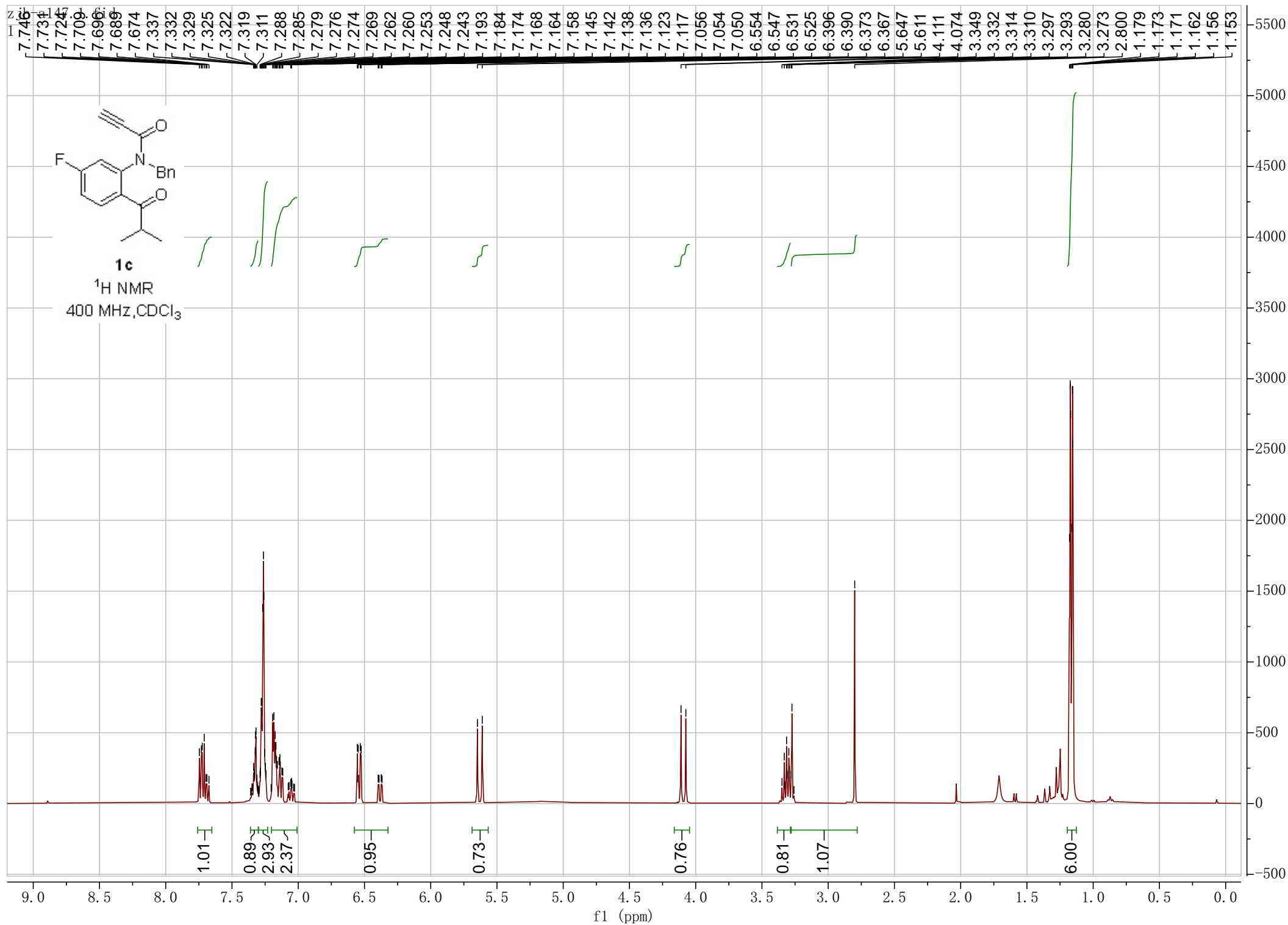




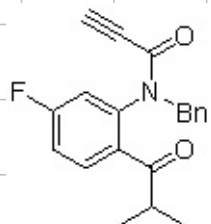
1b

^{13}C NMR
100 MHz, CDCl_3



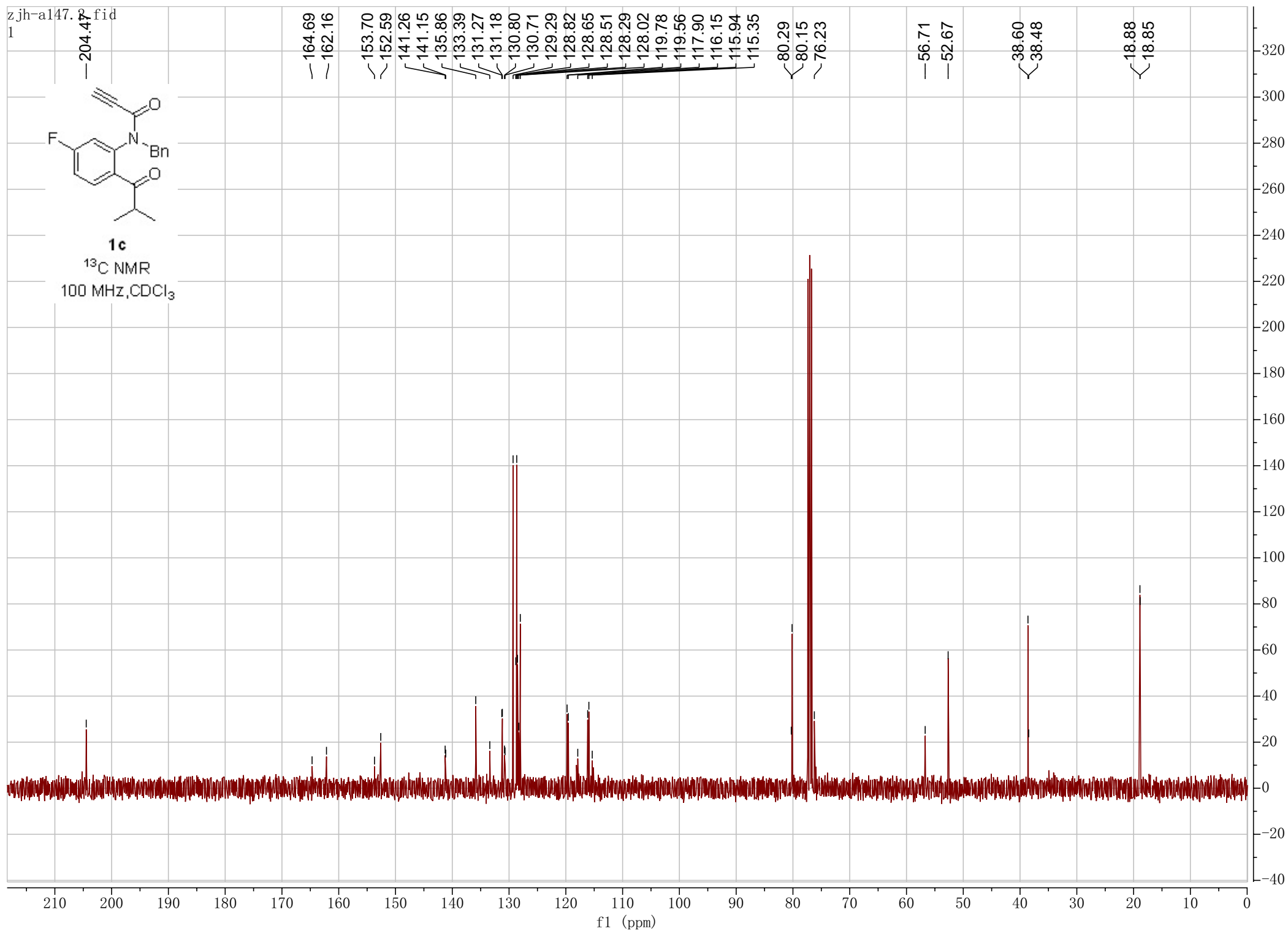


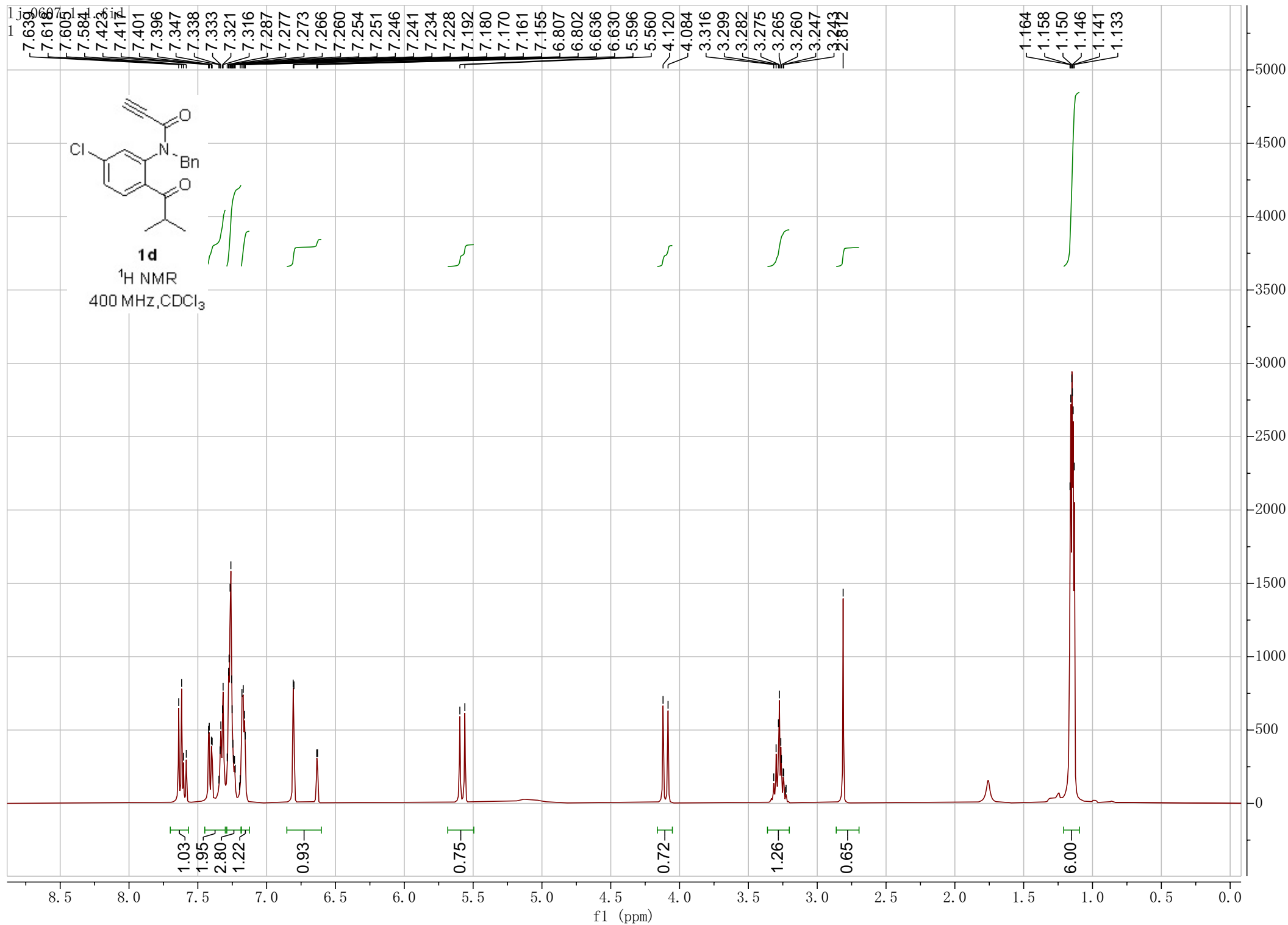
zjh-a147.8 fid
1



1c

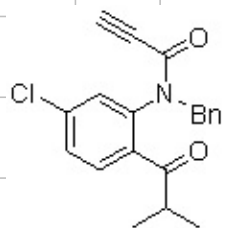
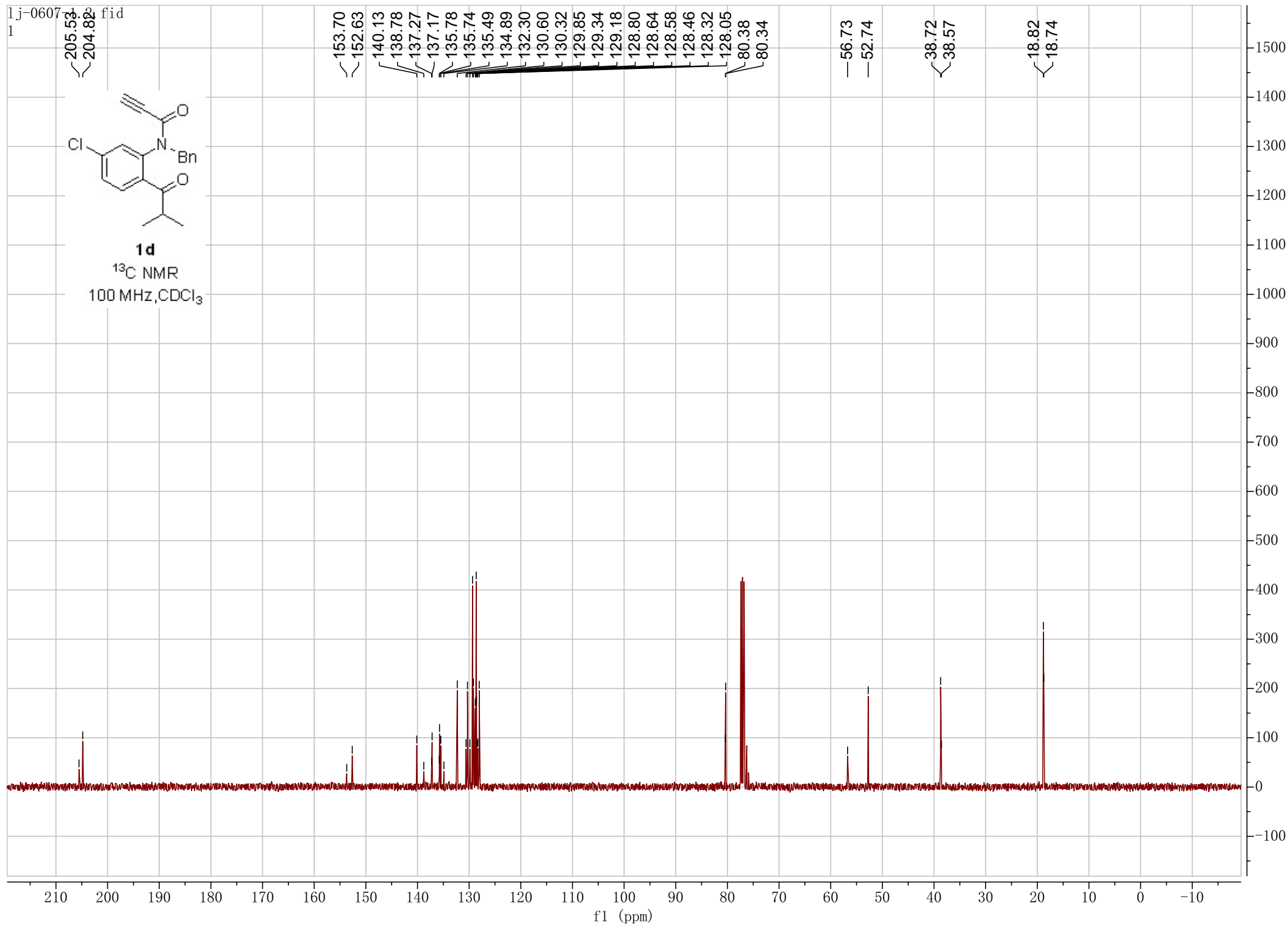
^{13}C NMR
100 MHz, CDCl_3

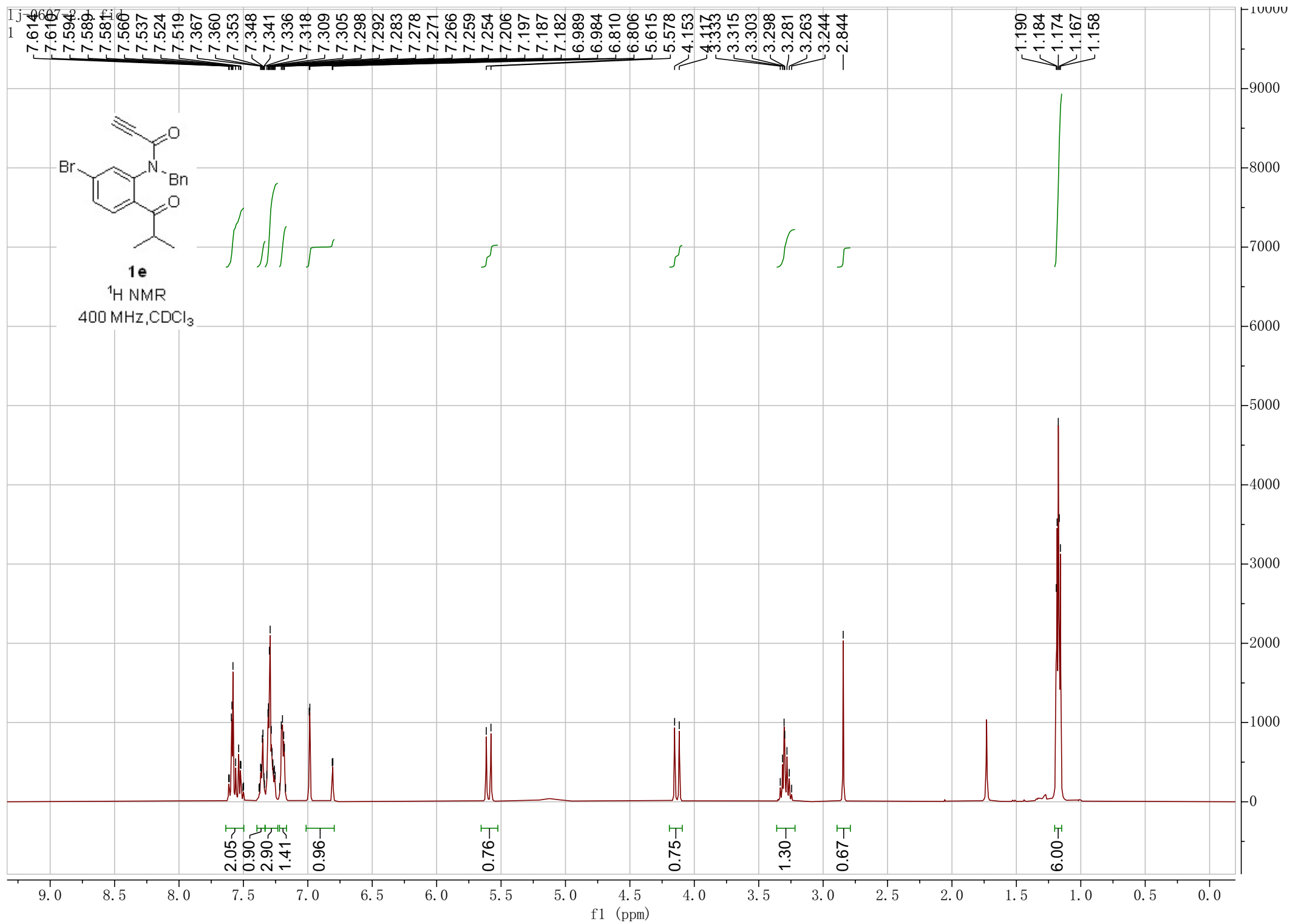


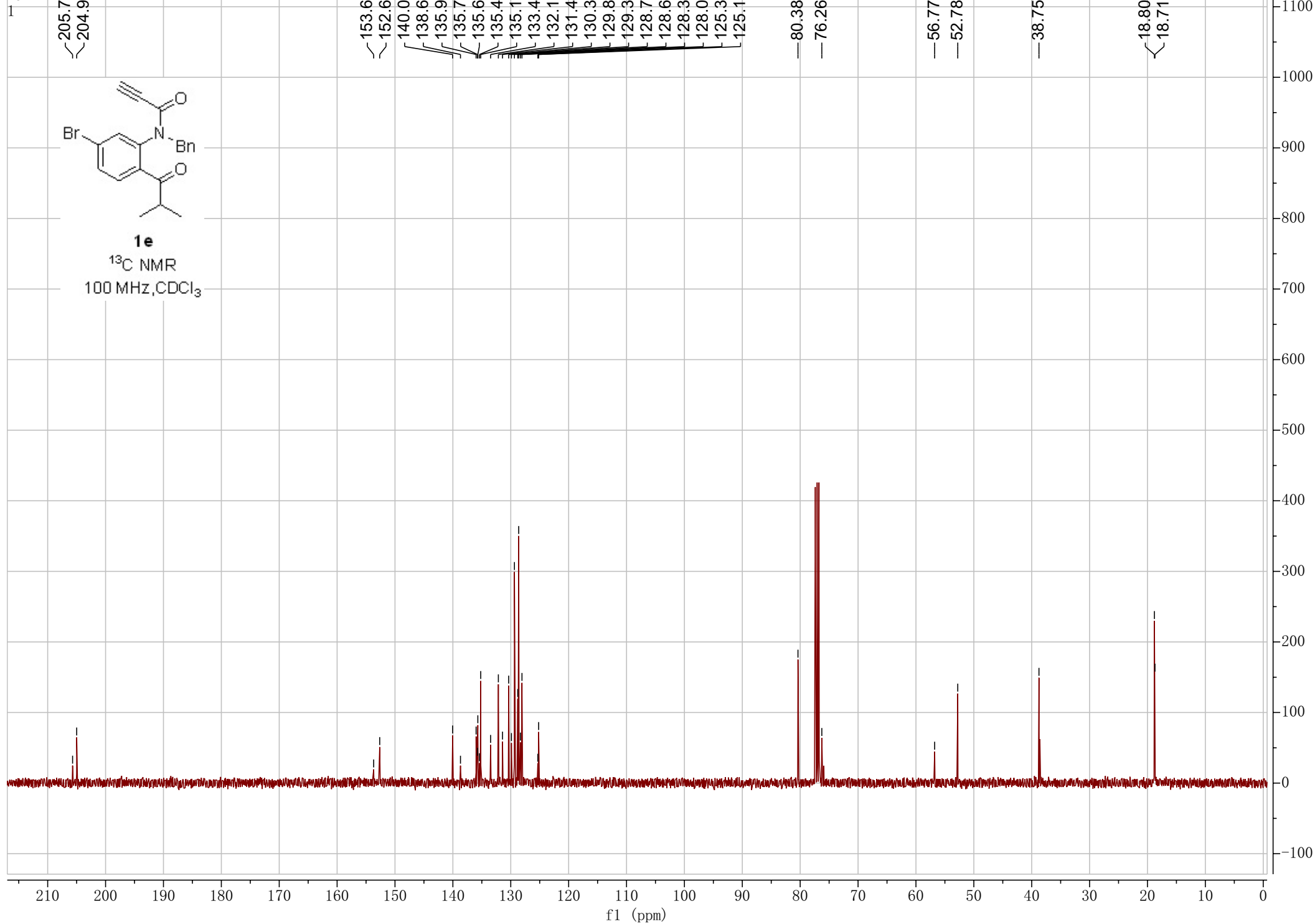


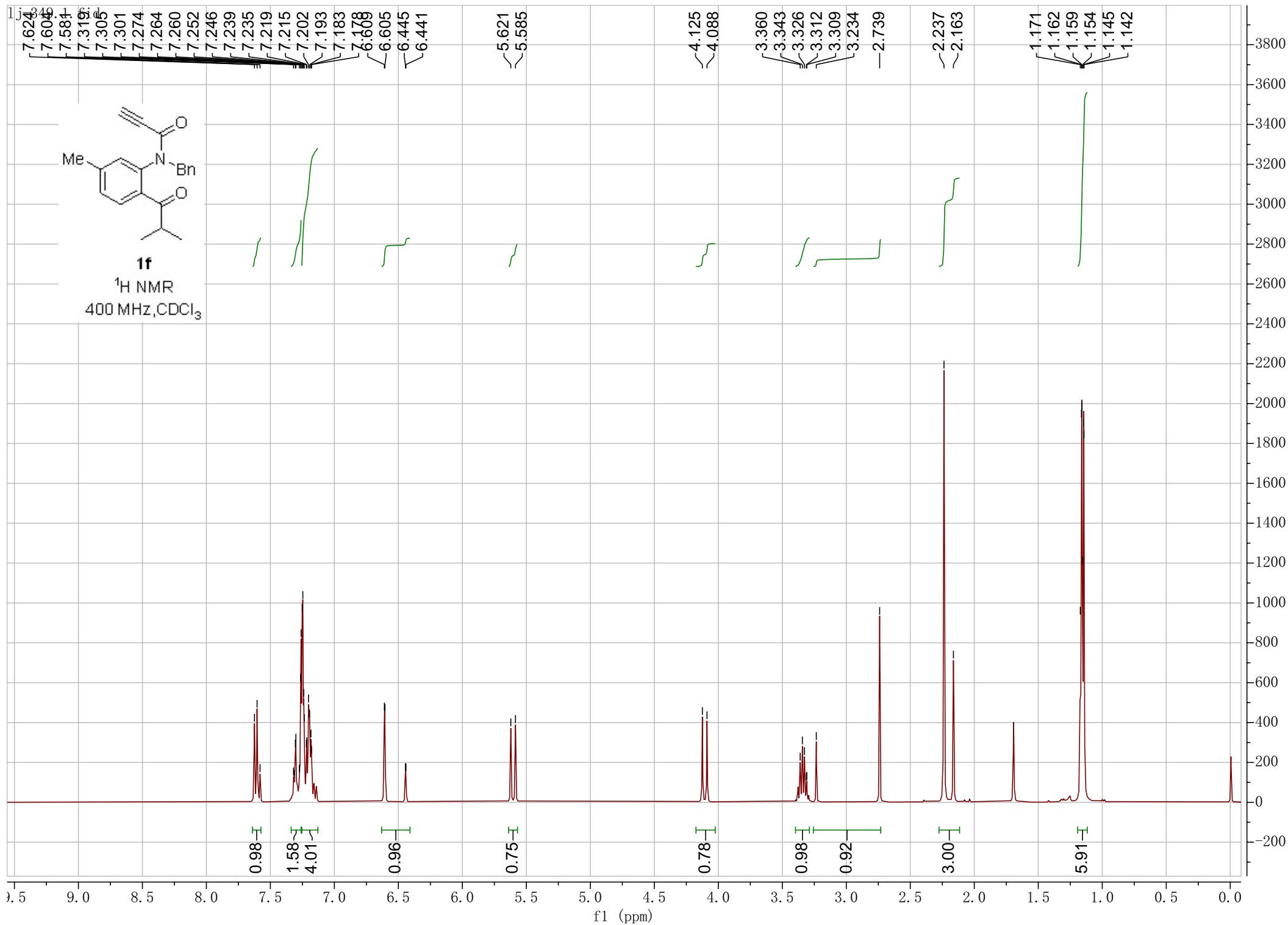
lj-06072.fid

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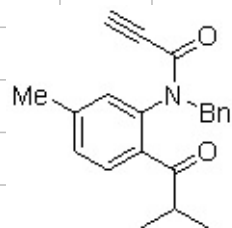
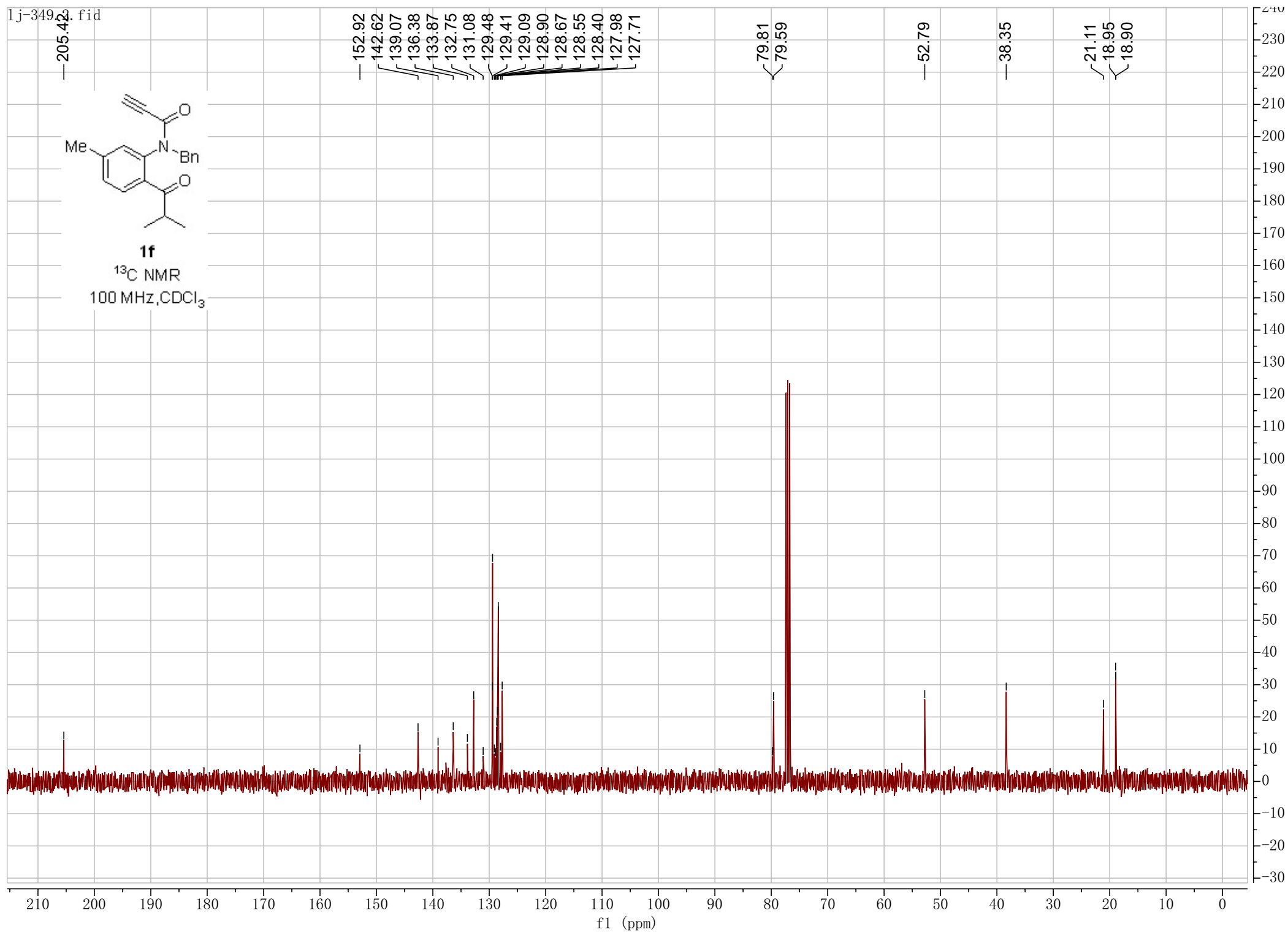
**1d**¹³C NMR
100 MHz, CDCl₃



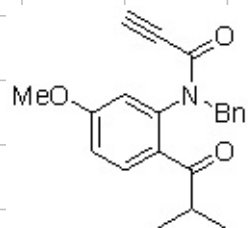




lj-3492.fid

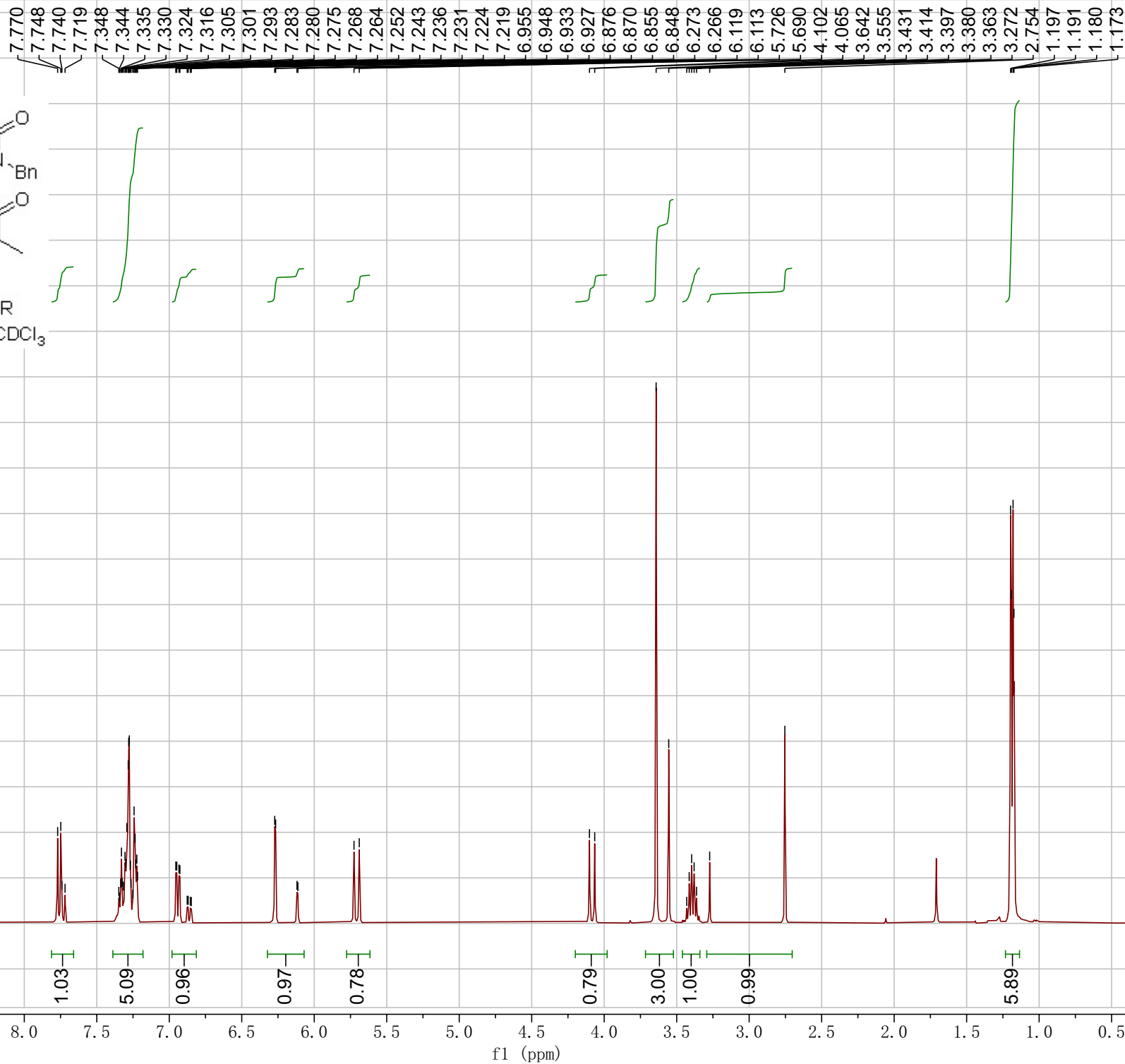
**1f**¹³C NMR
100 MHz, CDCl₃

lj366-2.1.fid
1H

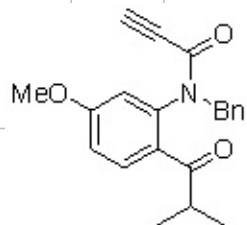


1g

¹H NMR
400 MHz, CDCl₃

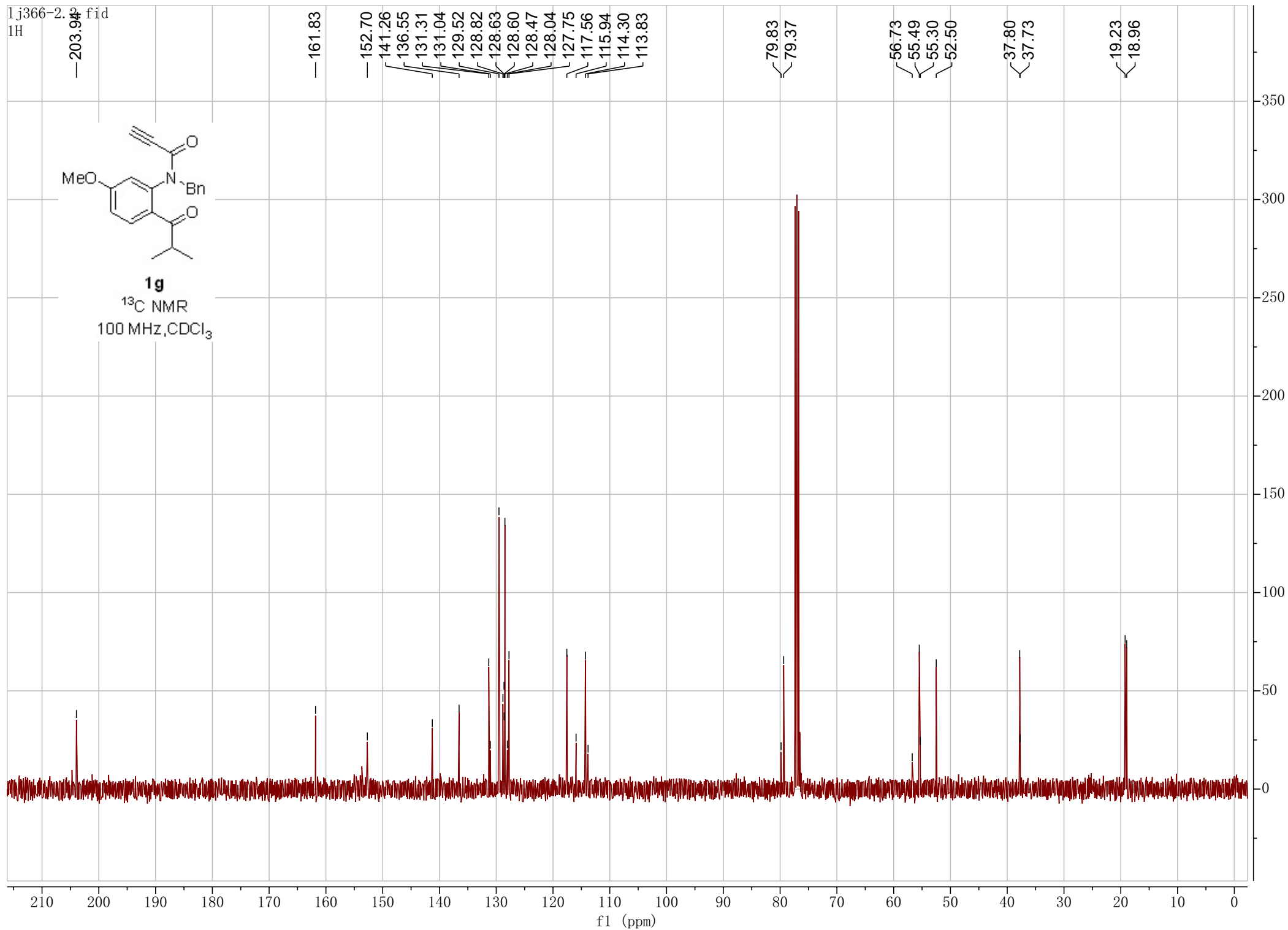


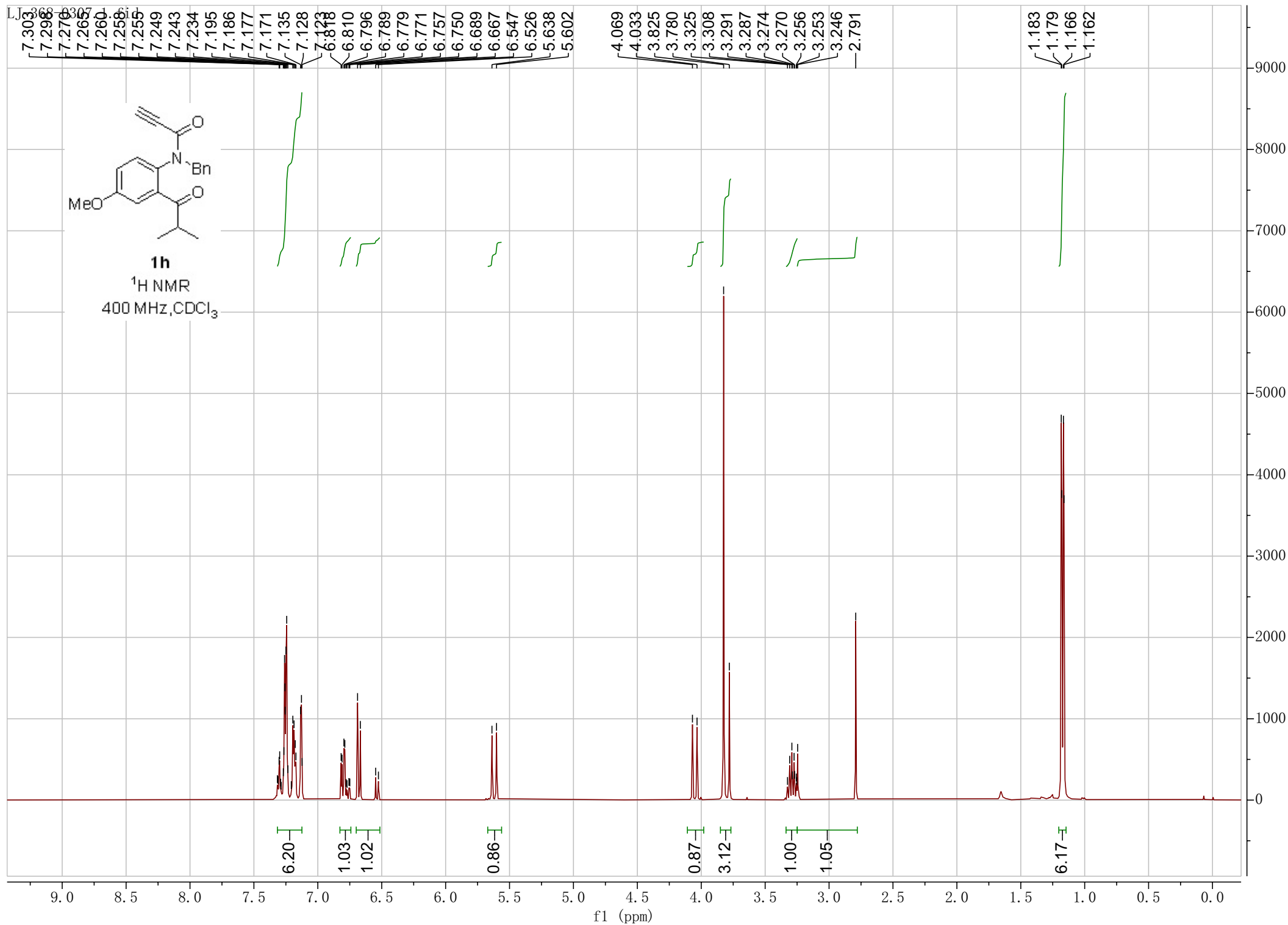
lj366-2.fid
1H

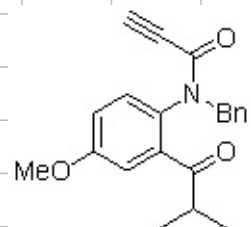


1g

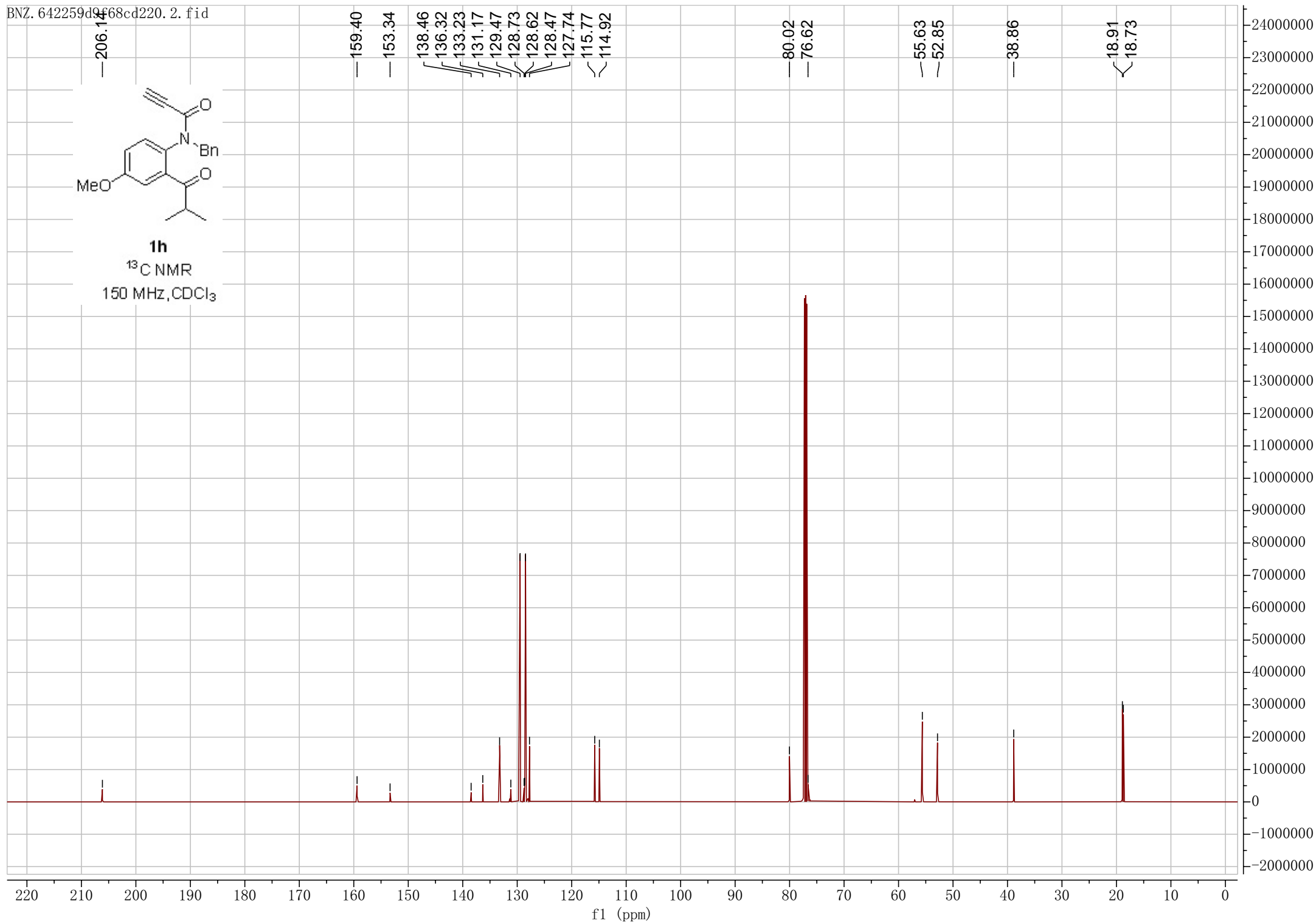
^{13}C NMR
100 MHz, CDCl_3

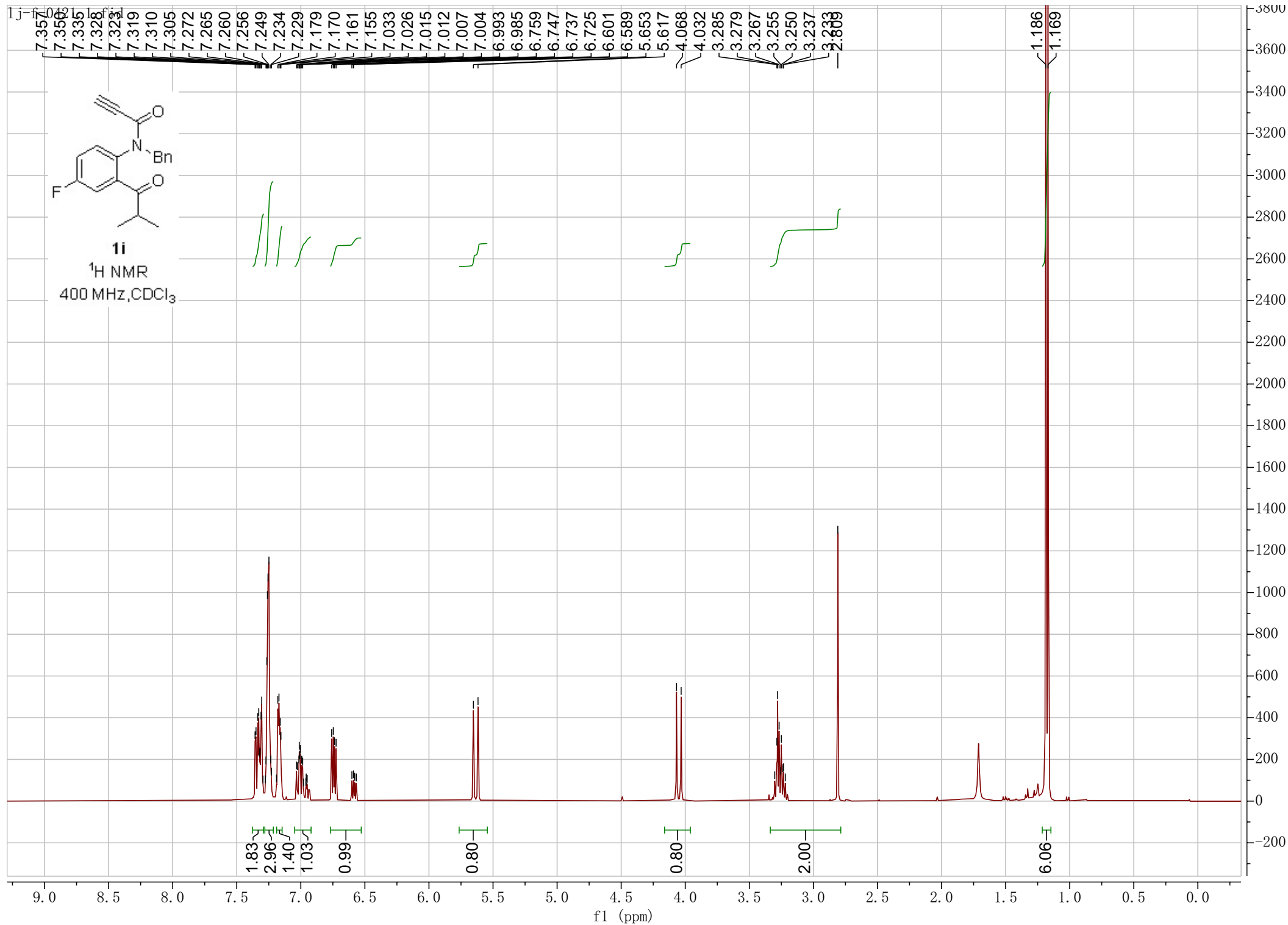




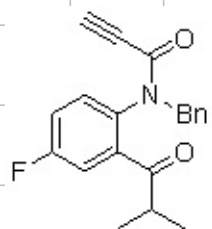
**1h**

^{13}C NMR
150 MHz, CDCl_3



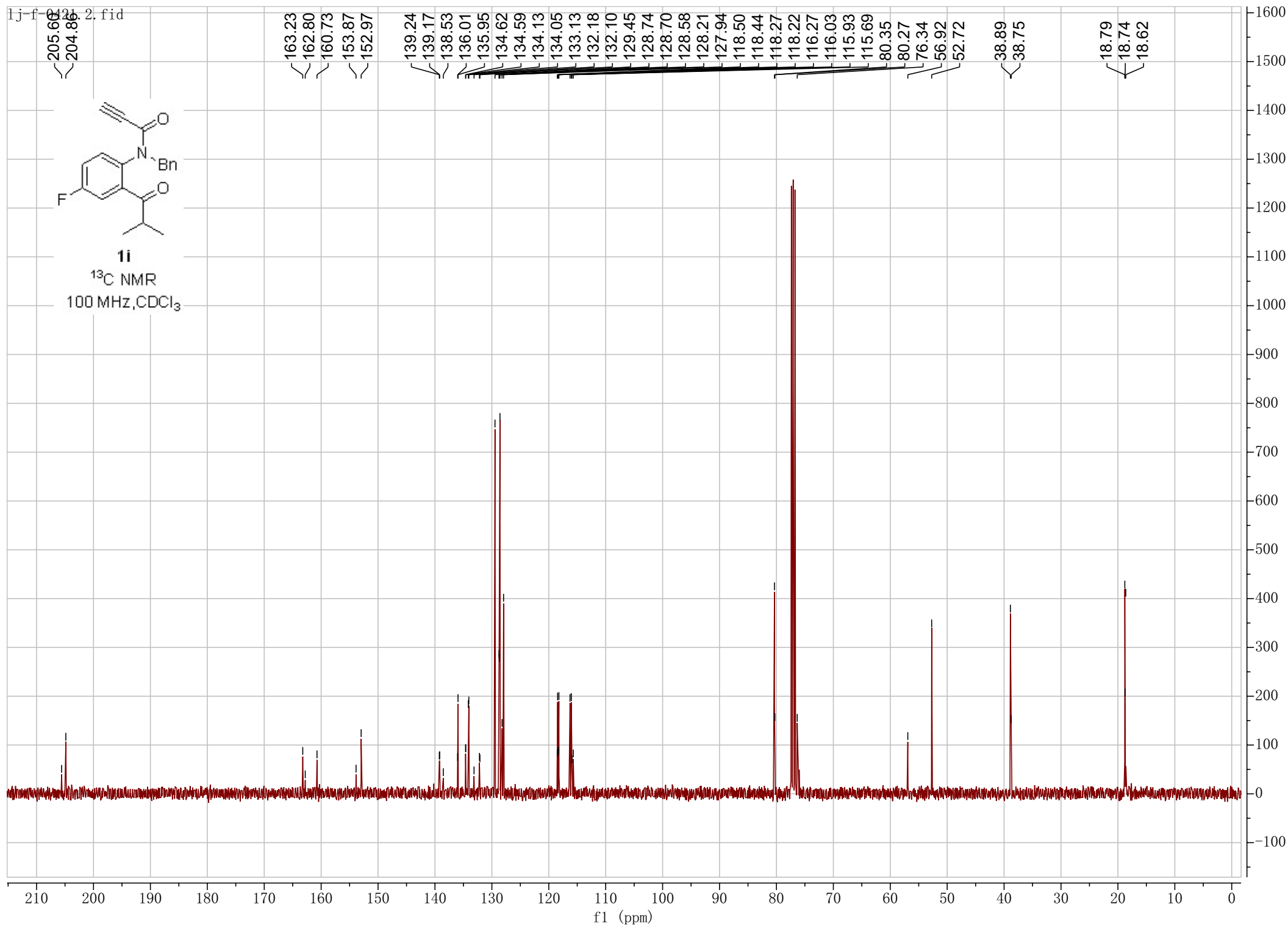


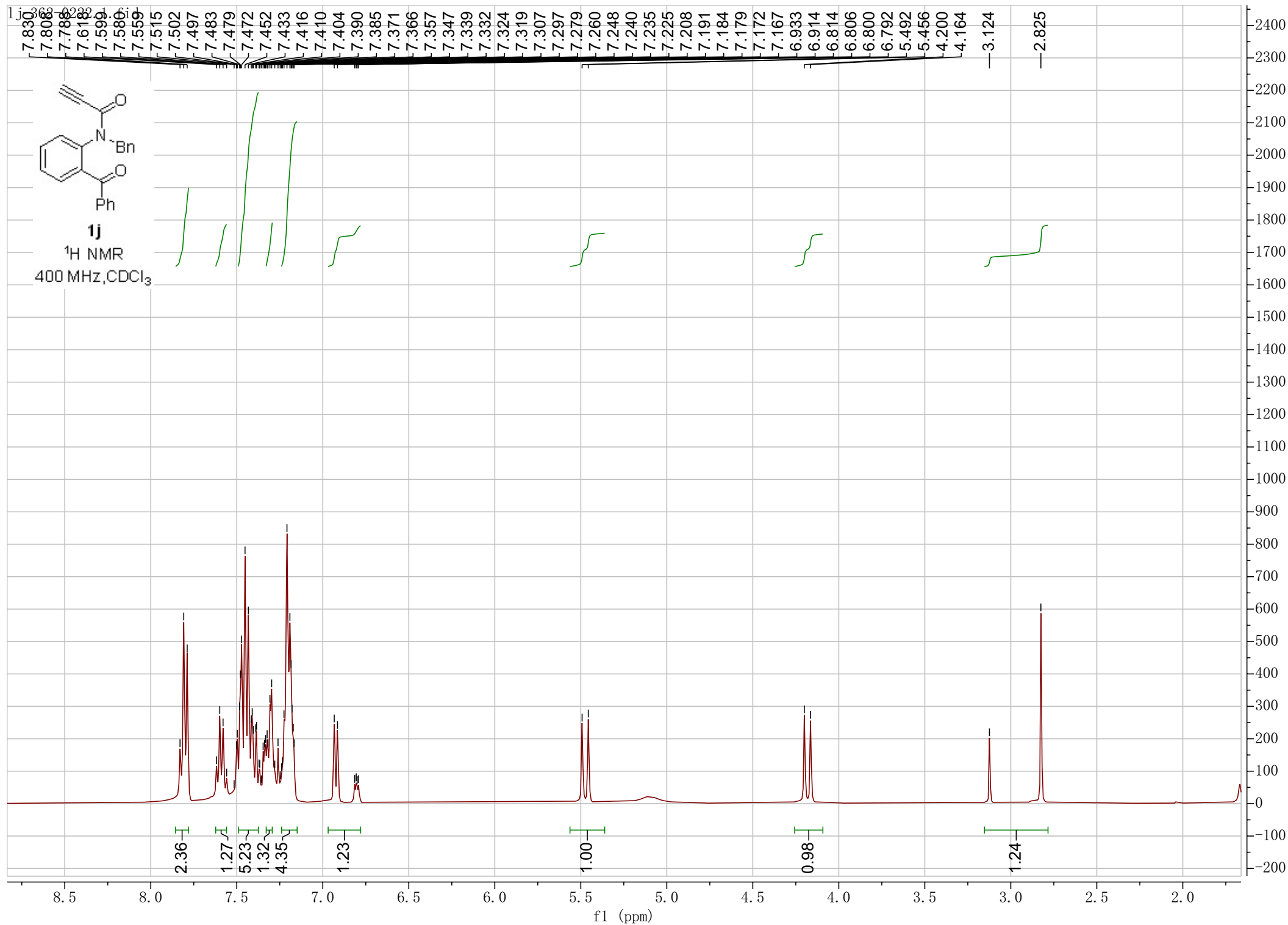
lj-f-0421-2.fid



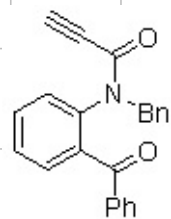
1i

^{13}C NMR
100 MHz, CDCl_3



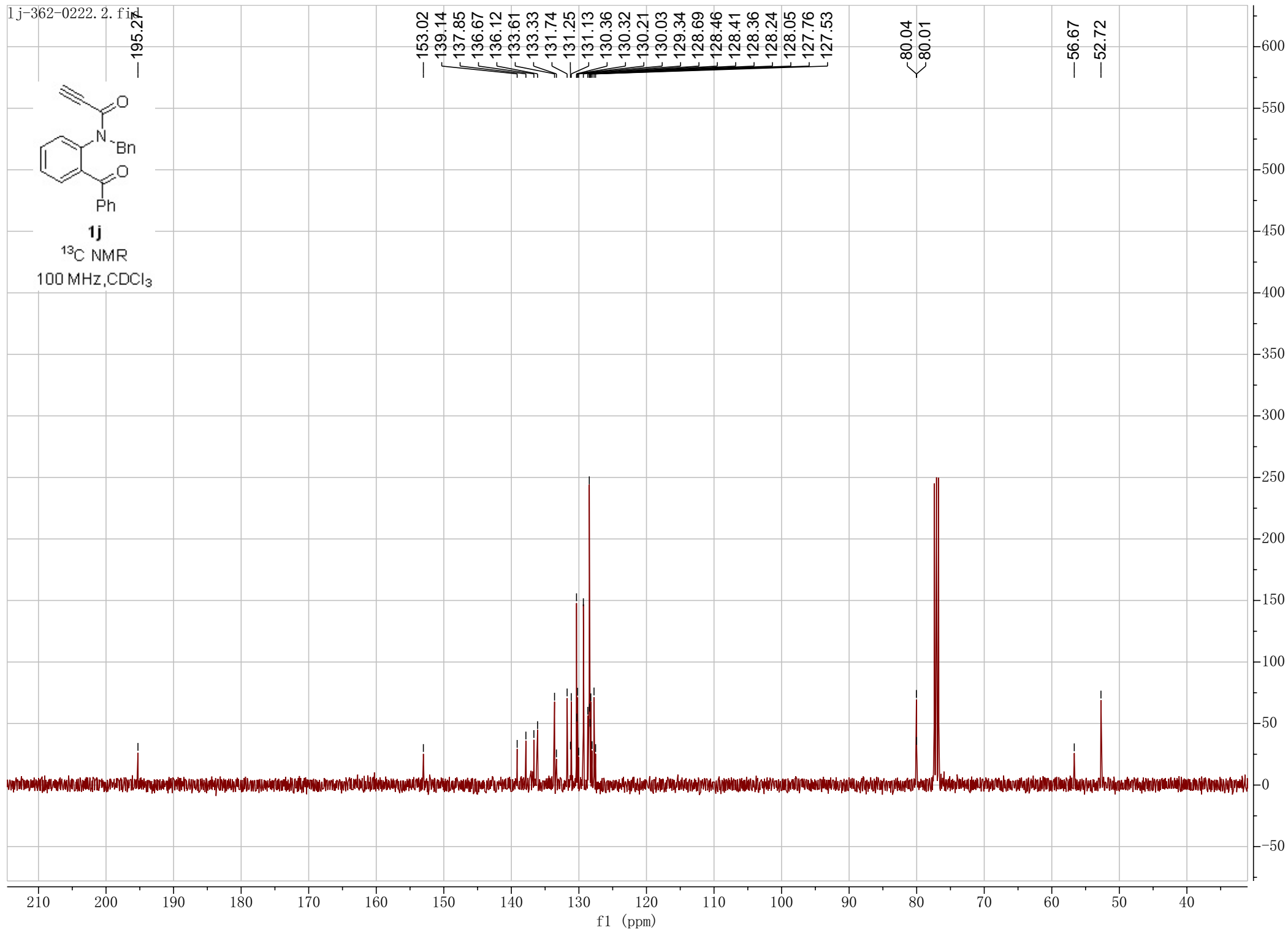


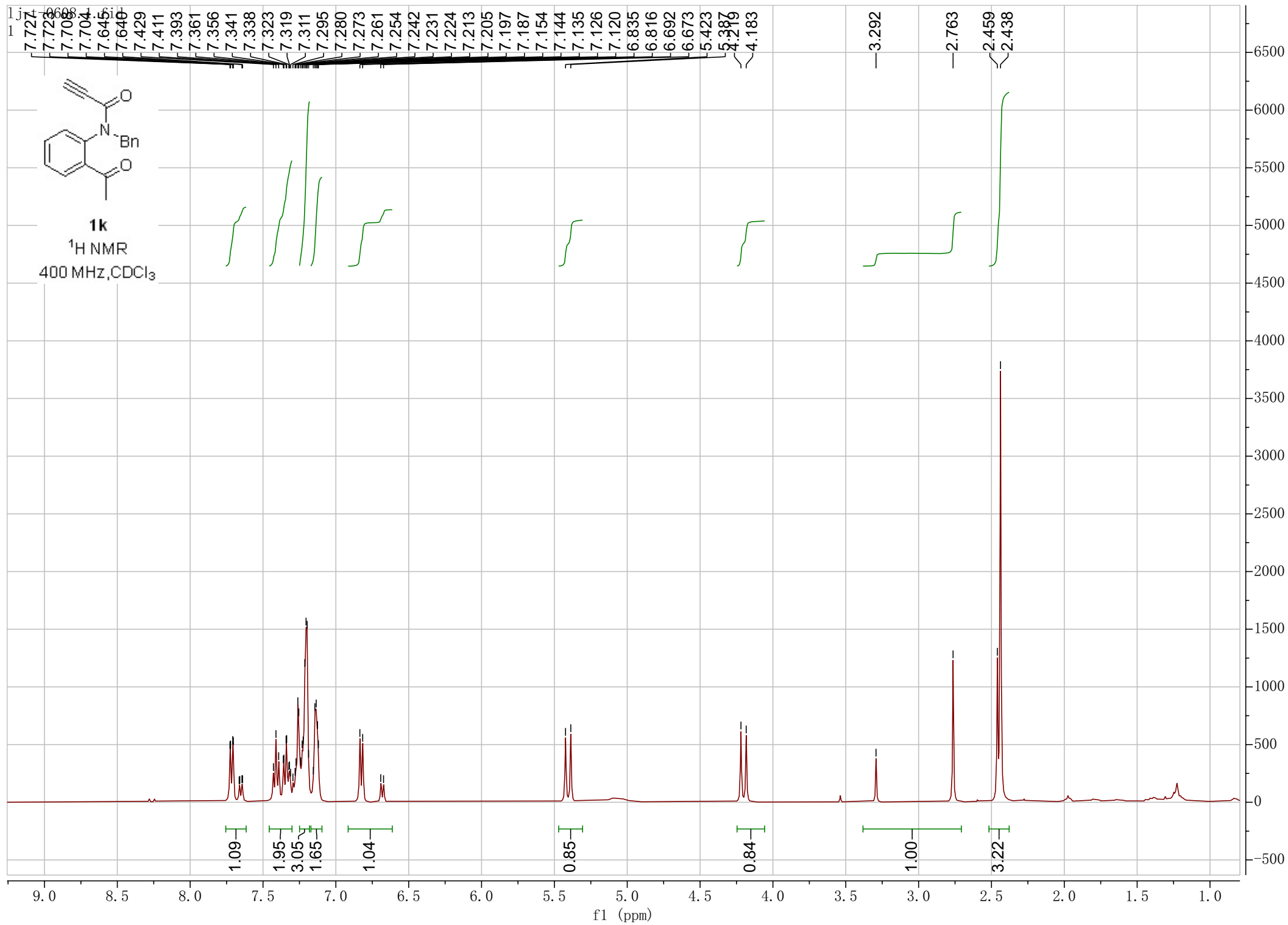
lj-362-0222. 2. f1



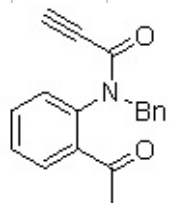
1j

^{13}C NMR
100 MHz, CDCl_3



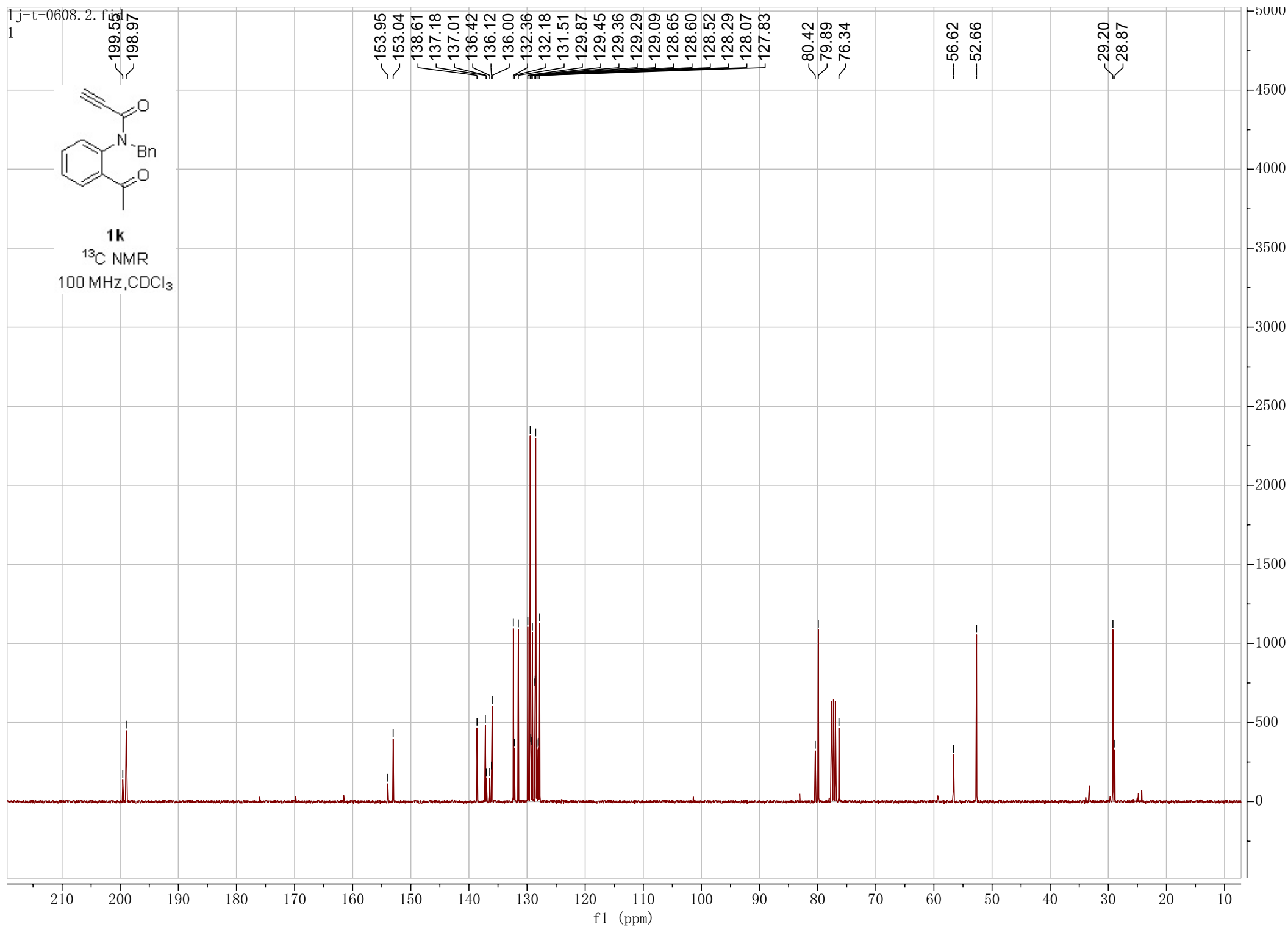


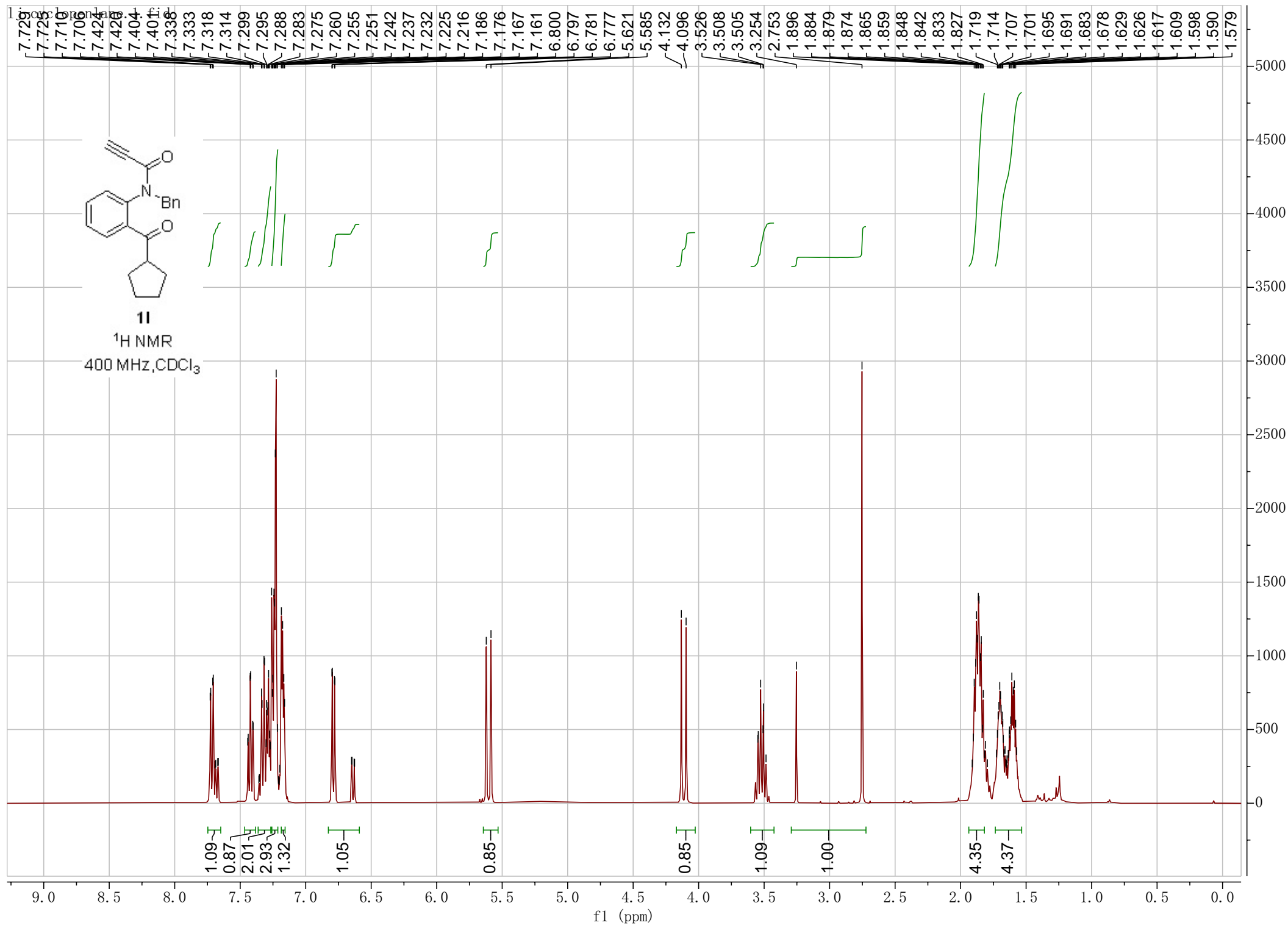
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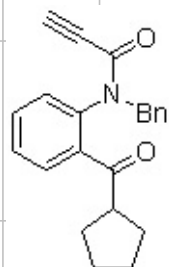


1k

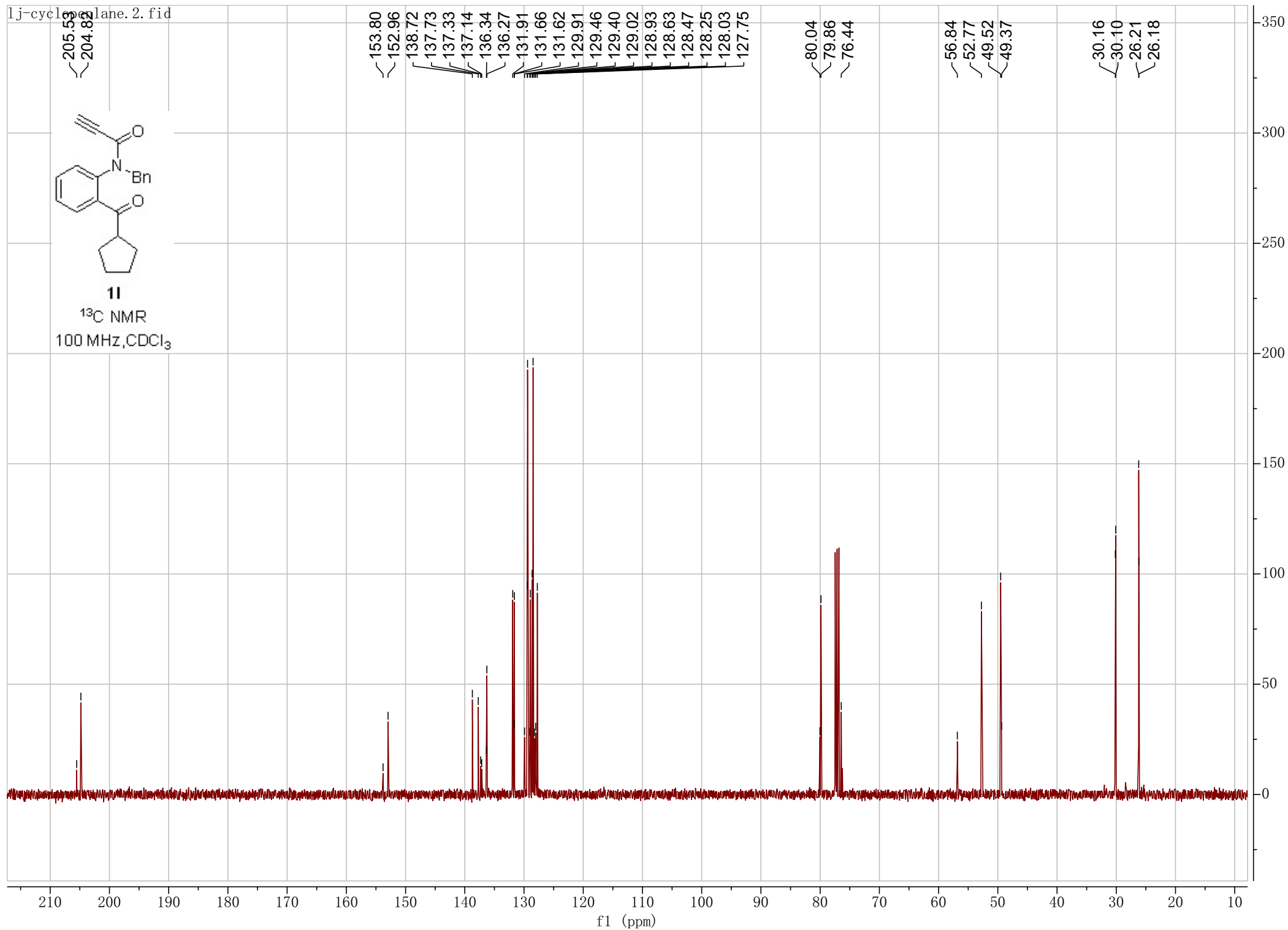
¹³C NMR
100 MHz, CDCl₃

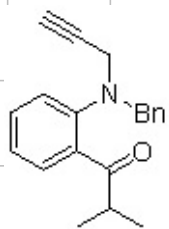




**11**

^{13}C NMR
100 MHz, CDCl_3



**7a**

^1H NMR
400 MHz, CDCl_3

7.447
7.443
7.426
7.425
7.409
7.405
7.362
7.351
7.338
7.326
7.320
7.307
7.303
7.294
7.198
7.196
7.180
7.178
7.161
7.159

4.299

3.654
3.648
3.640
3.623
3.605
3.588

2.292
2.286
2.280

1.195
1.178

0.99
6.63
1.05

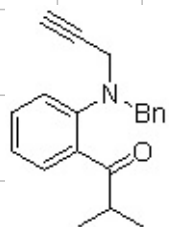
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1.80
1.05

0.90

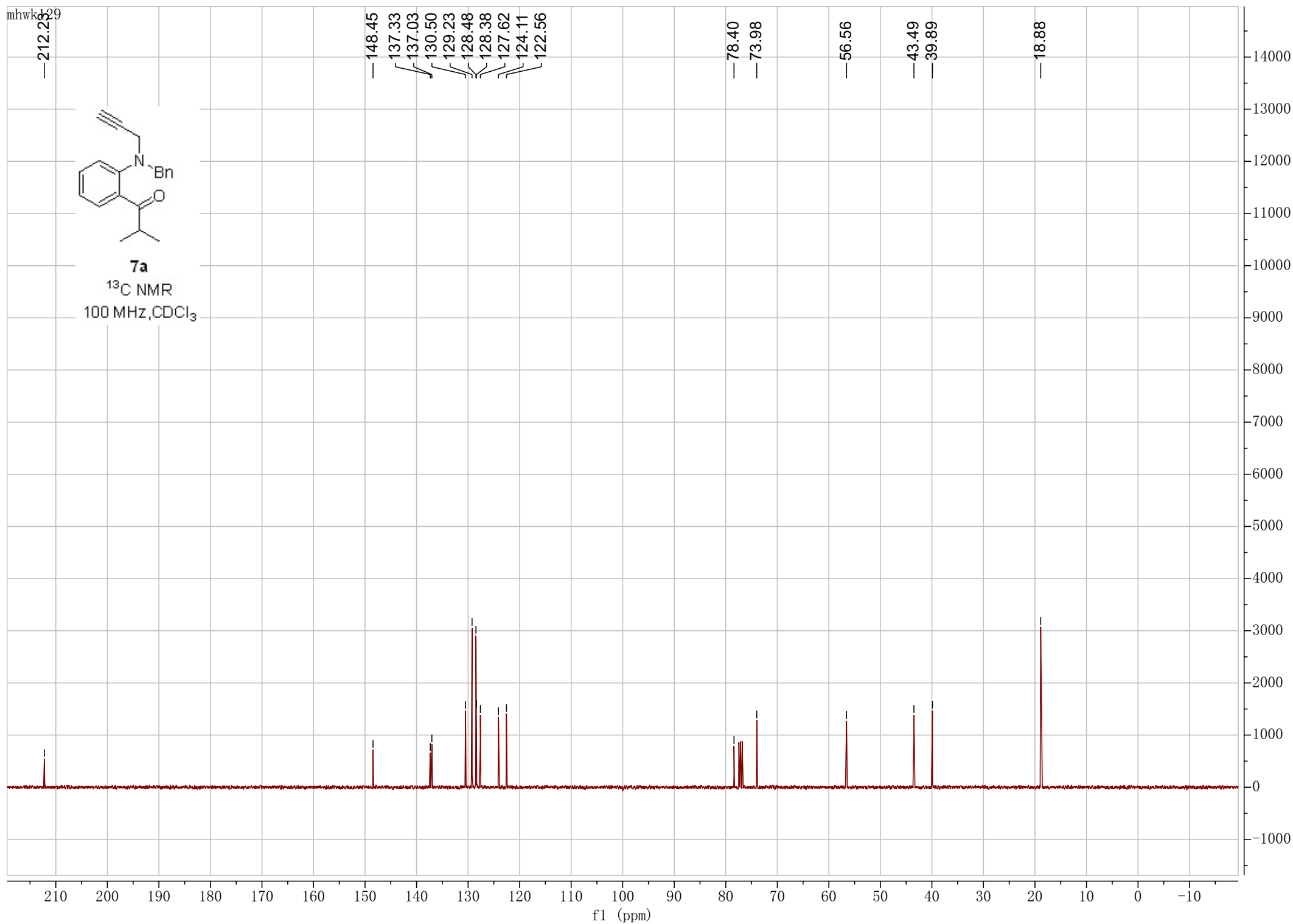
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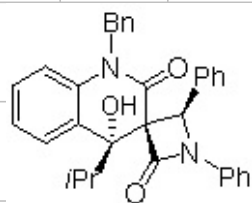
f1 (ppm)



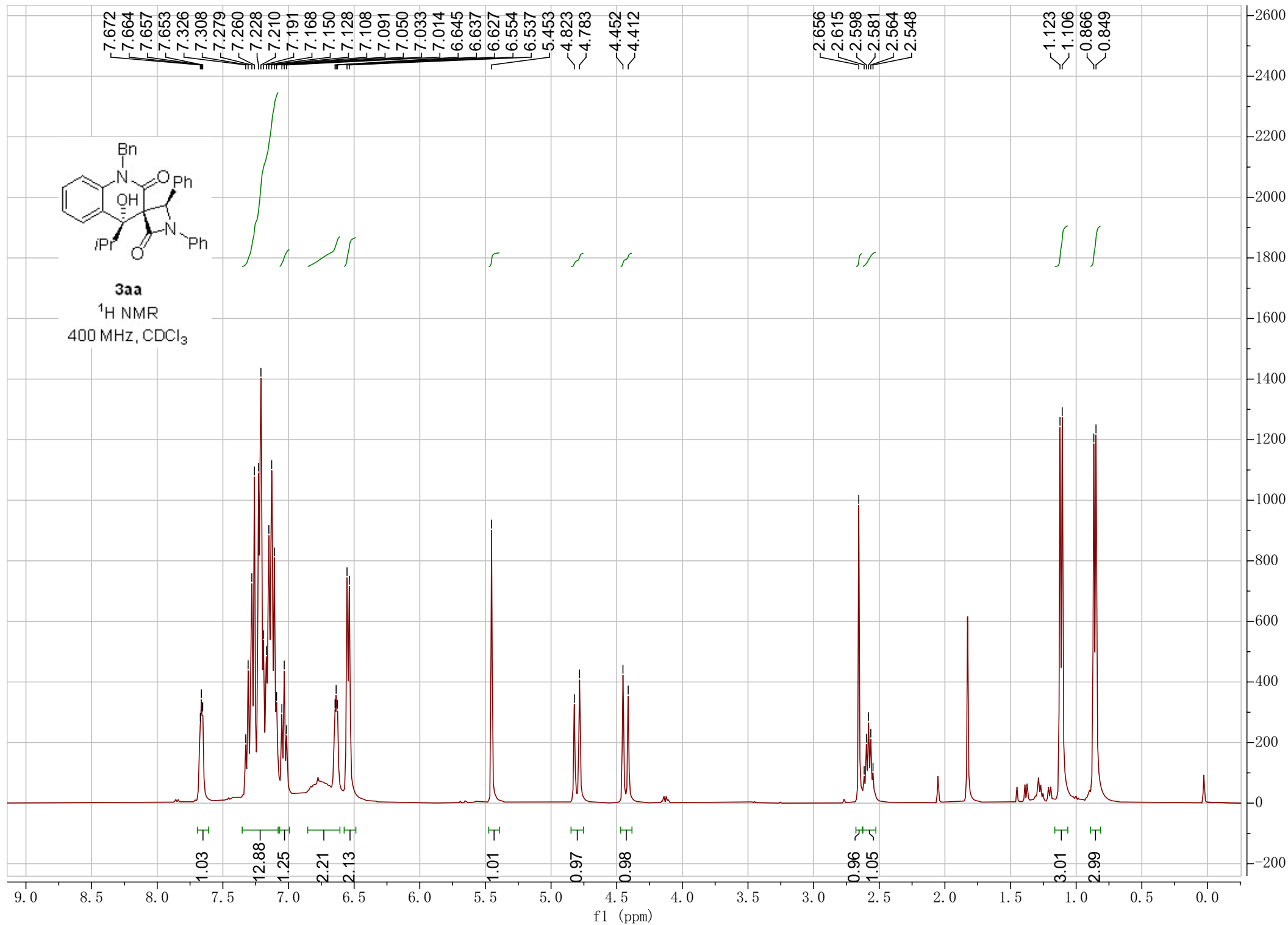
7a

^{13}C NMR
100 MHz, CDCl_3

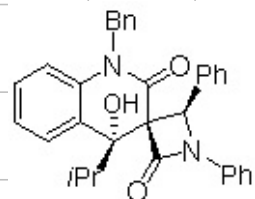




3aa
 ^1H NMR
 400 MHz, CDCl_3



lj-310-4
1



3aa

^{13}C NMR
100 MHz, CDCl_3

165.89
161.47
138.05
136.74
136.43
132.93
128.92
128.84
128.76
128.55
128.42
127.80
127.69
126.86
126.79
126.64
124.11
123.54
117.60
116.22

75.37

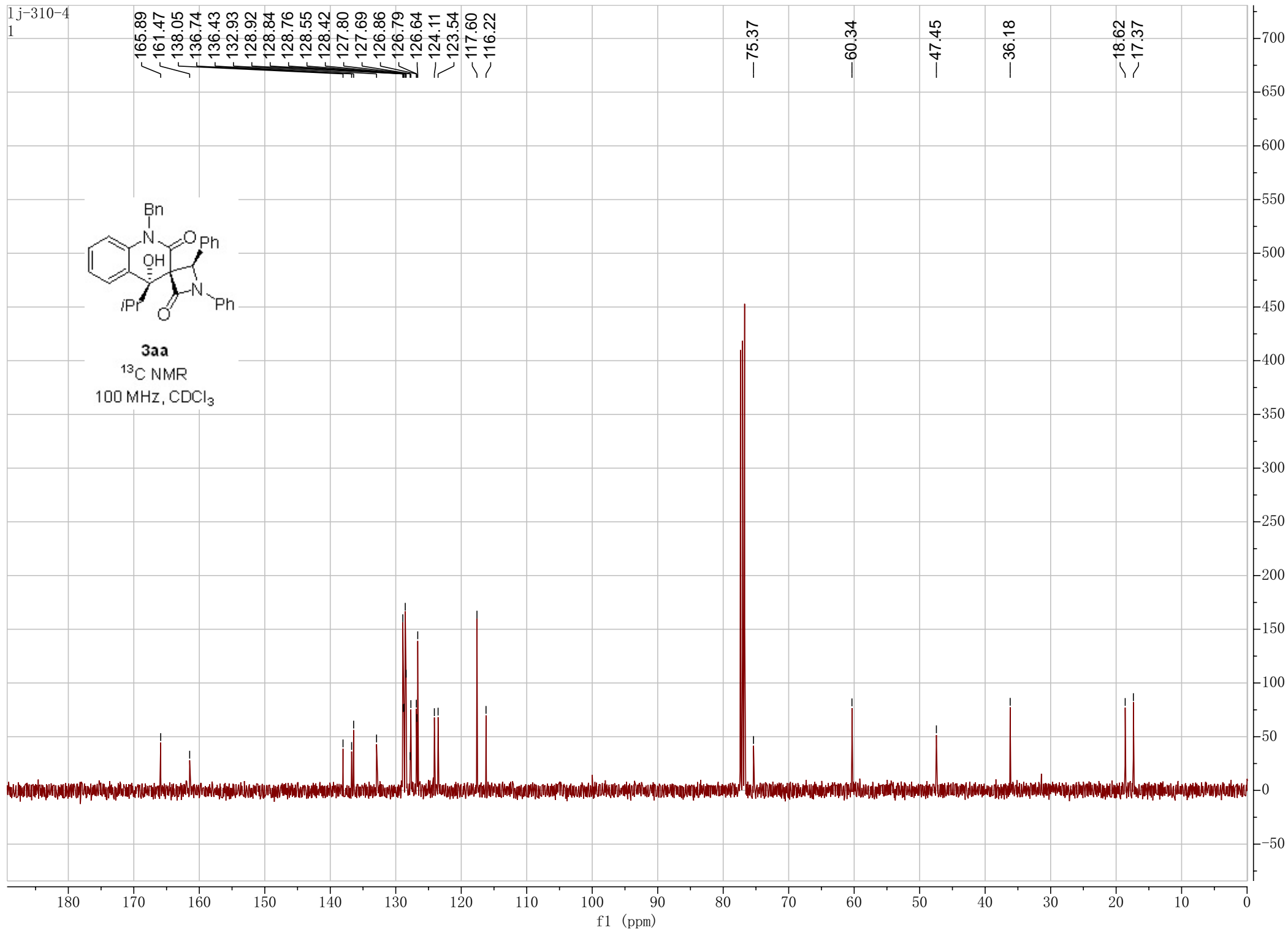
60.34

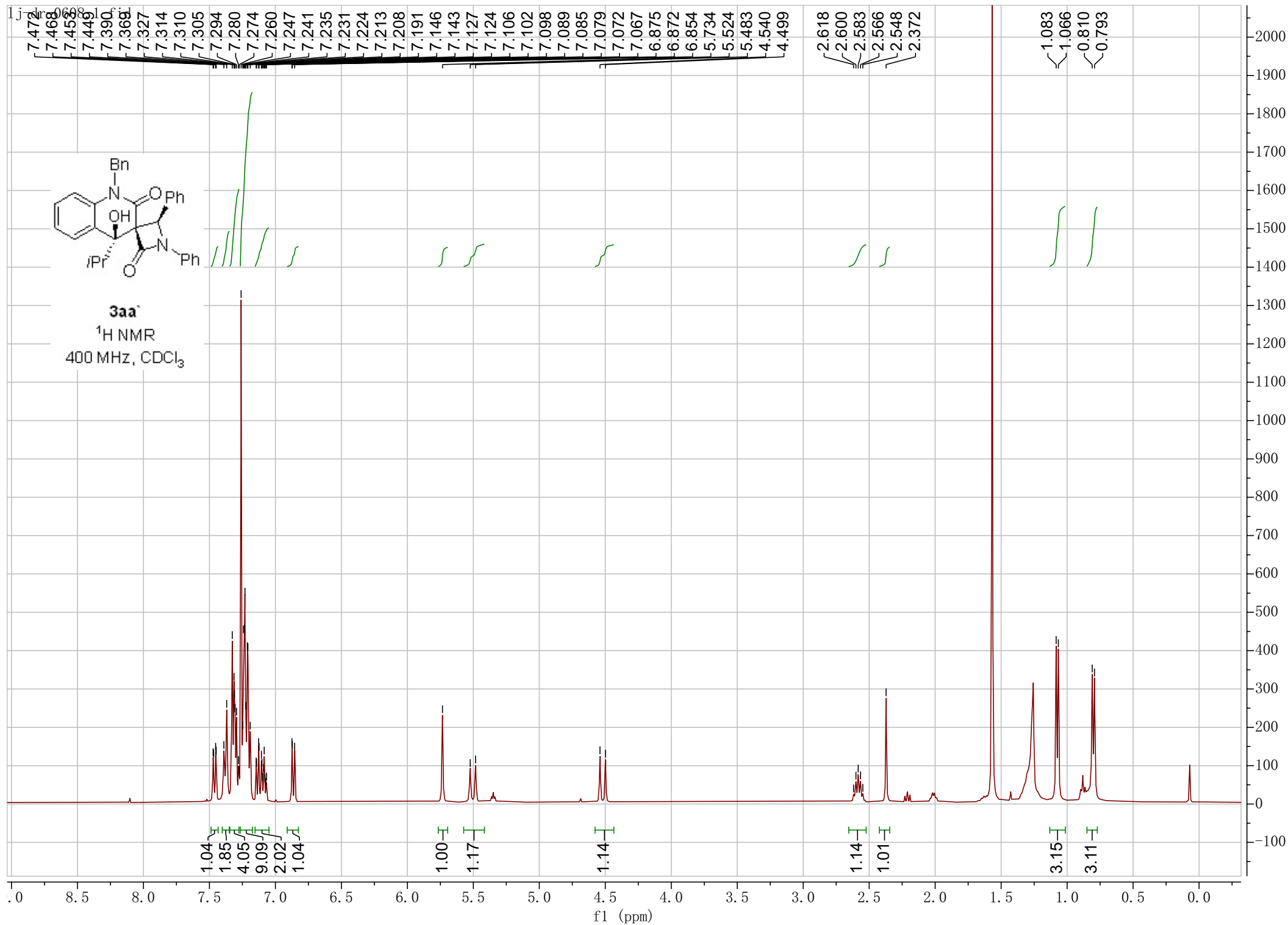
47.45

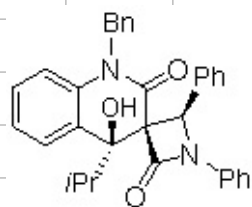
36.18

18.62

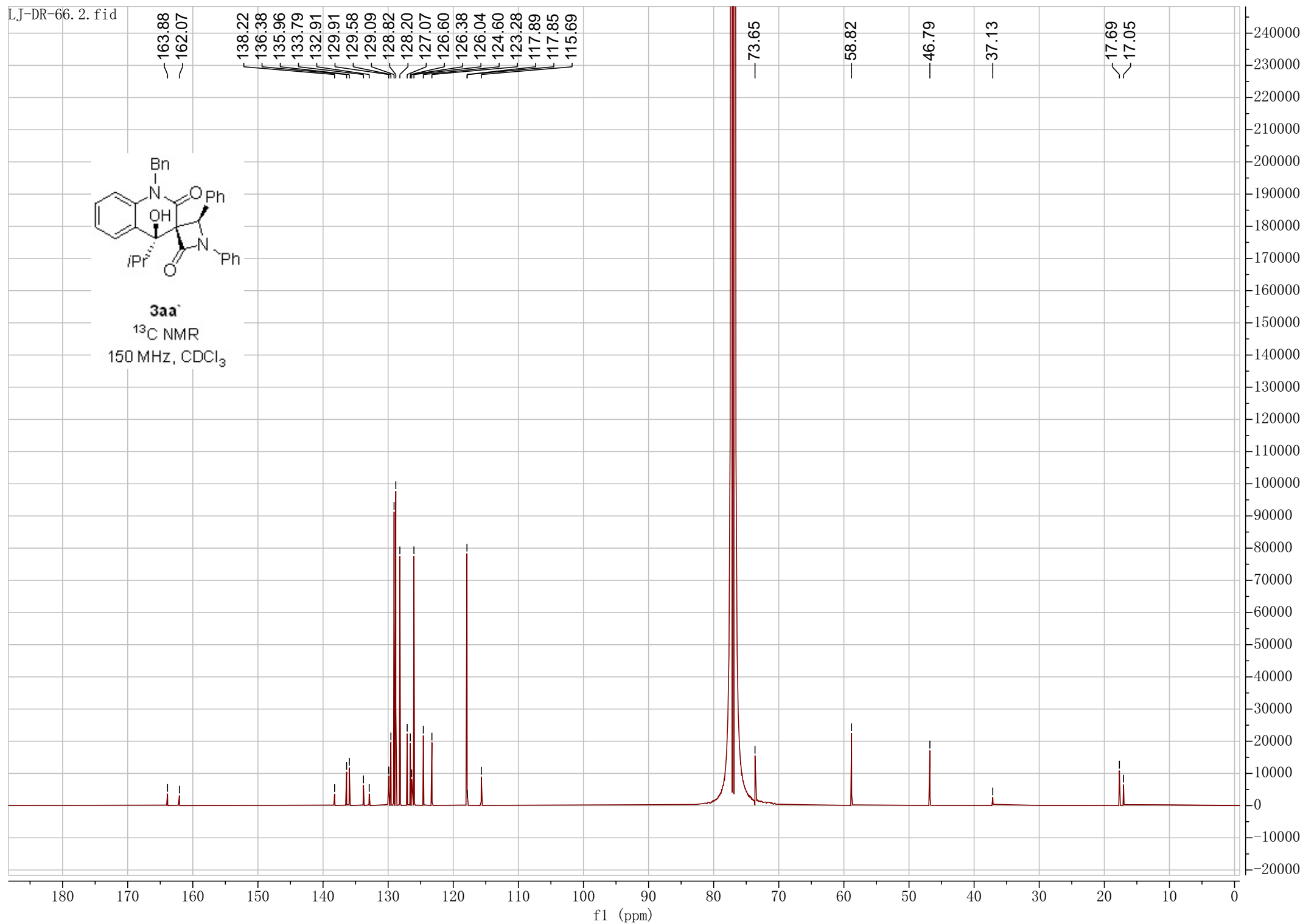
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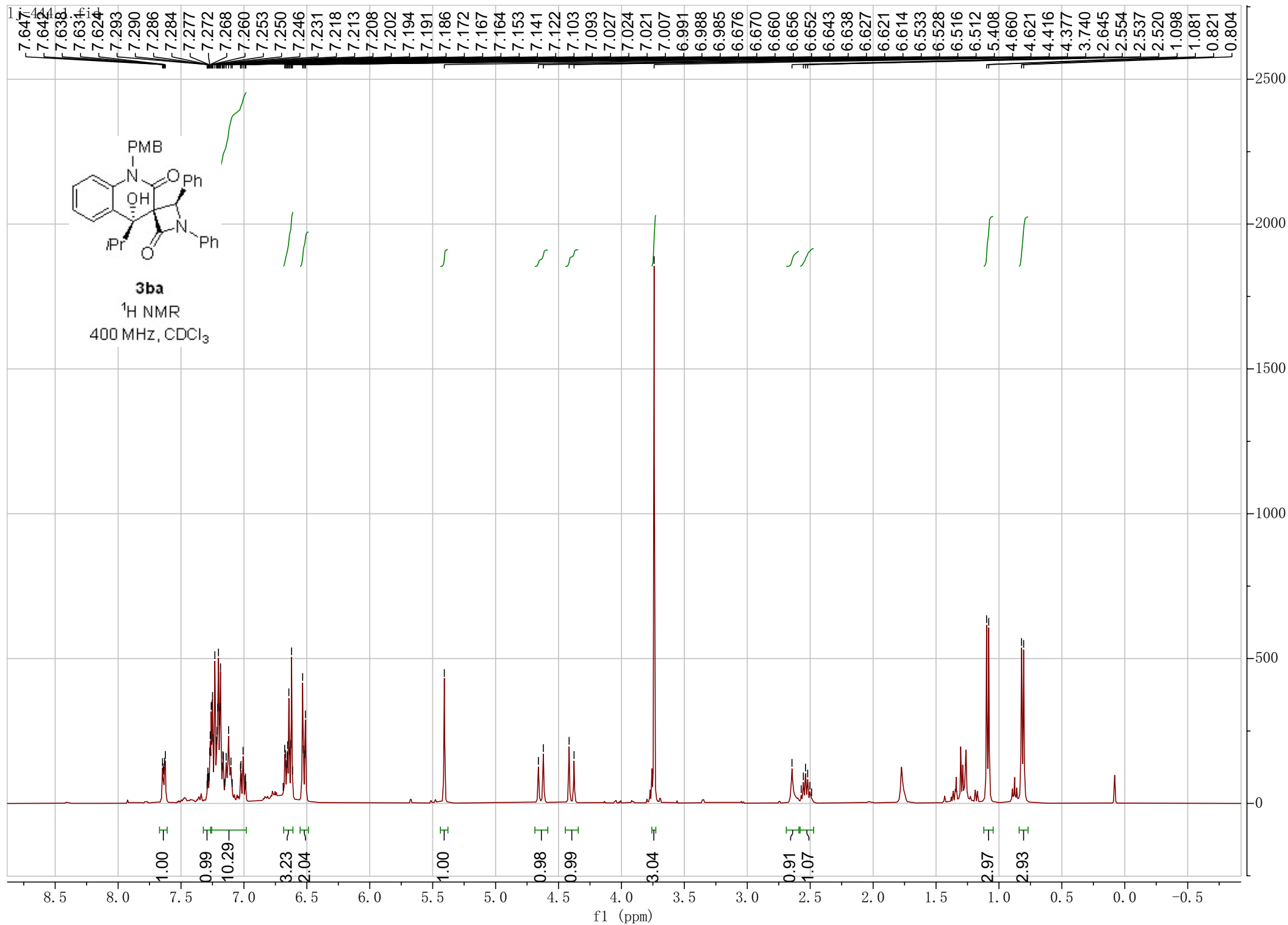




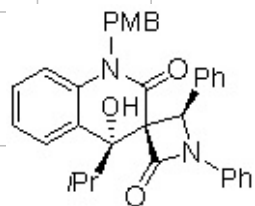


3aa
¹³C NMR
150 MHz, CDCl₃



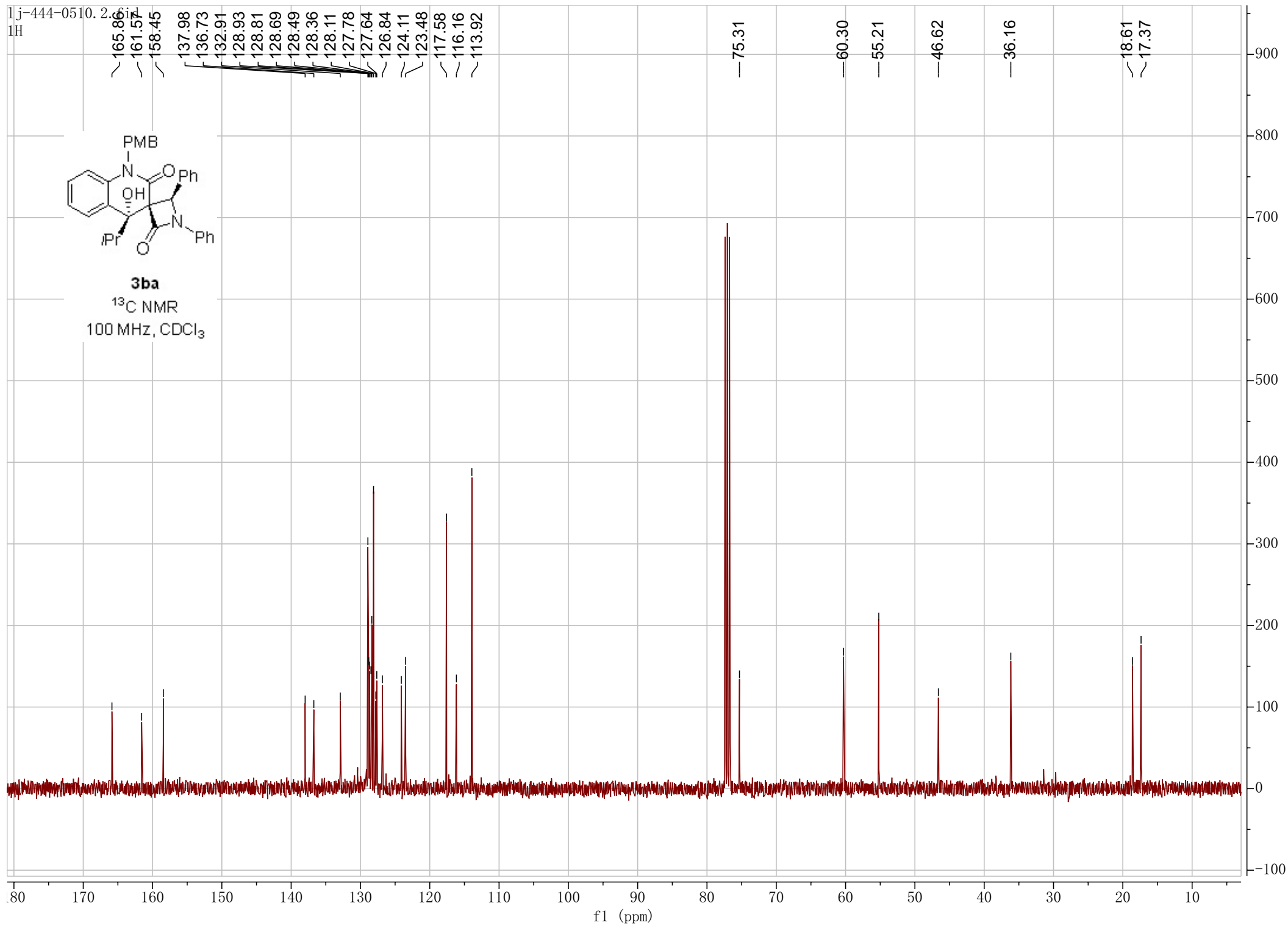


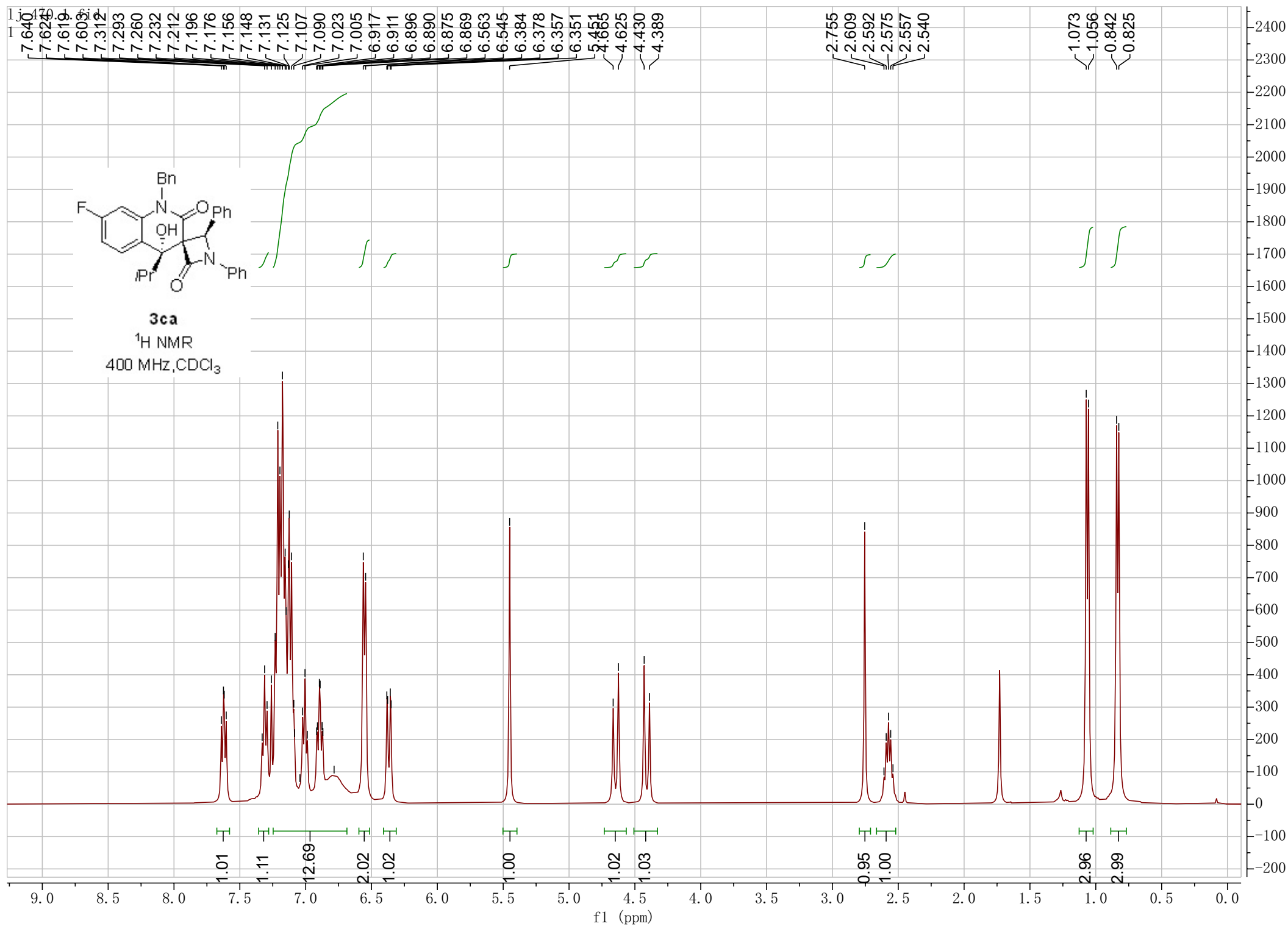
lj-444-0510.2.tif
1H

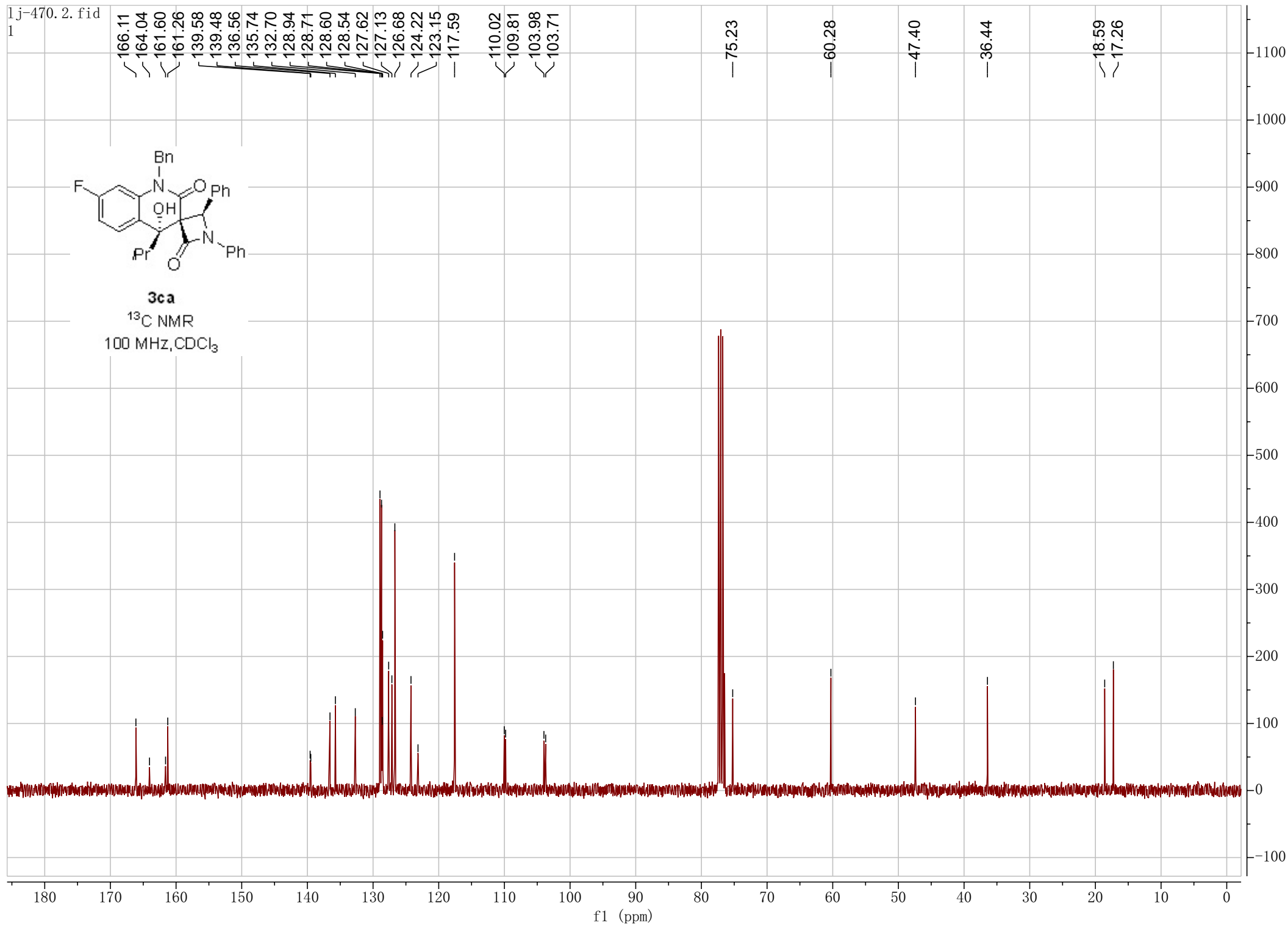


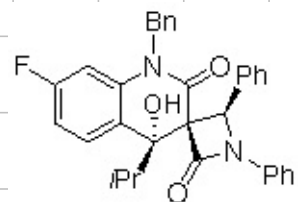
3ba

^{13}C NMR
100 MHz, CDCl_3







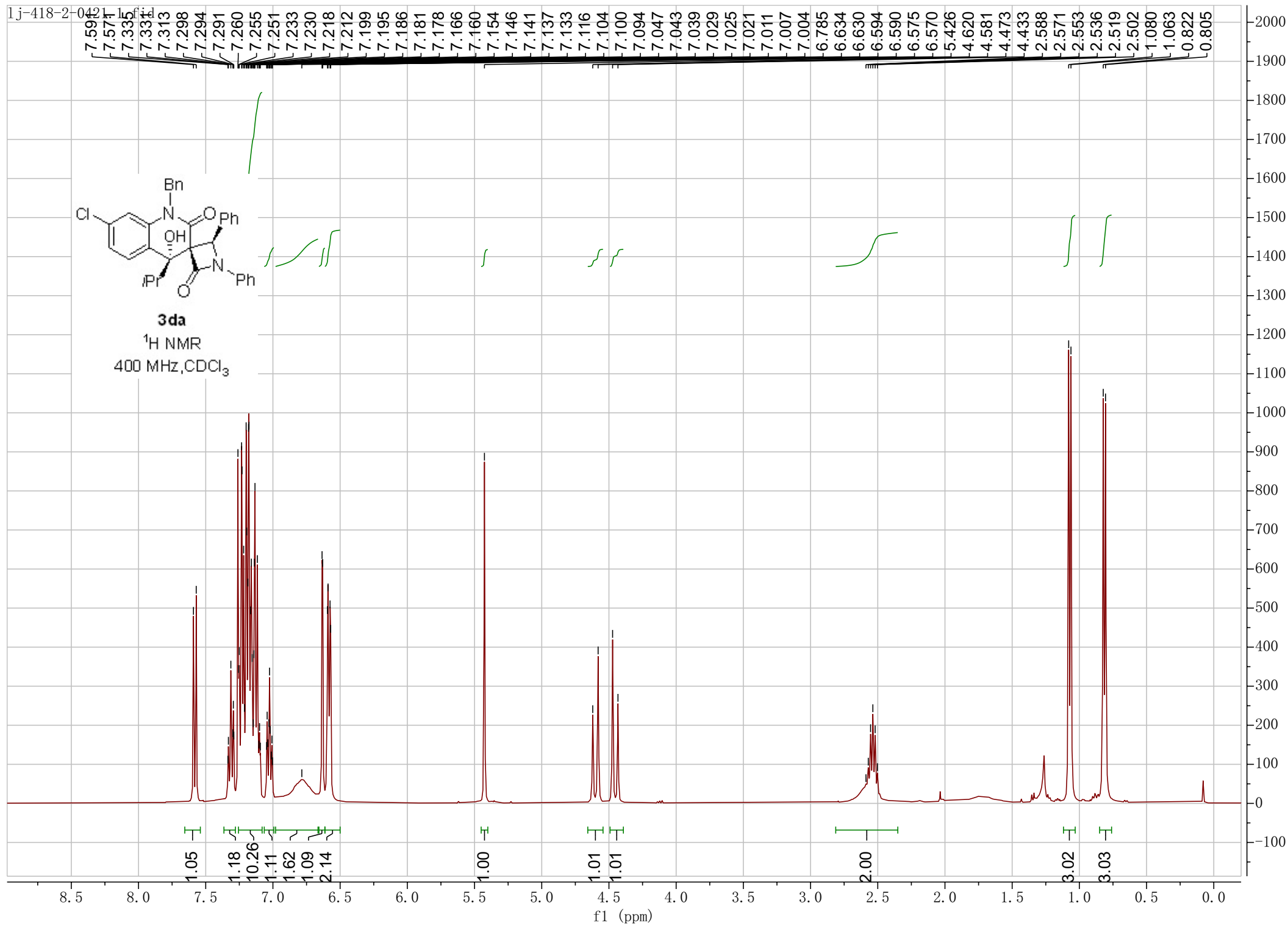
**3ca**

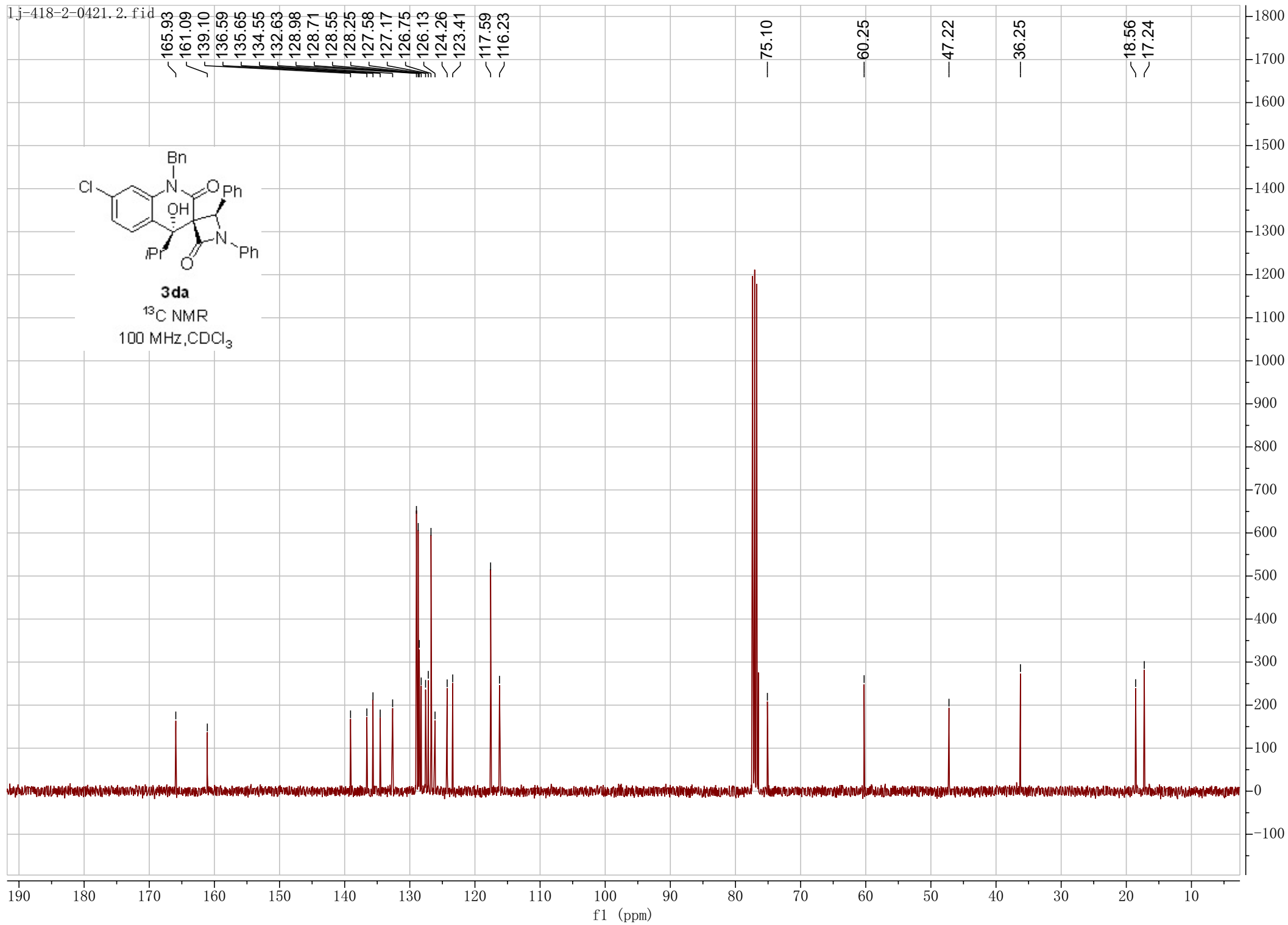
^{19}F NMR
376 MHz, CDCl_3

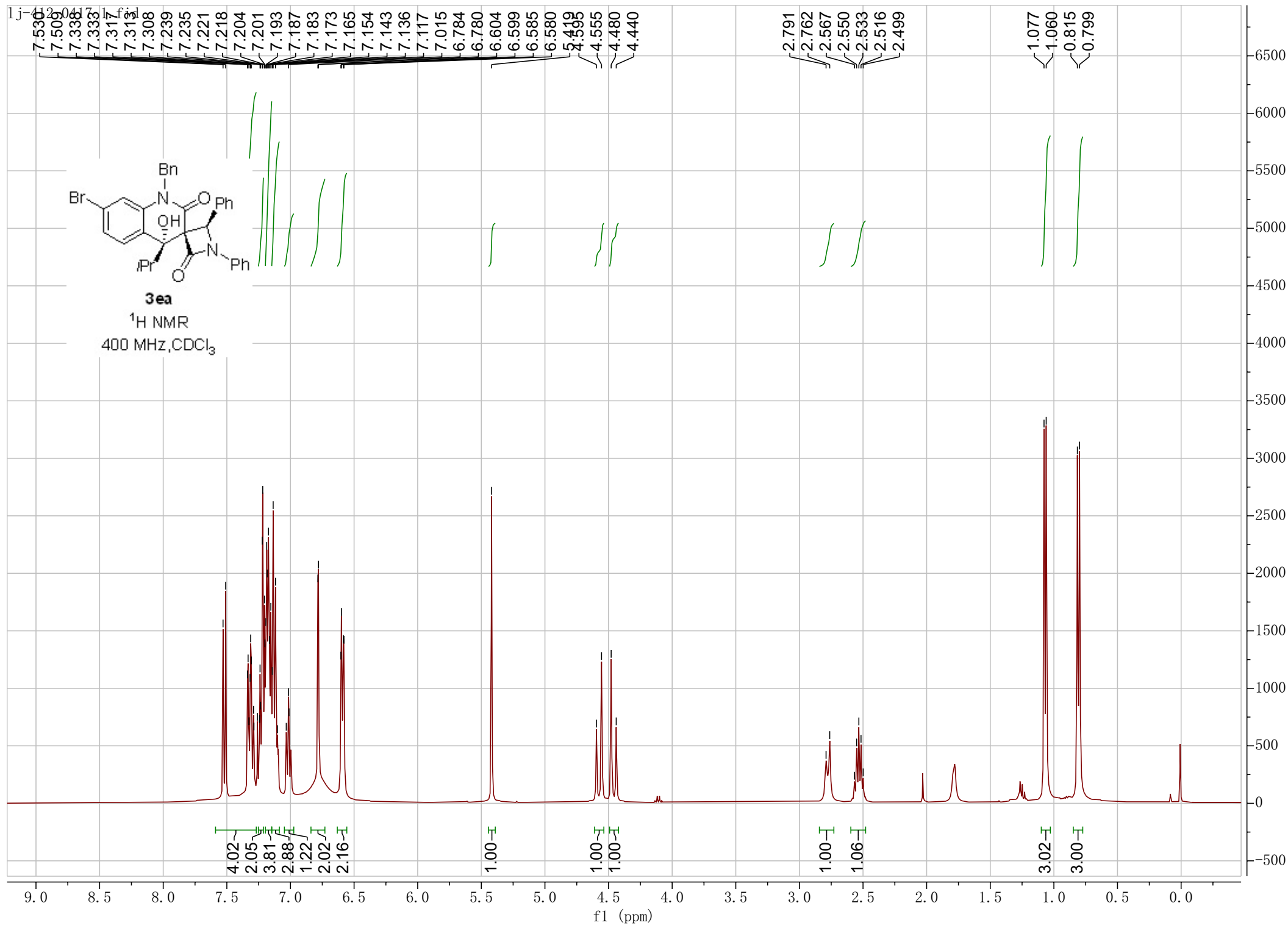
f1 (ppm)

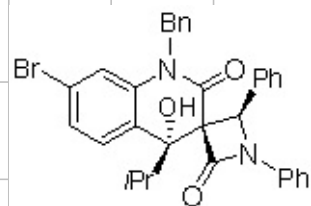
---111.649

17000
16000
15000
14000
13000
12000
11000
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
-1000

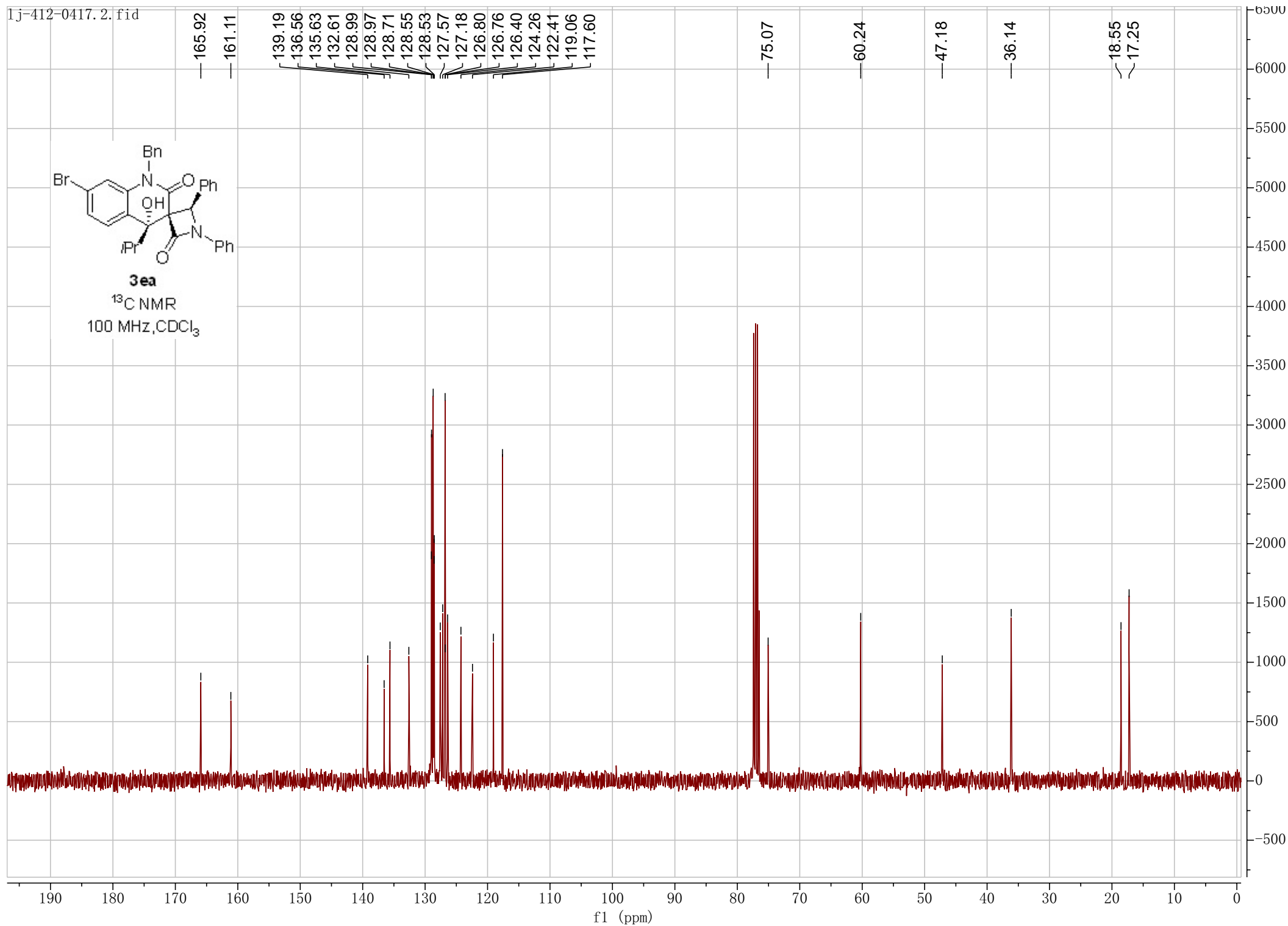


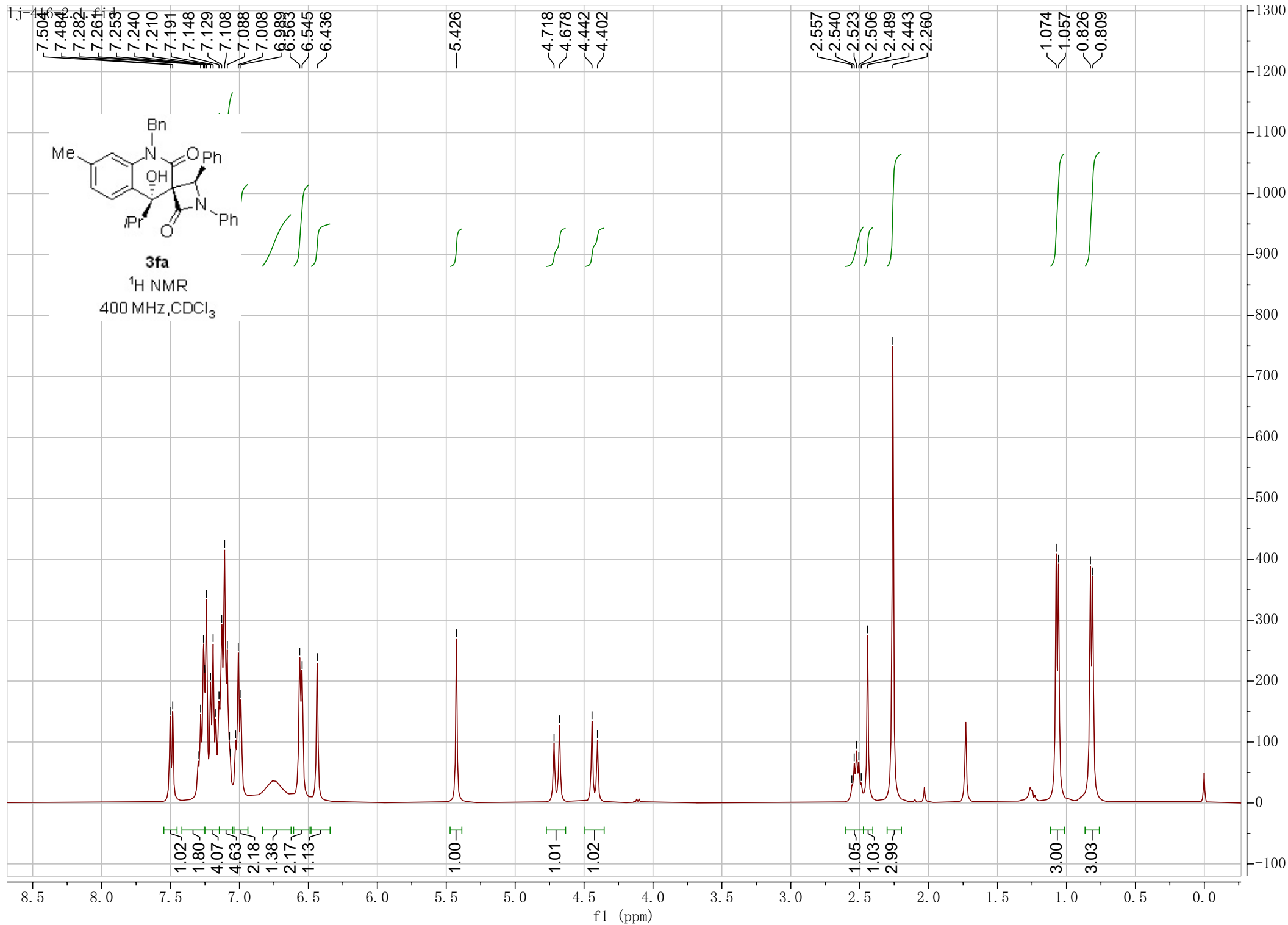


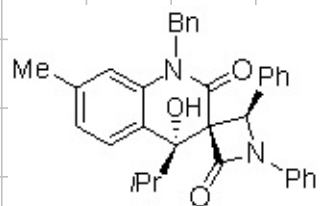


**3ea**

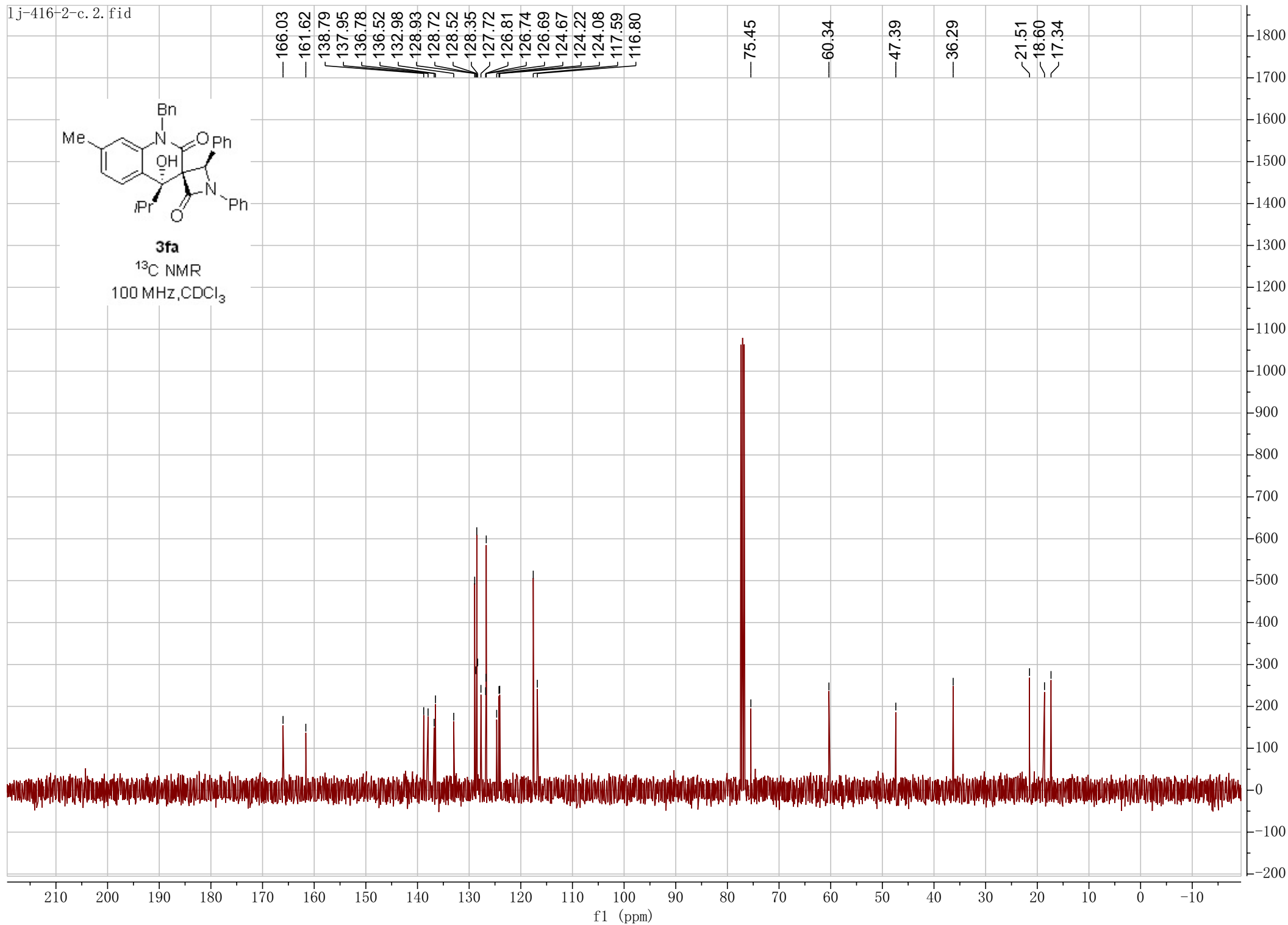
^{13}C NMR
100 MHz, CDCl_3

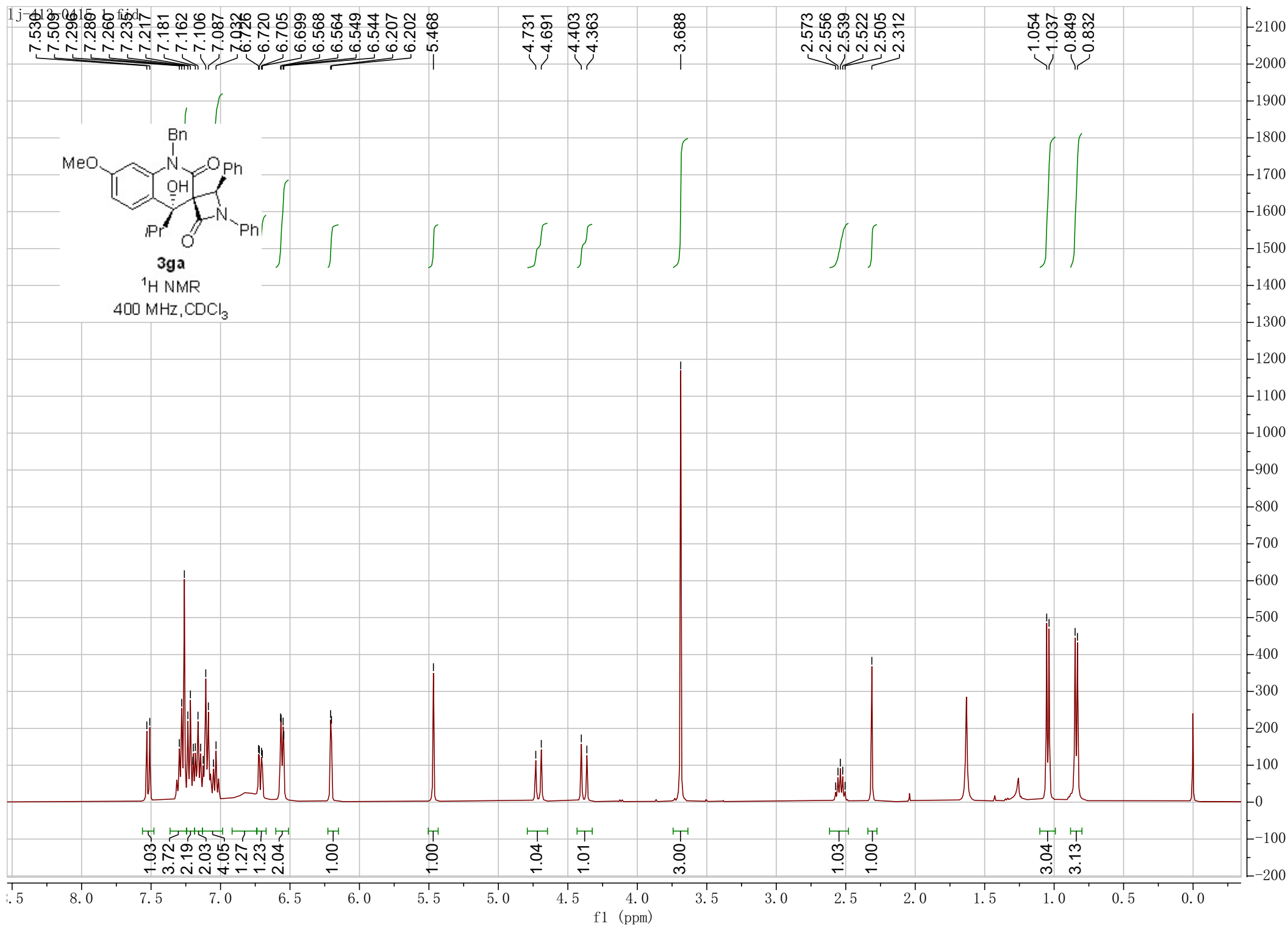




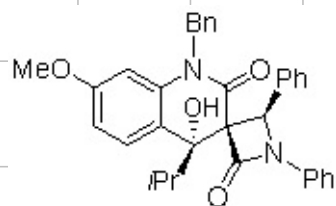
**3fa**

^{13}C NMR
100 MHz, CDCl_3



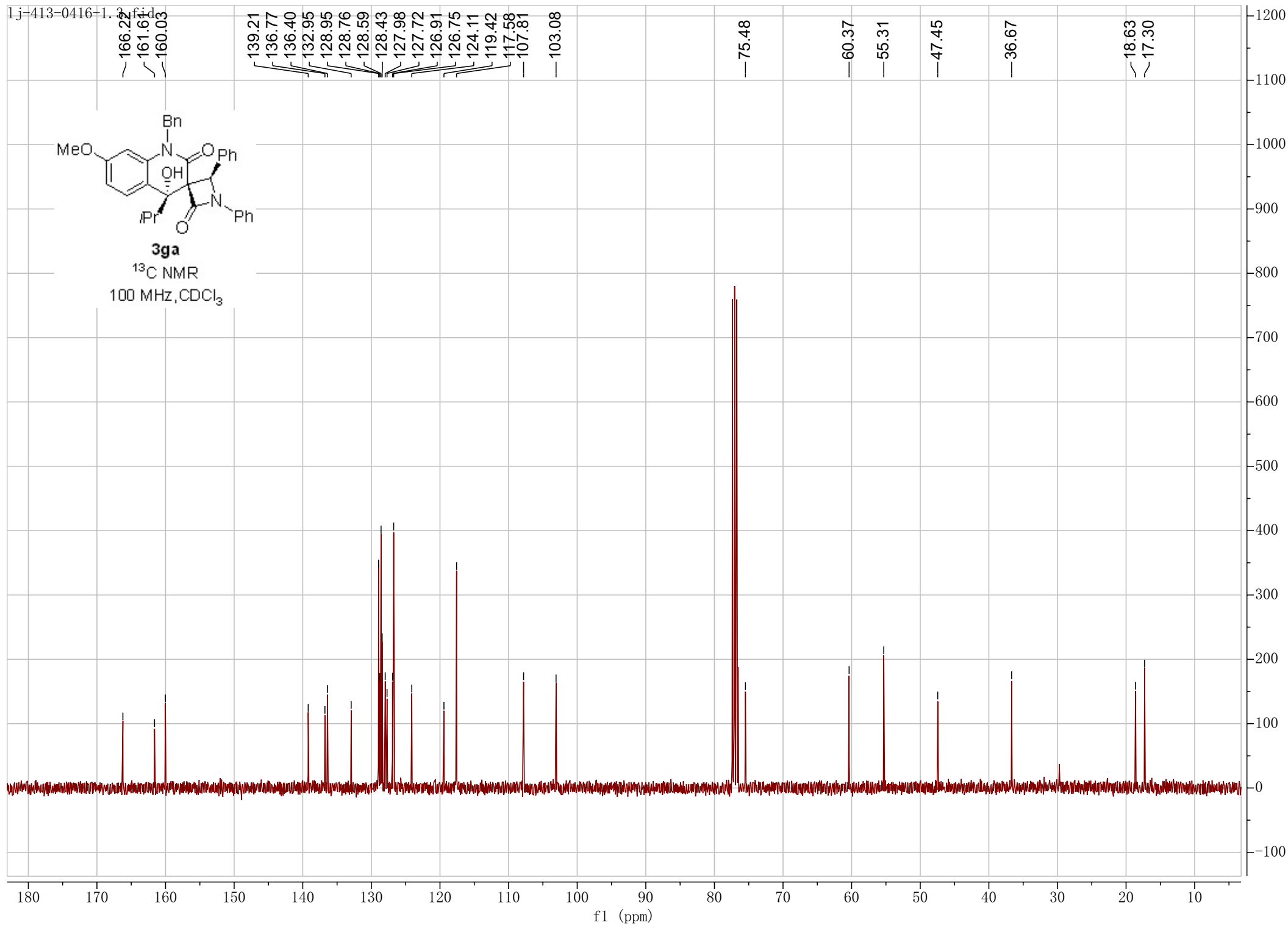


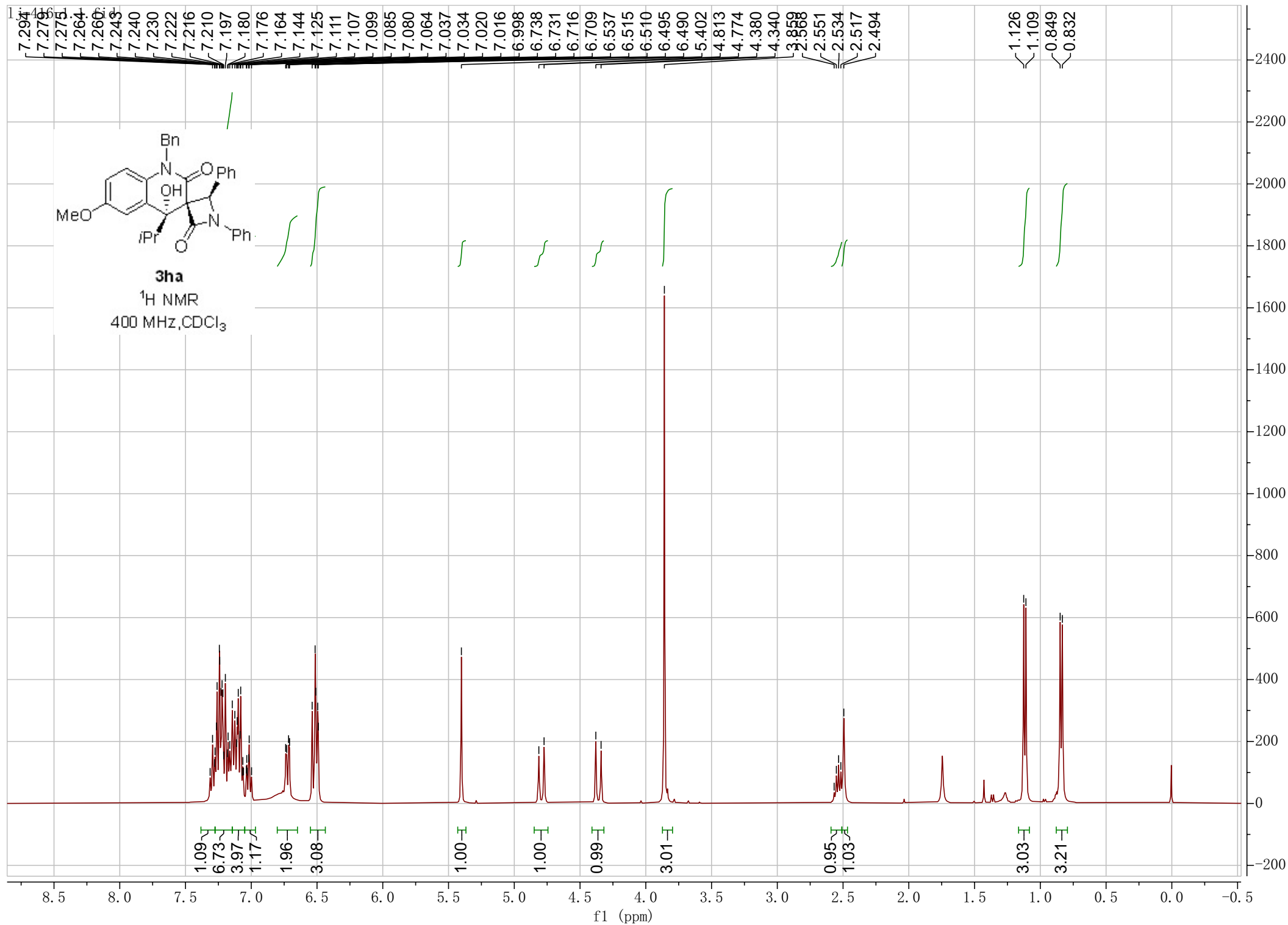
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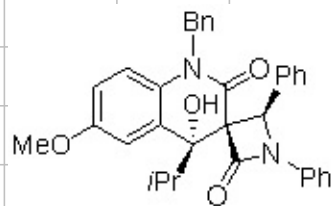


3ga

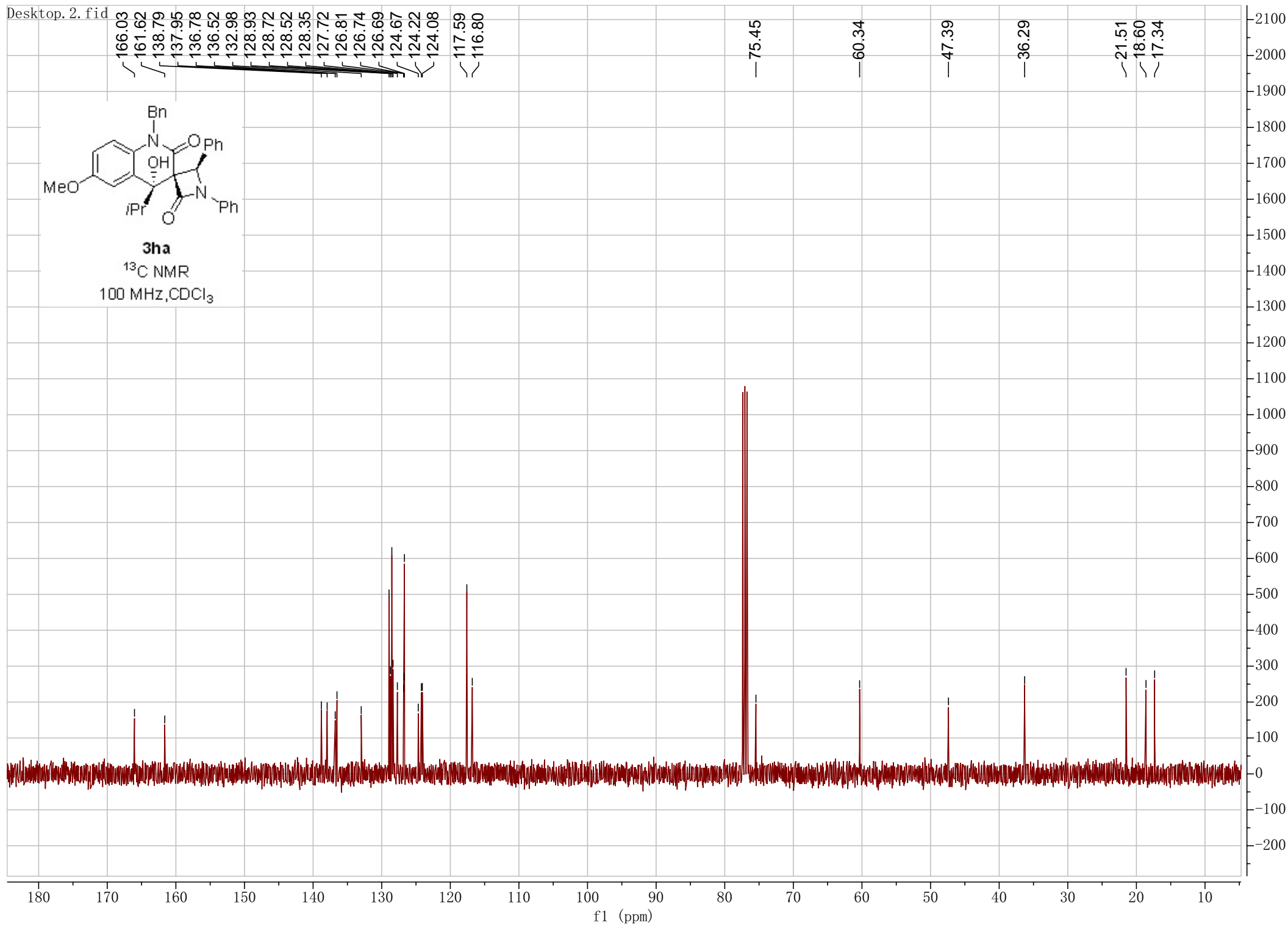
^{13}C NMR
100 MHz, CDCl_3

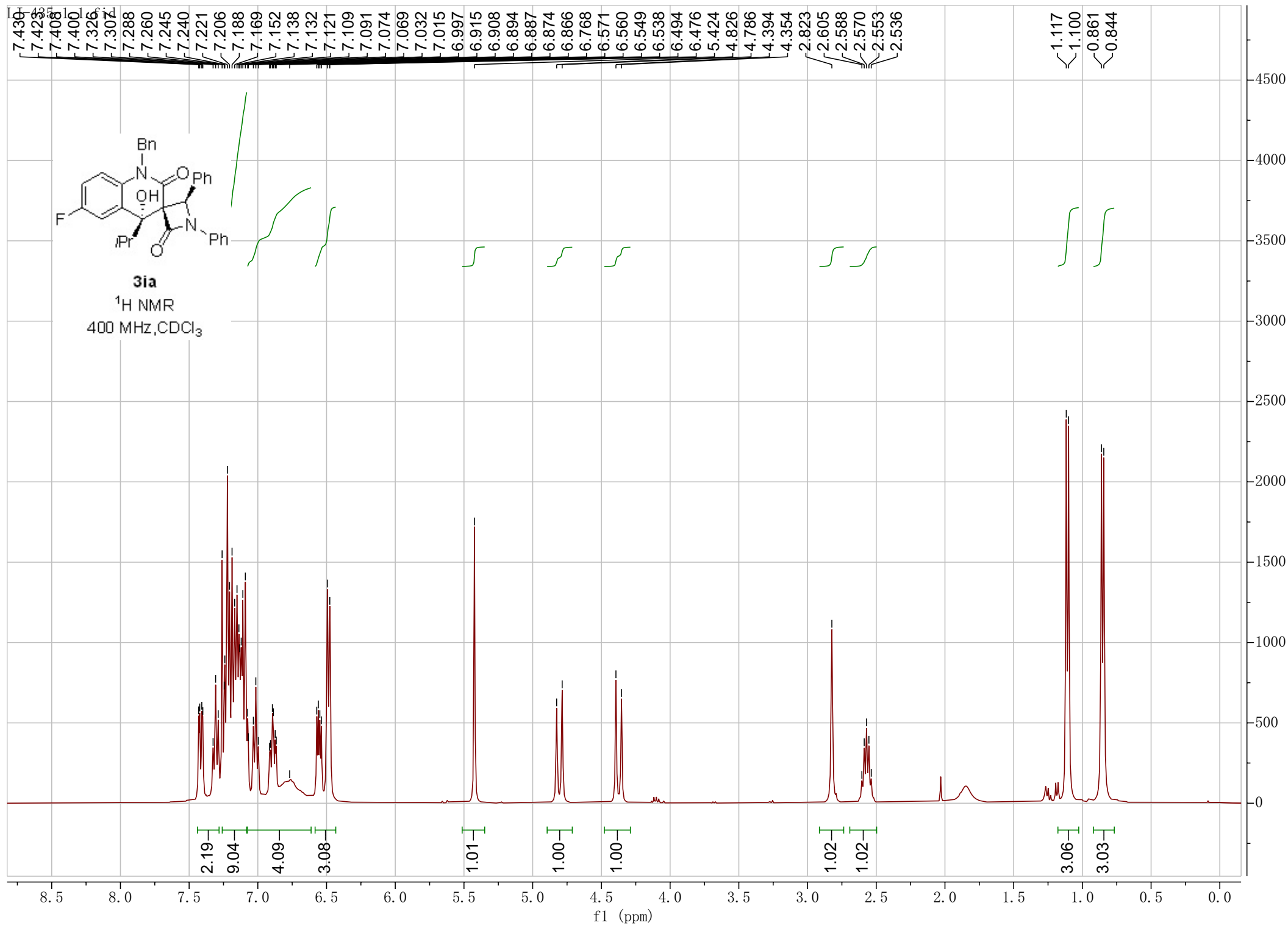


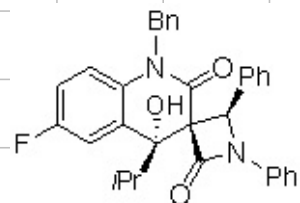


**3ha**

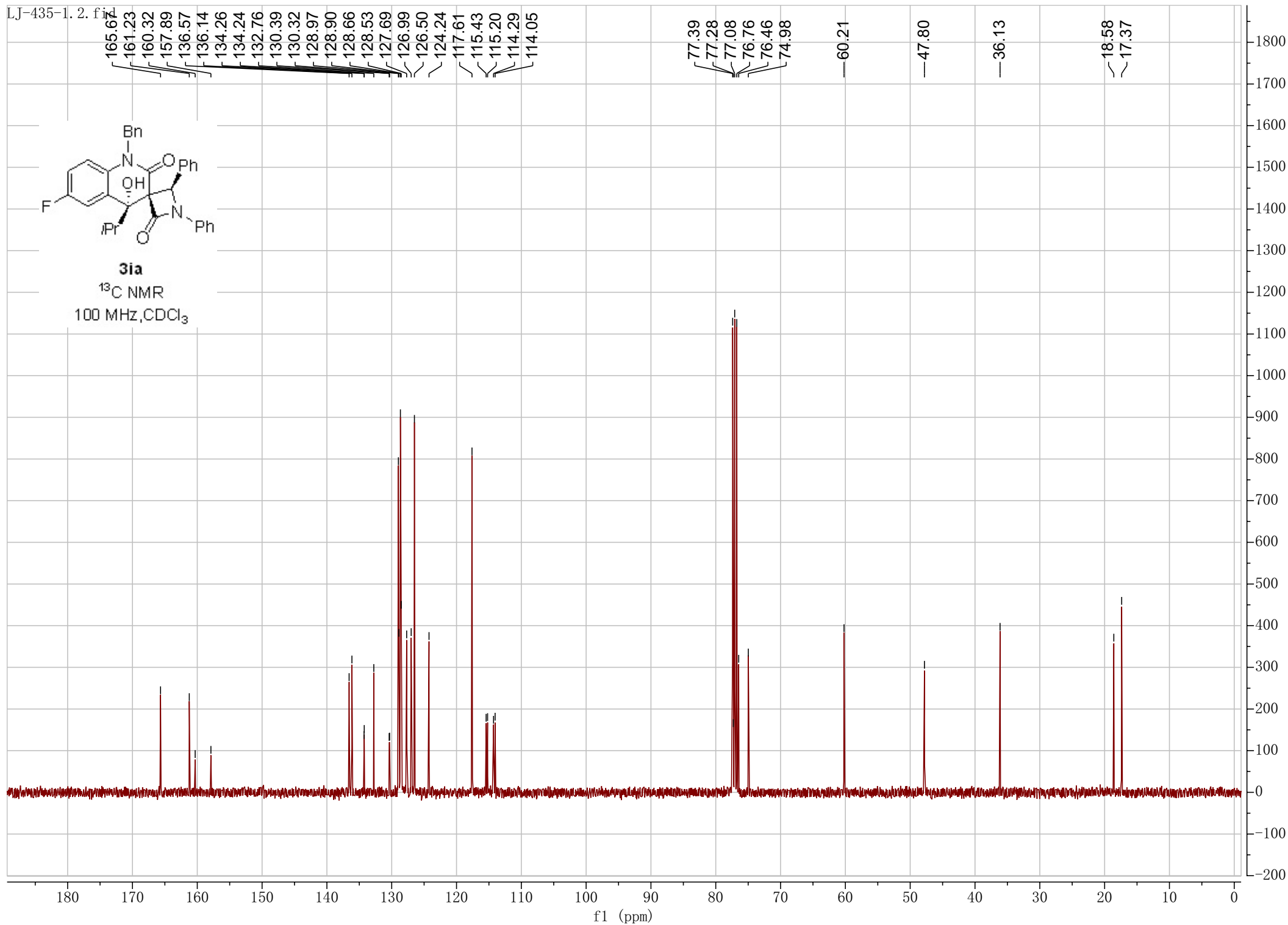
^{13}C NMR
100 MHz, CDCl_3

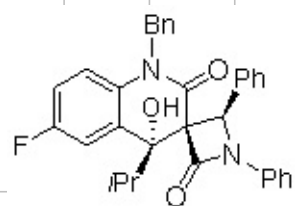




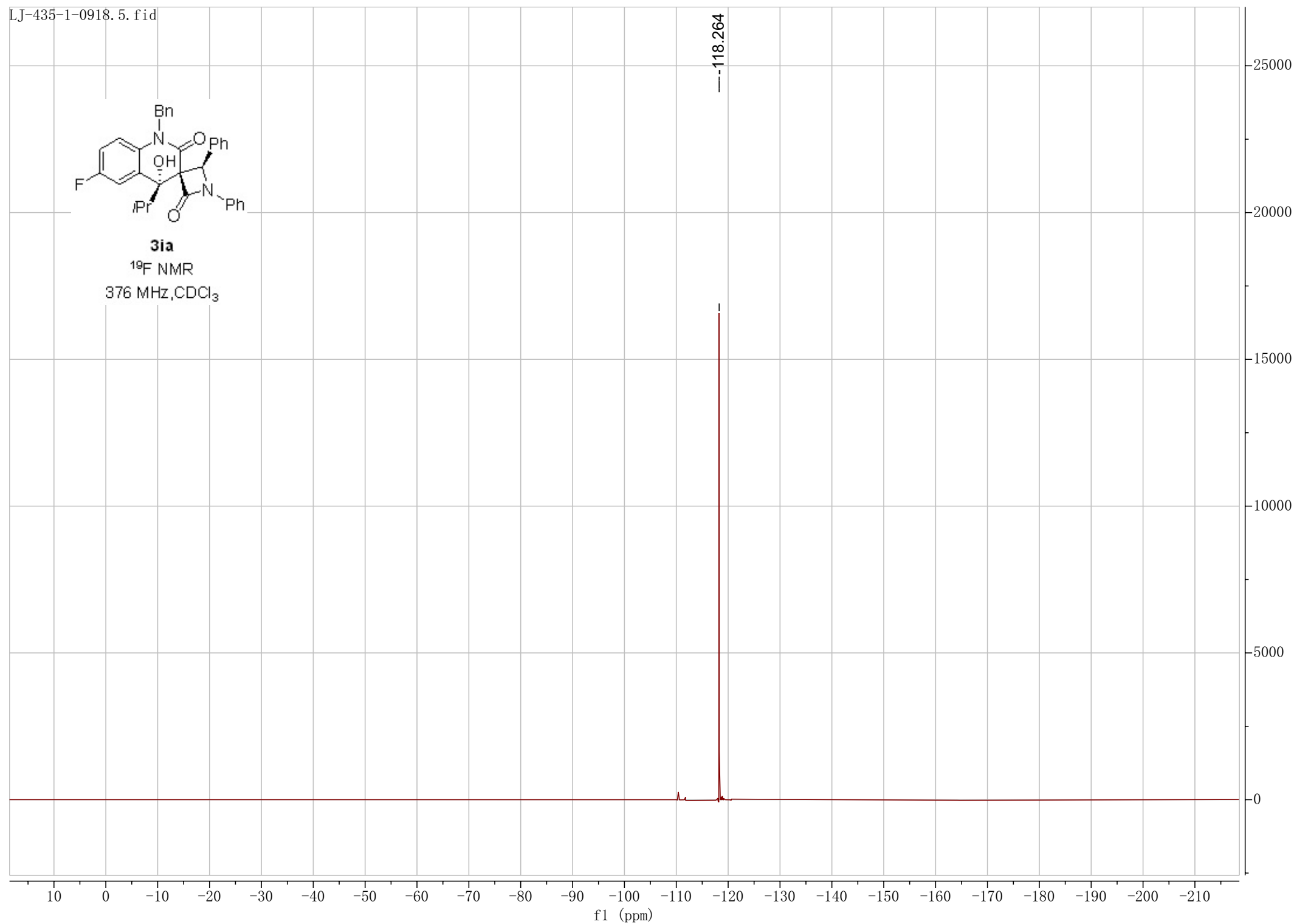
**3ia**

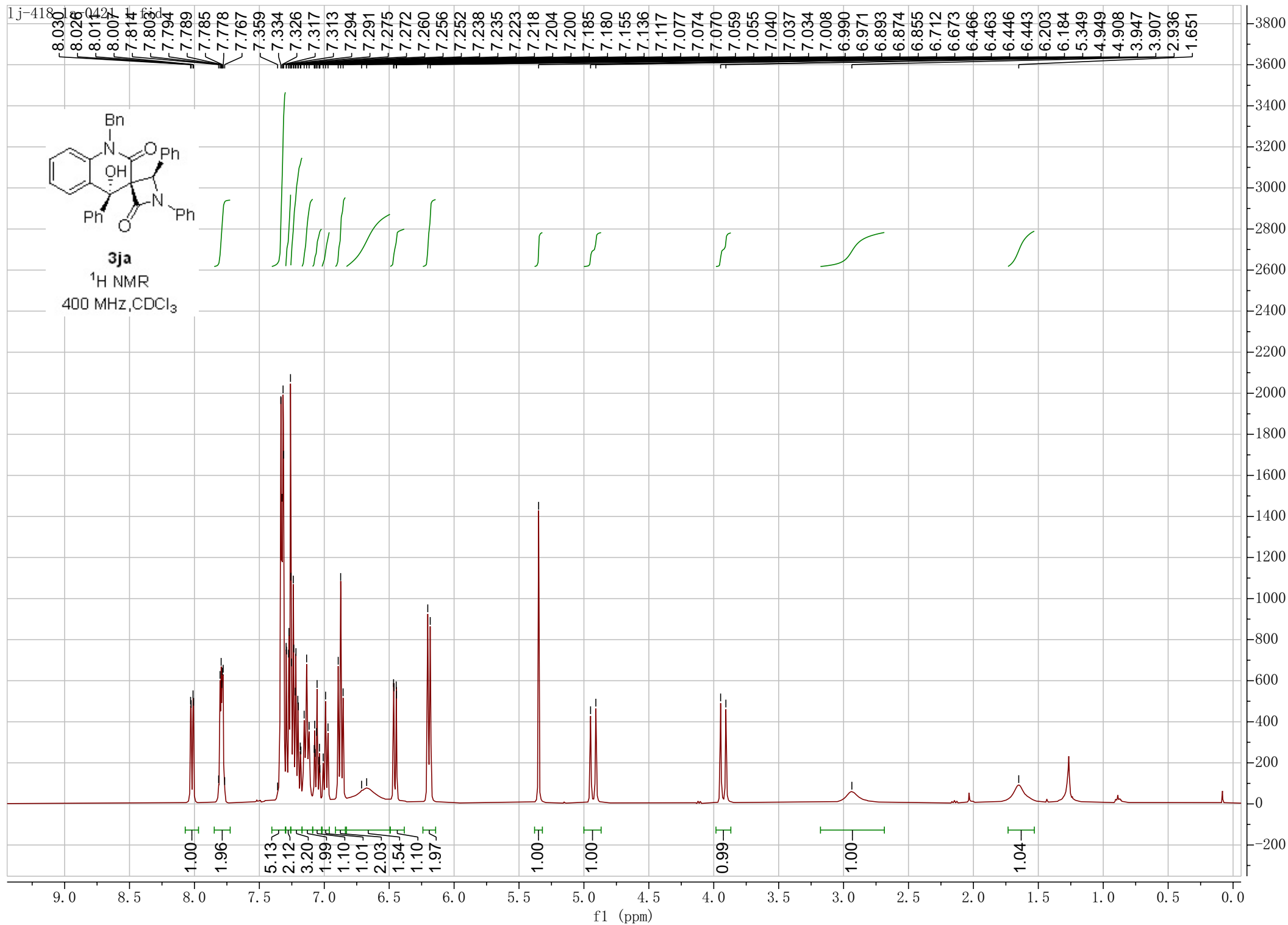
^{13}C NMR
100 MHz, CDCl_3

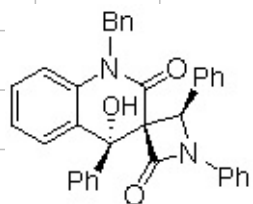


**3ia** ^{19}F NMR376 MHz, CDCl_3

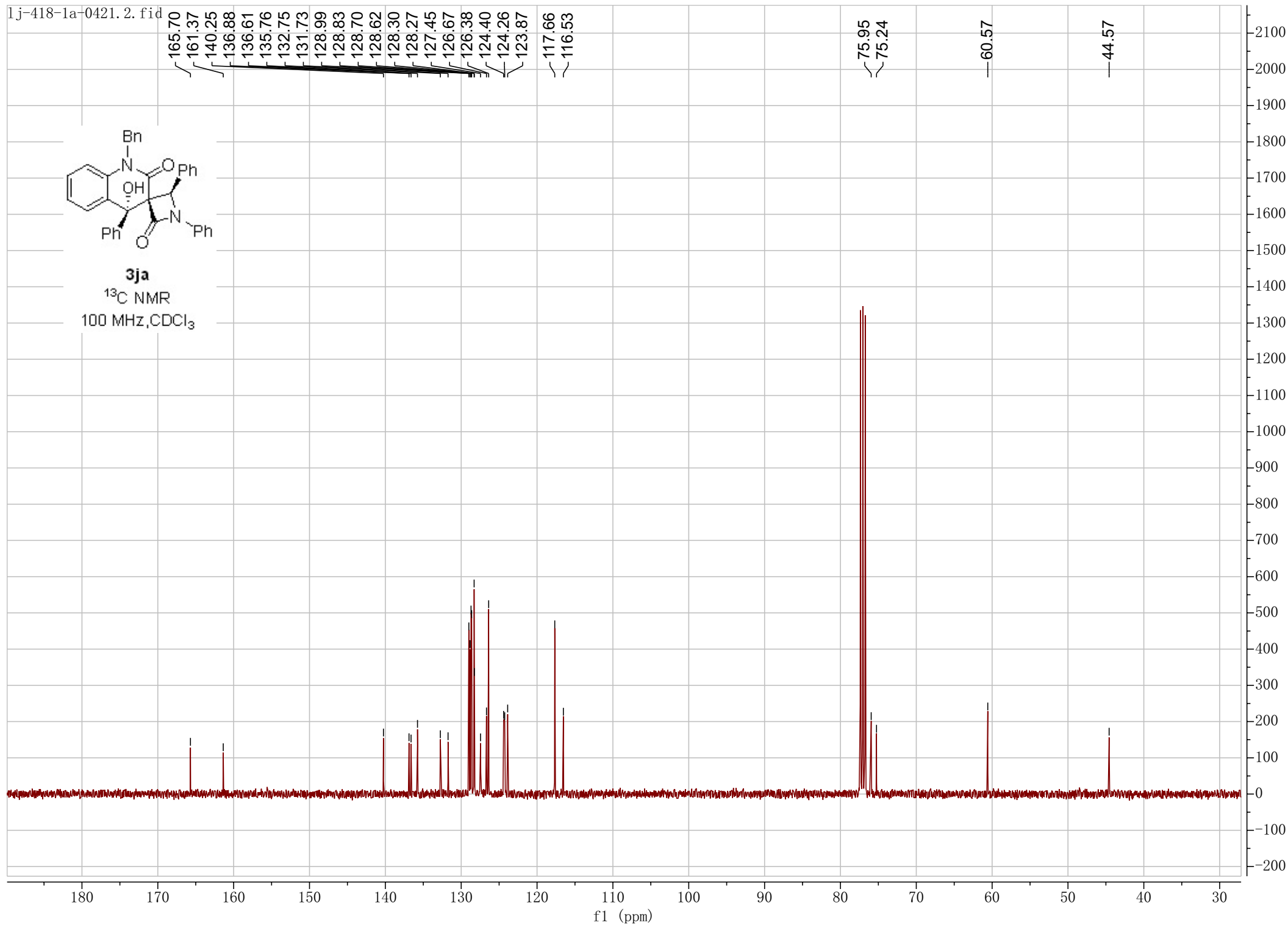
-118.264

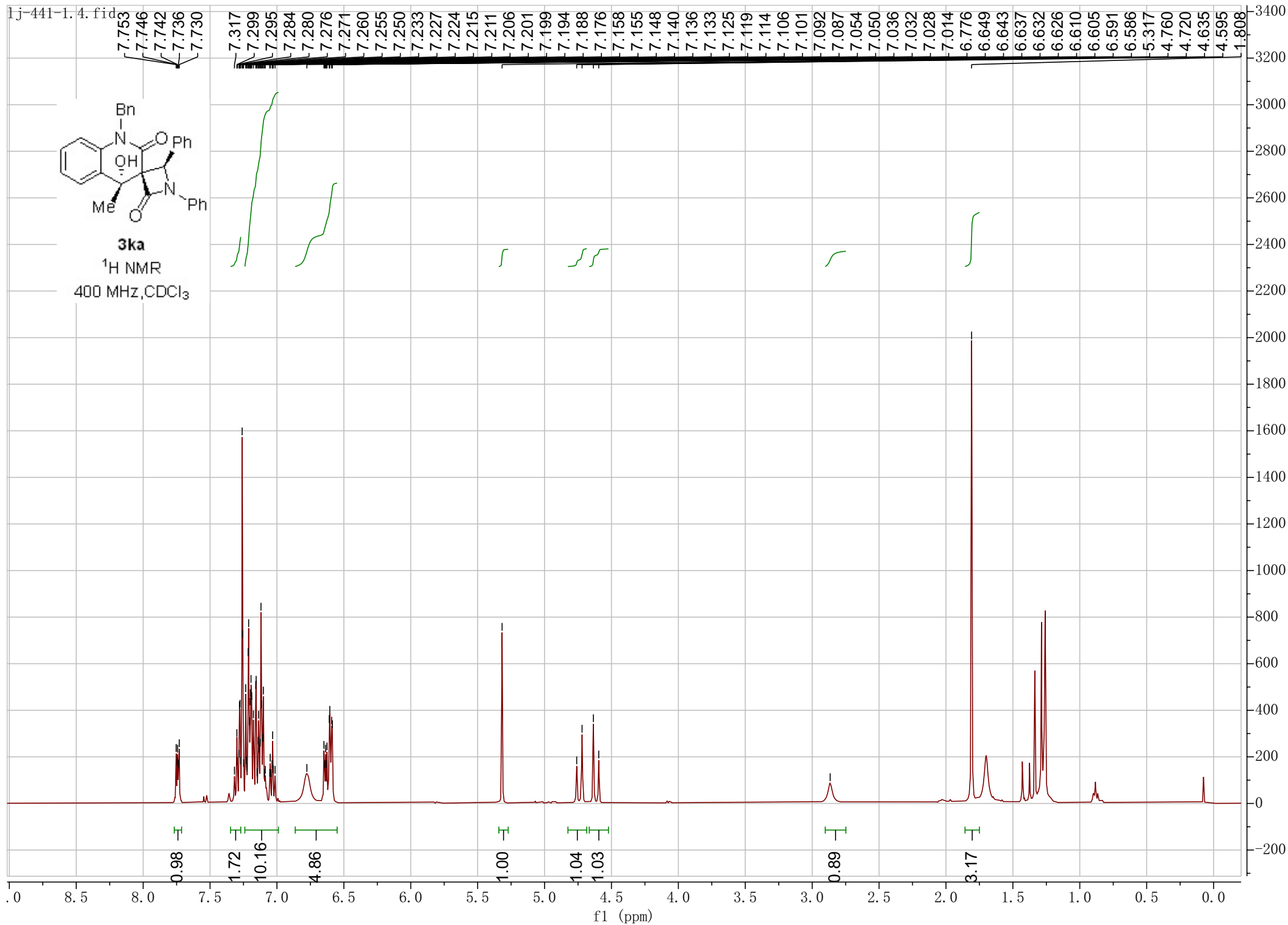


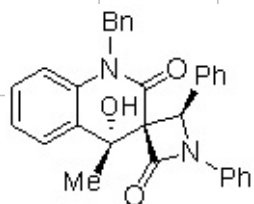




3ja
 ^{13}C NMR
100 MHz, CDCl_3





**3ka**

^{13}C NMR
150 MHz, CDCl_3

— 165.26
— 162.30
— 136.81
— 136.75
— 136.31
— 132.95
— 131.62
— 128.99
— 128.84
— 128.81
— 128.64
— 128.52
— 127.30
— 126.94
— 126.50
— 124.29
— 124.23
— 124.04
— 117.59
— 116.10

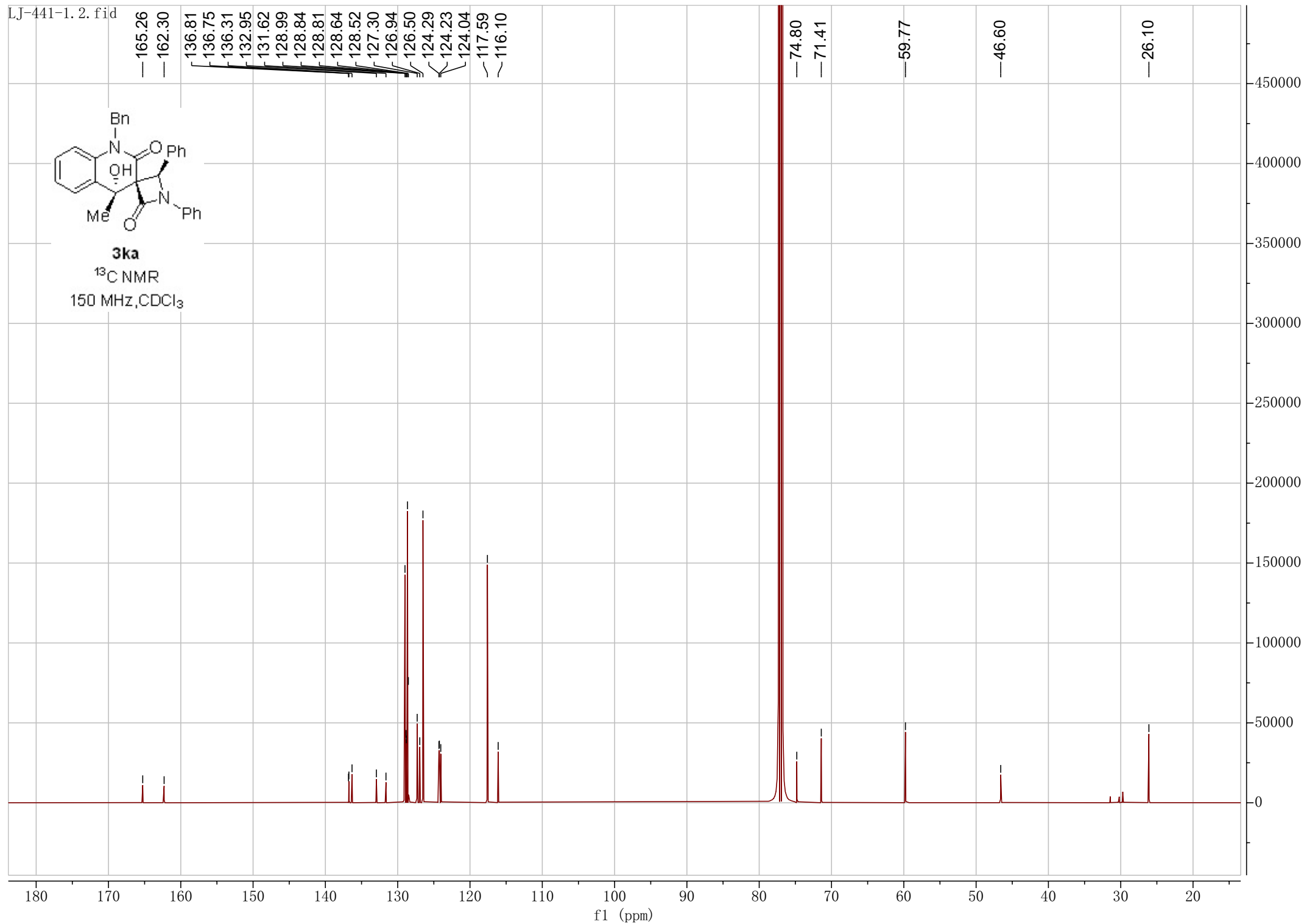
— 74.80

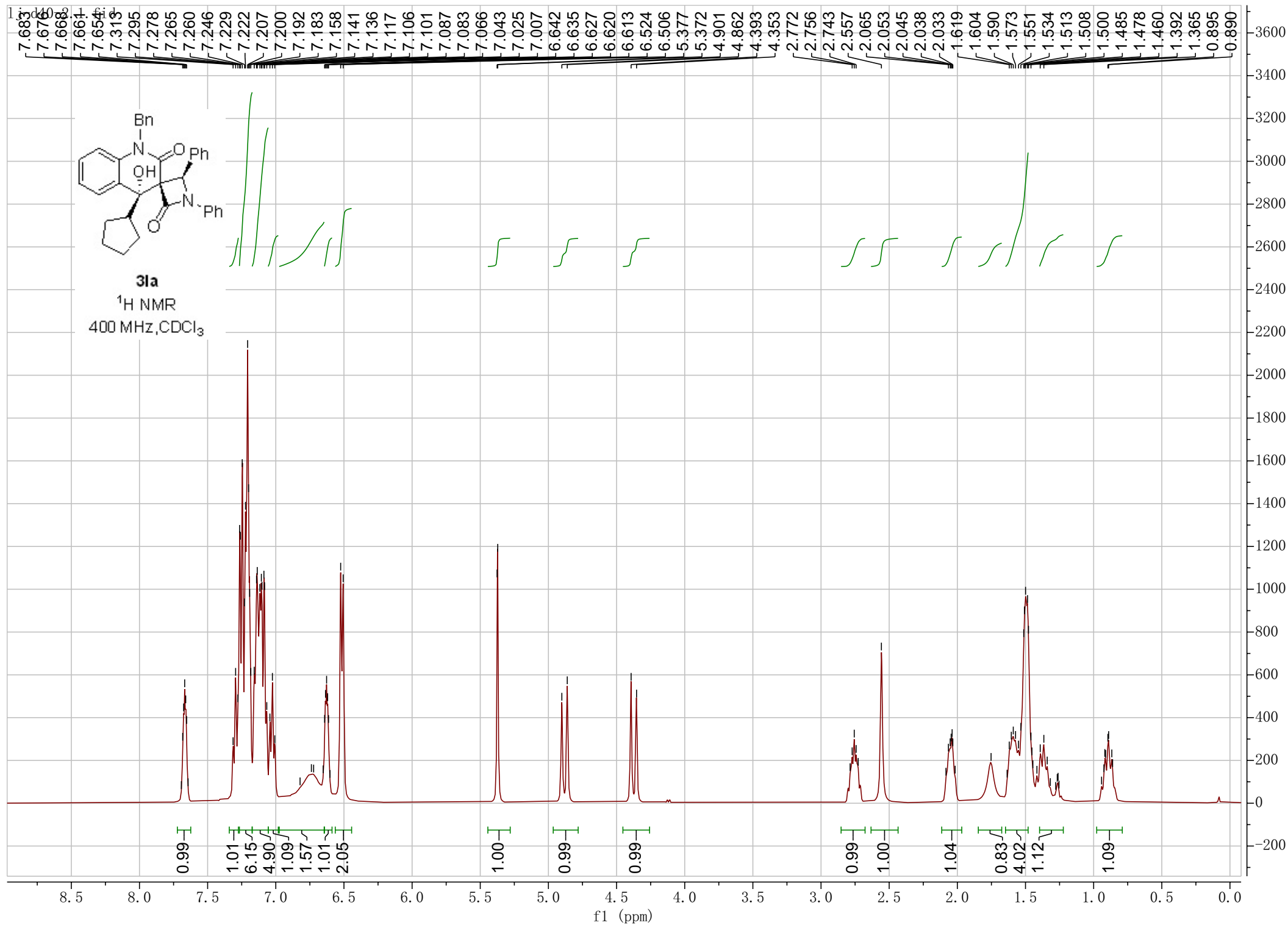
— 71.41

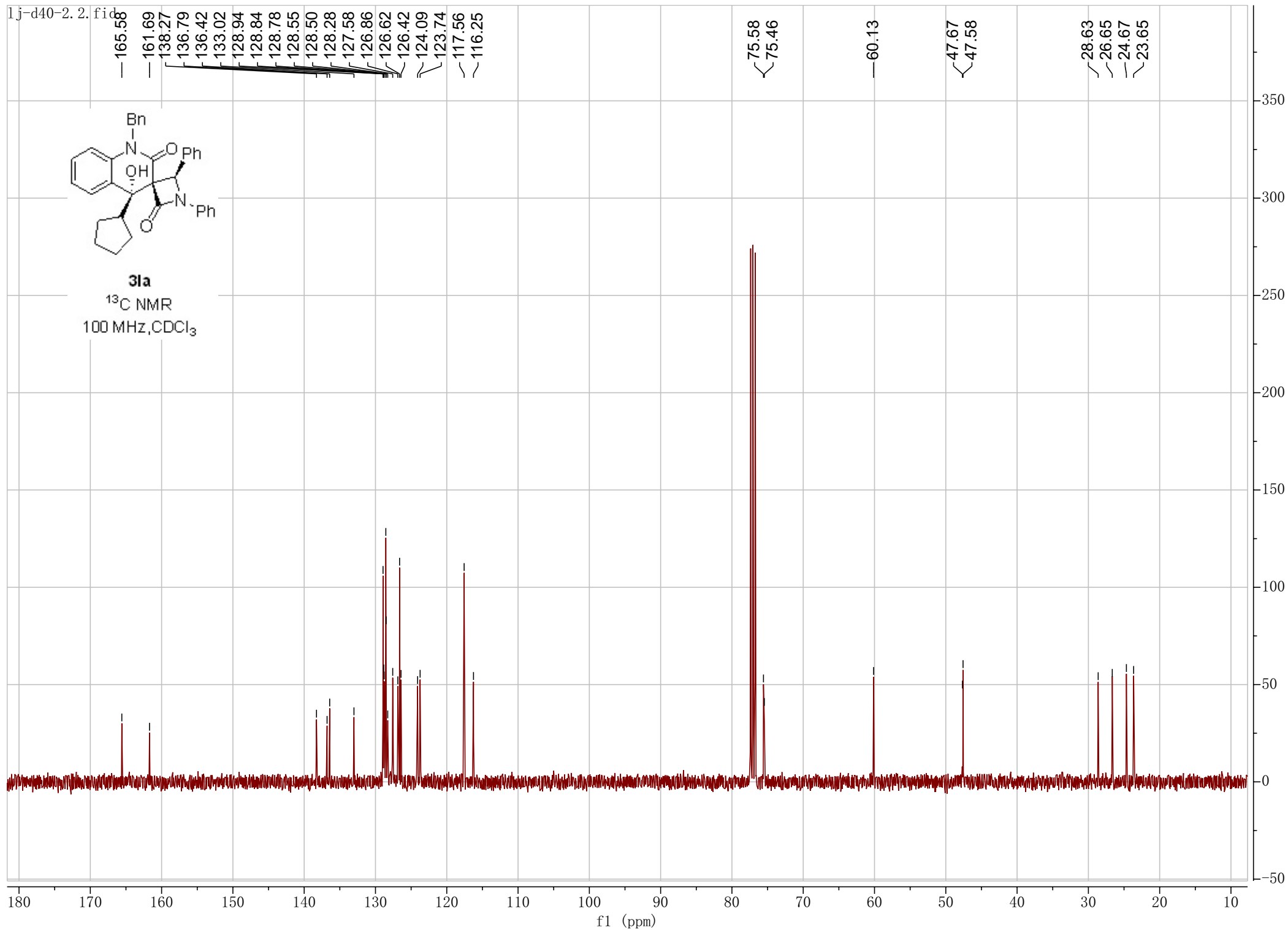
— 59.77

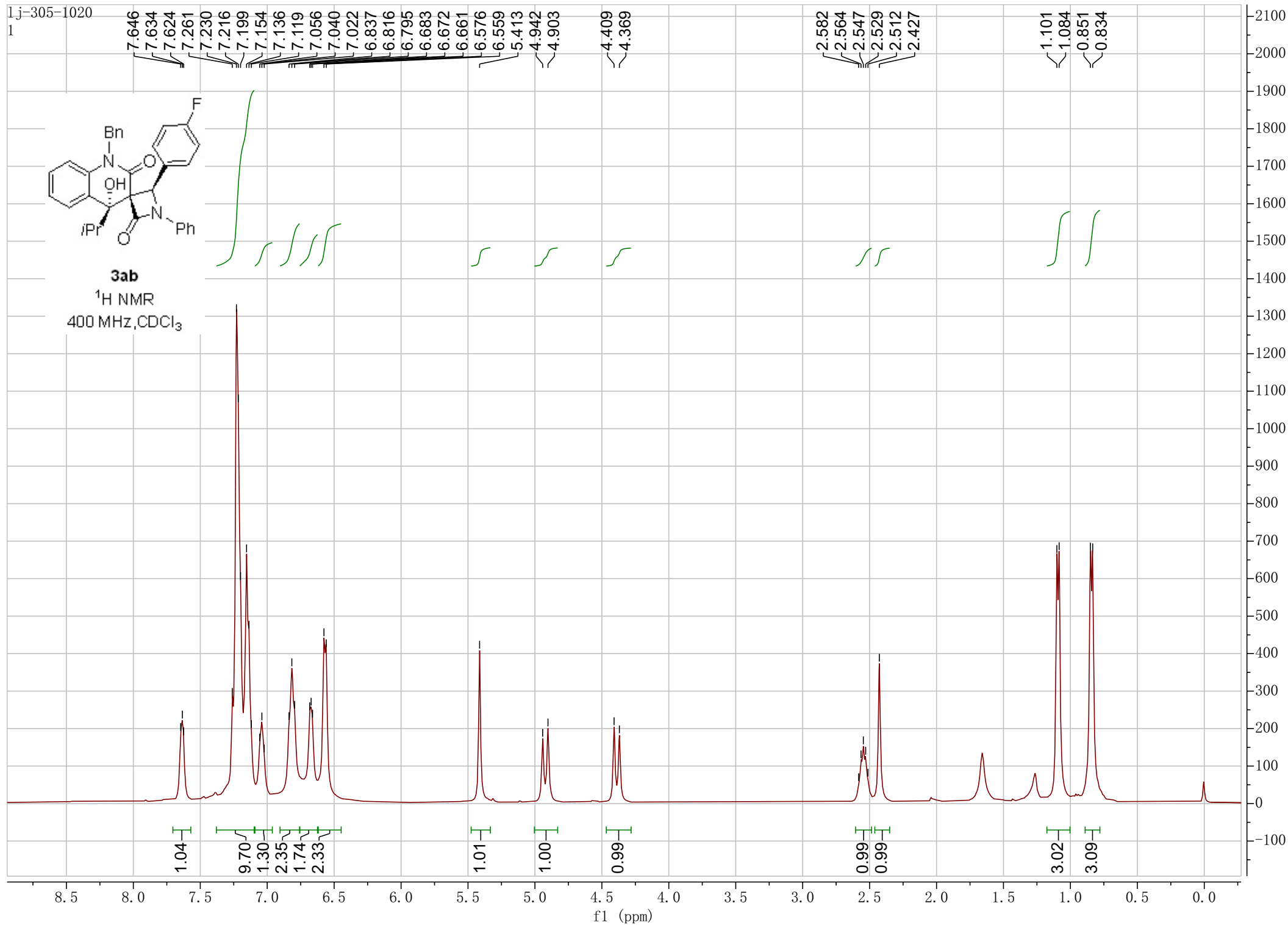
— 46.60

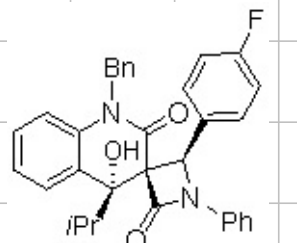
— 26.10



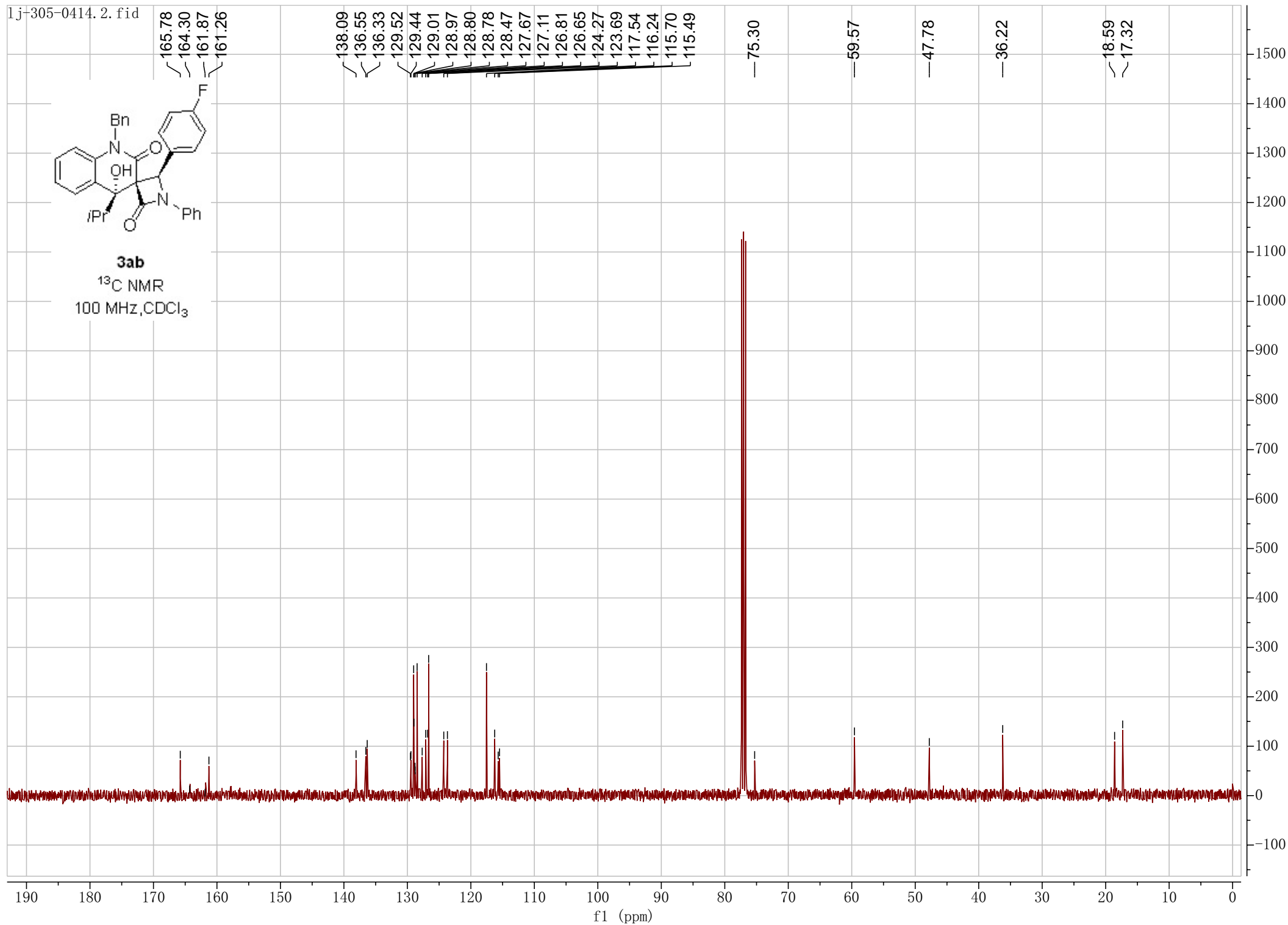


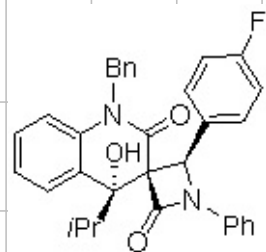
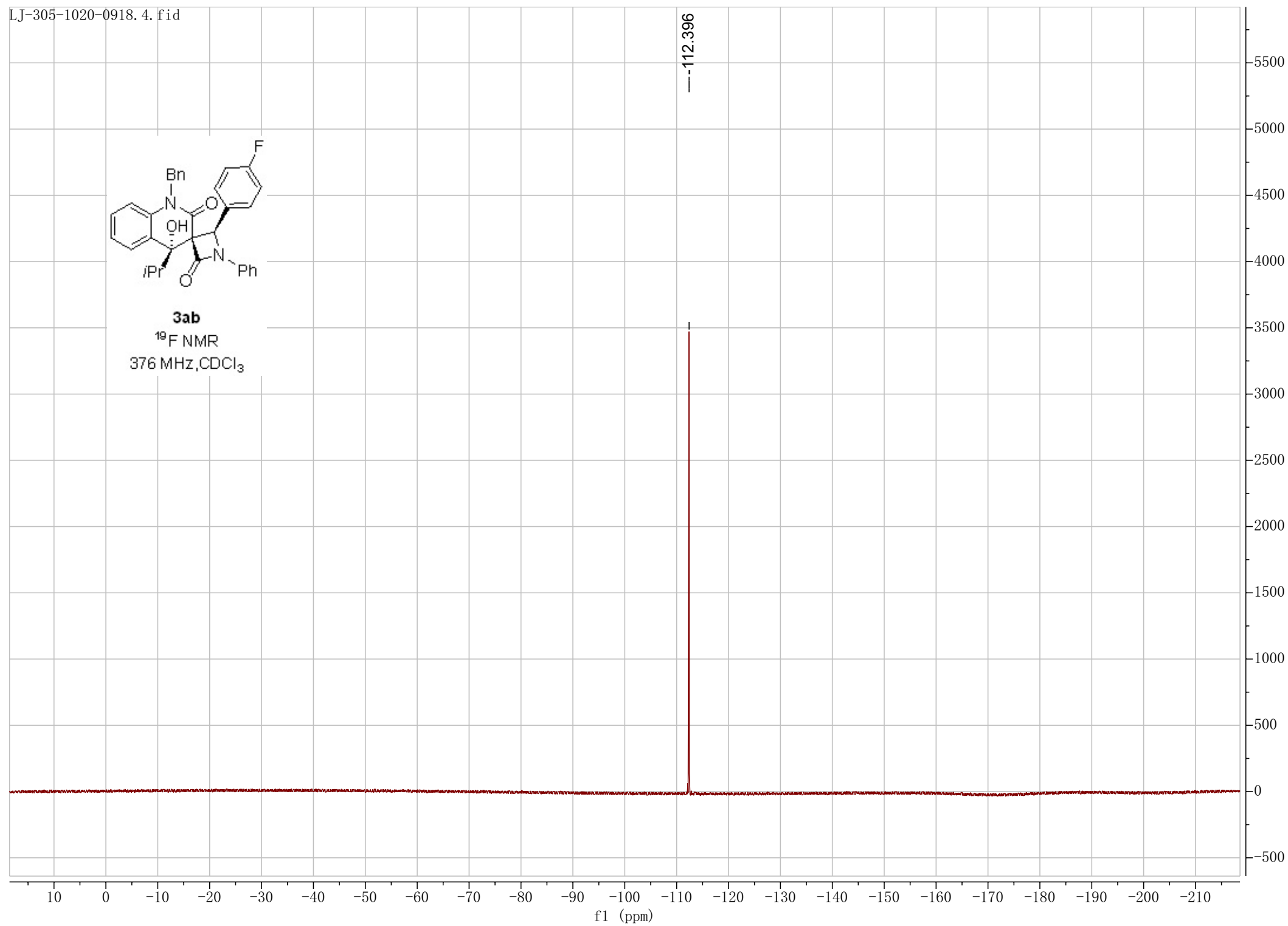


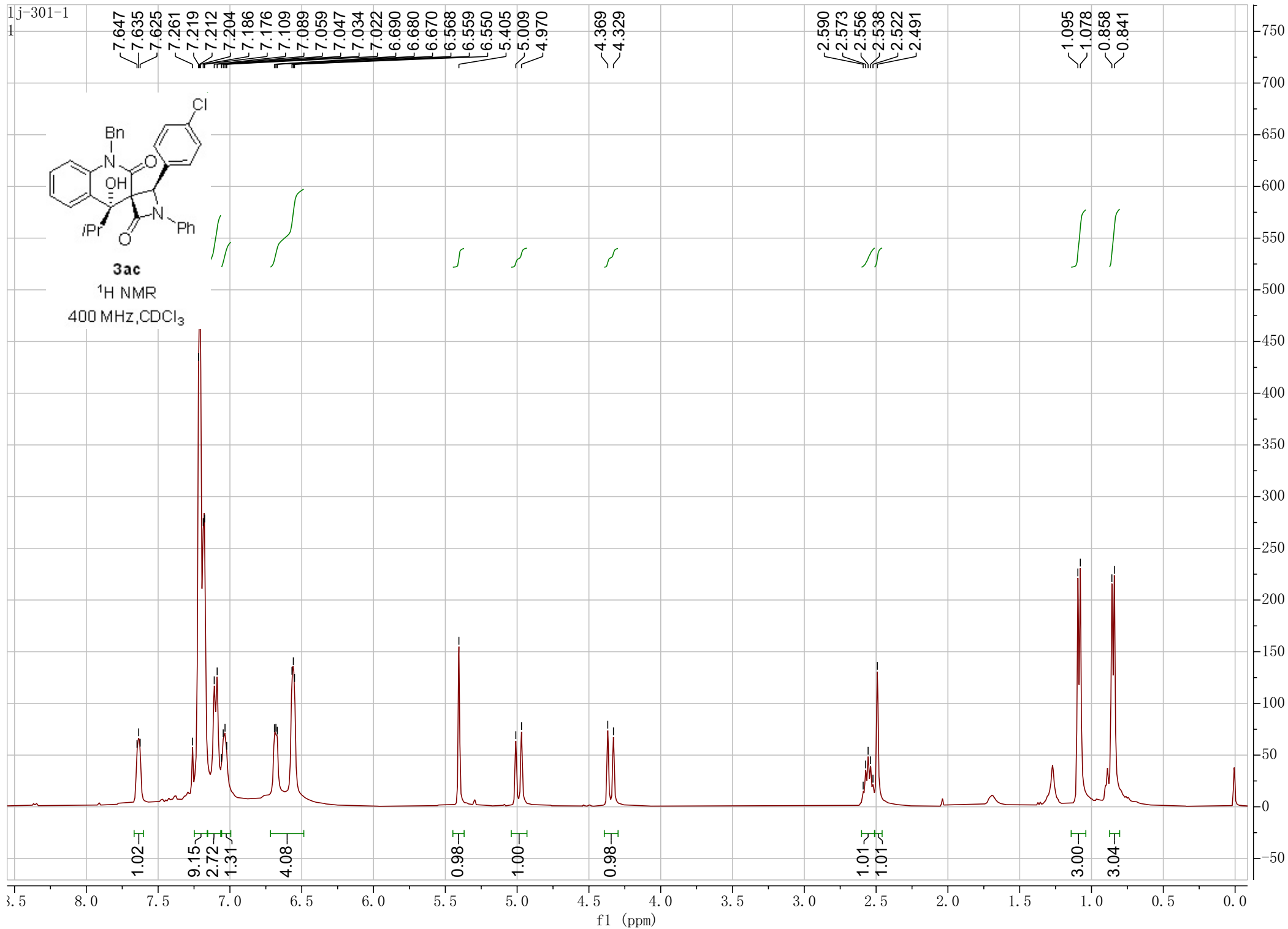


**3ab**

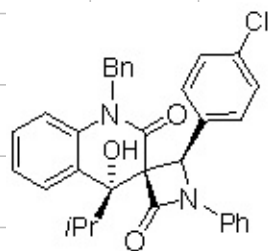
^{13}C NMR
100 MHz, CDCl_3



**3ab**¹⁹F NMR376 MHz, CDCl₃

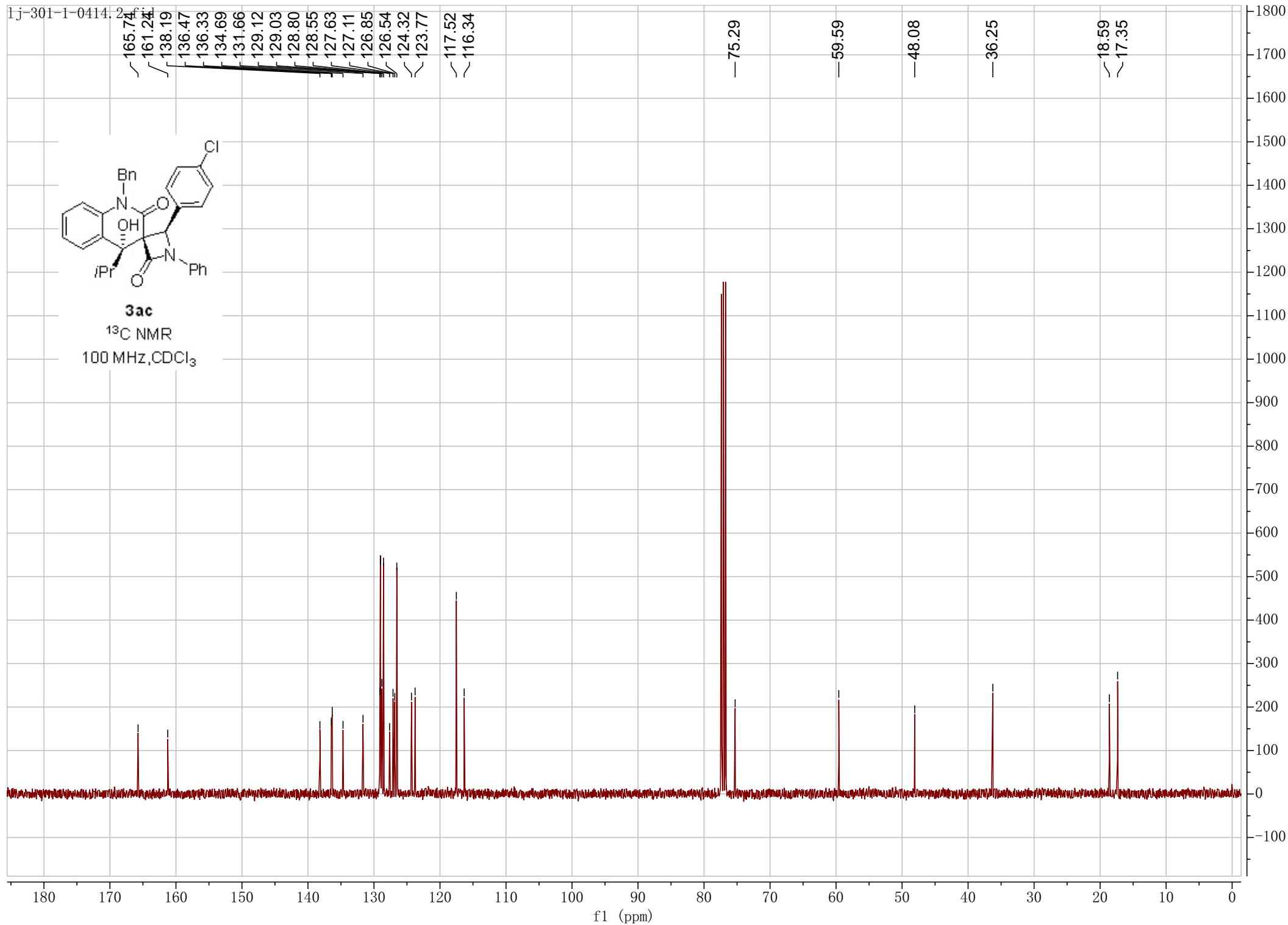


Ij-301-1-0414; 2 f1

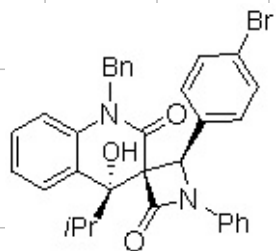


3ac

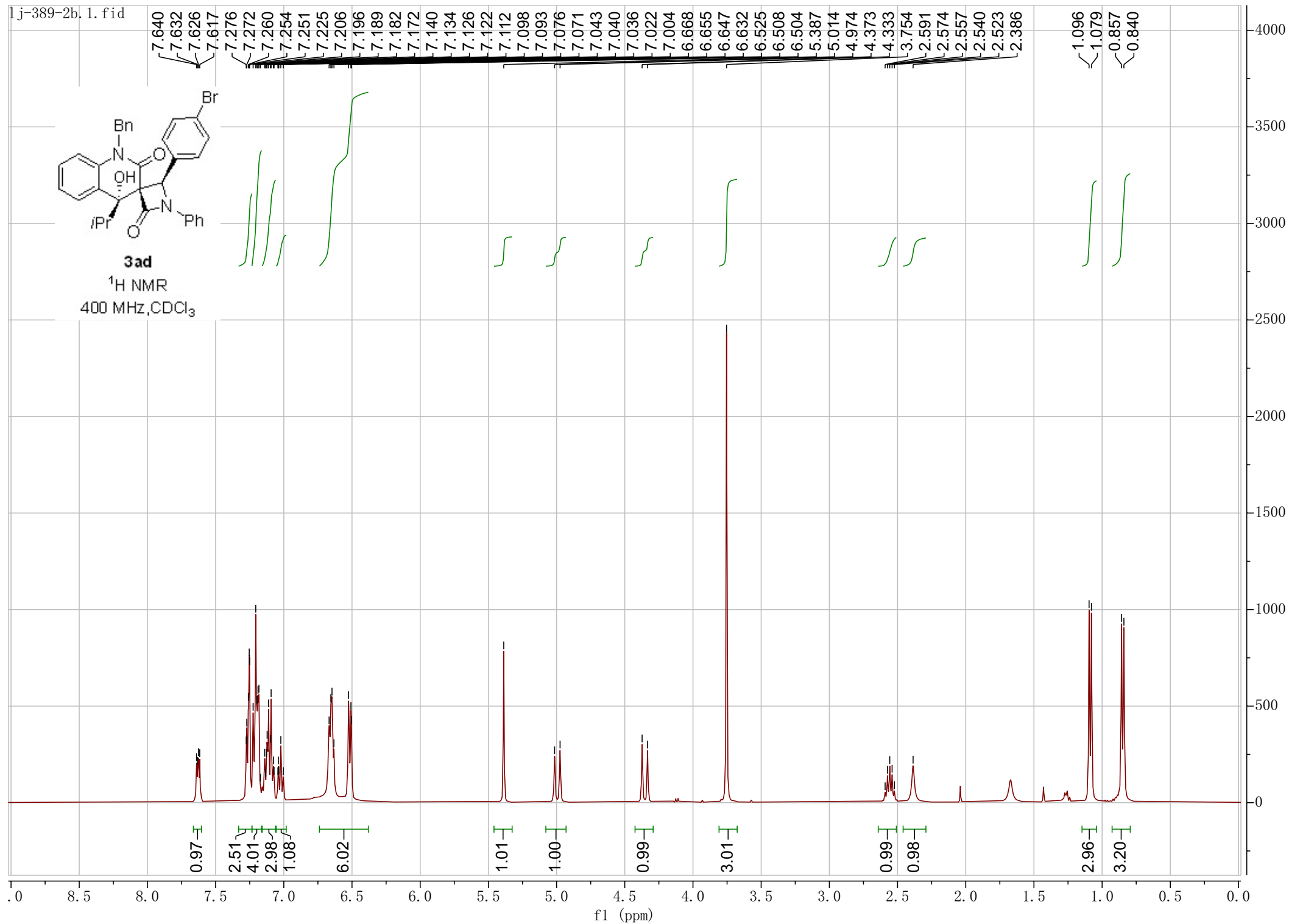
^{13}C NMR
100 MHz, CDCl_3



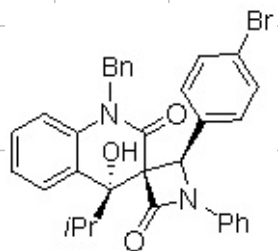
lj-389-2b, 1. fid

**3ad**

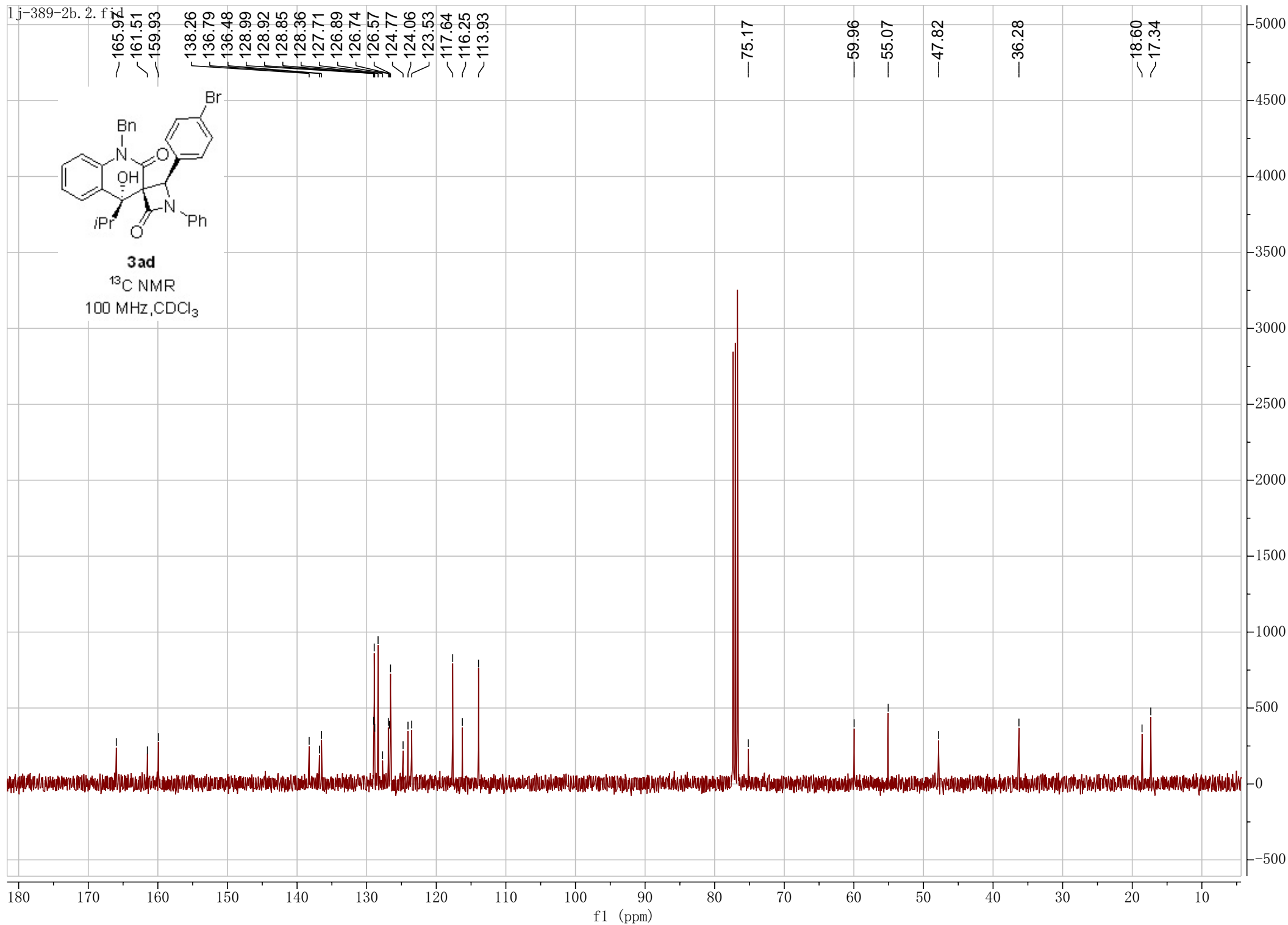
¹H NMR
400 MHz, CDCl₃

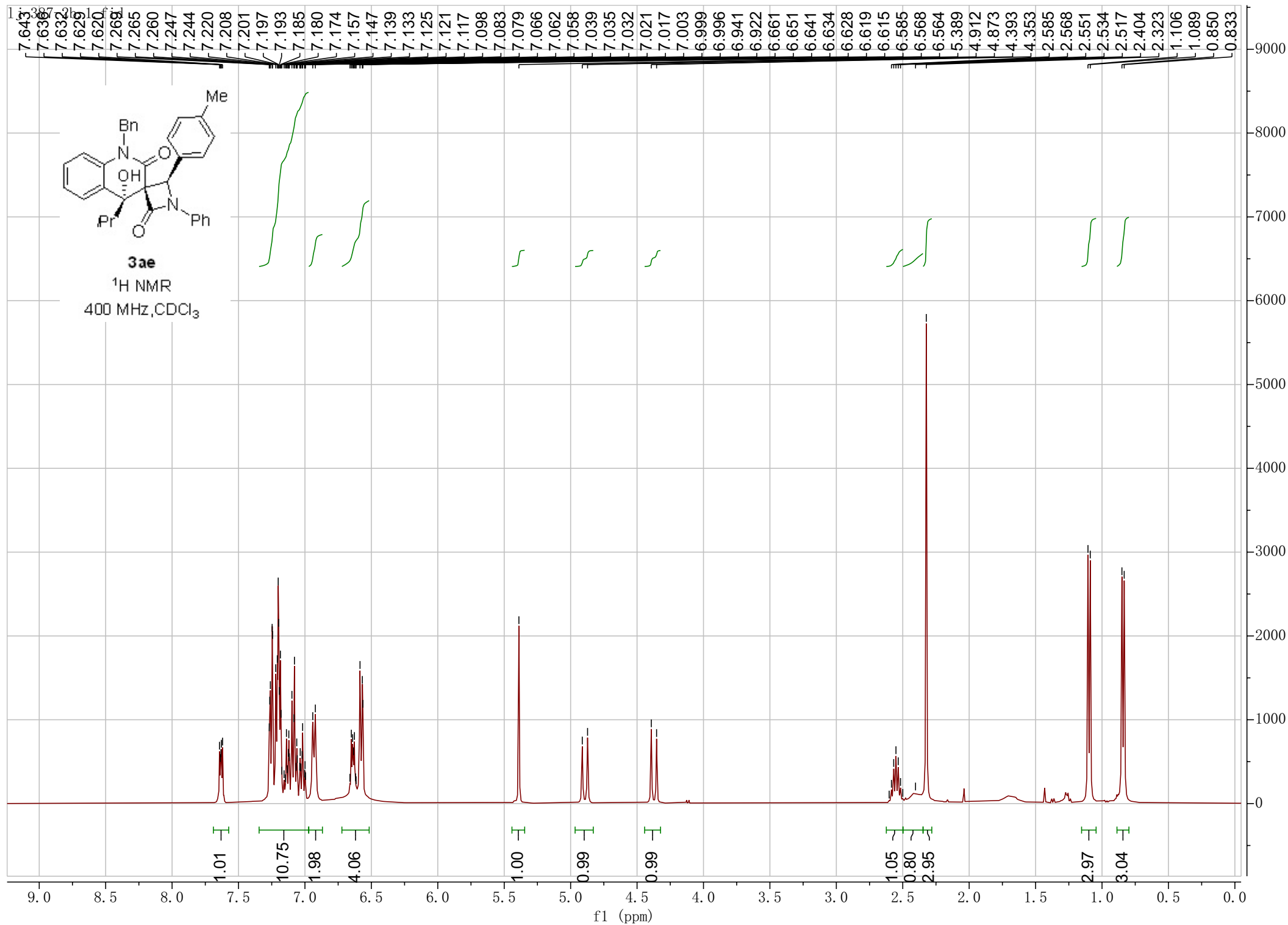


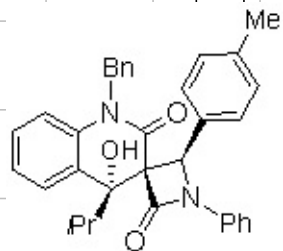
lj-389-2b. 2. f1



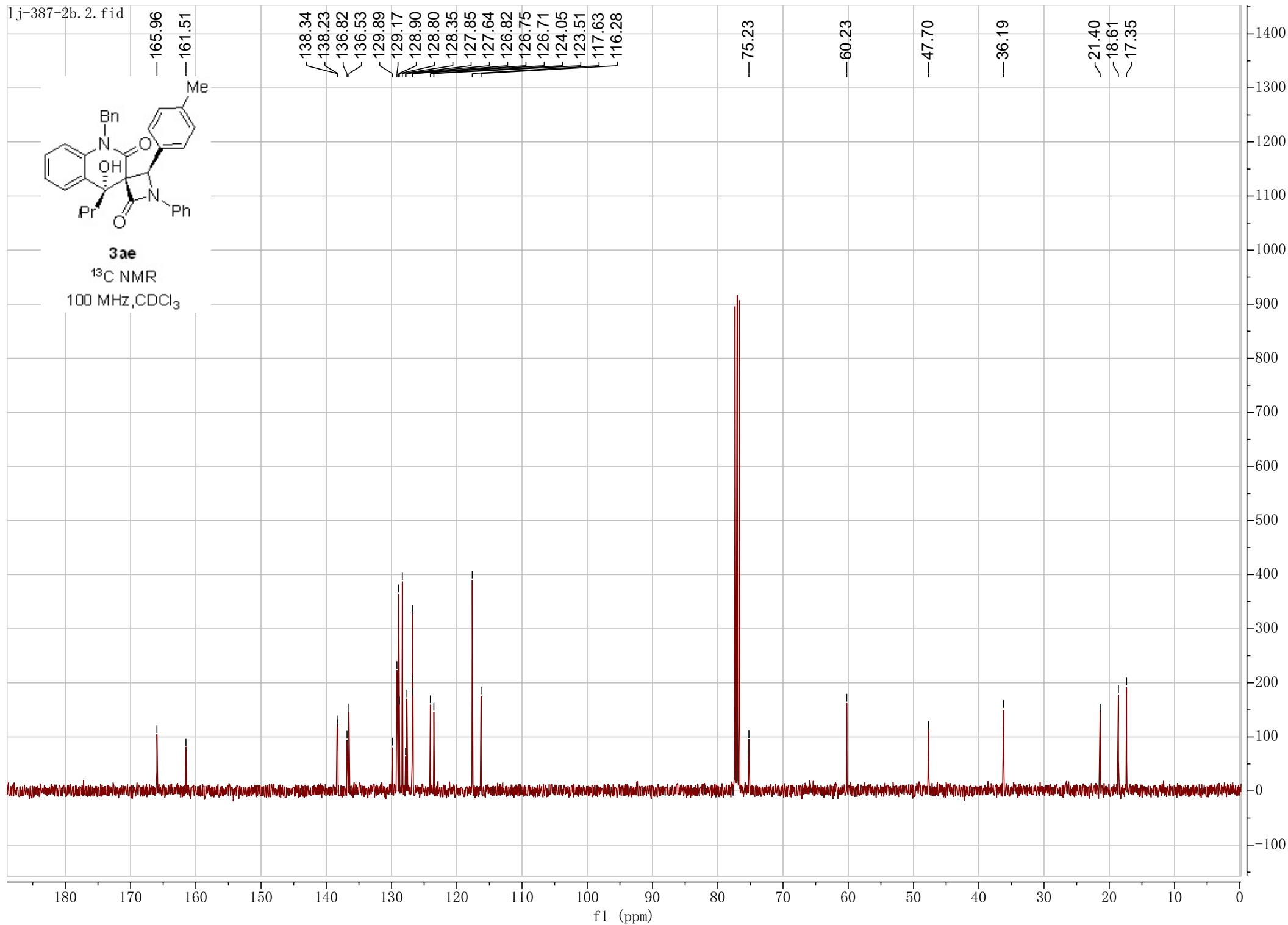
3ad
 ^{13}C NMR
 100 MHz, CDCl_3

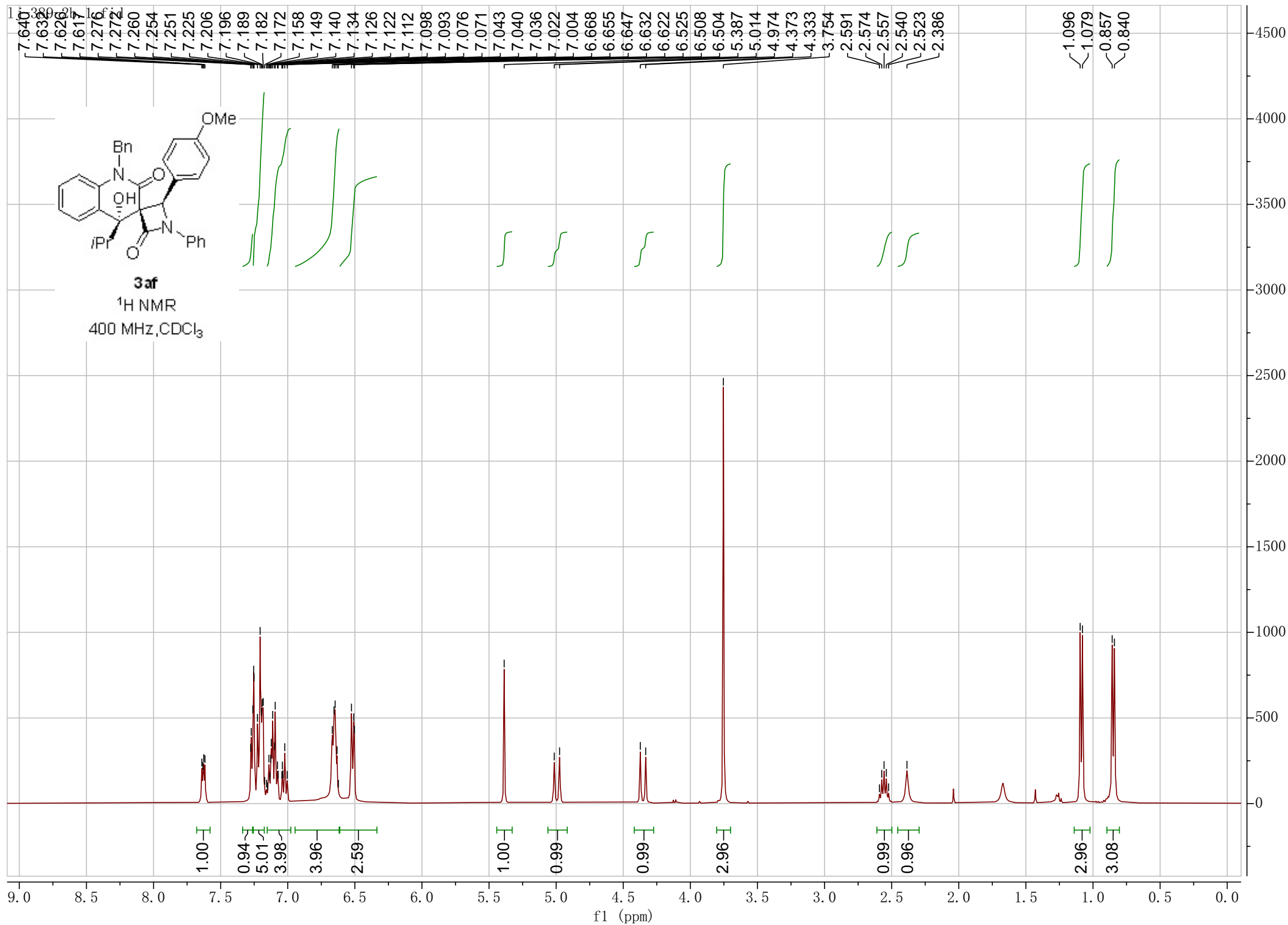




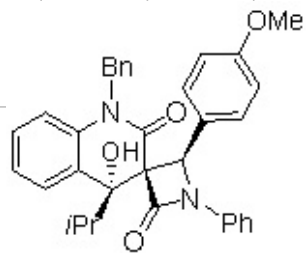
**3ae**

^{13}C NMR
100 MHz, CDCl_3





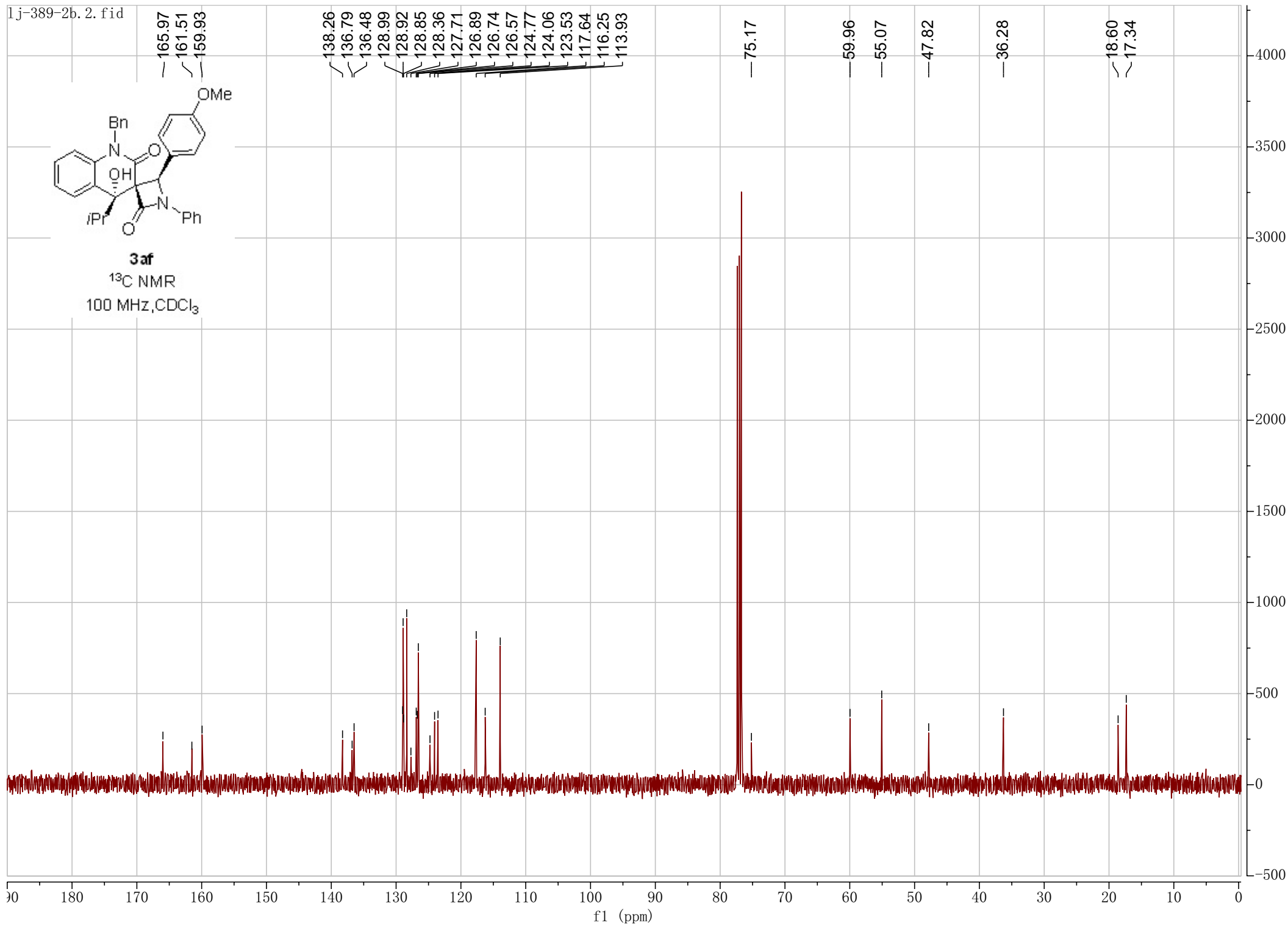
lj-389-2b. 2. fid

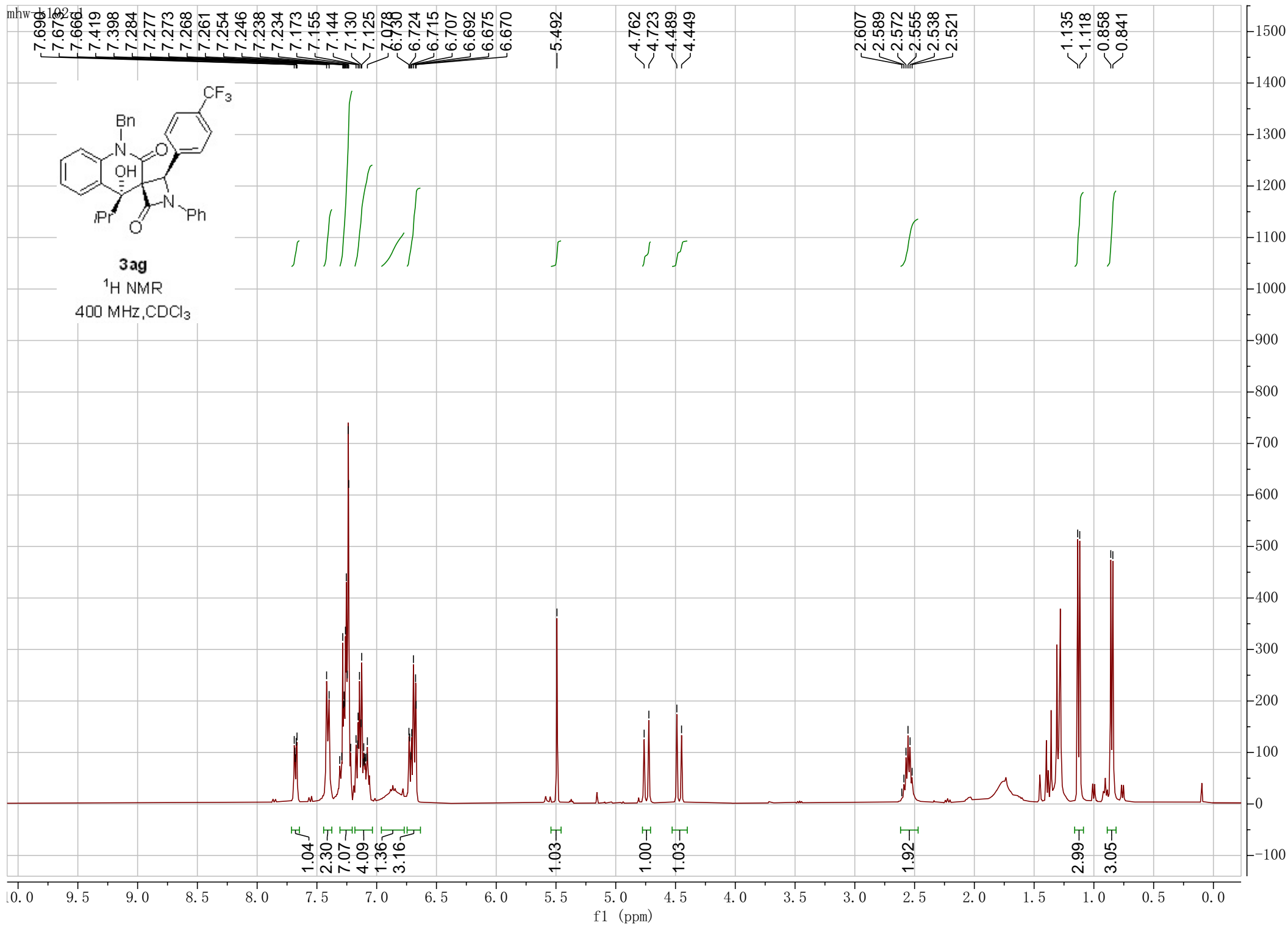


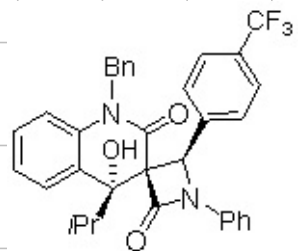
3af

^{13}C NMR

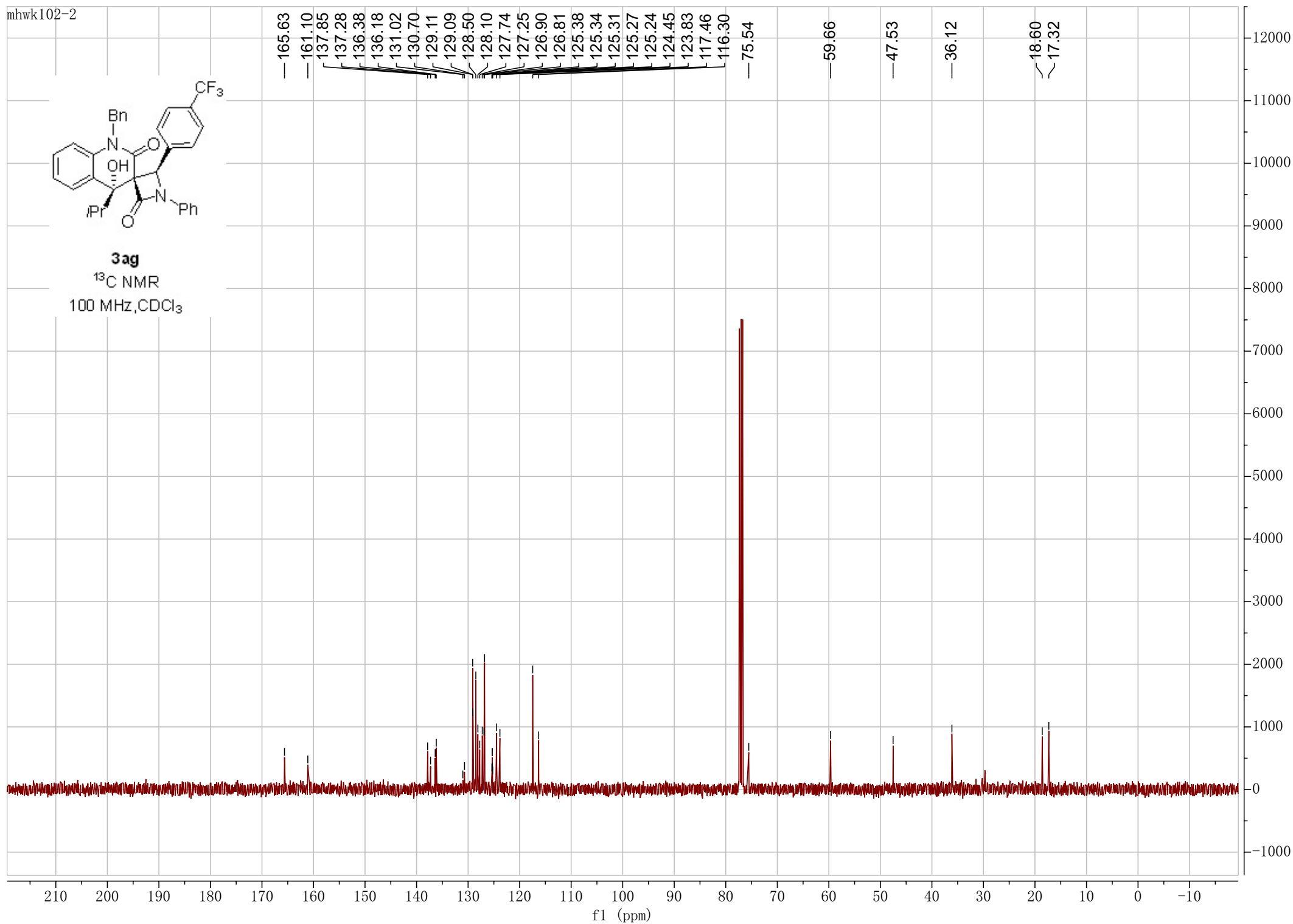
100 MHz, CDCl_3



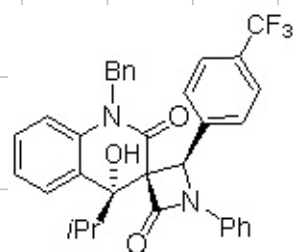


**3ag**

^{13}C NMR
100 MHz, CDCl_3



lj-d107-1.1.fid

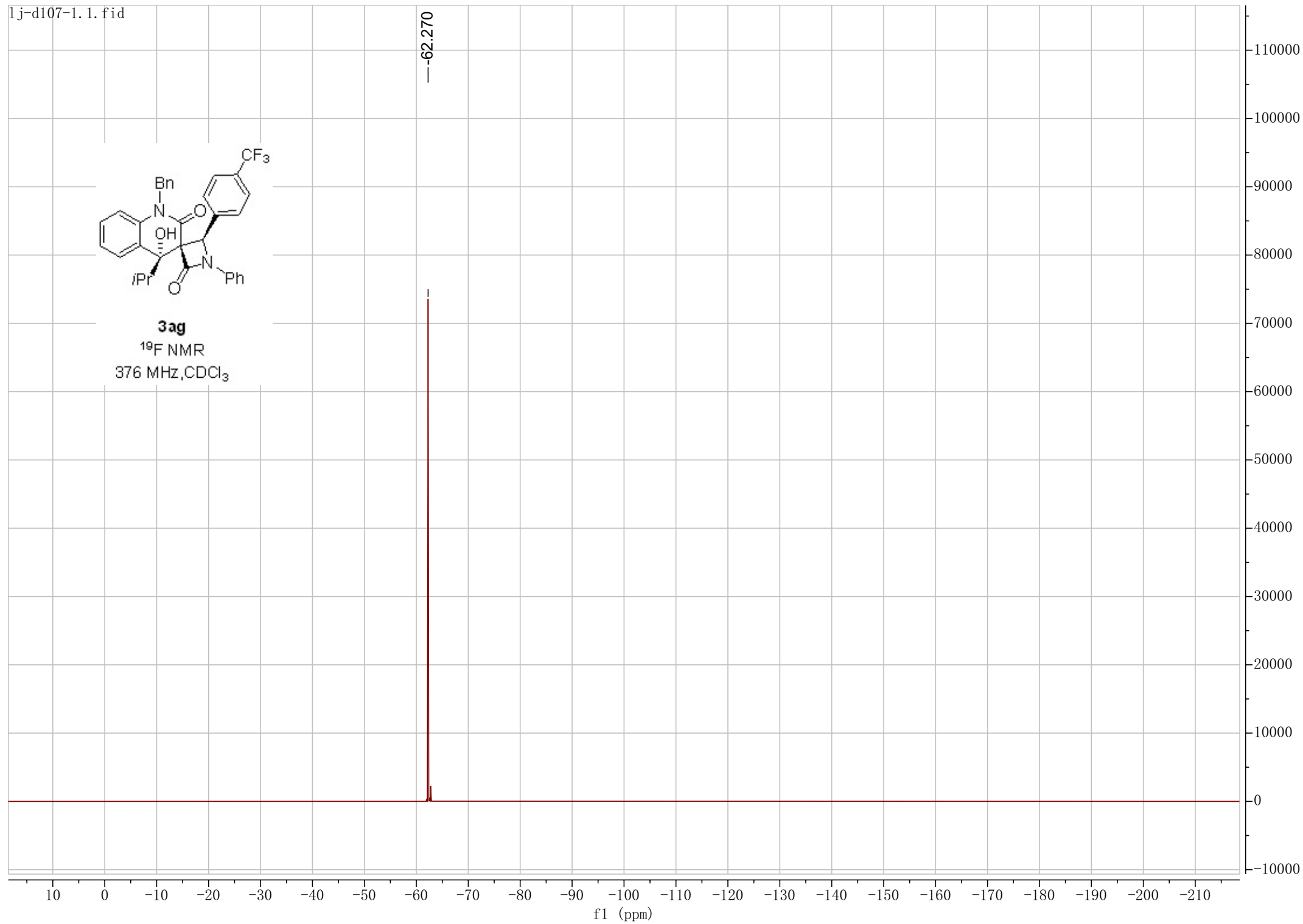


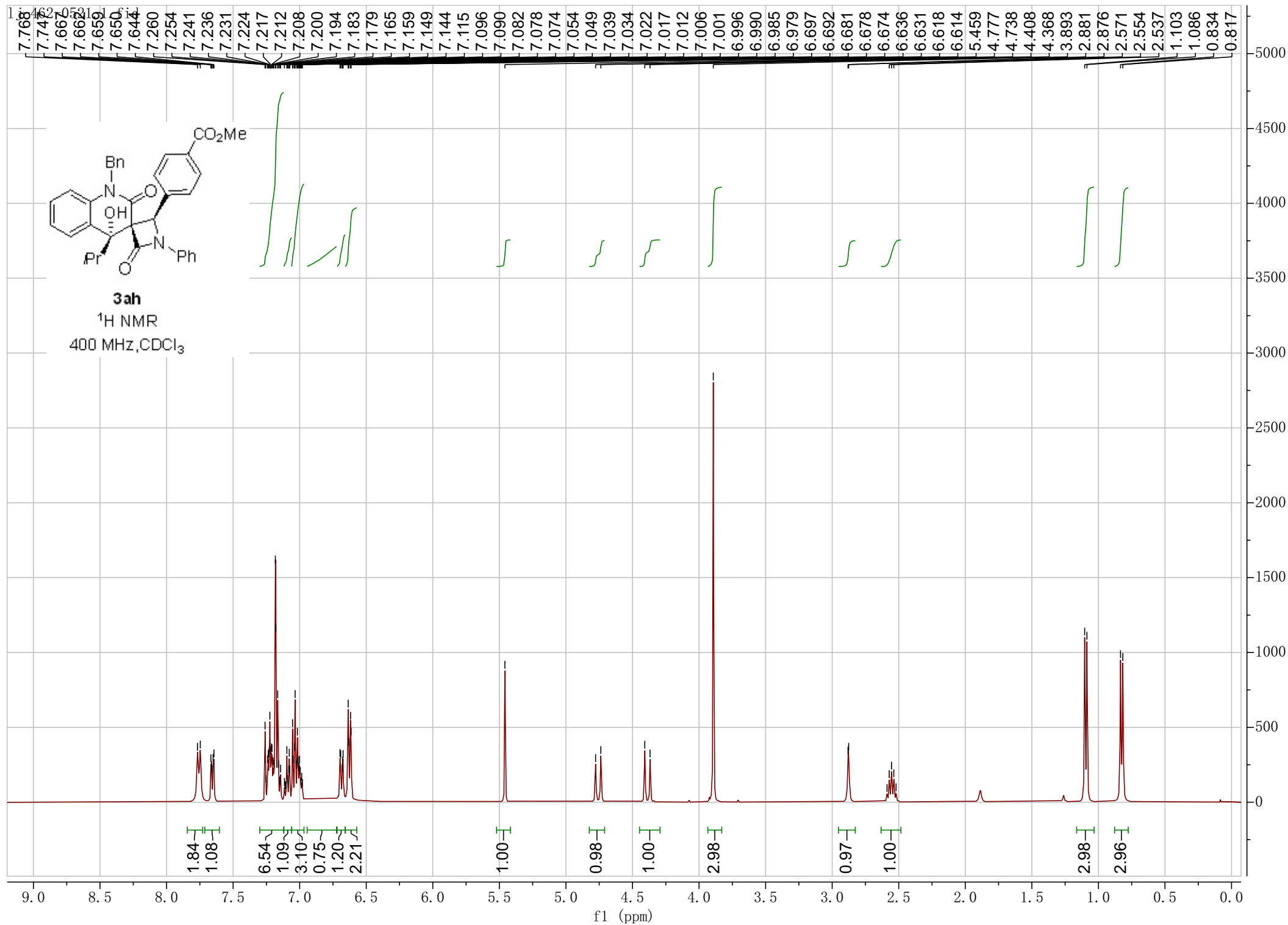
3ag

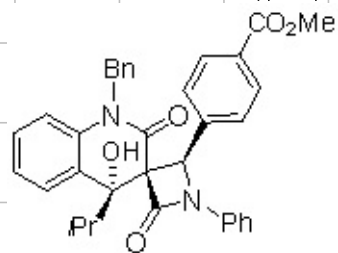
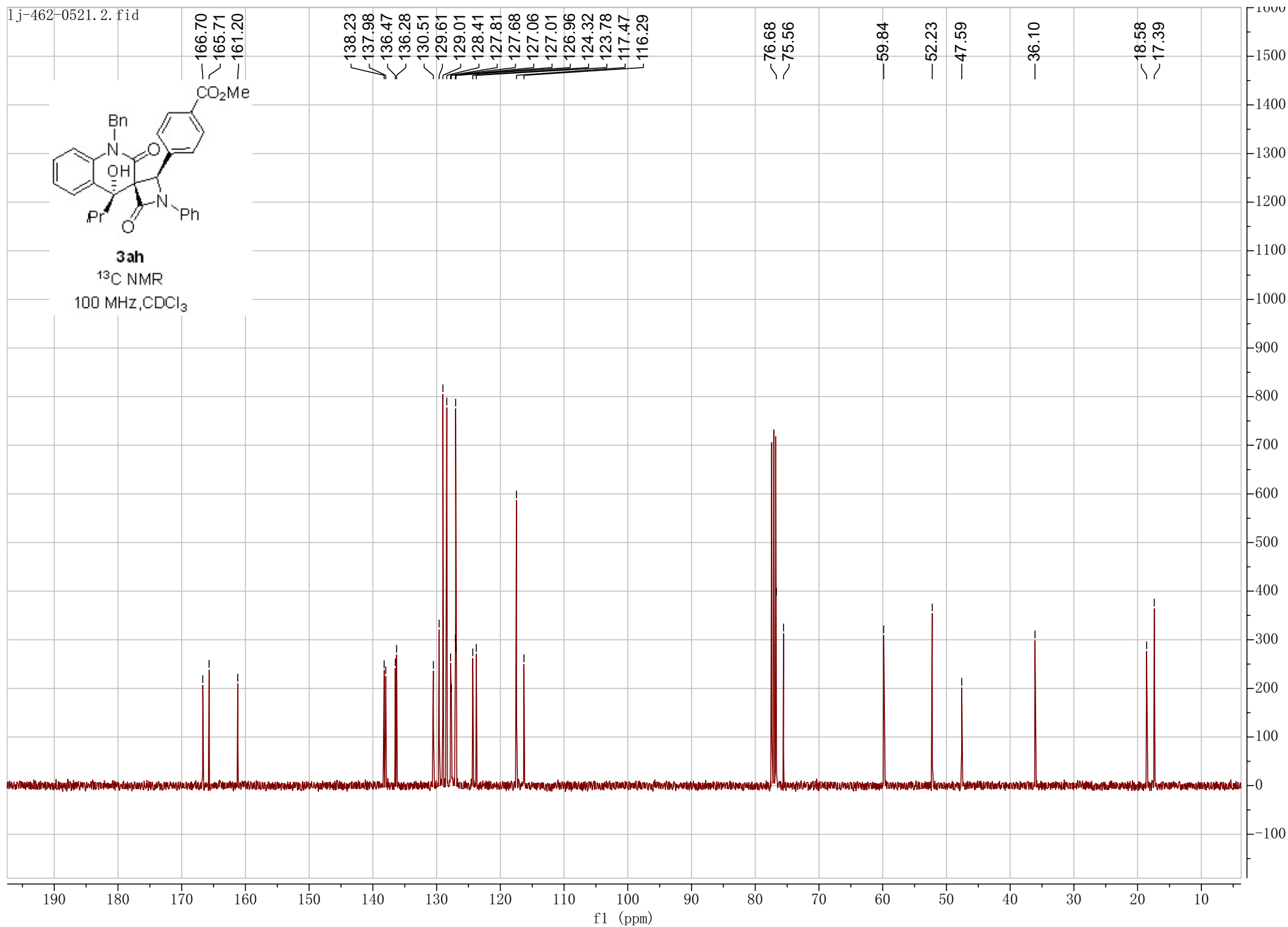
^{19}F NMR

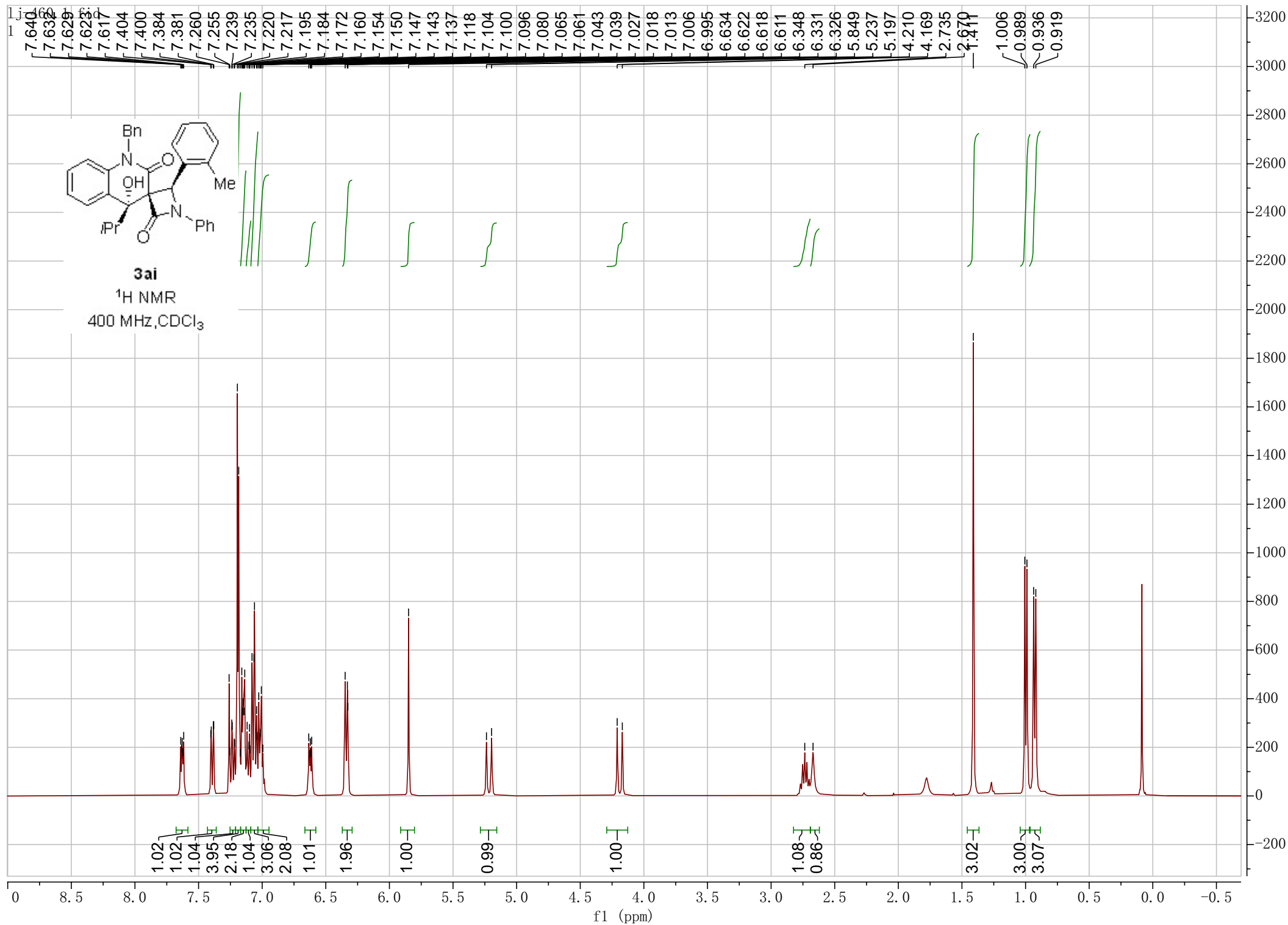
376 MHz, CDCl_3

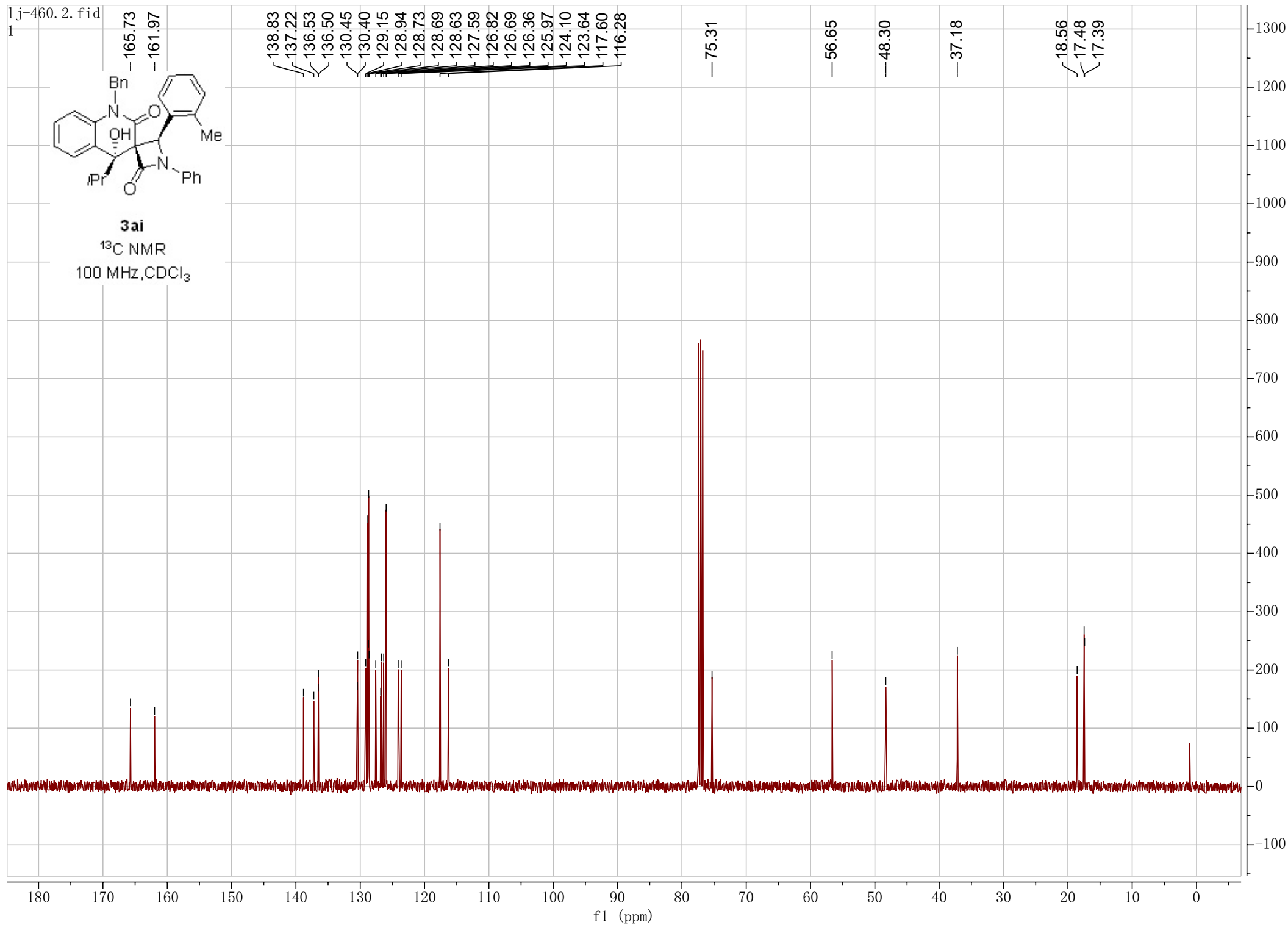
— -62.270

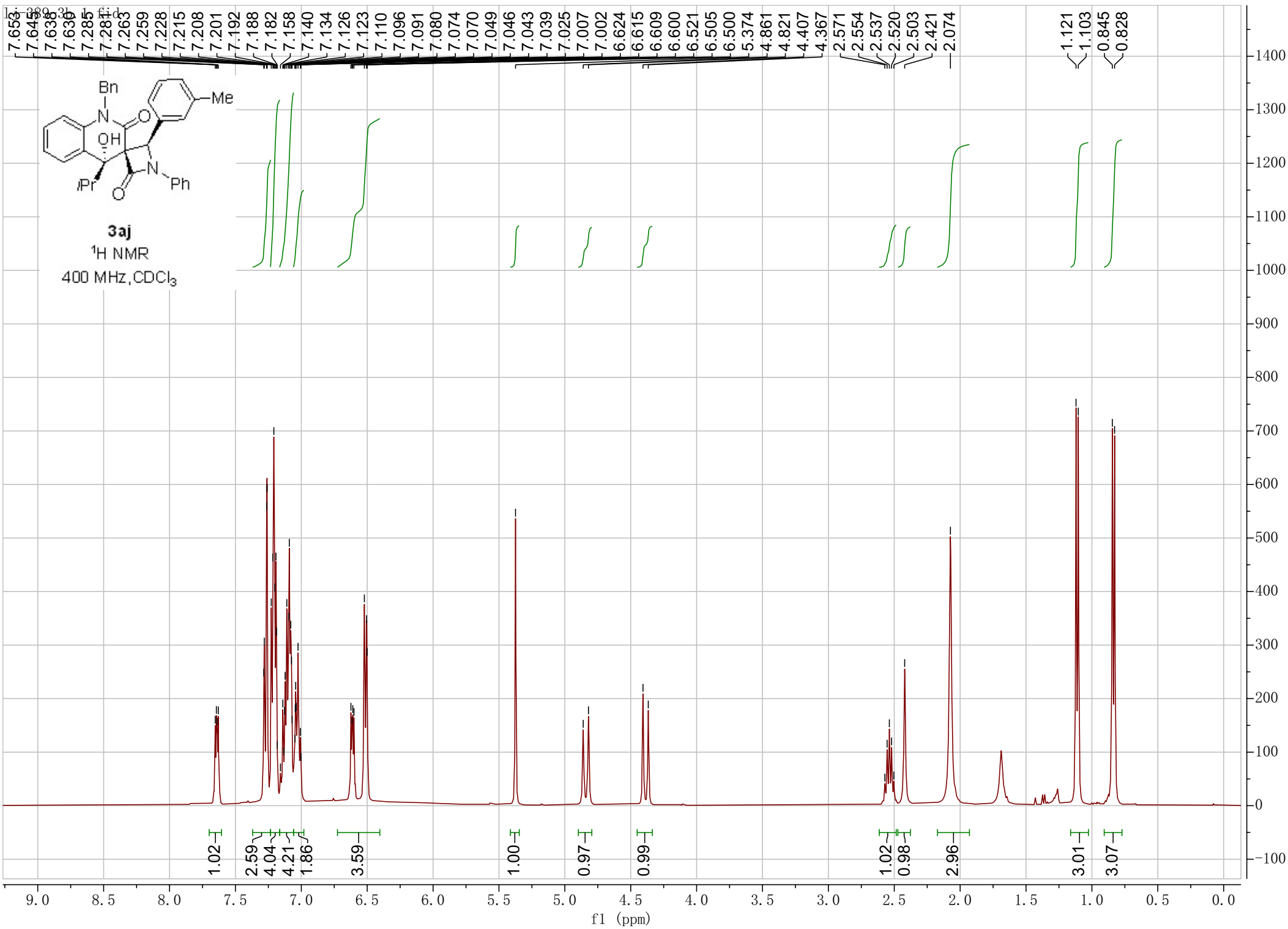




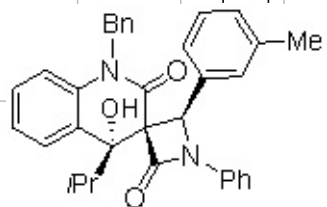
**3ah** ^{13}C NMR100 MHz, CDCl_3 







1j-392-3b-0325.2.tif



3aj

^{13}C NMR
100 MHz, CDCl_3

165.96
161.51
138.32
137.98
136.88
136.55
132.83
129.53
128.92
128.68
128.51
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128.03
126.87
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126.57
124.07
123.57
117.60
116.22

75.31

60.33

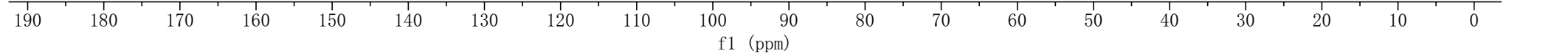
47.65

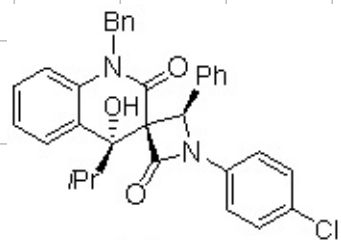
36.07

21.20

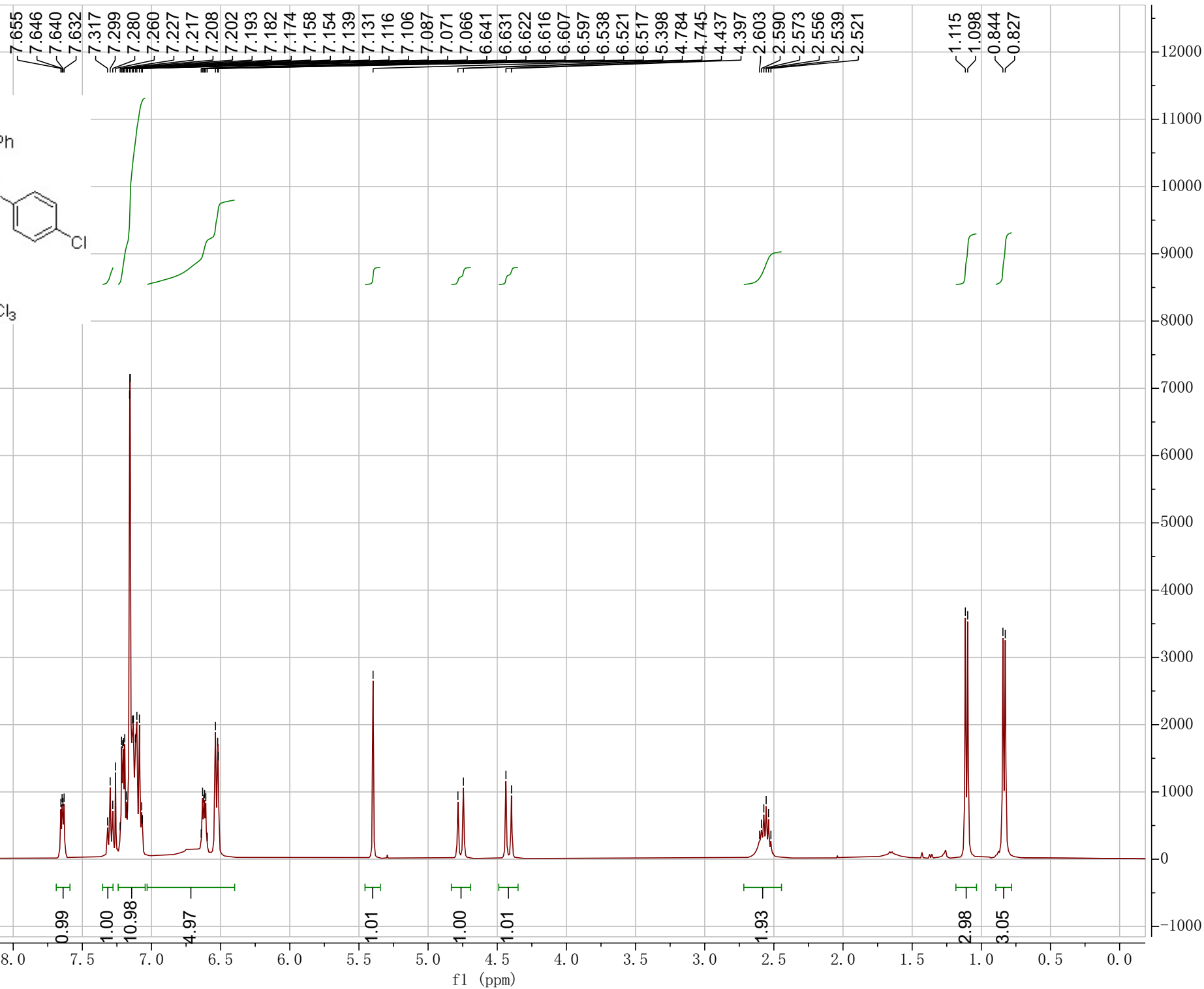
18.62

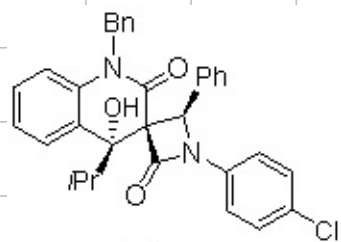
17.38



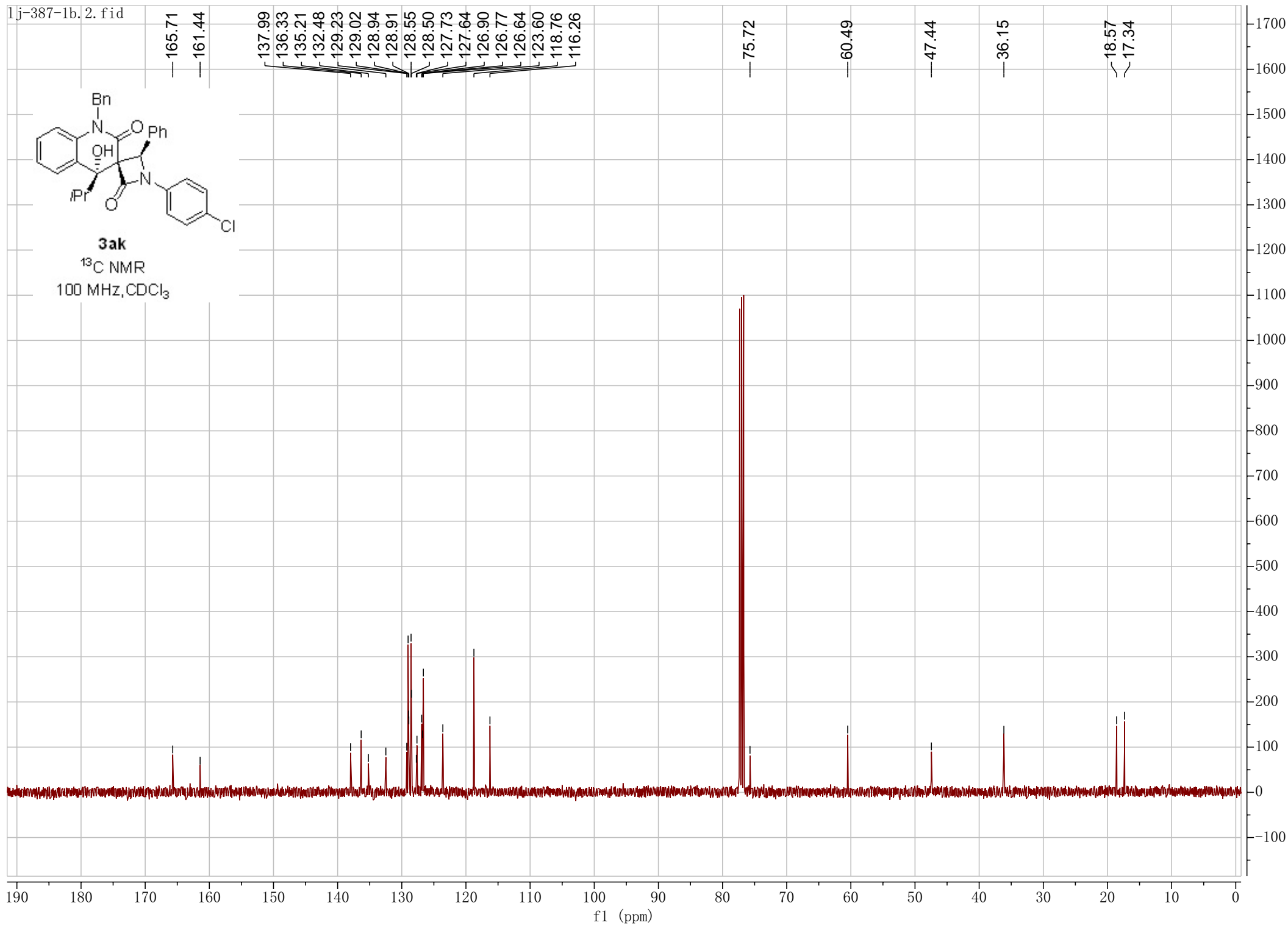


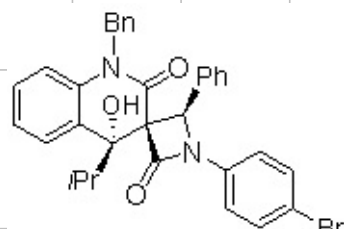
3ak
 ^1H NMR
400 MHz, CDCl_3



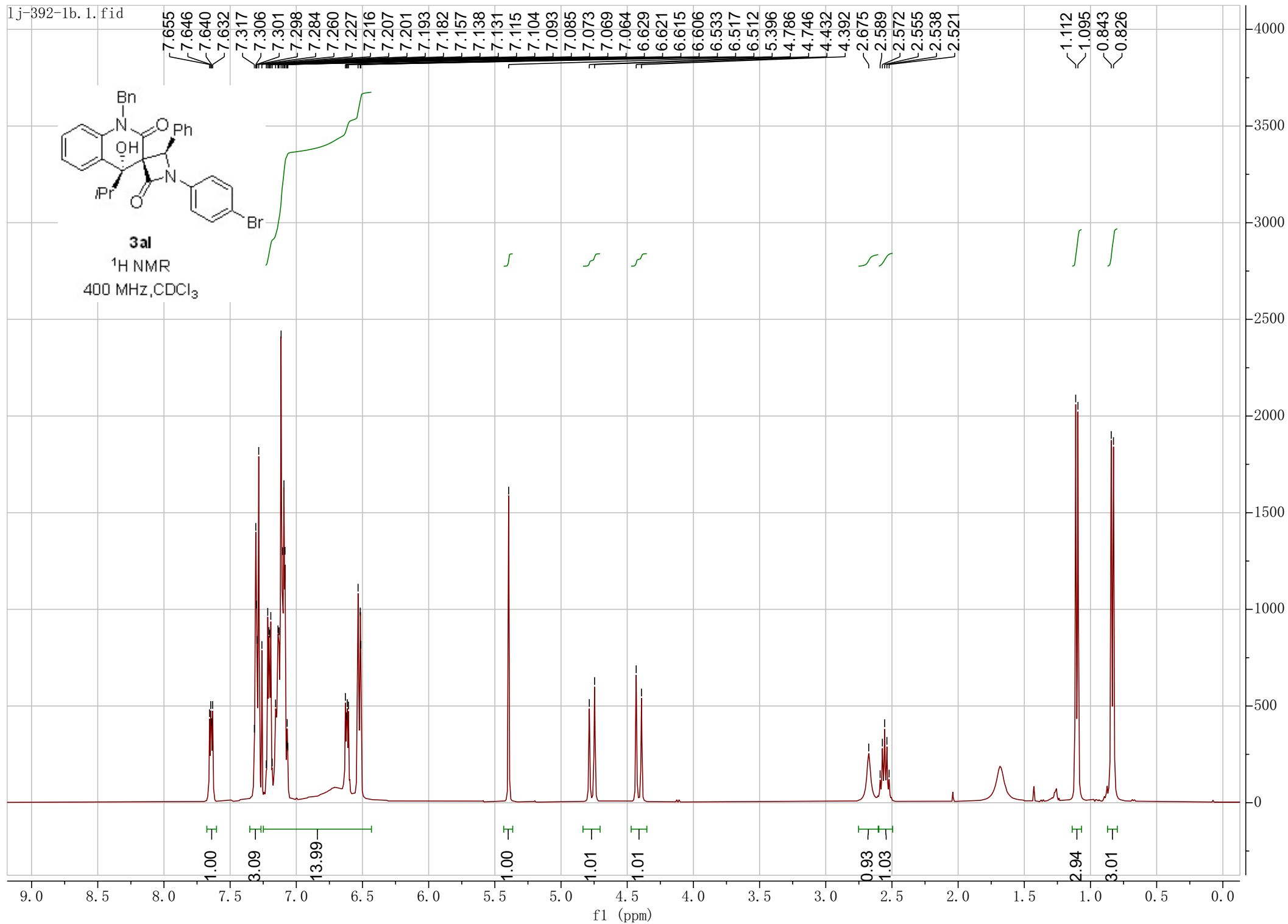
**3ak**

^{13}C NMR
100 MHz, CDCl_3

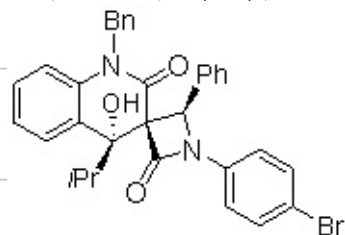




3al
 ^1H NMR
400 MHz, CDCl_3

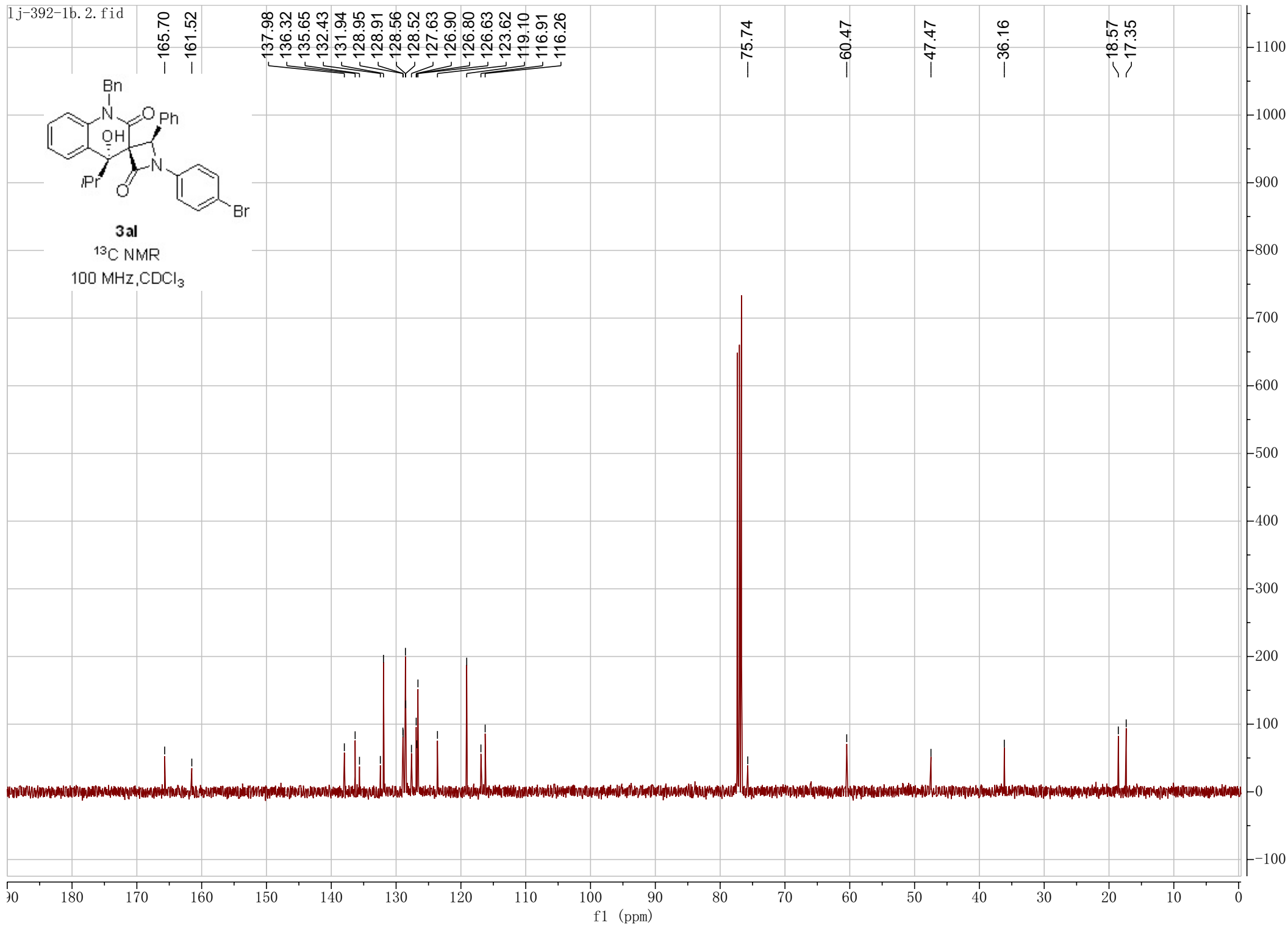


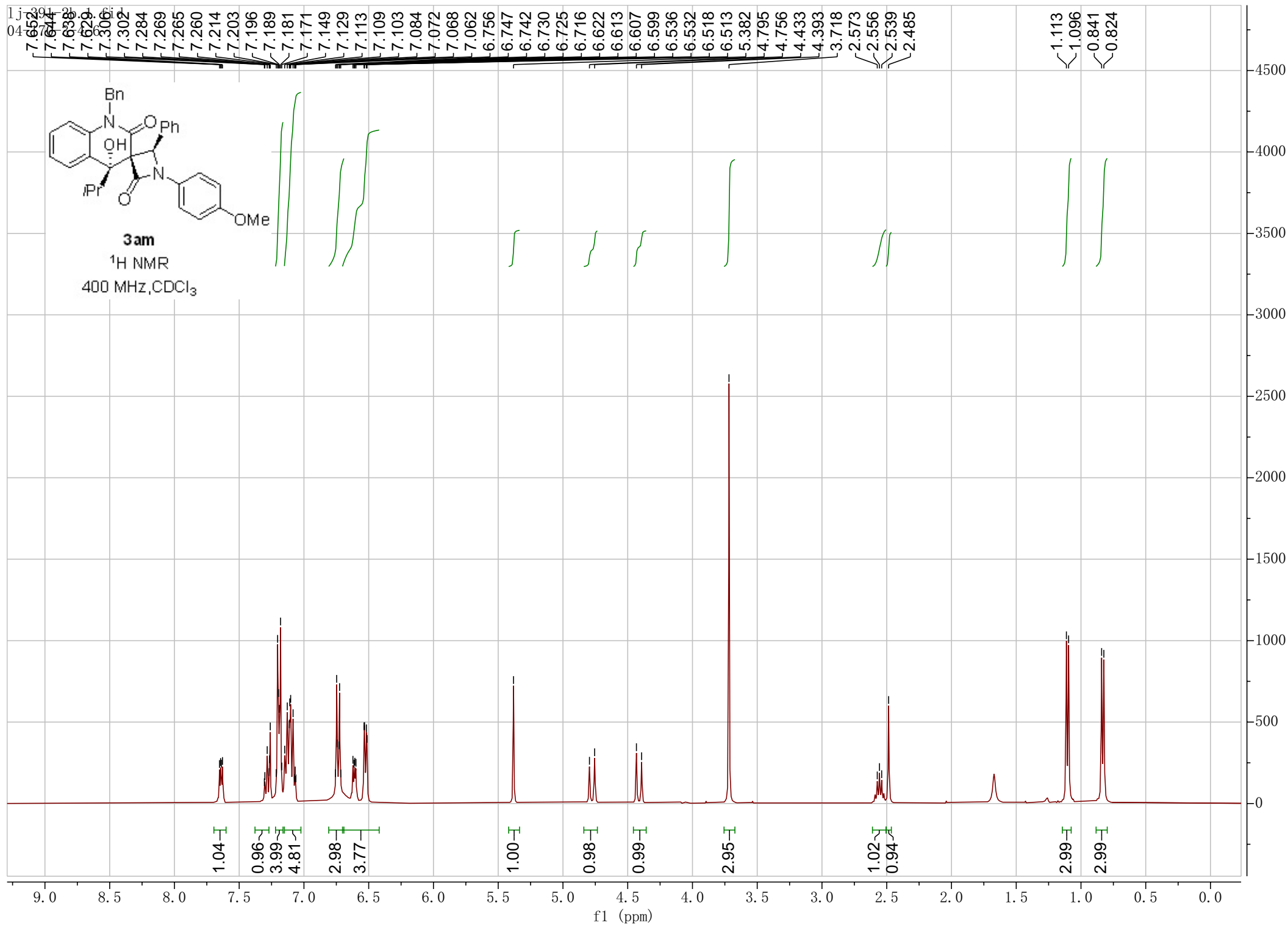
lj-392-1b. 2. fid



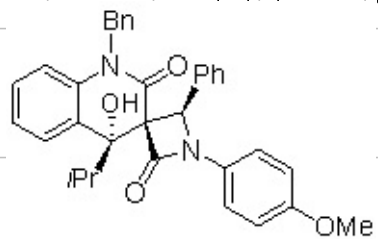
3al

^{13}C NMR
100 MHz, CDCl_3





lj-391-2b. 2. fid
04-170-3-4-6



3am

^{13}C NMR
100 MHz, CDCl_3

-165.96
-160.82
-156.14

138.07
136.46
133.01
130.33
128.80
128.73
128.54
128.38
127.86
127.74
126.83
126.74
126.63
123.50
118.88
116.20
114.21

—75.36

—60.36

—55.40

—47.43

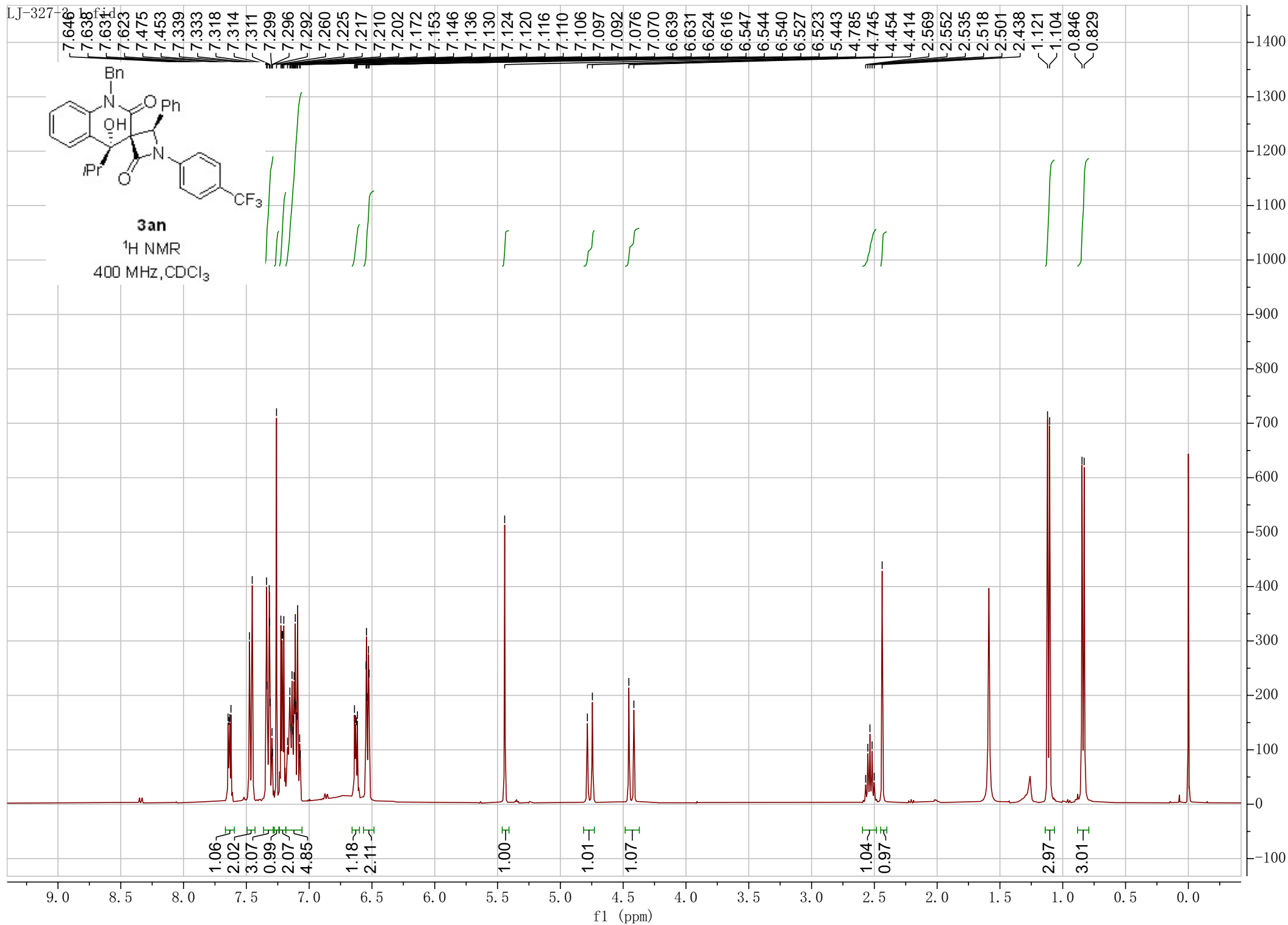
—36.16

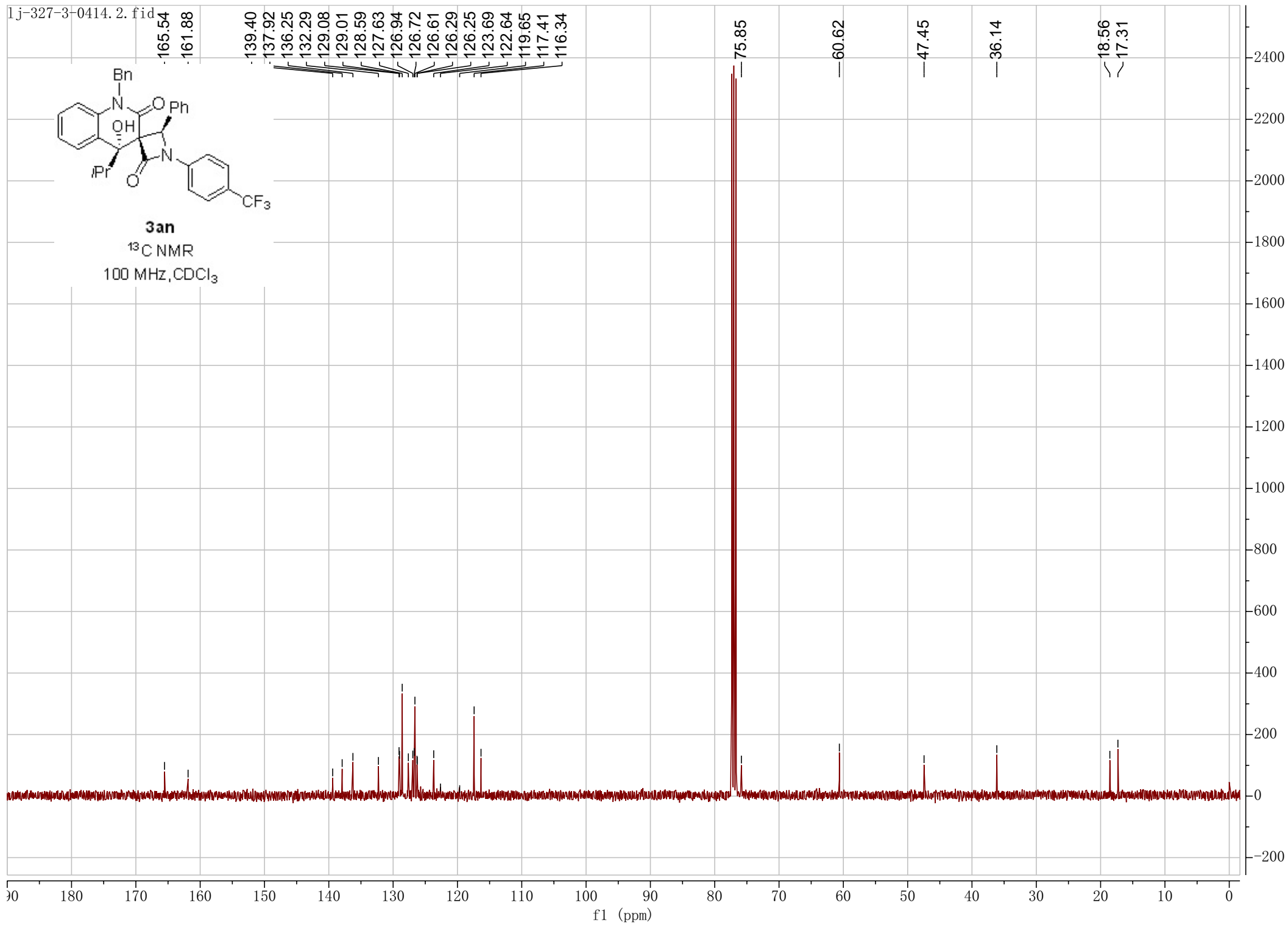
~18.61

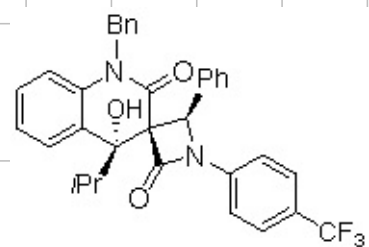
~17.36

30 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0

f1 (ppm)

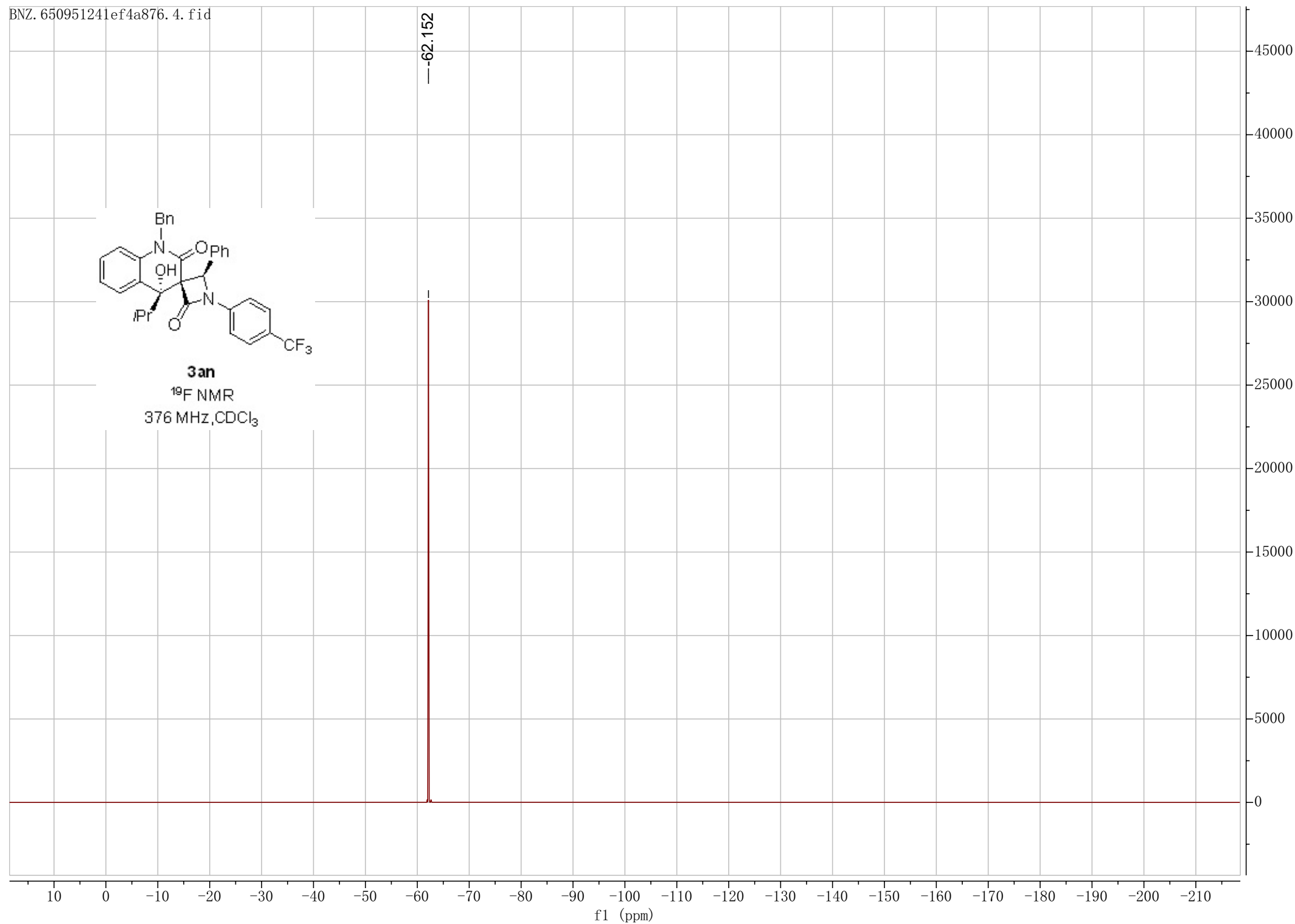


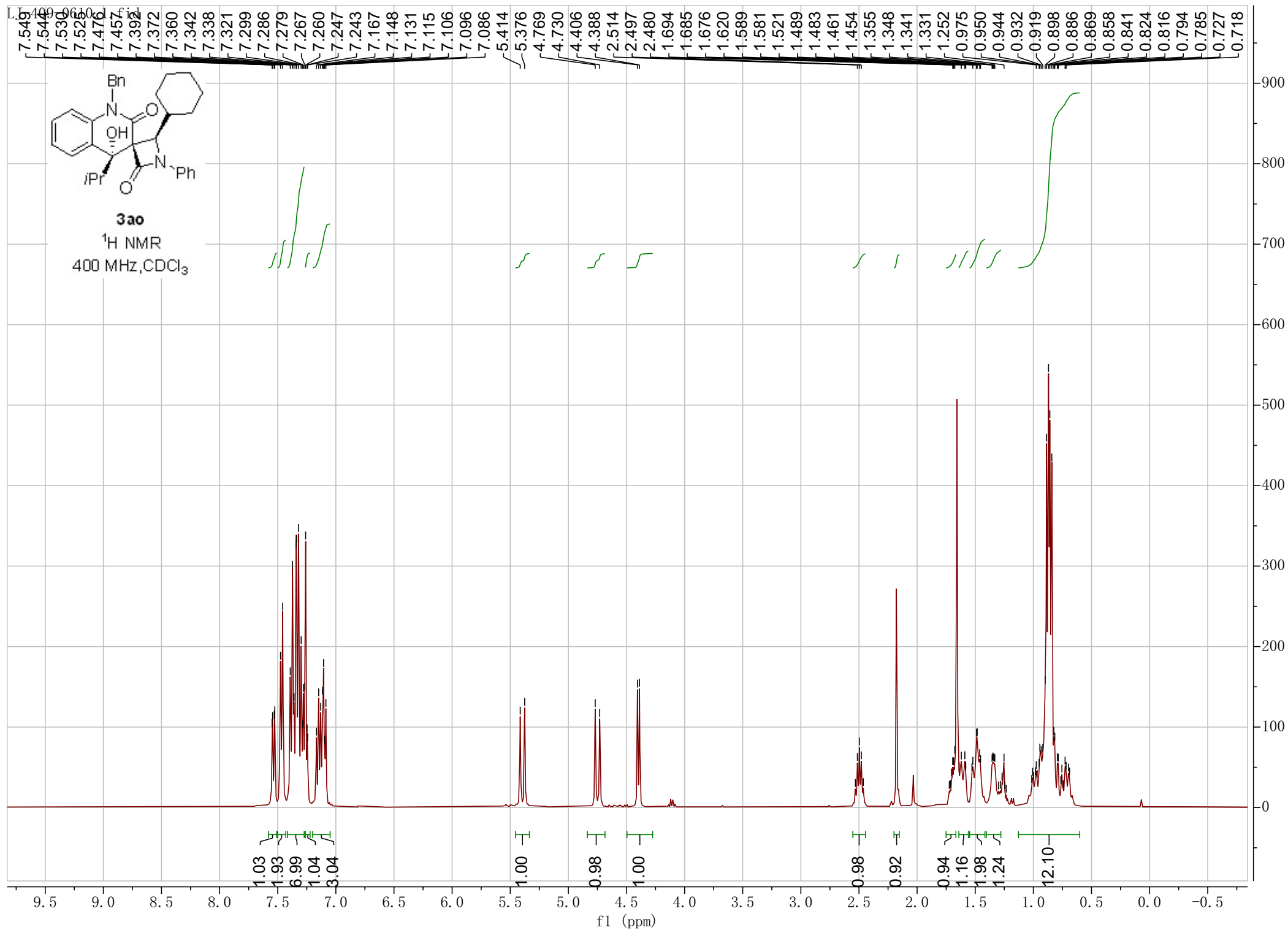




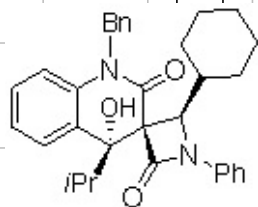
3an
¹⁹F NMR
376 MHz, CDCl₃

---62.152



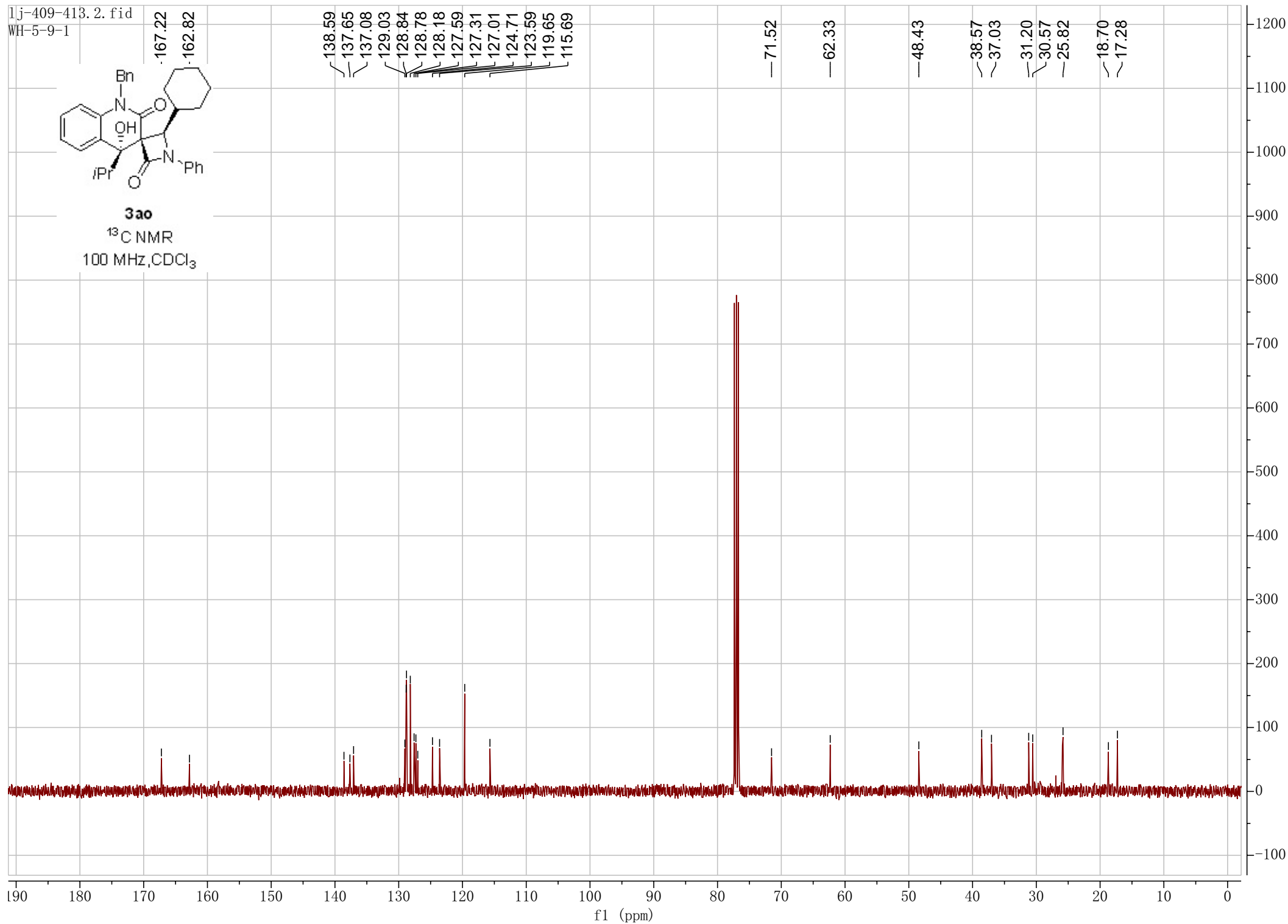


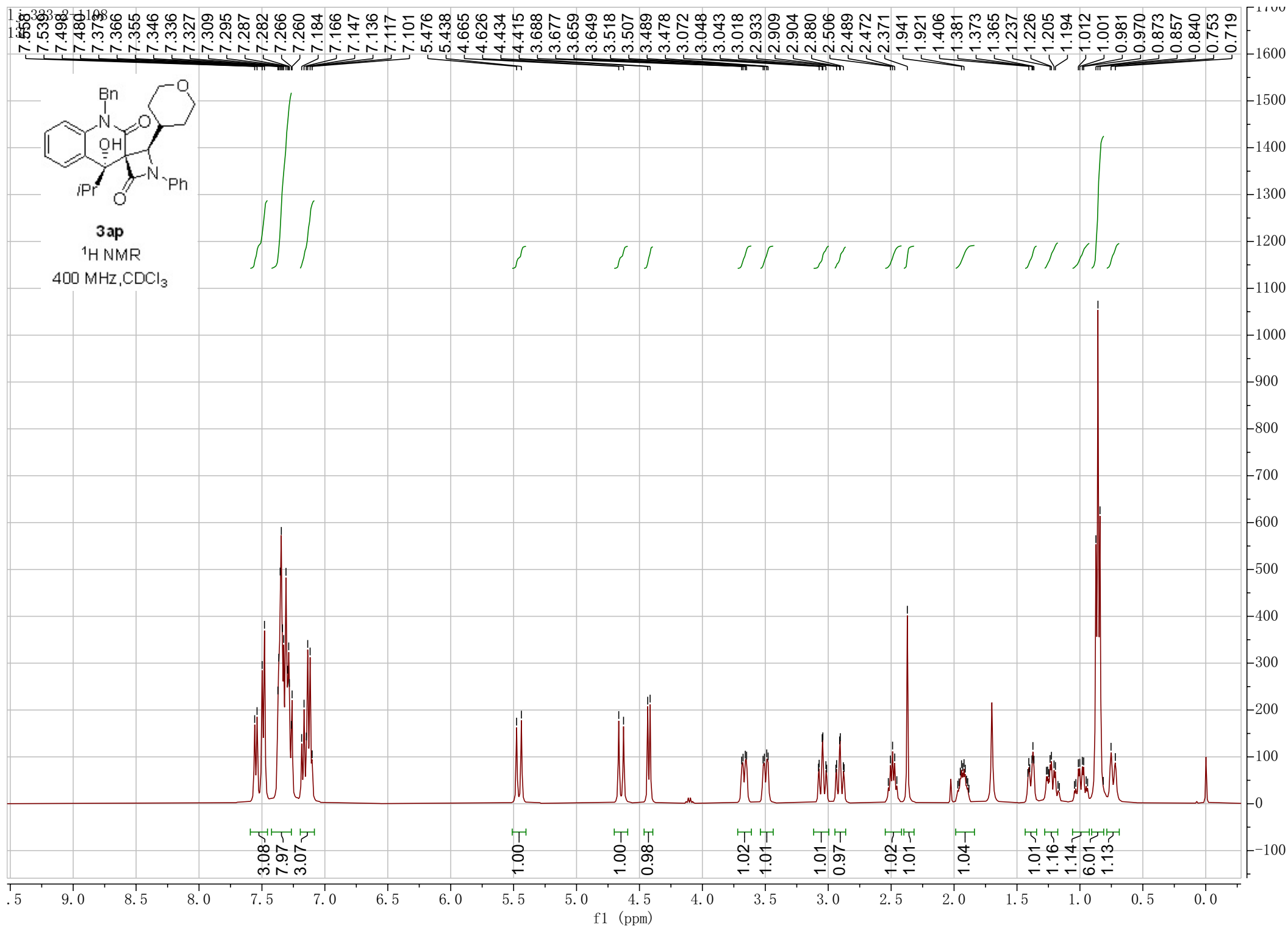
lj-409-413.2.fid
WH-5-9-1



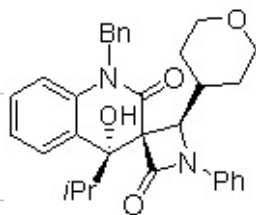
3ao

^{13}C NMR
100 MHz, CDCl_3



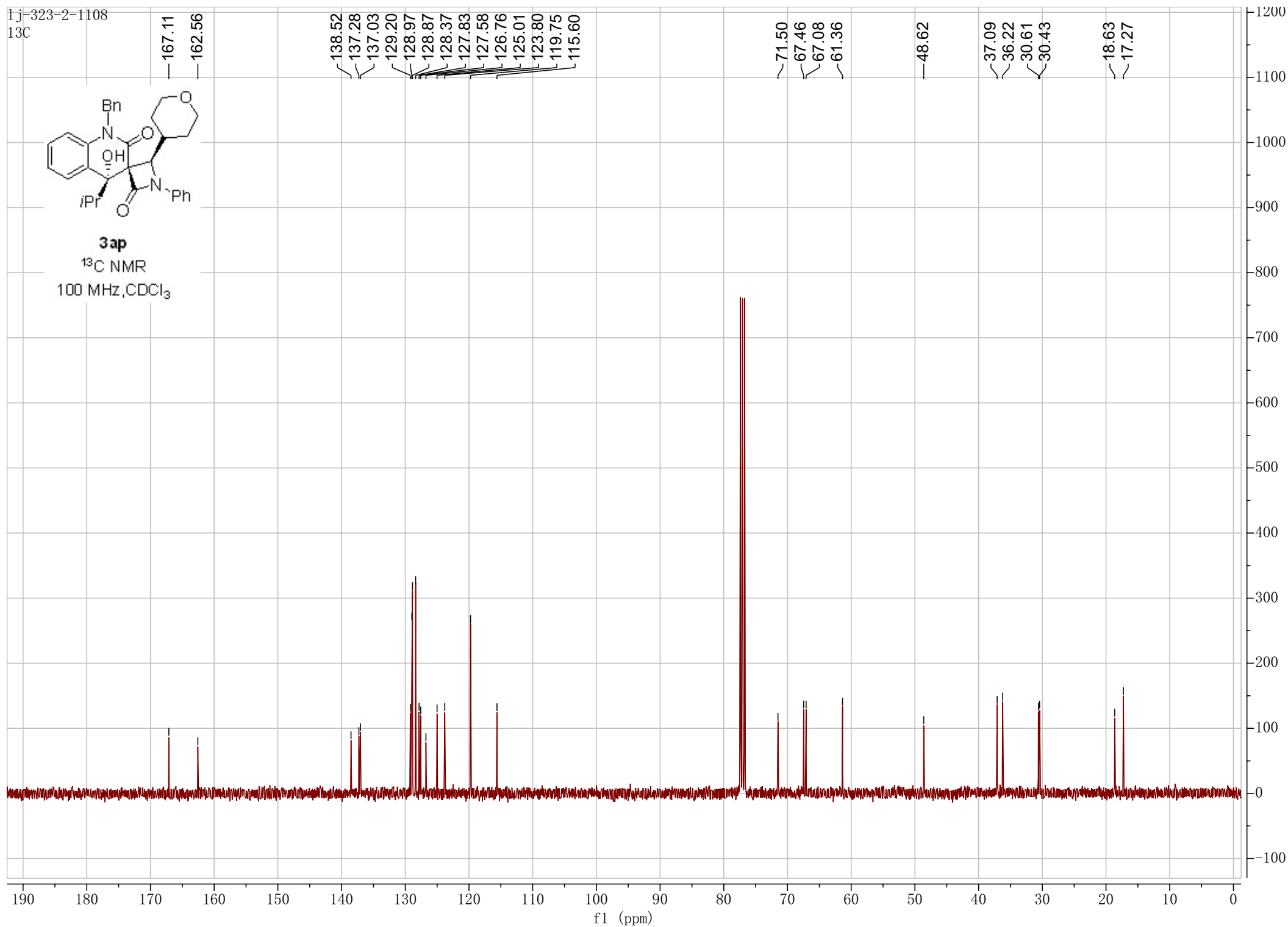


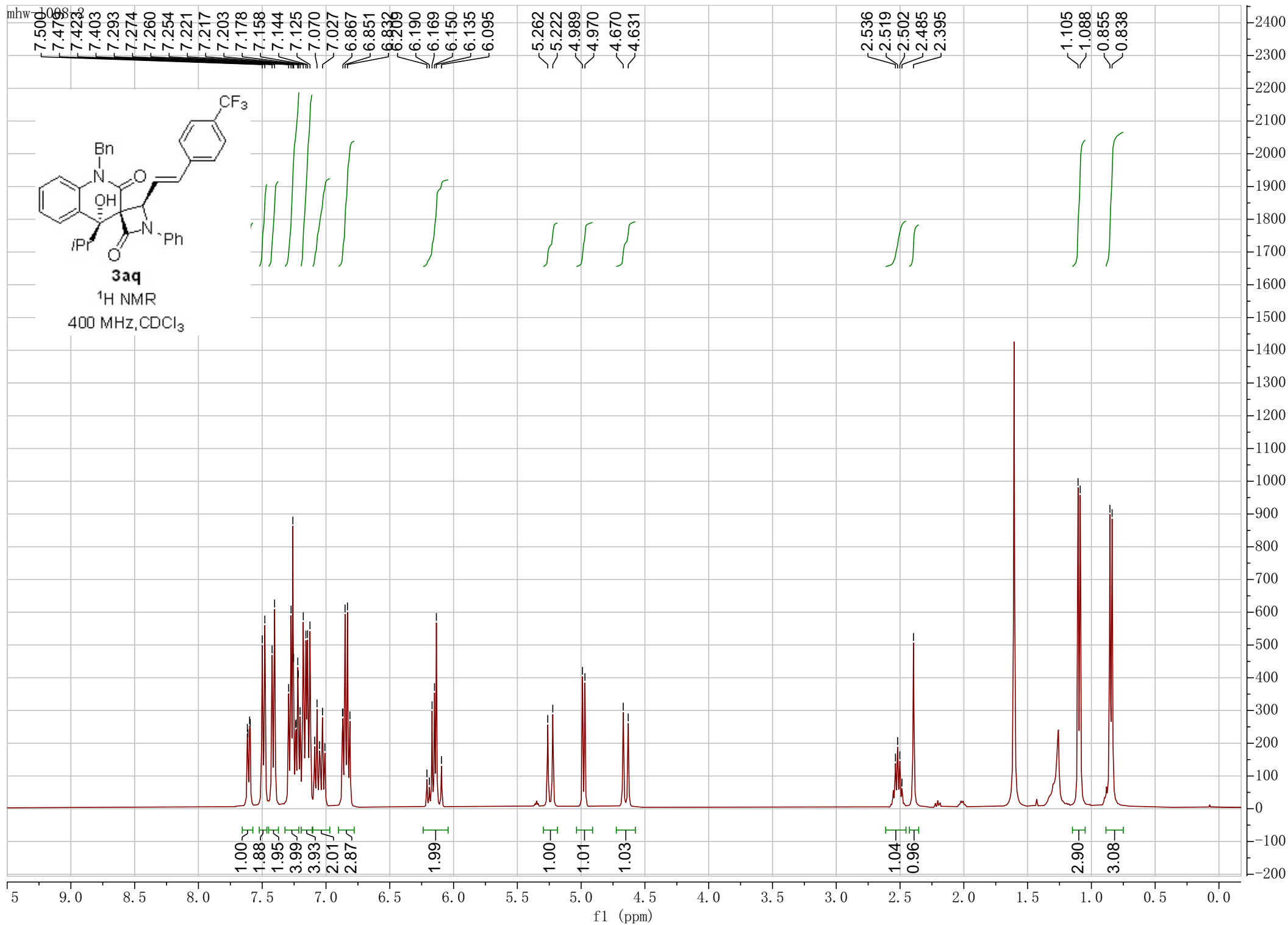
lj-323-2-1108
13C



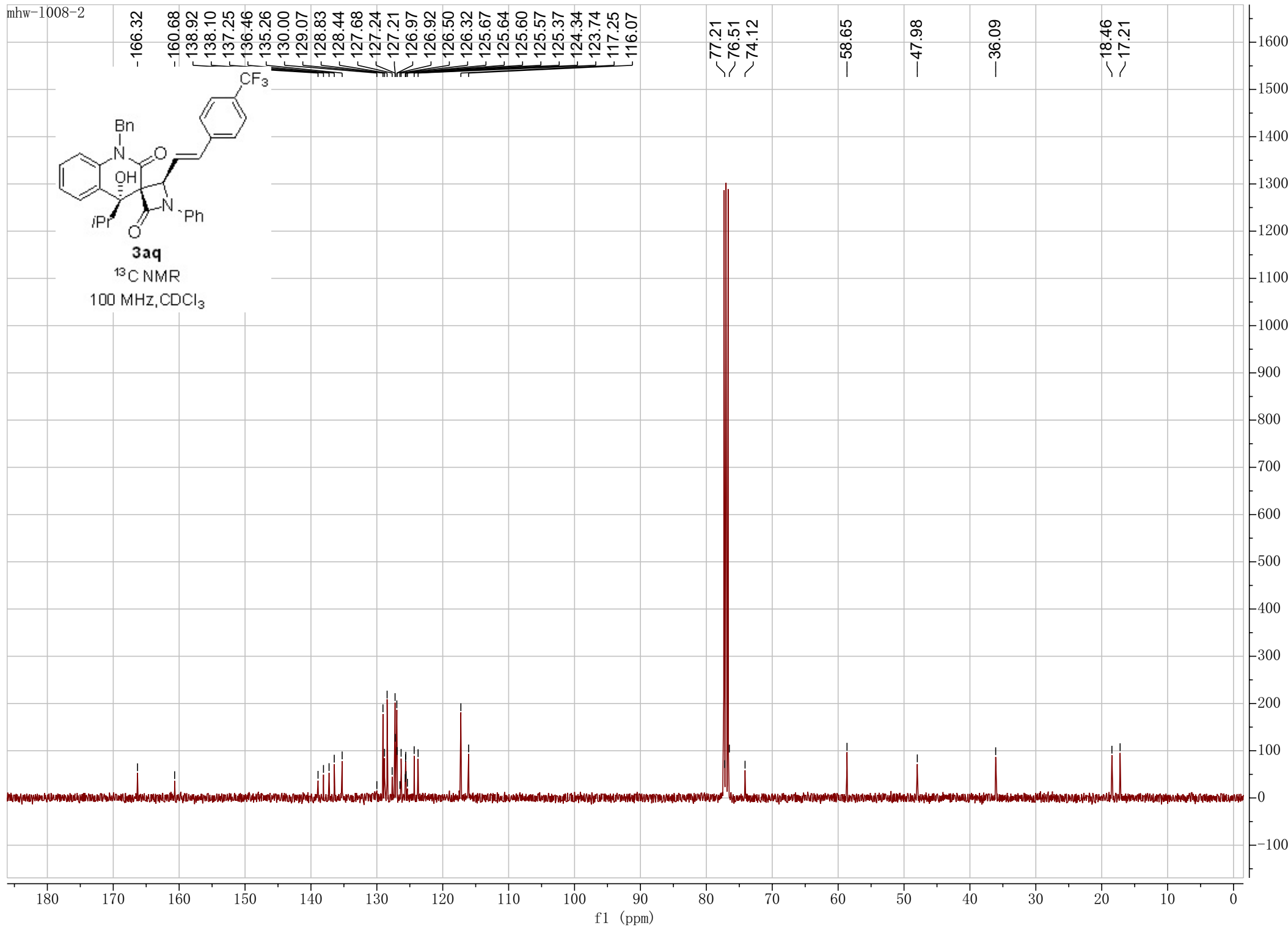
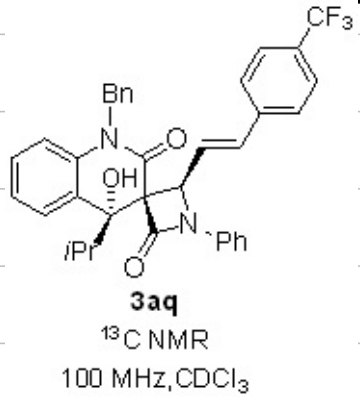
3ap

^{13}C NMR
100 MHz, CDCl_3



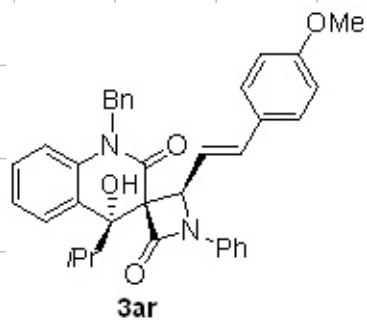


mhw-1008-2

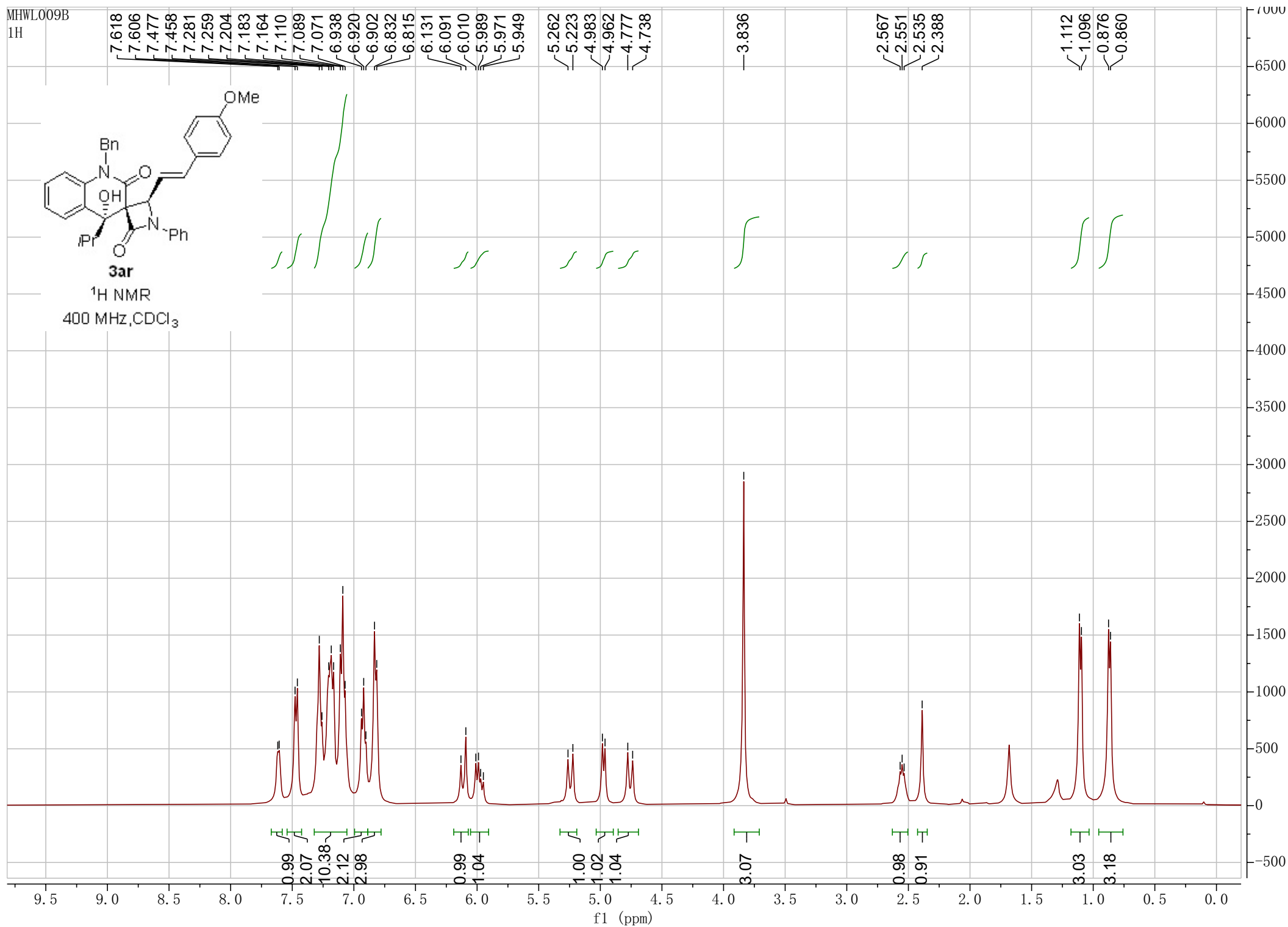


MHWL009B

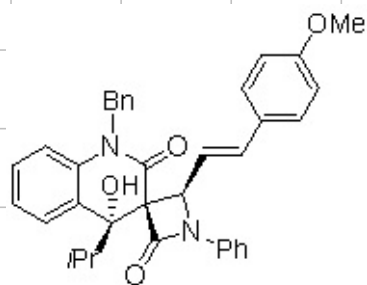
¹H



¹H NMR
400 MHz, CDCl₃

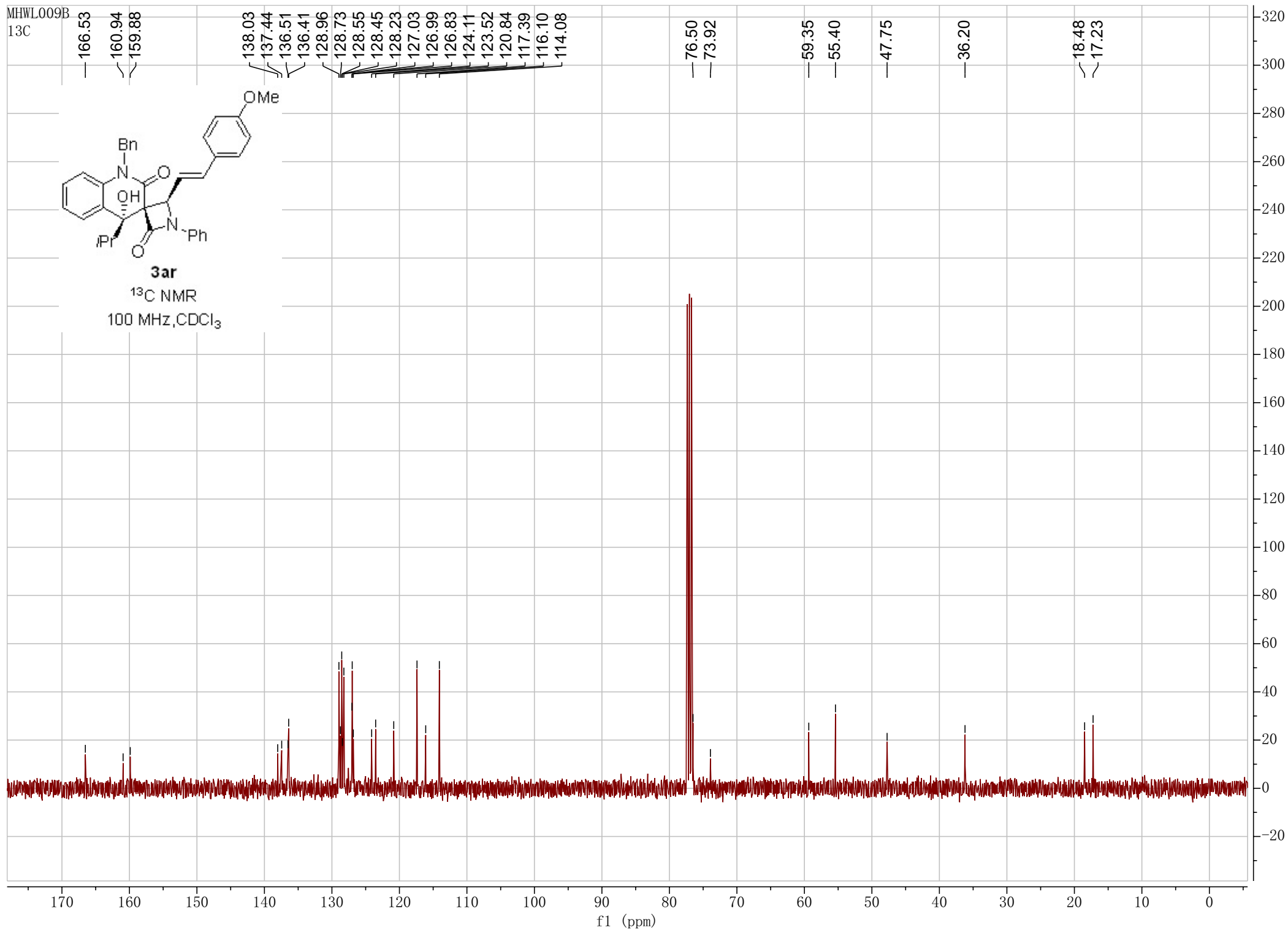


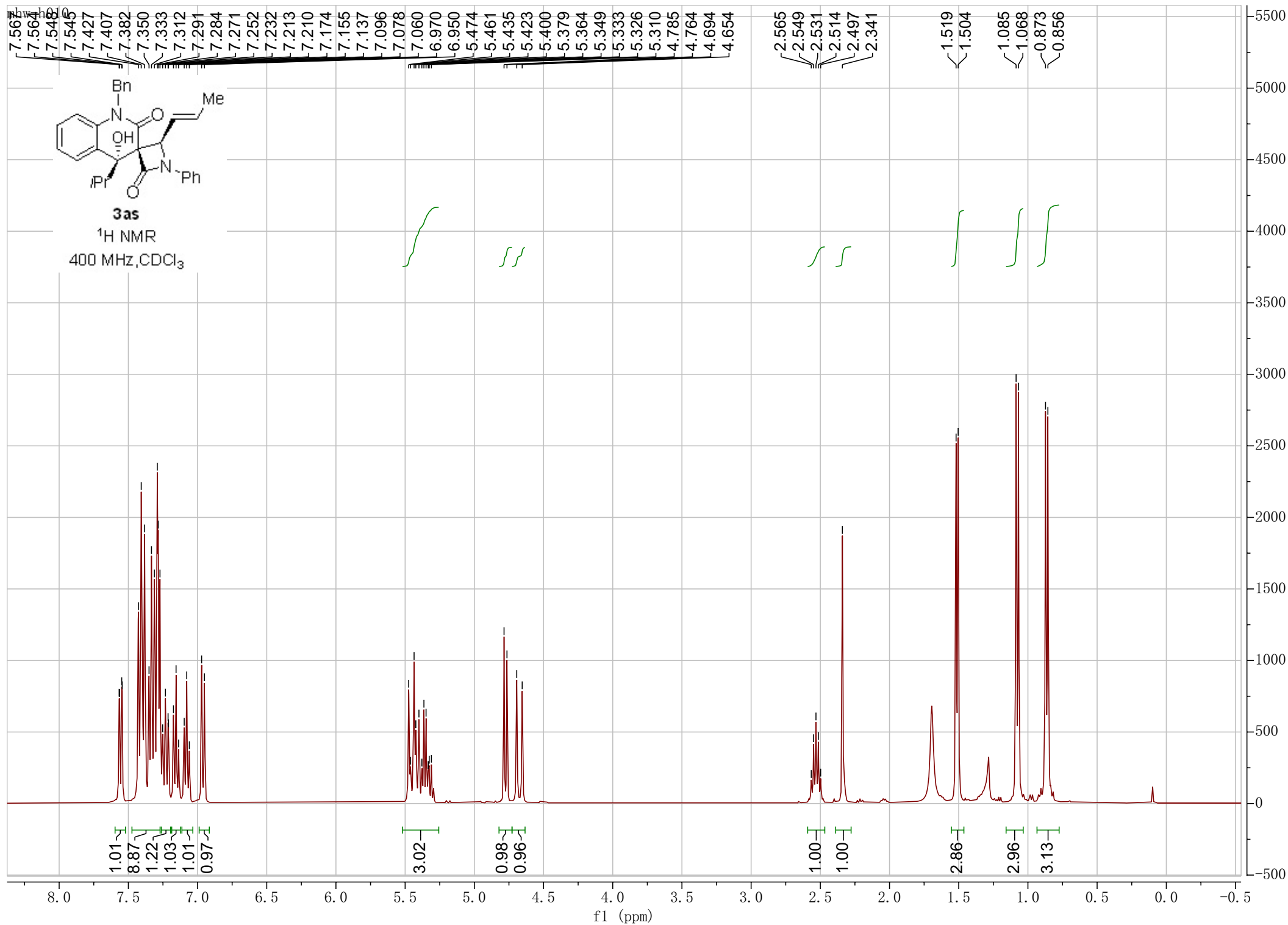
MHWL009B
13C



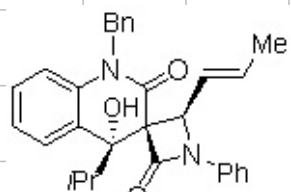
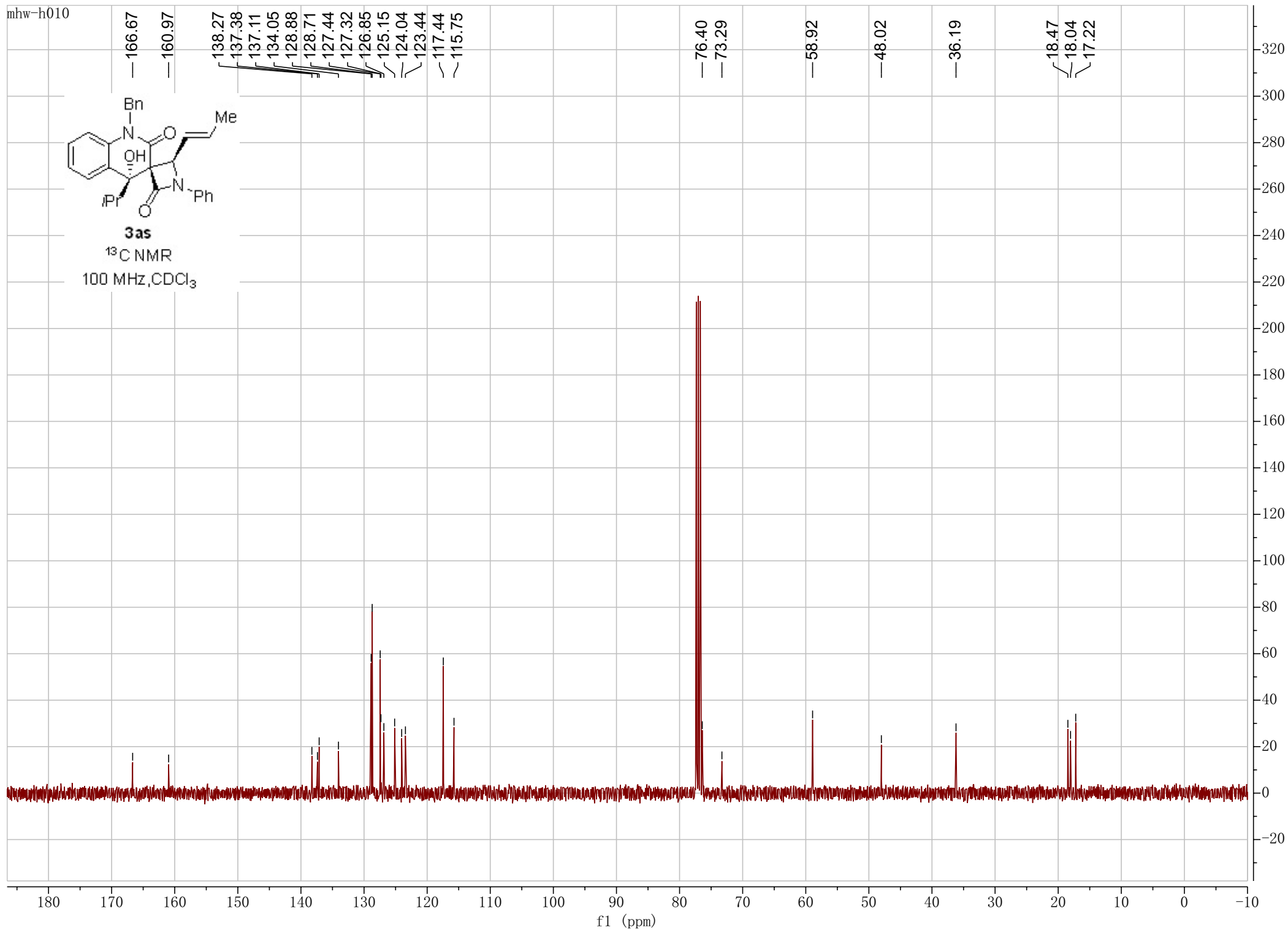
3ar

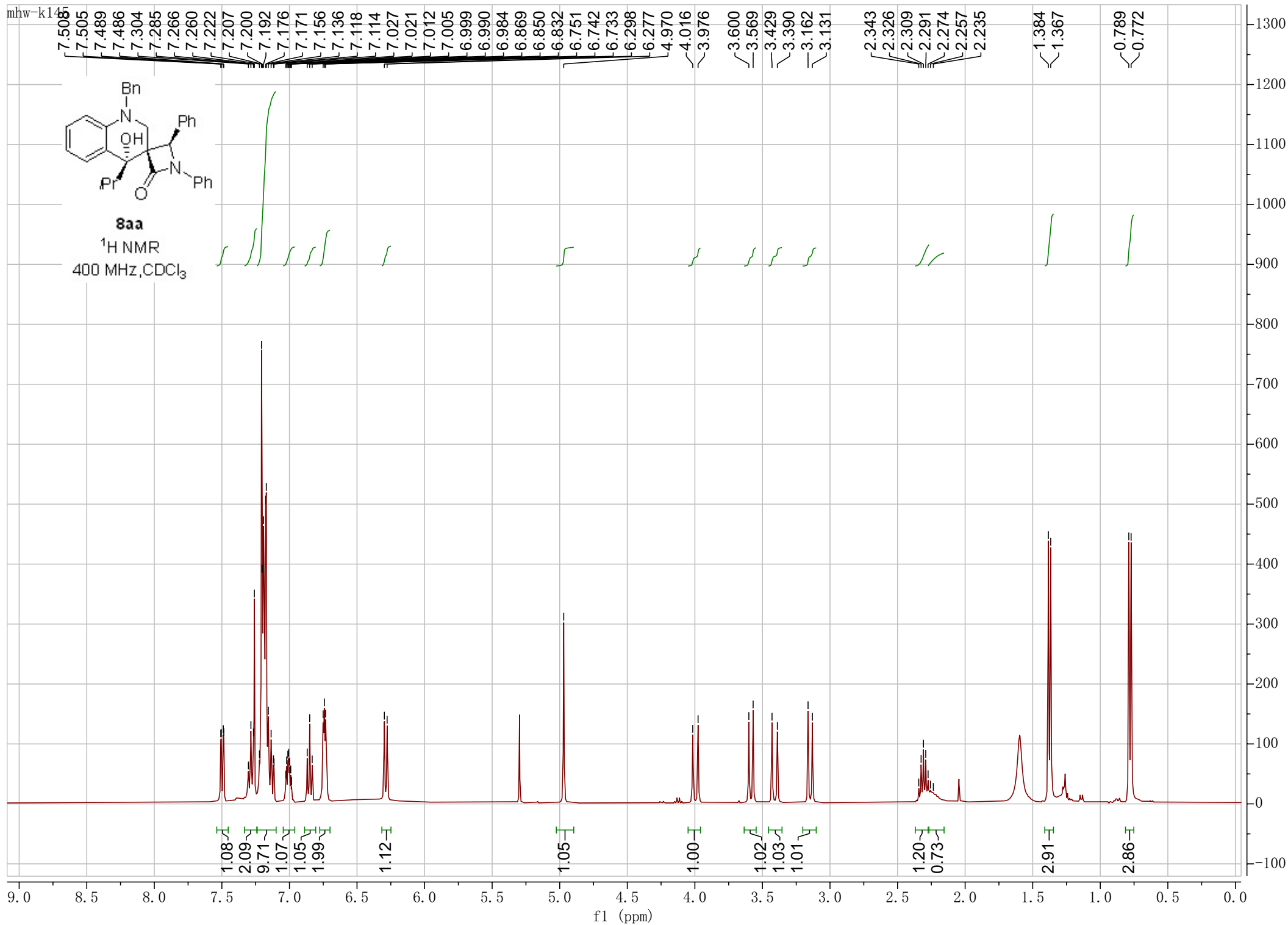
¹³C NMR
100 MHz, CDCl₃

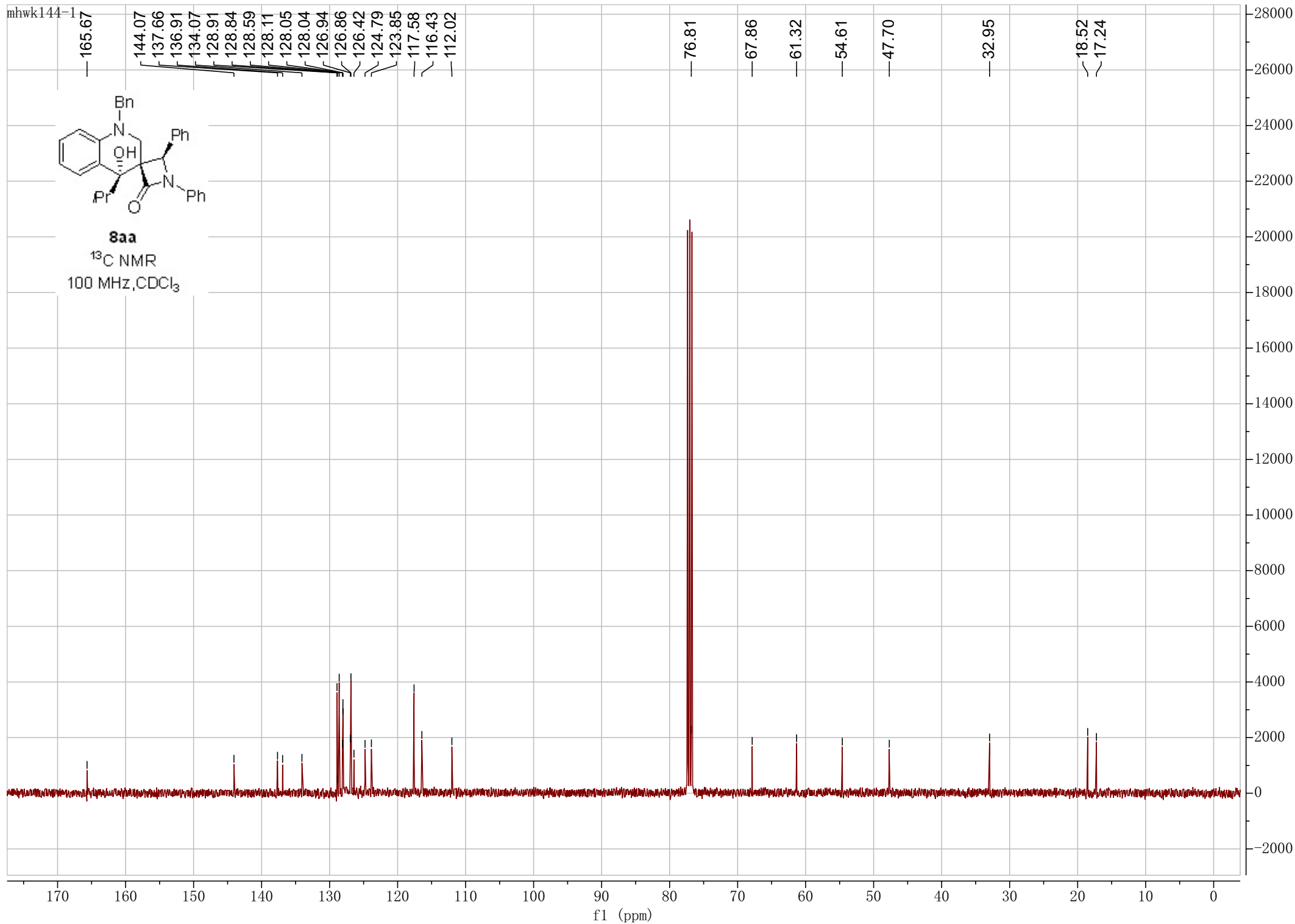


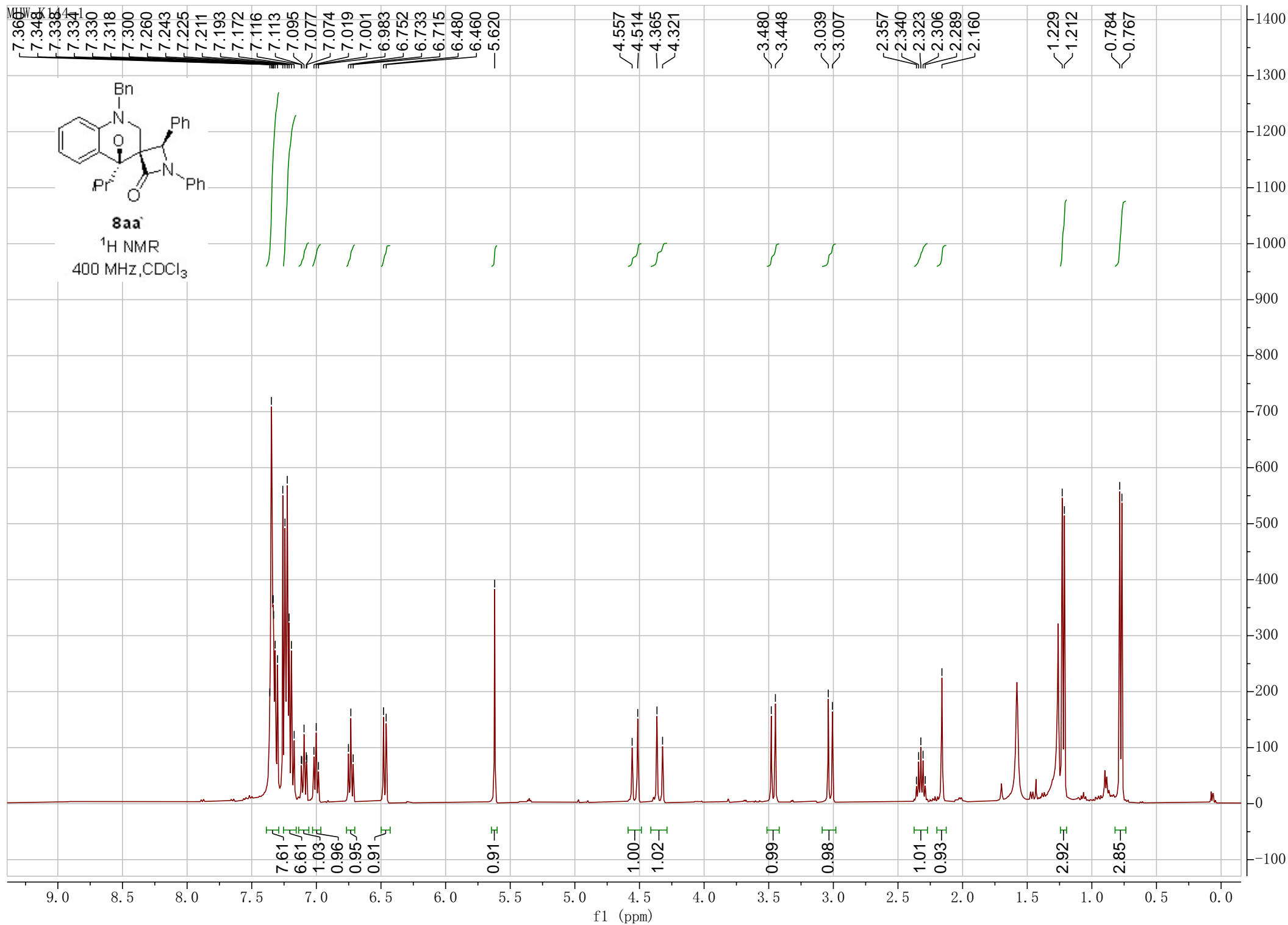


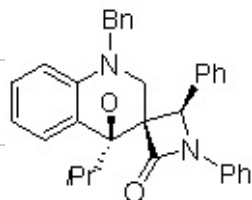
mhw-h010

**3as**¹³C NMR
100 MHz, CDCl₃

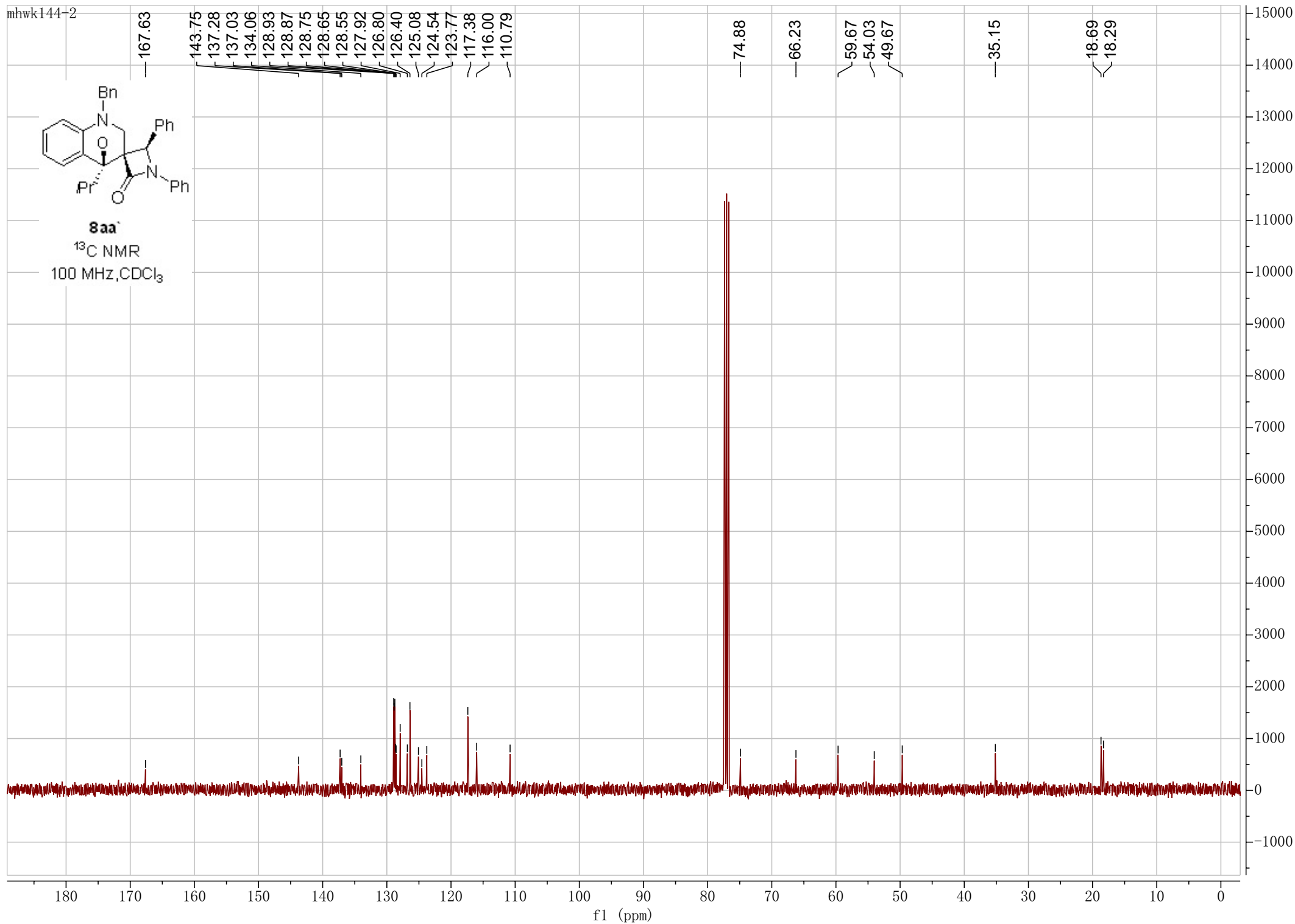


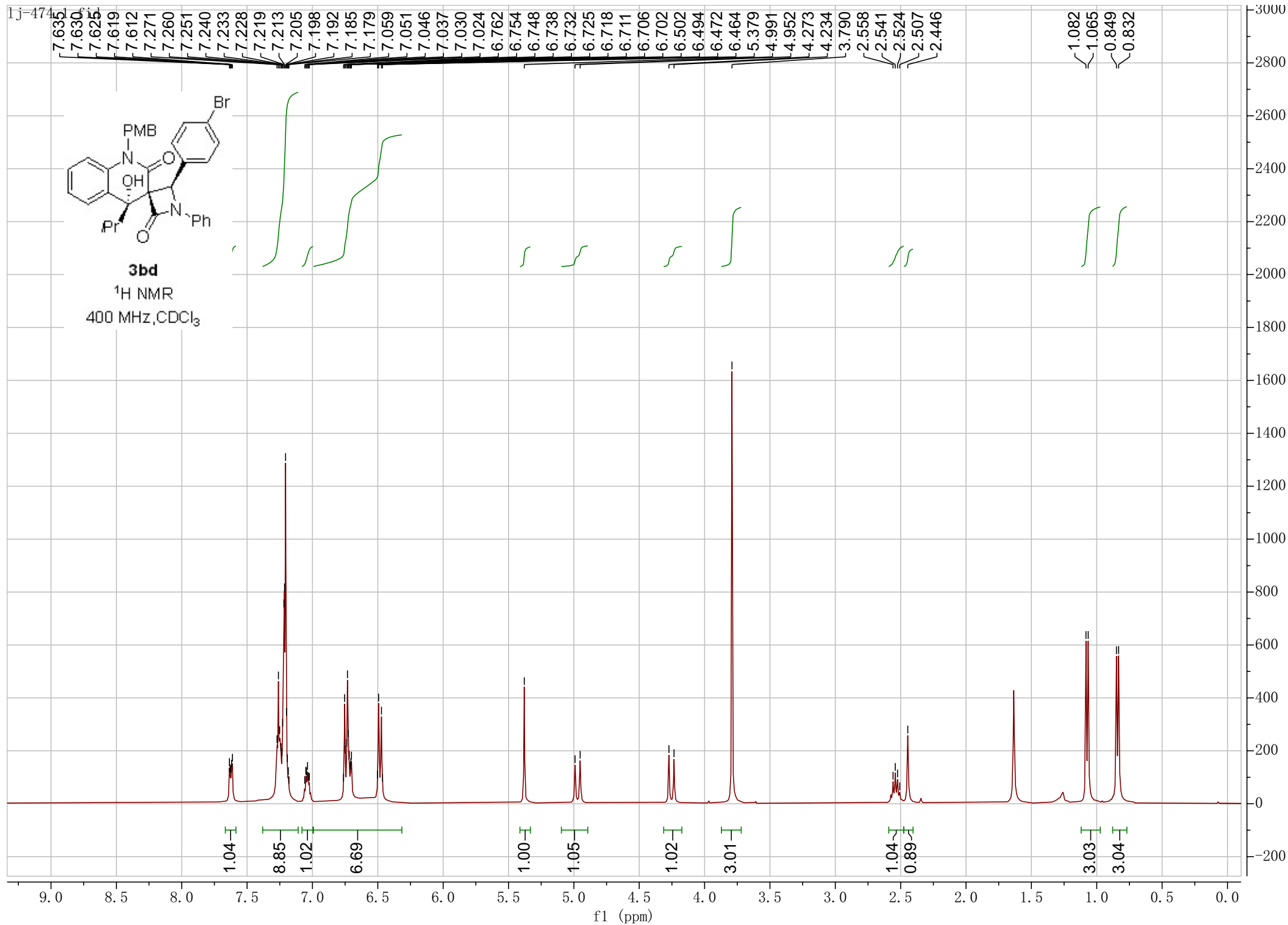


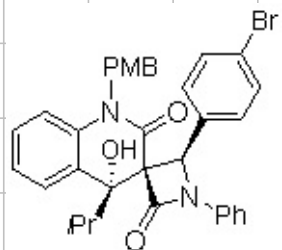




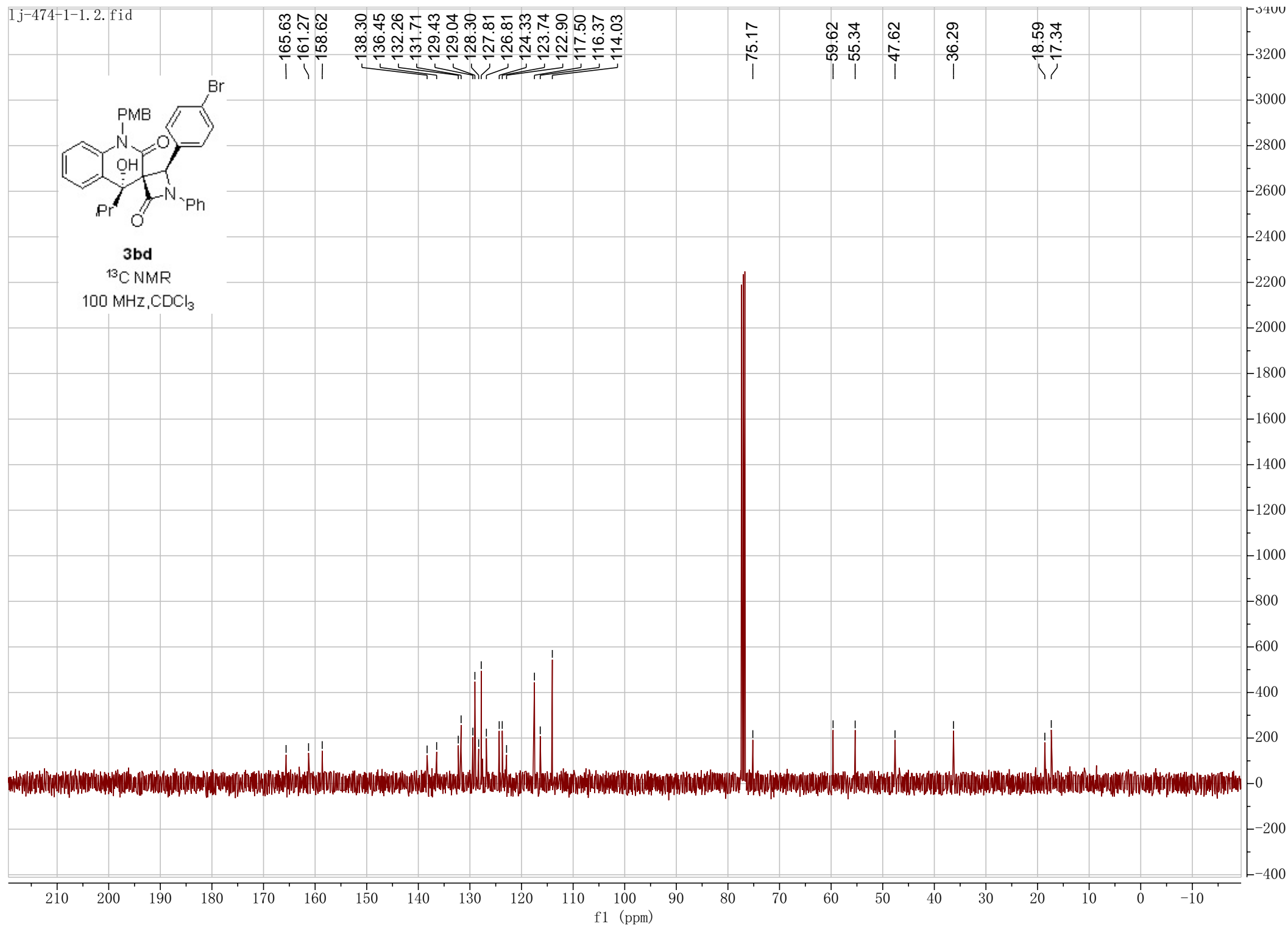
8aa
 ^{13}C NMR
100 MHz, CDCl_3

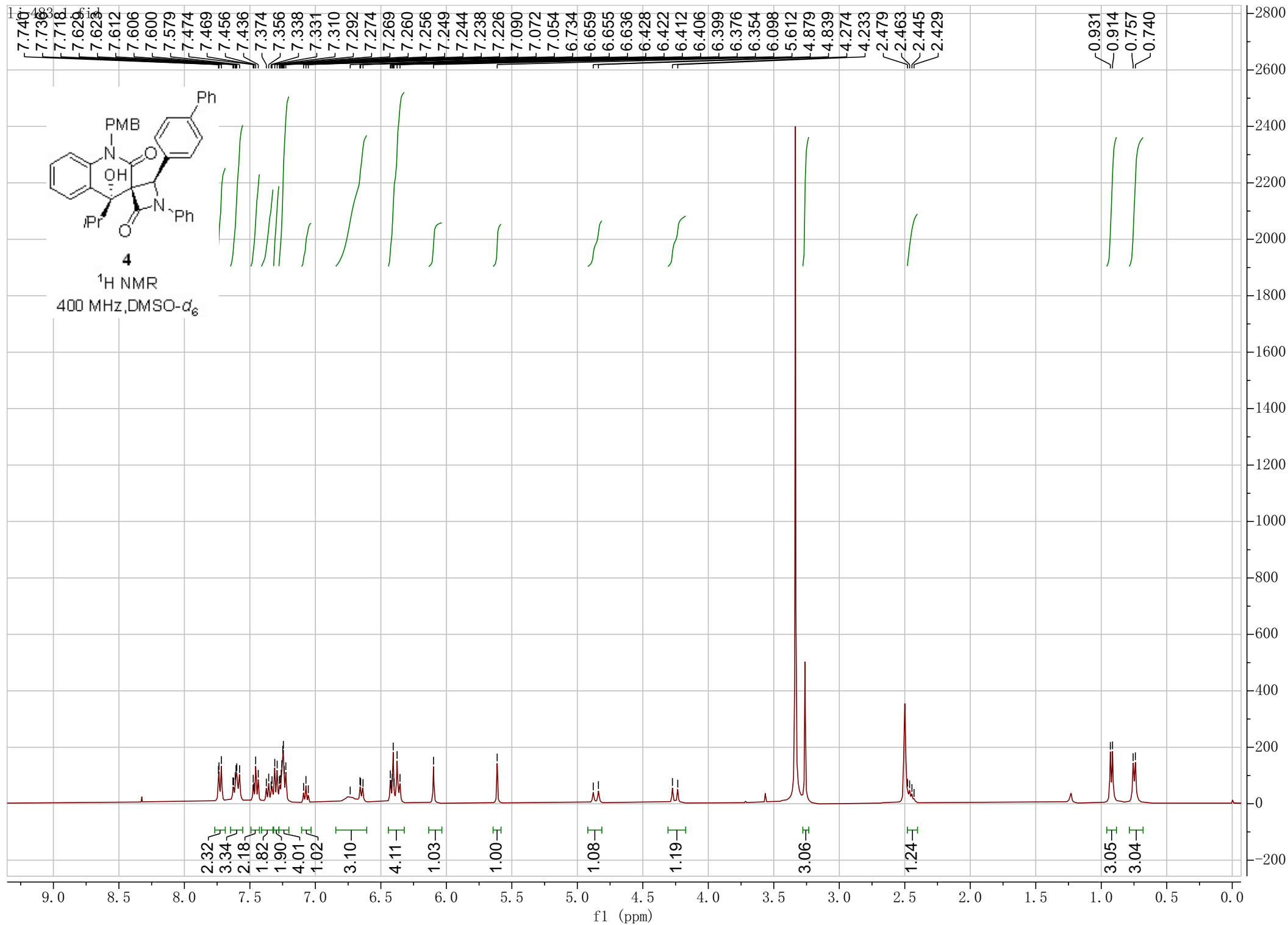


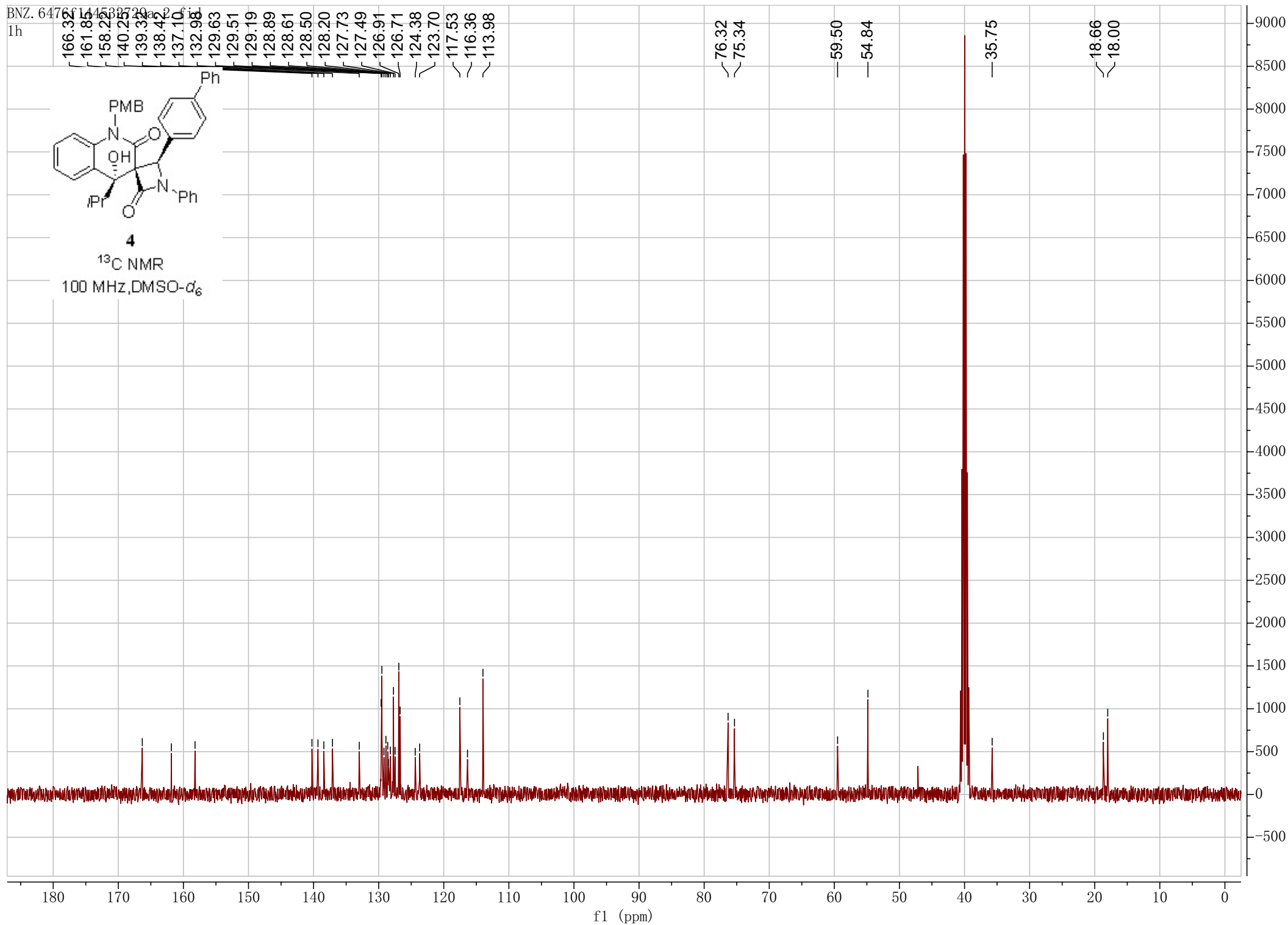


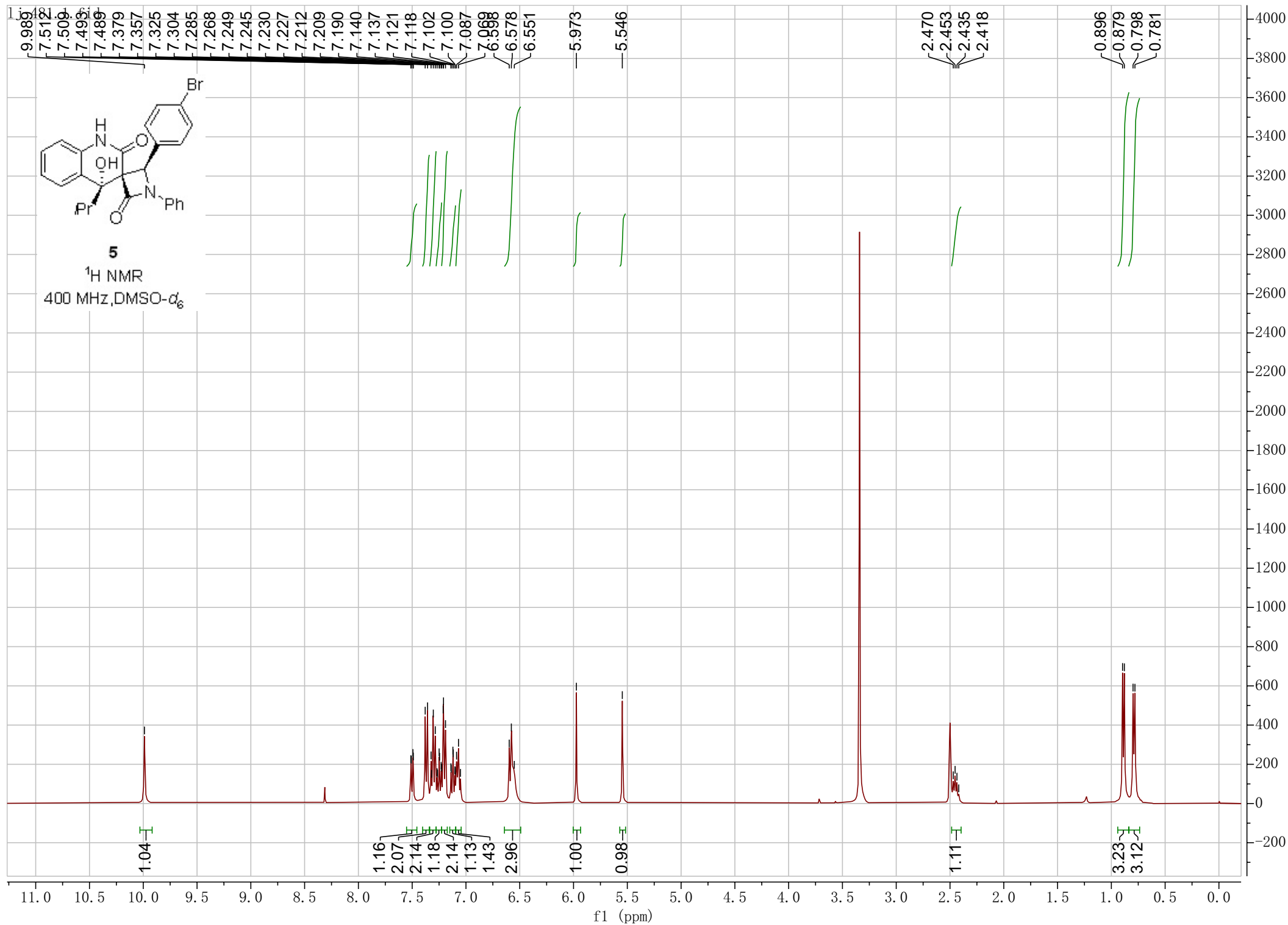
**3bd**

^{13}C NMR
100 MHz, CDCl_3









lj-481.2.fid

-166.40
-161.91

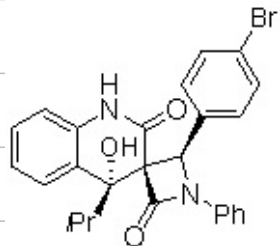
137.00
136.19
133.27
131.27
129.78
129.65
129.23
127.83
125.88
124.38
122.58
122.06
117.37
115.72

76.94
75.51

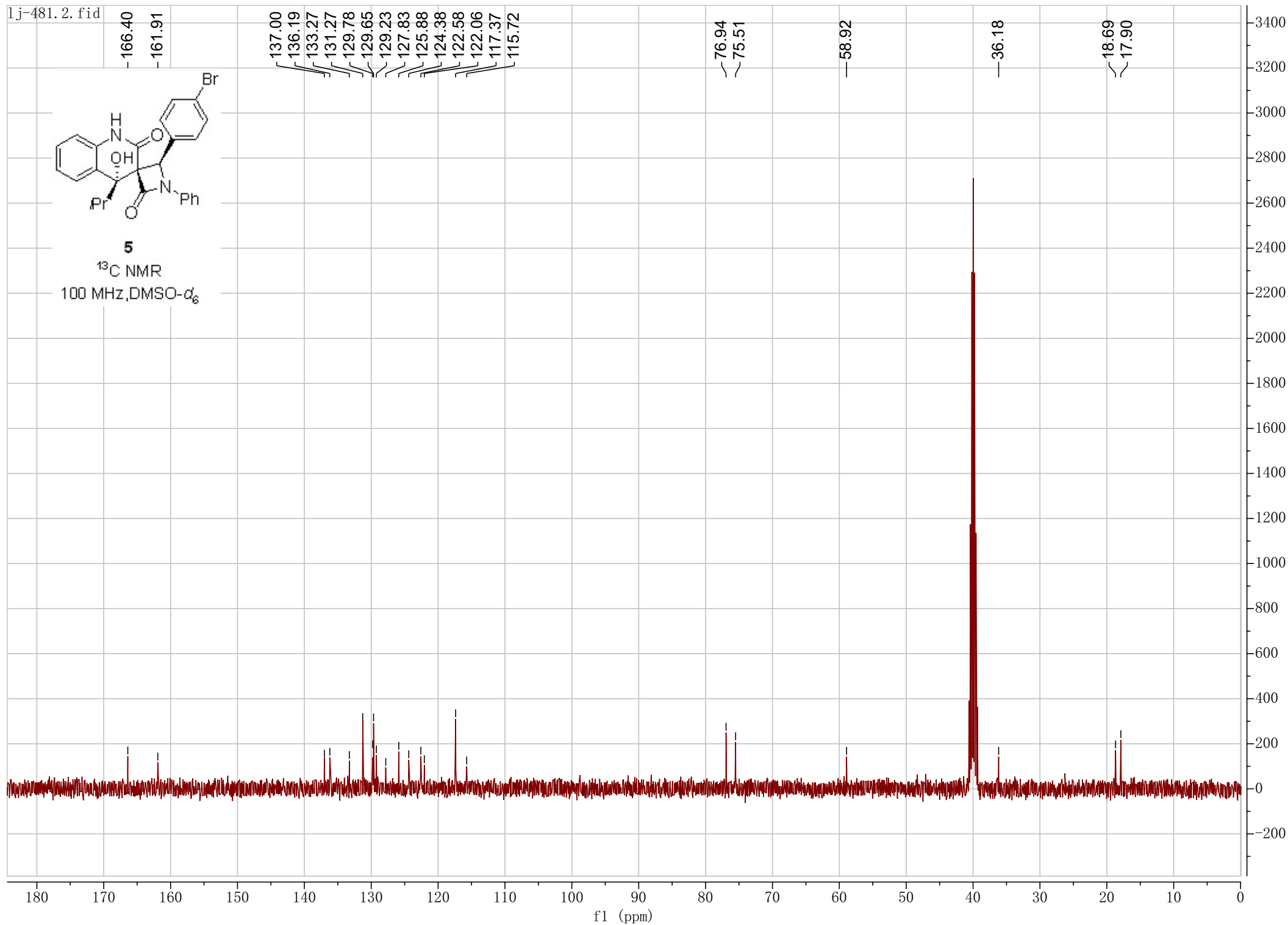
58.92

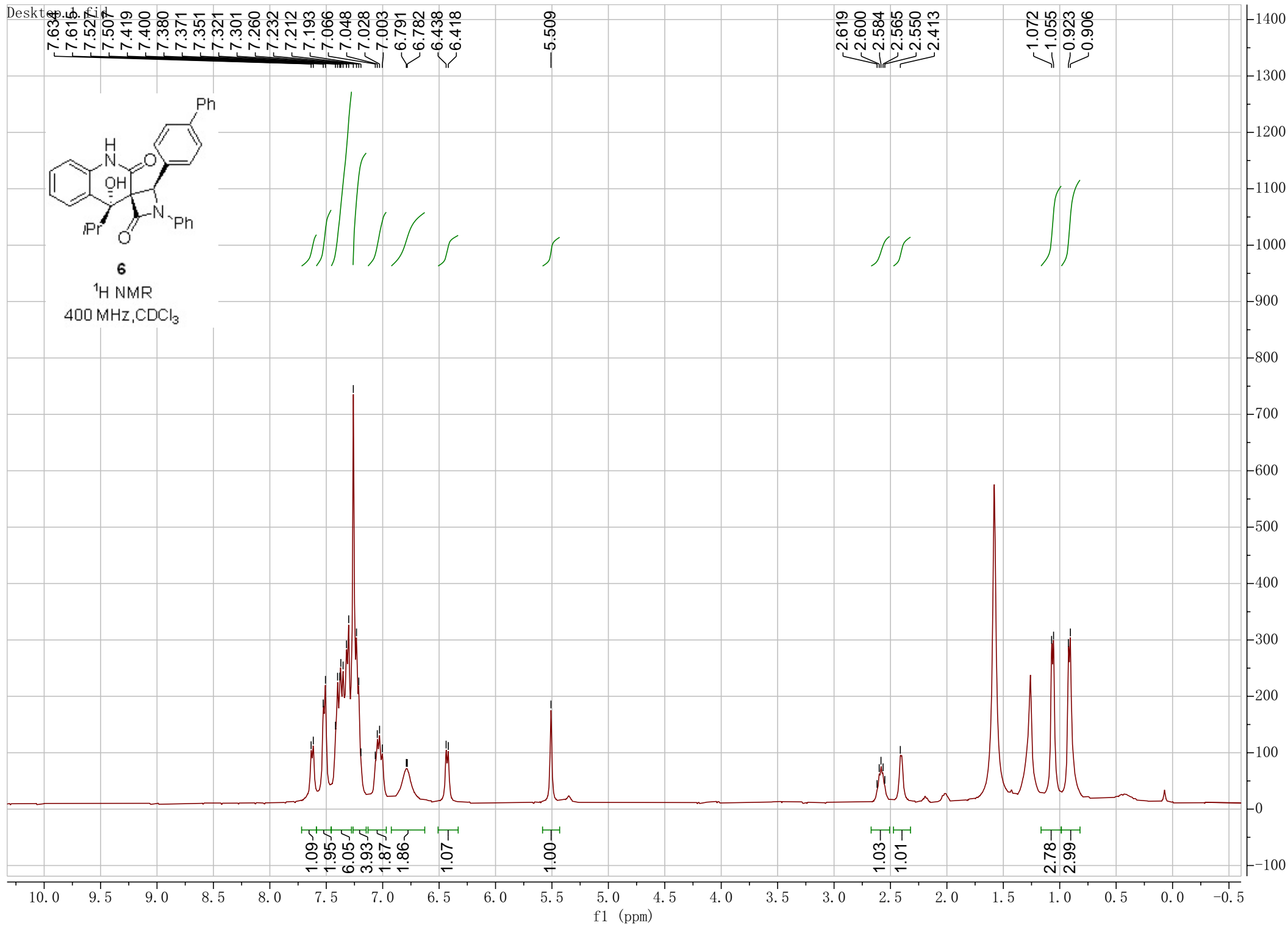
36.18

18.69
17.90

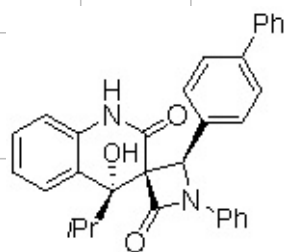
**5**

^{13}C NMR
100 MHz, DMSO- d_6



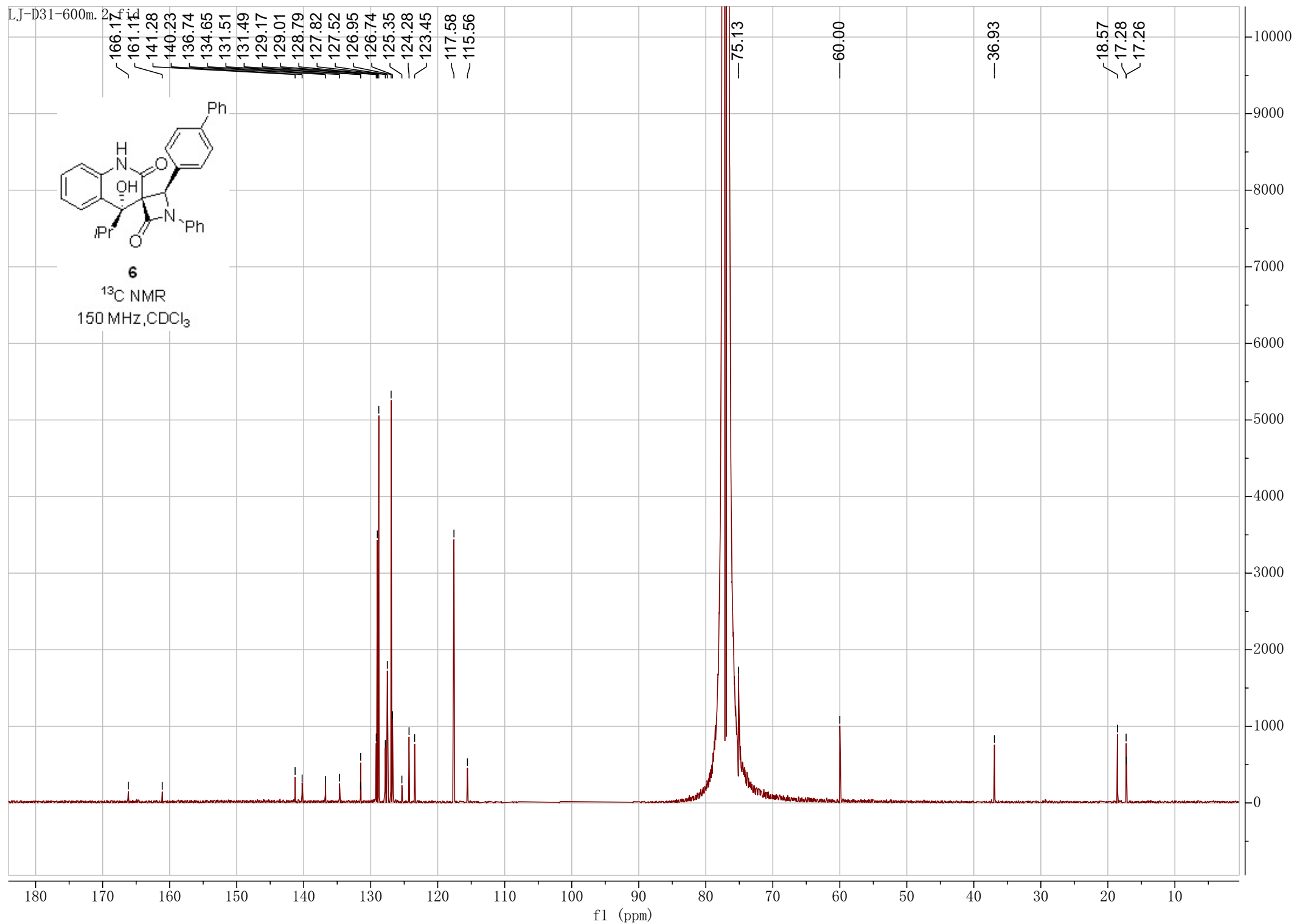


LJ-D31-600m. 2



6

^{13}C NMR
150 MHz, CDCl_3





SHIMADZU

LabSolutions

HPLC Reprot

<Sample Information>

Sample name : LJ-template-rac-AD20%

Data name : LJ-template-rac-AD20%.lcd

Acq. name : AD-20%.lcm

Location : 1-1
: 1 uL

Sample Type : unknown

Ana. Date : 2023/6/8 11:01:20

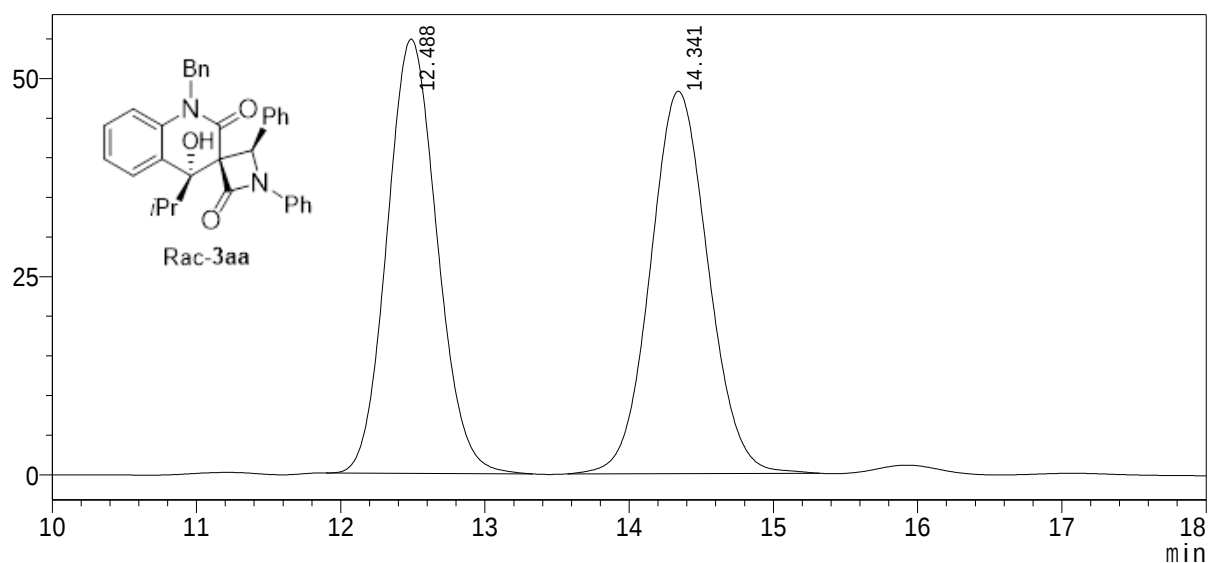
Analyst : System Administrator

Pro. Date : 2023/6/8 11:21:04

Processor : System Administrator

mV

SPD-20A 254nm



SPD-20A

Entry	RT[min]	Area	Height	Area%			
1	12.488	1320217	54807	49.563		M	
2	14.341	1343511	48250	50.437		M	
Sum		2663728	103058				



SHIMADZU

LabSolutions

HPLC Reprot

<Sample Information>

Sample name : LJ-D009-CHIRAL-AD20%

Data name : LJ-D009-CHIRAL-AD20%1.lcd

Acq. name : AD-20%.lcm

Location : 1-1

: 1 uL

Sample Type : unknown

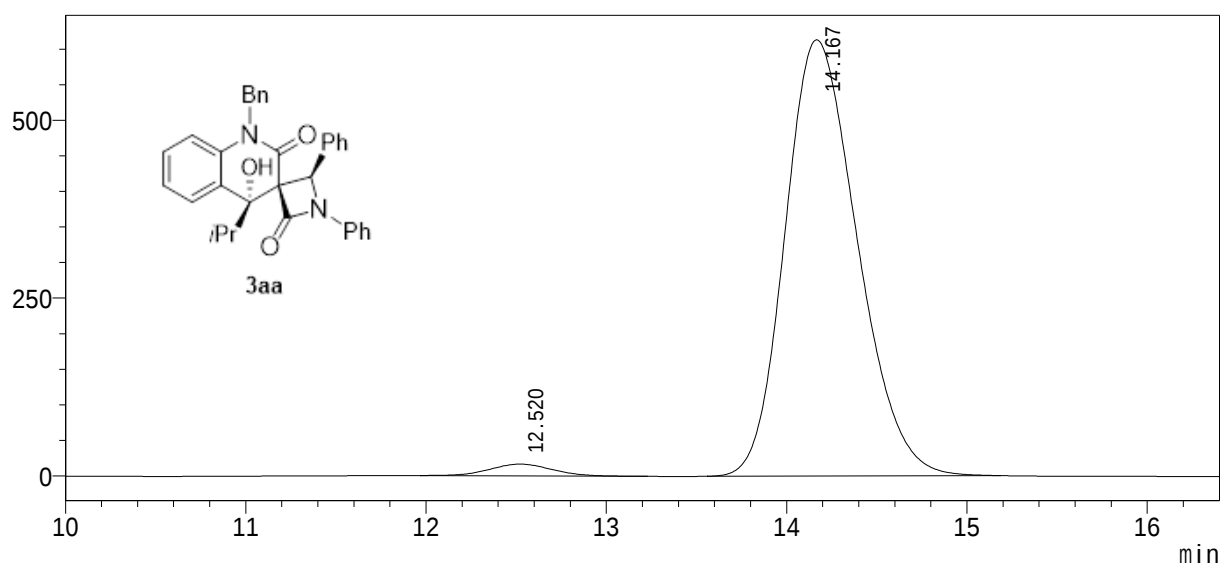
Ana. Date : 2023/6/7 10:09:13

Analyst : System Administrator

Pro. Date : 2023/6/7 10:27:28

Processor : System Administrator

mV SPD-20A 254nm



SPD-20A

Entry	RT[min]	Area	Height	Area%			
1	12.520	398928	16527	2.286		M	
2	14.167	17049512	613366	97.714		M	
Sum		17448440	629892				



SHIMADZU

LabSolutions

HPLC Report

<Sample information>

Sample name : LJ-325-ad-10

Data name : LJ-325-AD-10%.lcd

Acq. name : AD-10%-H.lcm

Location : 1-1
: 1 uL

Sample Type : 未知

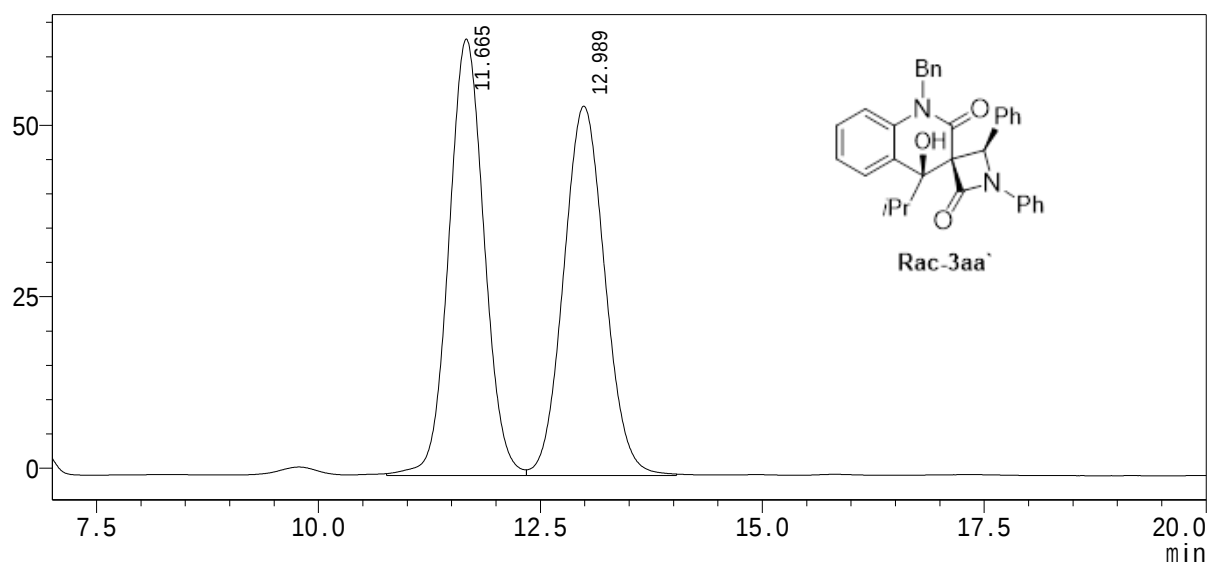
Ana. Date : 2022/11/8 12:56:29

Analyst : System Administrator

Pro. Date : 2023/6/6 21:01:51

Processor : System Administrator

mV SPD-20A 254nm



SPD-20A

Entry	RT[min]	Area	Height	Area%		化合物名
1	11.665	1760687	63645	50.314	M	
2	12.989	1738685	53857	49.686	V M	
Sum		3499372	117502			



SHIMADZU

LabSolutions

HPLC Reprot

<Sample Information>

Sample name : MHWL004-1

Data name : MHWL004-1-AD10%.lcd

Acq. name : AD-10%-H.lcm

Location : 1-1

: 1 uL

Ana. Date : 2023/6/11 13:06:38

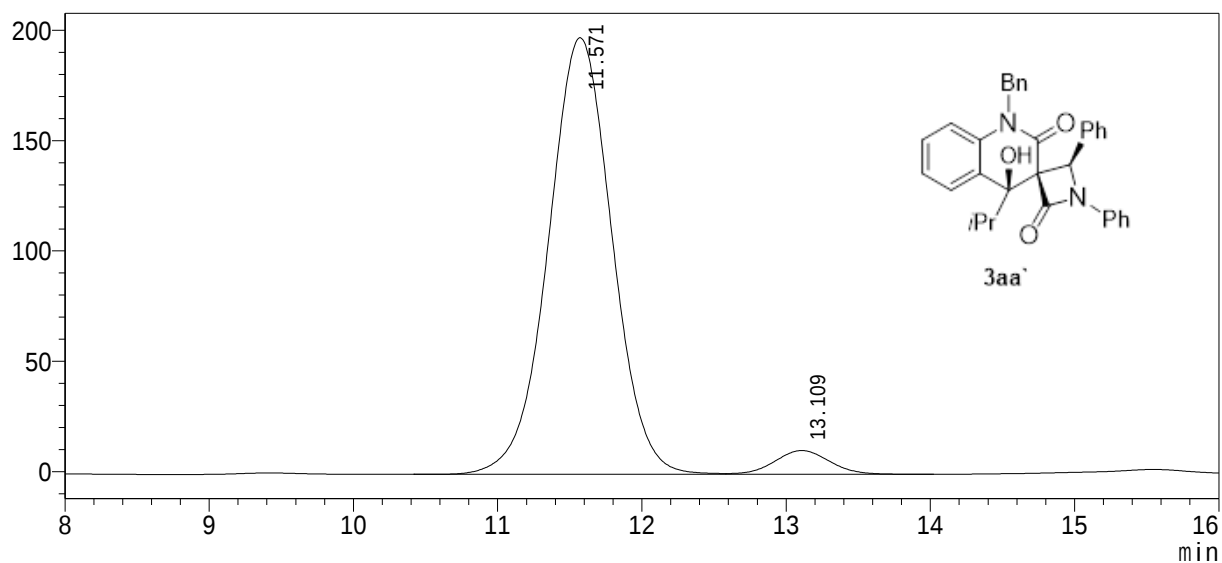
Pro. Date : 2023/6/11 13:25:30

Sample Type : unknown

Analyst : System Administrator

Processor : System Administrator

mV SPD-20A 254nm



SPD-20A

Entry	RT[min]	Area	Height	Area%			
1	11.571	6067956	197835	95.516			
2	13.109	284849	10736	4.484		V	
Sum		6352805	208571				



SHIMADZU

LabSolutions

HPLC Reprot

<Sample Information>

Sample name : LJ-444-RAC-IC20%

Data name : LJ-444-RAC-IC20%.lcd

Acq. name : IC-H-20%.lcm

Location : 1-1
: 1 uL

Sample Type : unknown

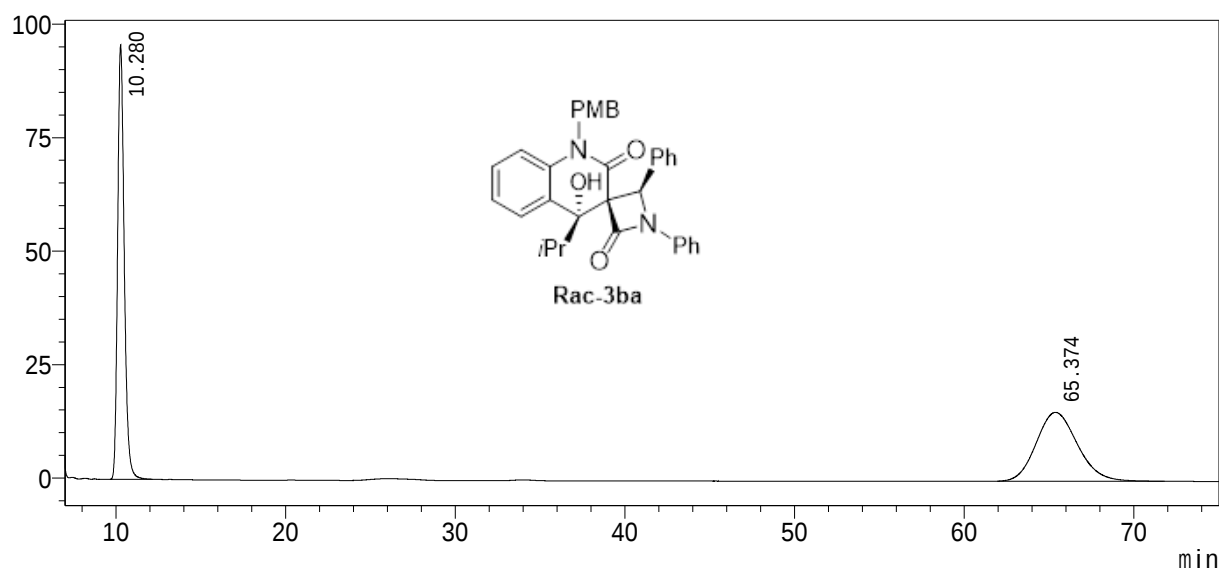
Ana. Date : 2023/6/8 18:58:28

Analyst : System Administrator

Pro. Date : 2023/6/8 20:44:08

Processor : System Administrator

mV SPD-20A 254nm



SPD-20A

Entry	RT[min]	Area	Height	Area%			
1	10.280	2594425	95751	50.363		M	
2	65.374	2557004	15163	49.637		M	
Sum		5151429	110913				



SHIMADZU
LabSolutions

HPLC Reprot

<Sample Information>

Sample name : pmb-0523

Data name : pmb-524.lcd

Acq. name : IC-H-20%.lcm

Location : 1-1

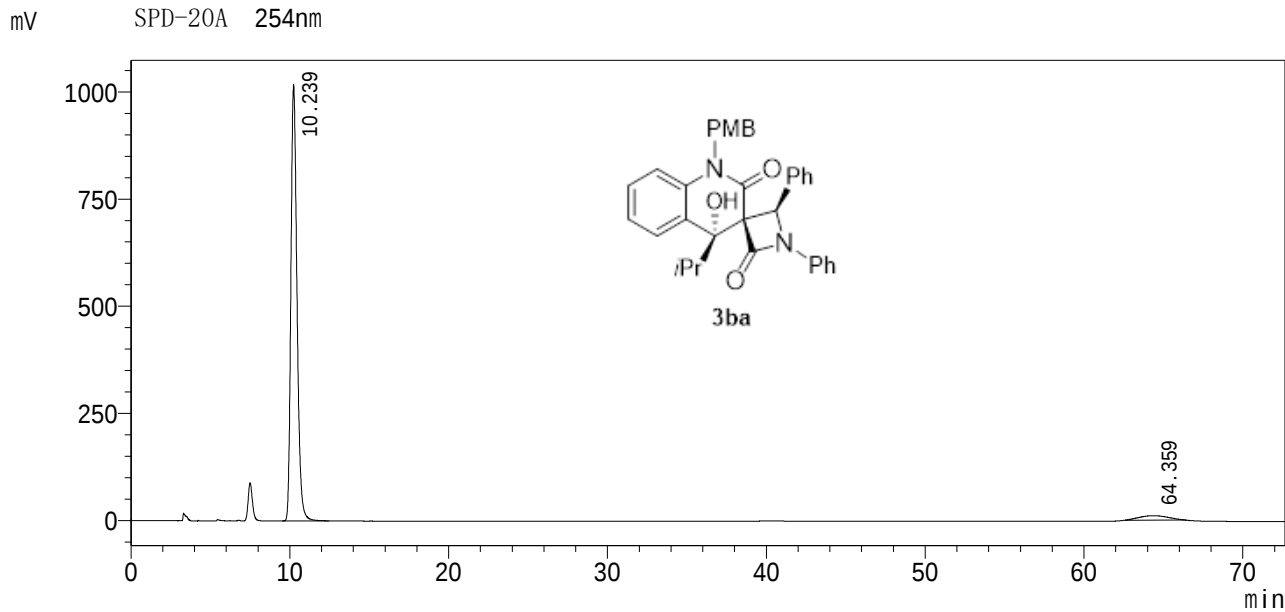
Ana. Date : 2023/5/23 17:03:08

Pro. Date : 2023/5/23 18:17:23

Sample Type : unknown

Analyst : System Administrator

Processor : System Administrator



SPD-20A

Entry	RT[min]	Area	Height	Area%			
1	10.239	27141979	1017710	95.328		M	
2	64.359	1330370	10449	4.672		M	
总计		28472348	1028159				



SHIMADZU

LabSolutions

HPLC Reprot

<Sample Information>

Sample name : LJ-470I-ad20%

Data name : LJ-470-ad20%4.lcd

Acq. name : AD-20%.lcm

Location : 1-1

: 1 uL

Sample Type : unknown

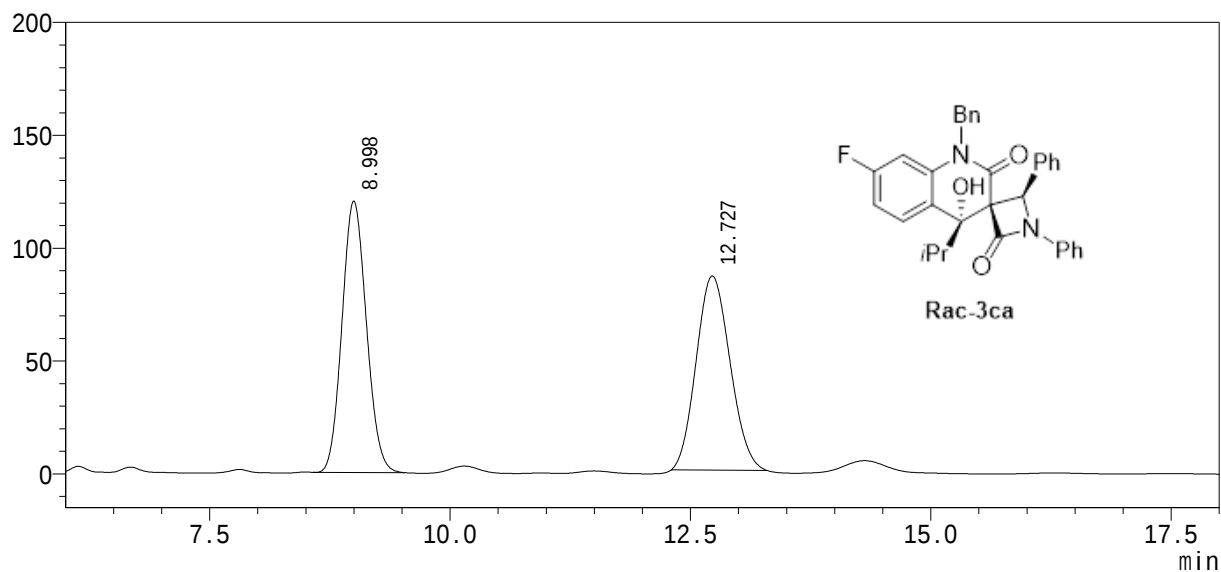
Ana. Date : 2023/5/24 18:47:58

Analyst : System Administrator

Pro. Date : 2023/6/6 23:46:34

Processor : System Administrator

mV SPD-20A 254nm



SPD-20A

Entry	RT[min]	Area	Height	Area%			
1	8.998	2123936	120319	50.194		M	
2	12.727	2107504	85979	49.806		M	
Sum		4231441	206297				



SHIMADZU

LabSolutions

HPLC Reprot

<Sample Information>

Sample name : LJ-470-chiral-ad20%

Data name : LJ-470-chiral-ad20%2.lcd

Acq. name : AD-20%.lcm

Location : 1-1
: 1 uL

Sample Type : unknown

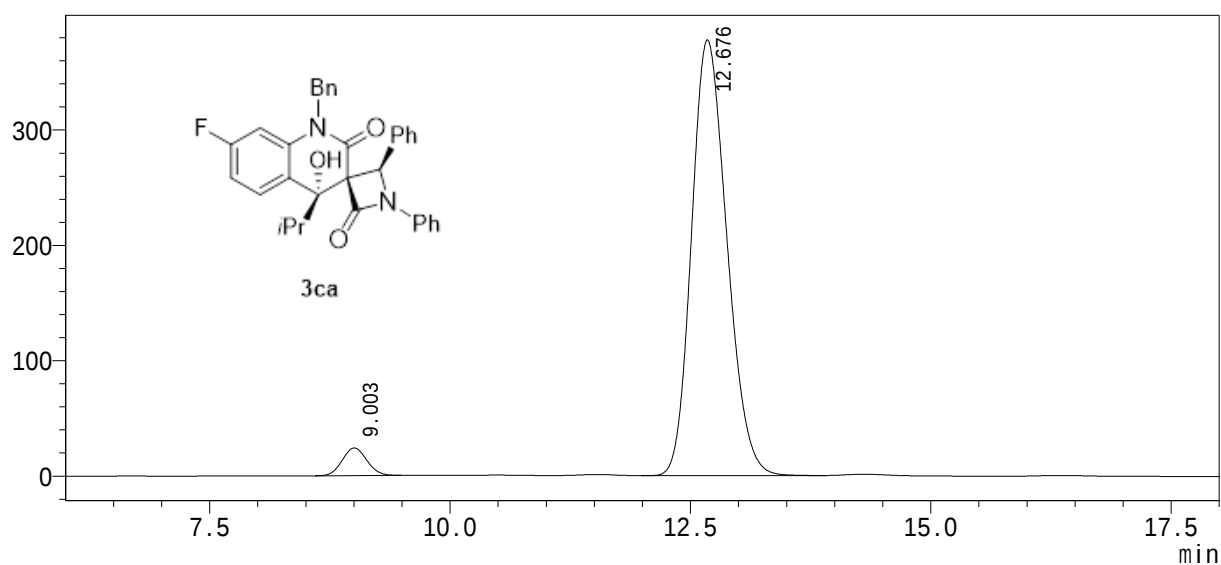
Ana. Date : 2023/5/24 17:27:26

Analyst : System Administrator

Pro. Date : 2023/6/6 23:47:20

Processor : System Administrator

mV SPD-20A 254nm



SPD-20A

Entry	RT[min]	Area	Height	Area%			
1	9.003	427783	24002	4.237		M	
2	12.676	9668177	377873	95.763		M	
Sum		10095960	401875				



SHIMADZU

LabSolutions

HPLC Reprot

<Sample Information>

Sample name : lj-418-2-ad20%

Data name : lj-418-2-ad20%1.lcd

Acq. name : AD-20%.lcm

Location : 1-1

: 1 uL

Sample Type : unknown

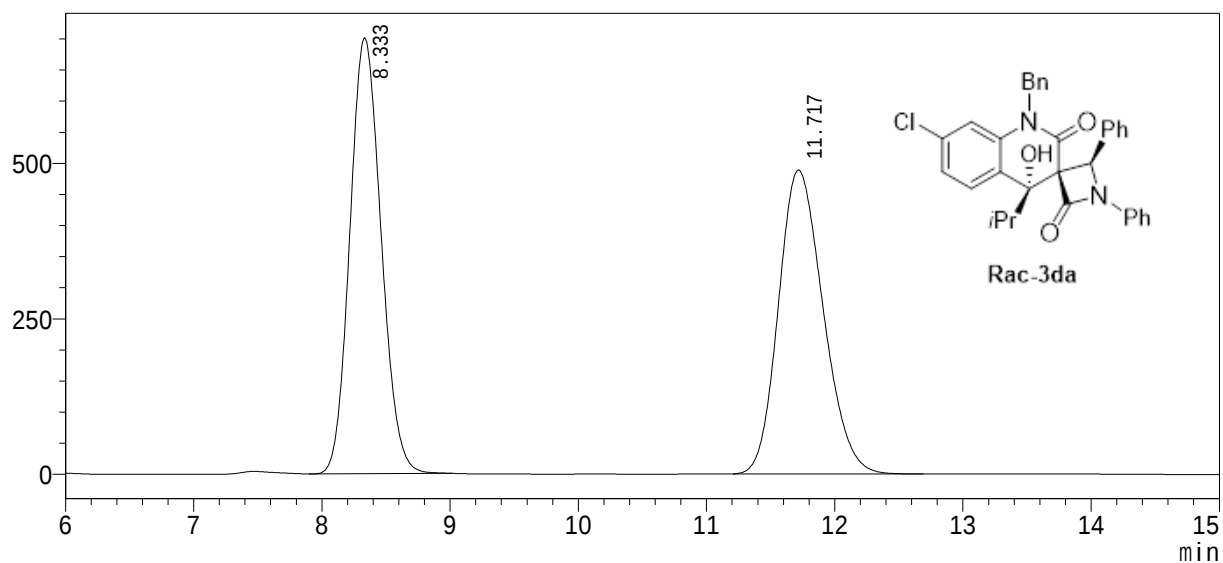
Ana. Date : 2023/4/22 14:15:18

Analyst : System Administrator

Pro. Date : 2023/6/6 23:31:06

Processor : System Administrator

mV SPD-20A 254nm



SPD-20A

Entry	RT[min]	Area	Height	Area%			
1	8.333	11868767	700923	50.061		M	
2	11.717	11839981	488671	49.939		M	
Sum		23708748	1189594				



SHIMADZU

LabSolutions

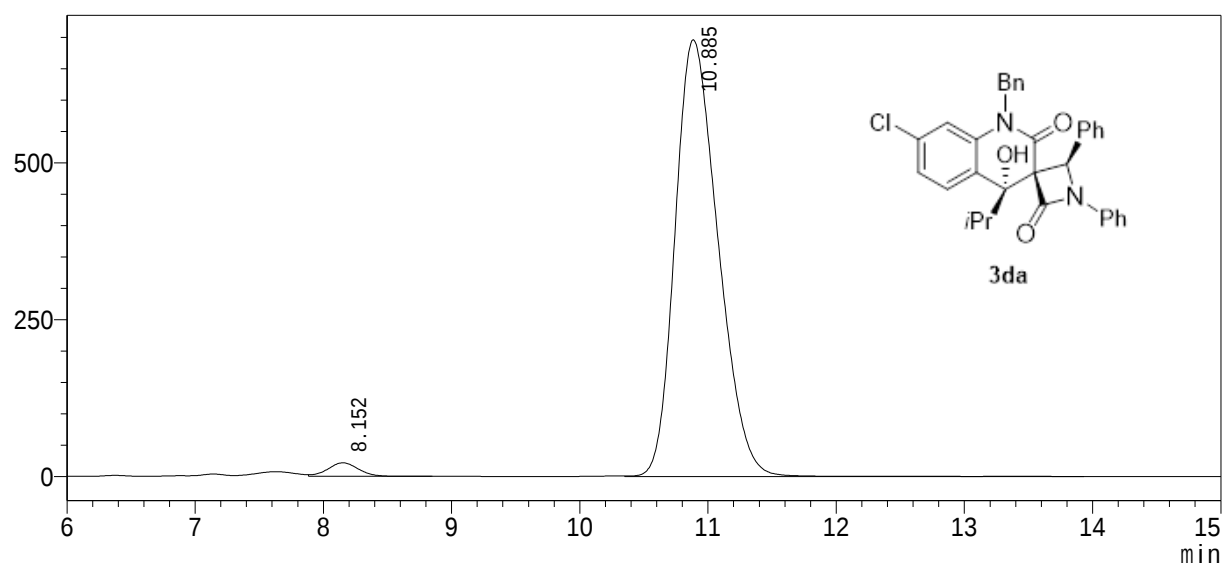
HPLC Reprot

<Sample Information>

Sample name : MHWK155-A
Data name : MHWK155-A-AD20%.lcd
Acq. name : AD-20%.lcm
Location : 1-1
Ana. Date : 2023/6/8 14:43:19
Pro. Date : 2023/6/8 15:09:49

Sample Tyle : unknown
Analyst : System Administrator
Processor : System Administrator

mV SPD-20A 254nm



SPD-20A

Entry	RT[min]	Area	Height	Area%			
1	8.152	361883	21634	2.185			
2	10.885	16202755	696210	97.815			
Sum		16564638	717844				



SHIMADZU

LabSolutions

HPLC Reprot

<Sample Information>

Sample name : LJ-398-1-AD20%

Data name : LJ-398-1-AD20%1.lcd

Acq. name : AD-20%.lcm

Location : 1-1
: 1 uL

Sample Type : unknown

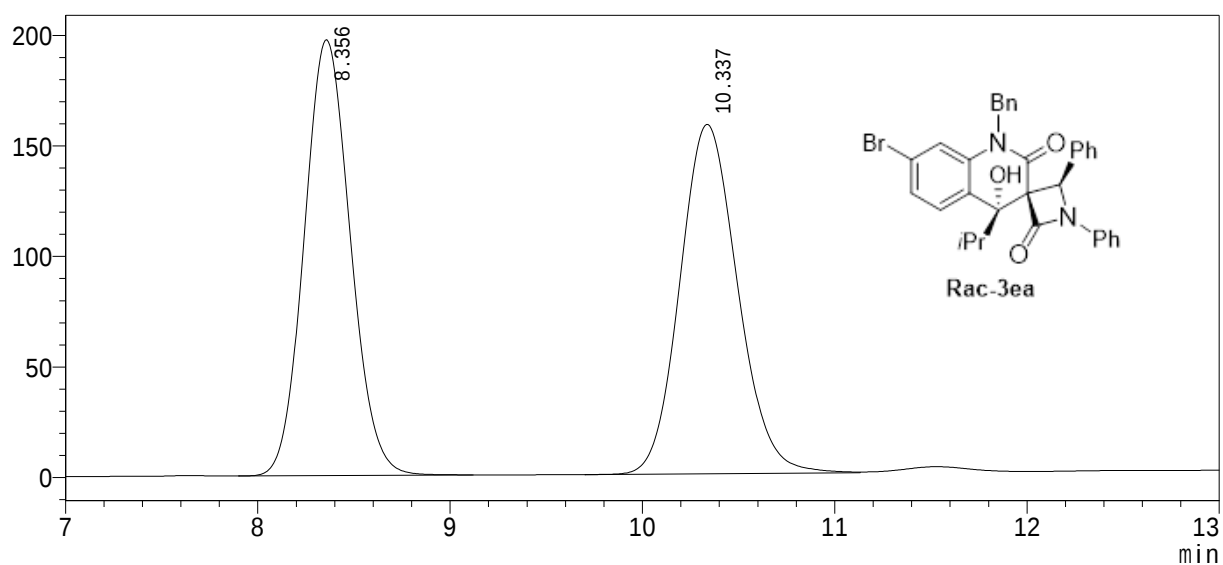
Ana. Date : 2023/4/15 14:58:07

Analyst : System Administrator

Pro. Date : 2023/6/6 23:14:44

Processor : System Administrator

mV SPD-20A 254nm



SPD-20A

Entry	RT[min]	Area	Height	Area%			
1	8.356	3287300	197187	49.908			
2	10.337	3299450	158054	50.092			
Sum		6586750	355241				



SHIMADZU

LabSolutions

HPLC Reprot

<Sample Information>

Sample name : MHWK155-B-2

Data name : MHWK155-B-2-AD20%.lcd

Acq. name : AD-20%.lcm

Location : 1-1

: 1 uL

Sample Type : unknown

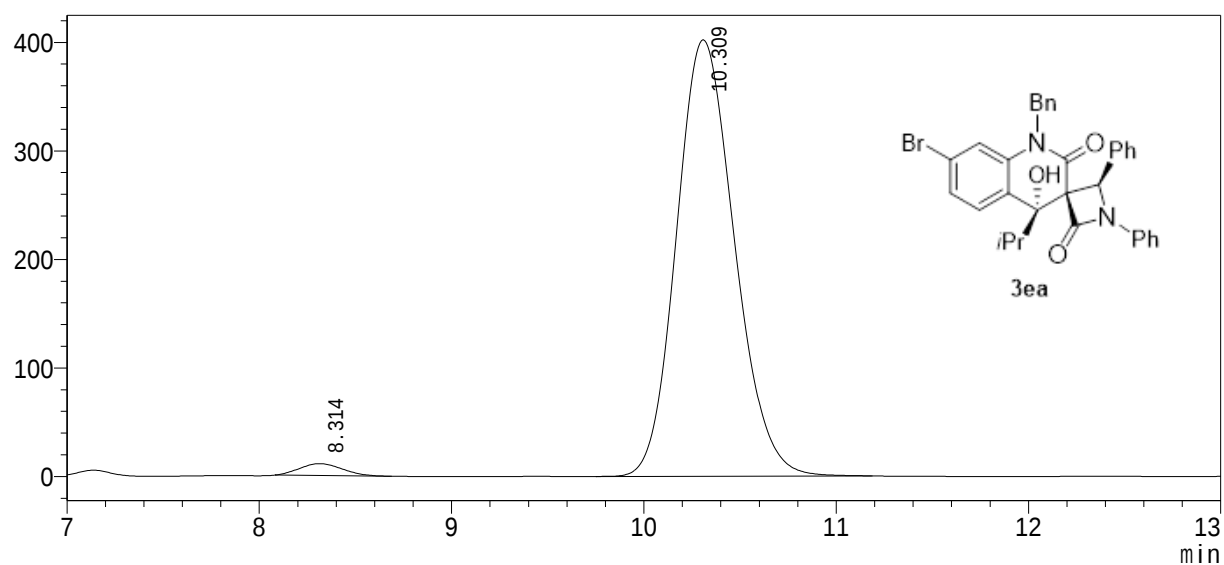
Ana. Date : 2023/6/8 17:27:09

Analyst : System Administrator

Pro. Date : 2023/6/8 17:44:32

Processor : System Administrator

mV SPD-20A 254nm



SPD-20A

Entry	RT[min]	Area	Height	Area%			
1	8.314	168745	10942	1.965		M	
2	10.309	8419926	402153	98.035		M	
Sum		8588671	413095				



SHIMADZU

LabSolutions

HPLC Reprot

<Sample Information>

Sample name : LJ-416-2-AD20%

Data name : LJ-416-2-AD20%.lcd

Acq. name : AD-20%.lcm

Location : 1-1

: 1 uL

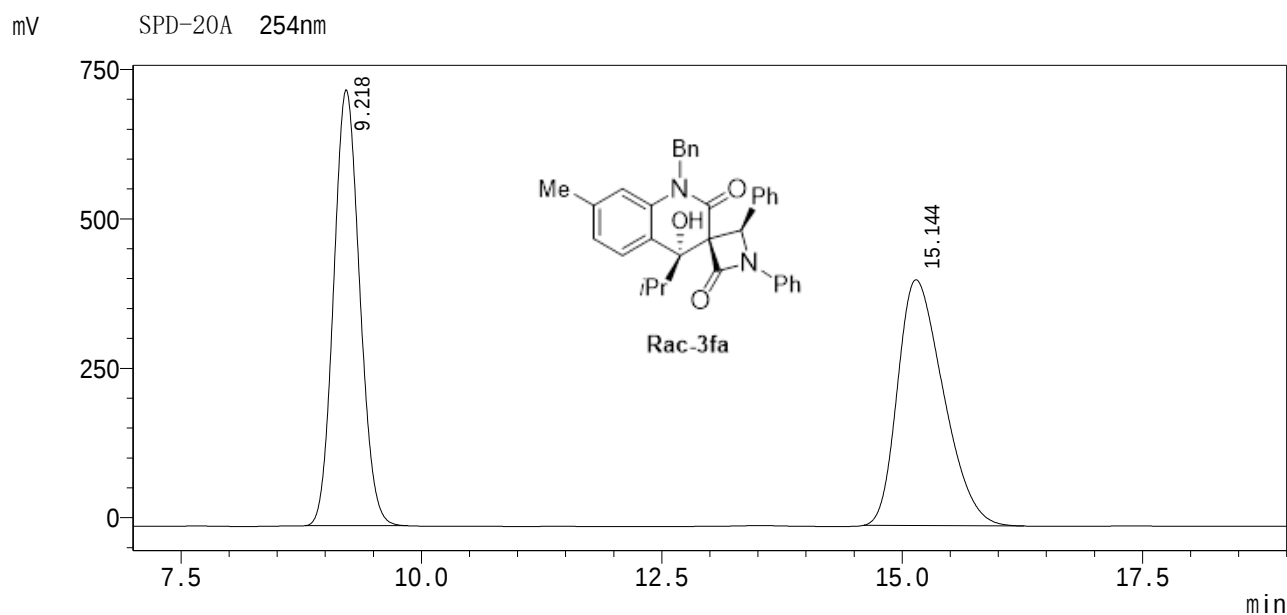
Ana. Date : 2023/4/17 16:41:28

Pro. Date : 2023/6/6 23:28:46

Sample Type : unknown

Analyst : System Administrator

Processor : System Administrator



SPD-20A

Entry	RT[min]	Area	Height	Area%			
1	9.218	13711591	729508	50.175		M	
2	15.144	13616202	411360	49.825		M	
Sum		27327793	1140868				



SHIMADZU

LabSolutions

HPLC Reprot

<Sample Information>

Sample name : LJ-416-2-CHIRAL-20%

Data name : LJ-416-2-CHIRAL-AD20%2.lcd

Acq. name : AD-20%.lcm

Location : 1-1
: 1 uL

Sample Type : unknown

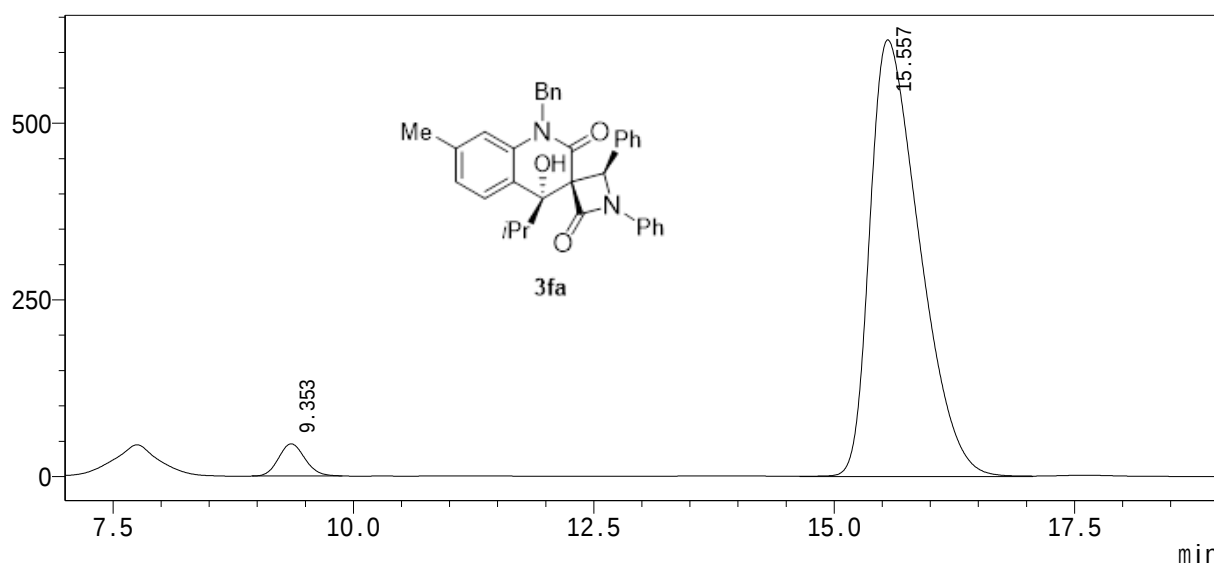
Ana. Date : 2023/4/18 15:36:00

Analyst : System Administrator

Pro. Date : 2023/6/6 23:29:41

Processor : System Administrator

mV SPD-20A 254nm



SPD-20A

Entry	RT[min]	Area	Height	Area%			
1	9.353	865349	45562	3.753		M	
2	15.557	22194704	618086	96.247			
Sum		23060053	663648				



SHIMADZU

LabSolutions

HPLC Reprot

<Sample Information>

Sample name : LJ-398-2-AD20%

Data name : LJ-398-2-AD20%1.lcd

Acq. name : AD-20%.lcm

Location : 1-1

: 1 uL

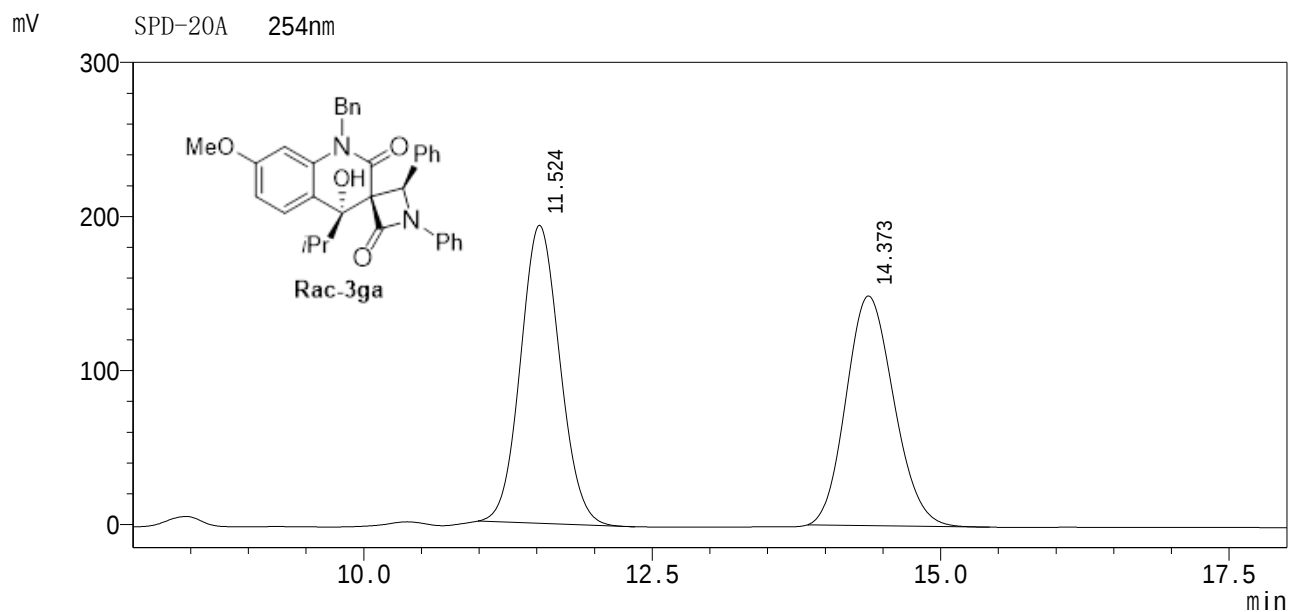
Sample Type : unknown

Ana. Date : 2023/4/15 15:50:13

Analyst : System Administrator

Pro. Date : 2023/6/6 23:16:01

Processor : System Administrator



SPD-20A

Entry	RT[min]	Area	Height	Area%			
1	11.524	4587334	193473	51.672		M	
2	14.373	4290525	149053	48.328		M	
Sum		8877860	342526				



SHIMADZU

LabSolutions

HPLC Reprot

<Sample Information>

Sample name : LJ-398-2-CHIRAL-AD20%

Data name : LJ-398-2-CHIRAL-AD20%2.lcd

Acq. name : AD-20%.lcm

Location : 1-1
: 1 uL

Sample Type : unknown

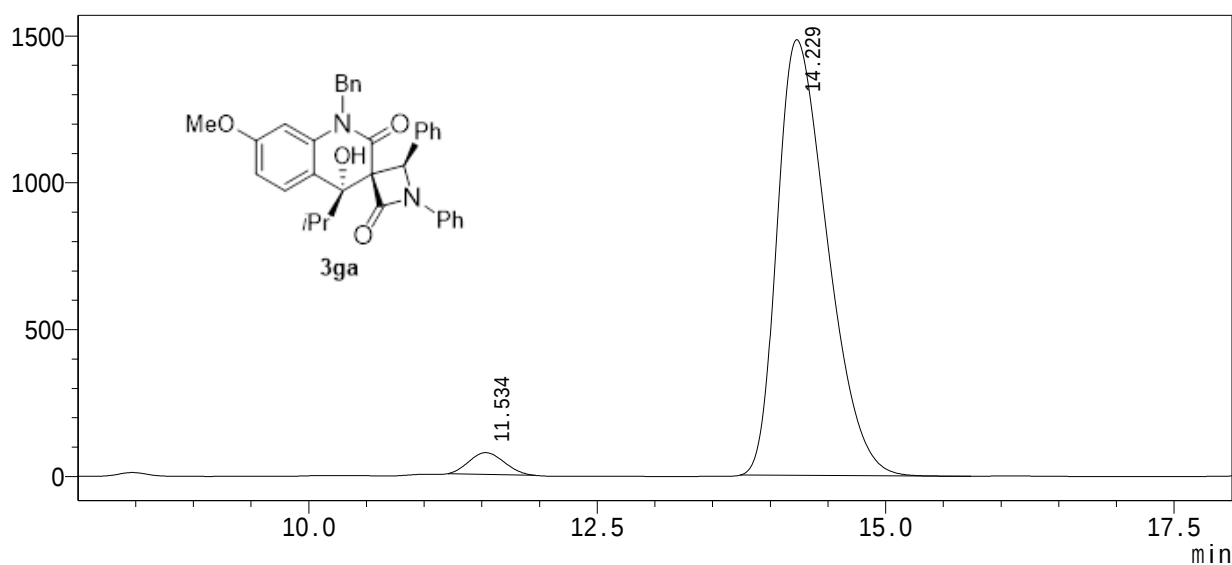
Ana. Date : 2023/4/15 16:12:15

Analyst : System Administrator

Pro. Date : 2023/6/6 23:16:58

Processor : System Administrator

mV SPD-20A 254nm



SPD-20A

Entry	RT[min]	Area	Height	Area%		
1	11.534	1568625	73872	3.381	M	
2	14.229	44828103	1483466	96.619	M	
Sum		46396727	1557338			



SHIMADZU

LabSolutions

HPLC Reprot

<Sample Information>

Sample name : LJ-416-1-AD20%

Data name : LJ-416-1-AD20%.lcd

Acq. name : AD-20%.lcm

Location : 1-1

: 1 uL

Ana. Date : 2023/4/17 15:49:51

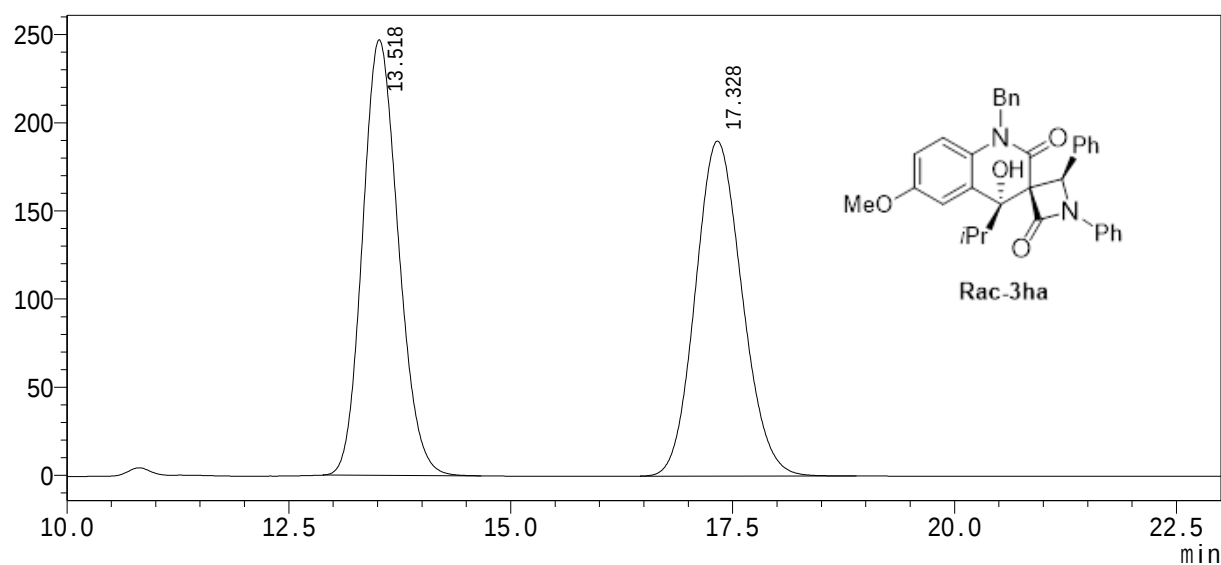
Pro. Date : 2023/6/6 23:27:27

Sample Type : unknown

Analyst : System Administrator

Processor : System Administrator

mV SPD-20A 254nm



SPD-20A

Entry	RT[min]	Area	Height	Area%			
1	13.518	6939917	247073	49.938		M	
2	17.328	6957023	190000	50.062		M	
Sum		13896940	437074				



SHIMADZU

LabSolutions

HPLC Reprot

<Sample Information>

Sample name : MHWK156-1

Data name : MHWK156-1-AD20%.lcd

Acq. name : AD-20%.lcm

Location : 1-1
: 1 uL

Sample Type : unknown

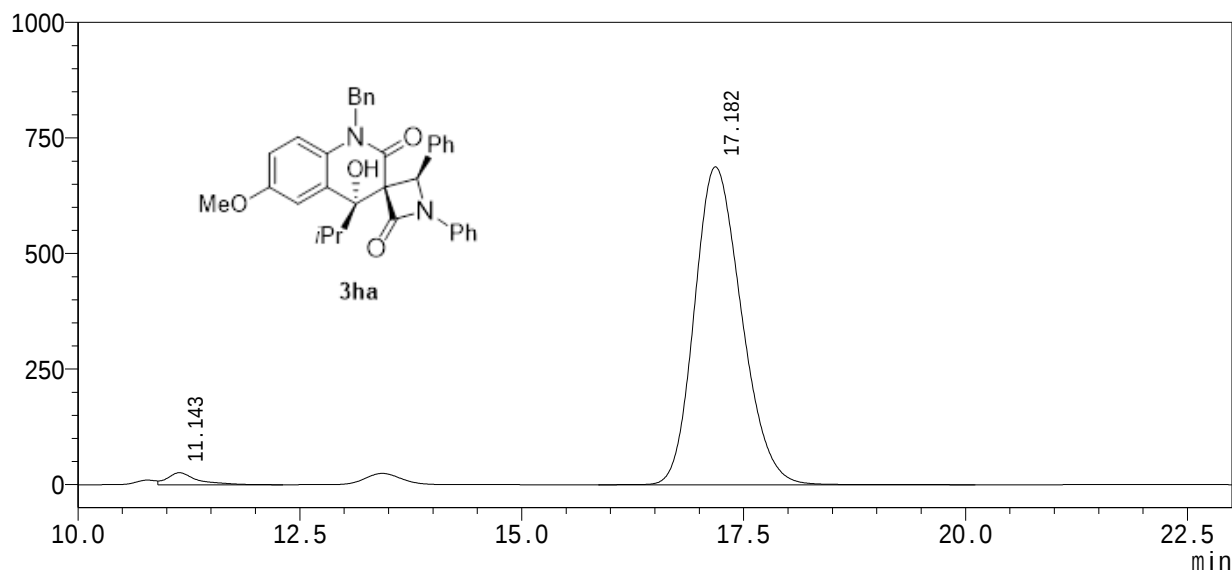
Ana. Date : 2023/6/8 16:27:58

Analyst : System Administrator

Pro. Date : 2023/6/8 18:06:47

Processor : System Administrator

mV SPD-20A 254nm



SPD-20A

Entry	RT[min]	Area	Height	Area%			
1	11.143	601363	25993	2.319			
2	17.182	25331690	688105	97.681			
Sum		25933053	714098				



SHIMADZU

LabSolutions

HPLC Reprot

<Sample Information>

Sample name : LJ-436-1-IC20%

Data name : LJ-436-1-IC20%1.lcd

Acq. name : IC-H-20%.lcm

Location : 1-1

: 1 uL

Sample Type : unknown

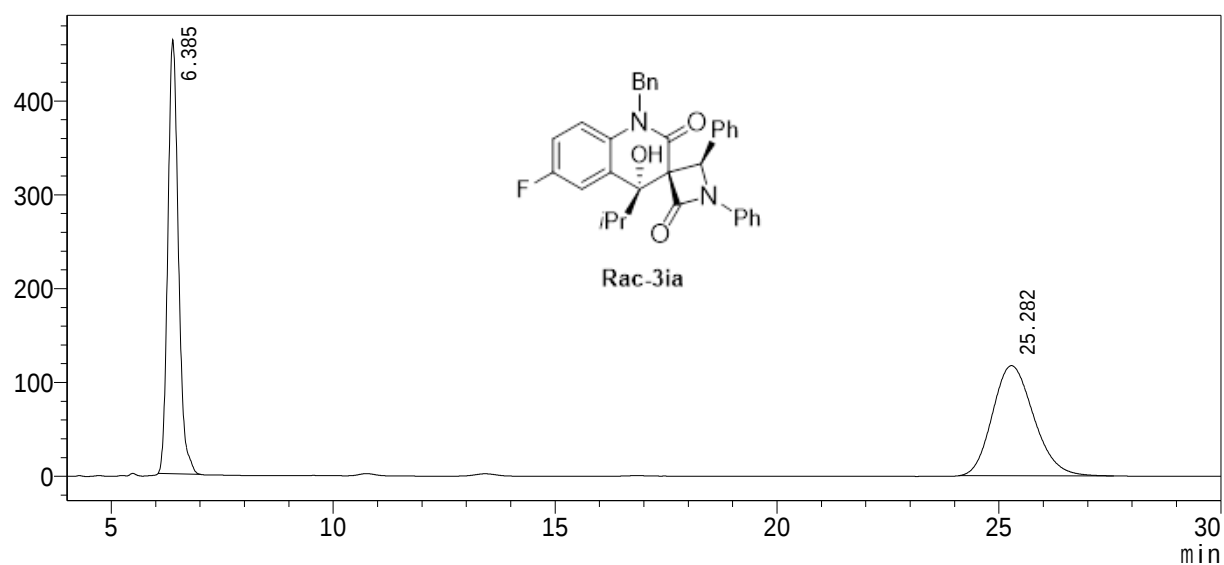
Ana. Date : 2023/5/11 9:14:53

Analyst : System Administrator

Pro. Date : 2023/6/6 23:33:08

Processor : System Administrator

mV SPD-20A 254nm



SPD-20A

Entry	RT[min]	Area	Height	Area%			
1	6.385	7643704	462505	50.178		M	
2	25.282	7589355	117369	49.822		M	
Sum		15233059	579874				



SHIMADZU

LabSolutions

HPLC Reprot

<Sample Information>

Sample name : LJ-436-1-CHIRAL-IC20%

Data name : LJ-436-1-CHIRAL-IC20%1.lcd

Acq. name : IC-H-20%.lcm

Location : 1-1
: 1 uL

Sample Type : unknown

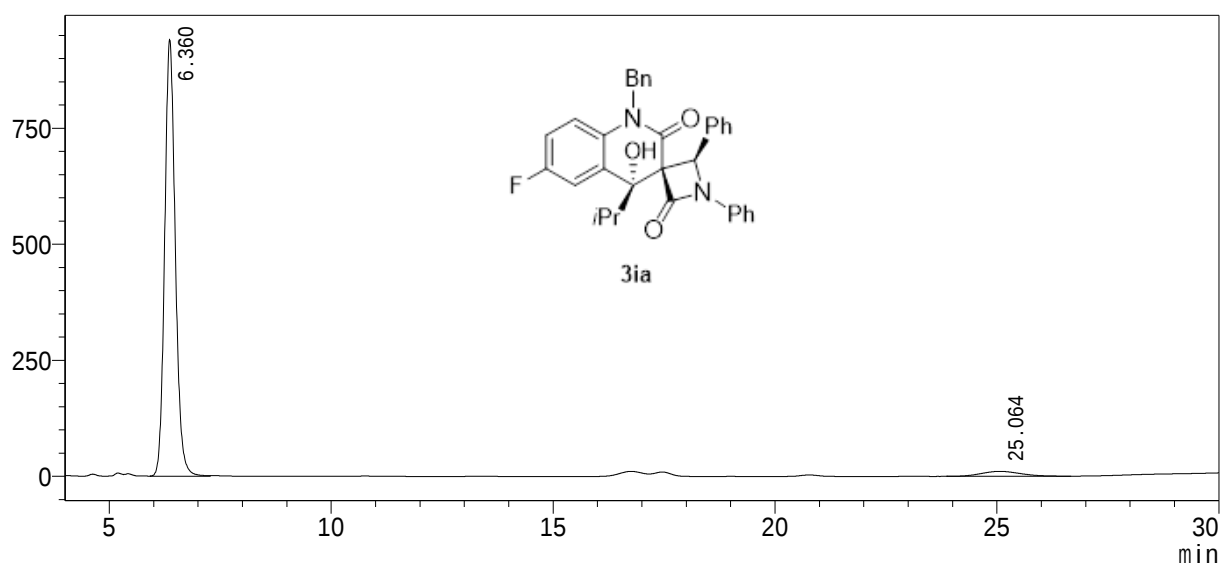
Ana. Date : 2023/5/12 16:27:21

Analyst : System Administrator

Pro. Date : 2023/6/6 23:33:49

Processor : System Administrator

mV SPD-20A 254nm



SPD-20A

Entry	RT[min]	Area	Height	Area%			
1	6.360	15672684	940160	96.041		M	
2	25.064	646007	10582	3.959		M	
Sum		16318691	950742				



SHIMADZU

LabSolutions

HPLC Reprot

<Sample Information>

Sample name : lj-418-1-ad20%

Data name : lj-418-1-ad20%1.lcd

Acq. name : AD-20%.lcm

Location : 1-1

: 1 uL

Sample Type : unknown

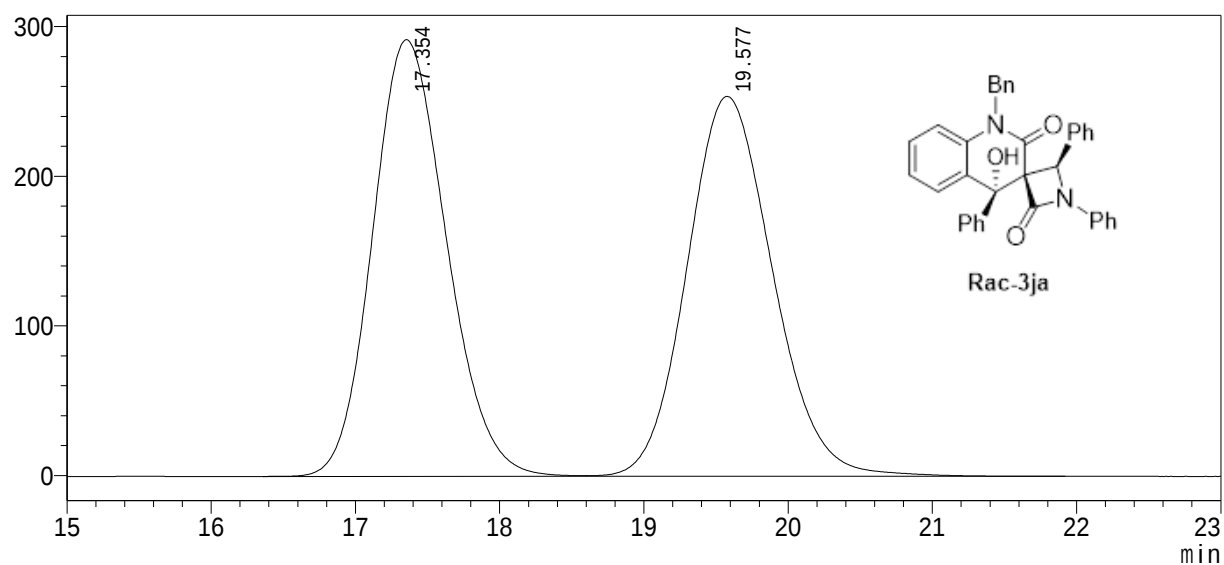
Ana. Date : 2023/4/22 10:45:32

Analyst : System Administrator

Pro. Date : 2023/6/6 23:30:00

Processor : System Administrator

mV SPD-20A 254nm



SPD-20A

Entry	RT[min]	Area	Height	Area%			
1	17.354	10394560	291776	49.787			
2	19.577	10483362	253903	50.213		V	
Sum		20877922	545679				



SHIMADZU

LabSolutions

HPLC Reprot

<Sample Information>

Sample name : lj-418-1-chiral-ad20%

Data name : lj-418-1-chiral-ad20%2.lcd

Acq. name : AD-20%.lcm

Location : 1-1

: 1 uL

Sample Type : unknown

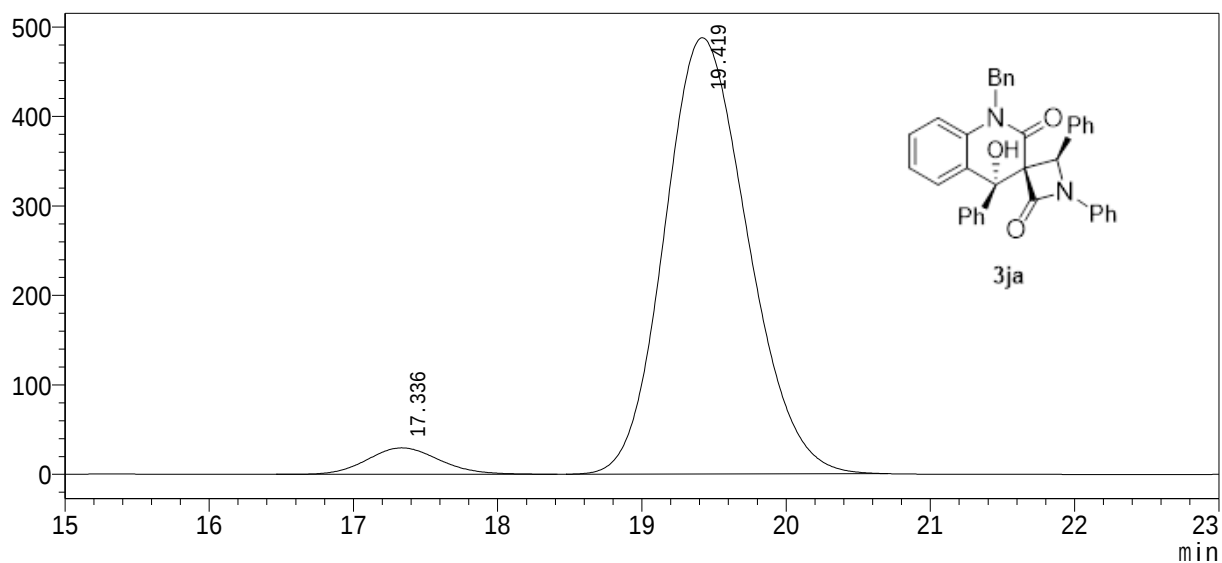
Ana. Date : 2023/4/22 11:27:10

Analyst : System Administrator

Pro. Date : 2023/6/6 23:30:36

Processor : System Administrator

mV SPD-20A 254nm



SPD-20A

Entry	RT[min]	Area	Height	Area%			
1	17.336	1045115	29675	5.071			
2	19.419	19564646	487520	94.929		M	
Sum		20609762	517195				



SHIMADZU

LabSolutions

HPLC Reprot

<Sample Information>

Sample name : LJ-446-1-IC20%

Data name : LJ-446-1-IC20%3.lcd

Acq. name : IC-H-20%.lcm

Location : 1-1

: 1 uL

Sample Type : unknown

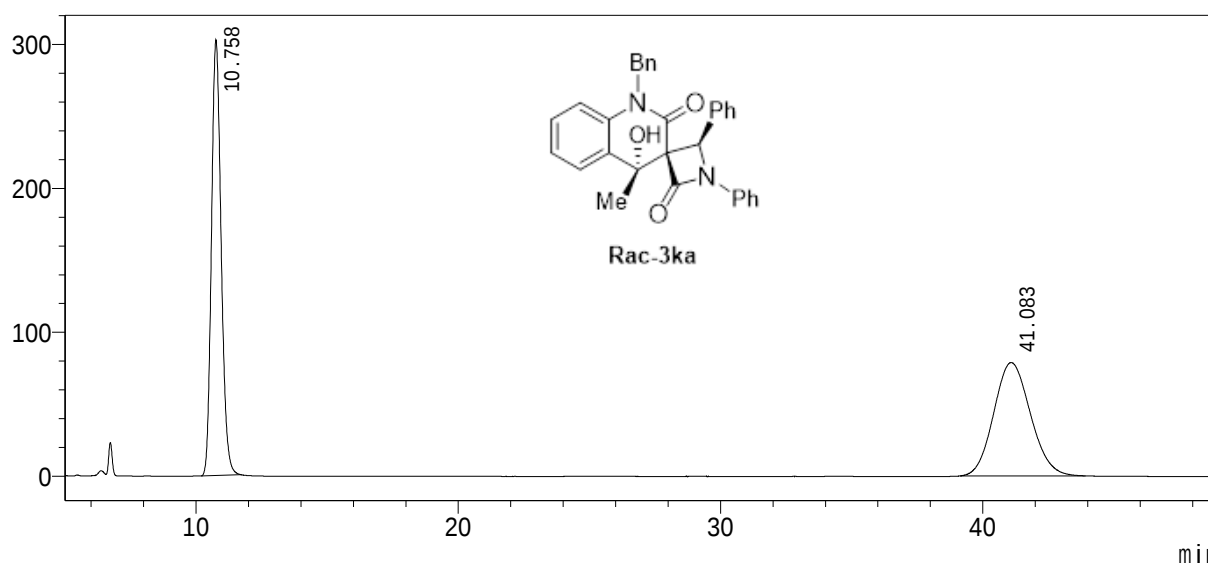
Ana. Date : 2023/5/11 10:26:56

Analyst : System Administrator

Pro. Date : 2023/6/6 23:40:01

Processor : System Administrator

mV SPD-20A 254nm



SPD-20A

Entry	RT[min]	Area	Height	Area%			
1	10.758	7759584	302683	50.362		M	
2	41.083	7648181	78761	49.638		M	
Sum		15407766	381445				



SHIMADZU

LabSolutions

HPLC Reprot

<Sample Information>

Sample name : LJ-446-1-CHIRAL-IC20%

Data name : LJ-446-1-CHIRAL-IC20%4.lcd

Acq. name : IC-H-20%.lcm

Location : 1-1

: 1 uL

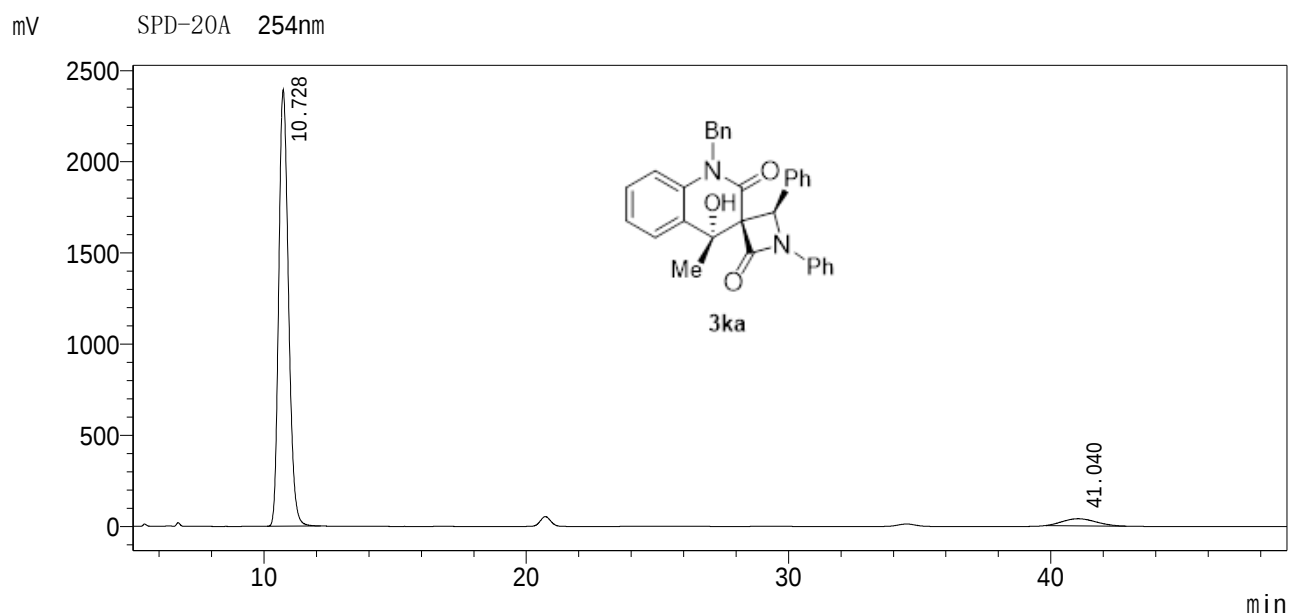
Sample Type : unknown

Ana. Date : 2023/5/11 11:17:07

Analyst : System Administrator

Pro. Date : 2023/6/6 23:40:45

Processor : System Administrator



SPD-20A

Entry	RT[min]	Area	Height	Area%			
1	10.728	61879968	2393874	94.863		M	
2	41.040	3350873	38376	5.137		M	
Sum		65230840	2432250				



SHIMADZU

LabSolutions

HPLC Reprot

<Sample Information>

Sample name : LJ-D40-2-RAC- IC10%

Data name : LJ-D40-2-RAC- IC10%.lcd

Acq. name : AS-H-10%.lcm

Location : 1-1

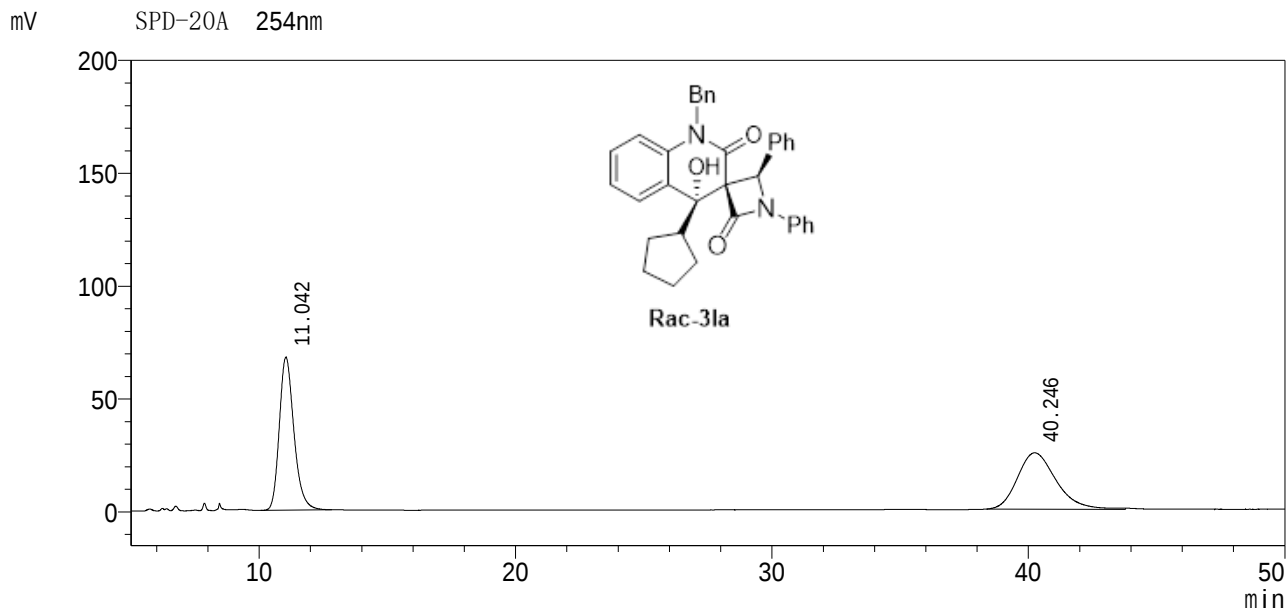
Ana. Date : 2023/6/16 17:20:23

Pro. Date : 2023/6/16 19:14:44

Sample Type : unknown

Analyst : System Administrator

Processor : System Administrator



SPD-20A

Entry	RT[min]	Area	Height	Area%			
1	11.042	2678857	67794	50.546			
2	40.246	2620971	24969	49.454		M	
Sum		5299829	92763				



SHIMADZU

LabSolutions

HPLC Reprot

<Sample Information>

Sample name : MHWL019-1

Data name : MHWL019-1-IC20%.lcd

Acq. name : IC-H-10%.lcm

Location : 1-1

: 1 uL

Ana. Date : 2023/6/18 10:59:16

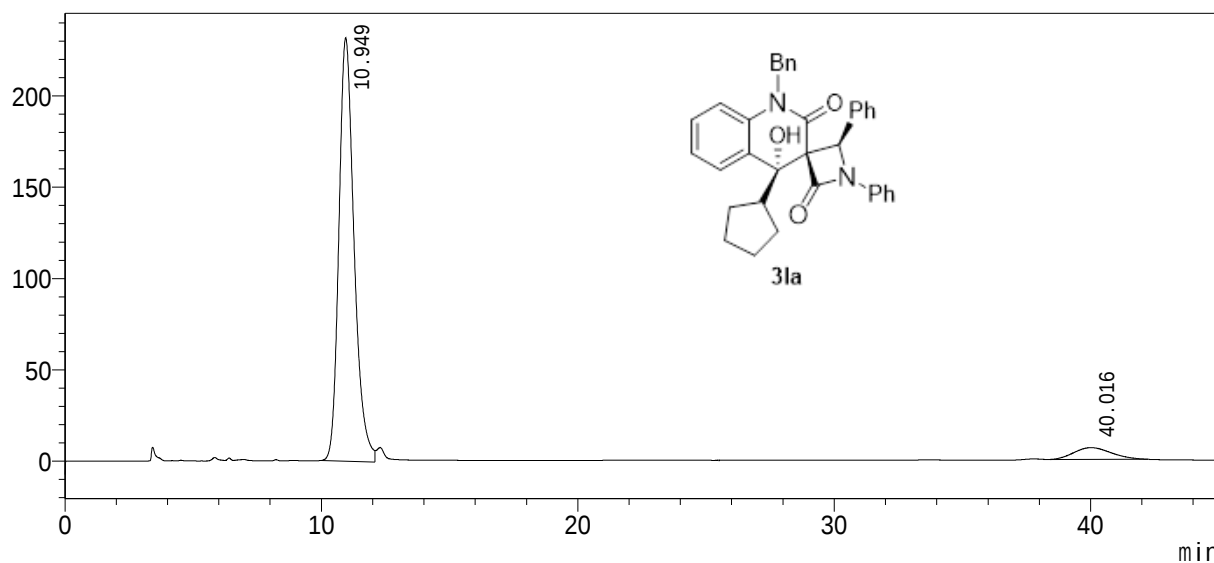
Pro. Date : 2023/6/18 12:22:42

Sample Type : unknown

Analyst : System Administrator

Processor : System Administrator

mV SPD-20A 254nm



SPD-20A

Entry	RT[min]	Area	Height	Area%			
1	10.949	9573530	231834	93.637		M	
2	40.016	650514	6414	6.363		M	
Sum		10224043	238248				



SHIMADZU

LabSolutions

HPLC Reprot

<Sample Information>

Sample name : lj-437-2-AD20%

Data name : lj-437-2L-AD20%2.lcd

Acq. name : AD-20%.lcm

Location : 1-1
: 1 uL

Sample Type : unknown

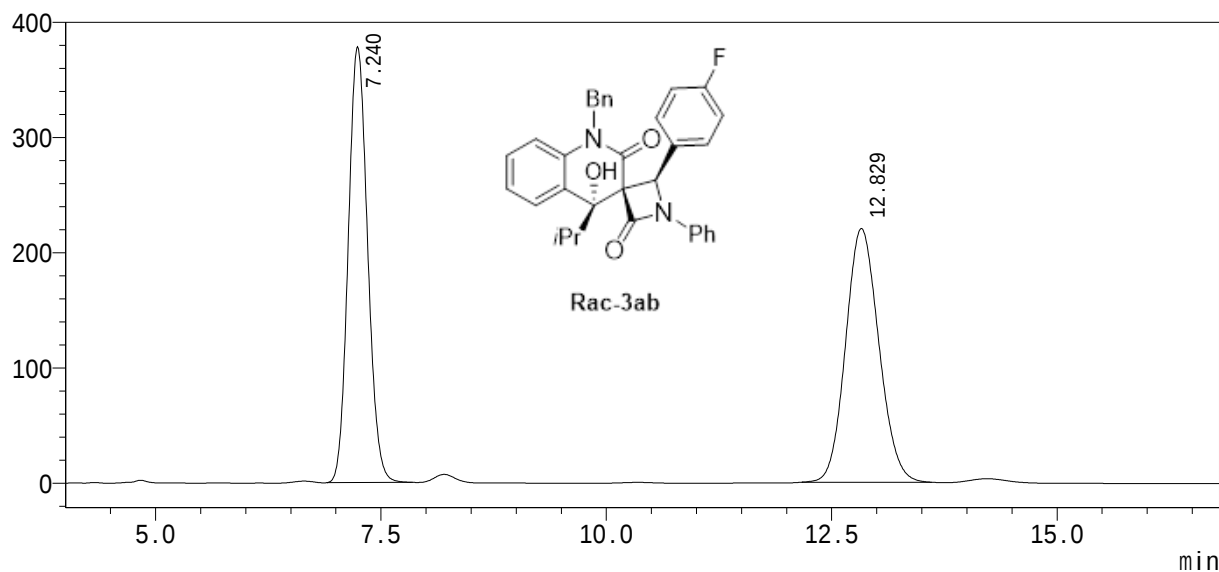
Ana. Date : 2023/4/29 21:09:27

Analyst : System Administrator

Pro. Date : 2023/6/6 23:55:26

Processor : System Administrator

mV SPD-20A 254nm



SPD-20A

Entry	RT[min]	Area	Height	Area%			
1	7.240	5648638	378142	50.027		M	
2	12.829	5642581	220257	49.973		M	
Sum		11291218	598399				



SHIMADZU

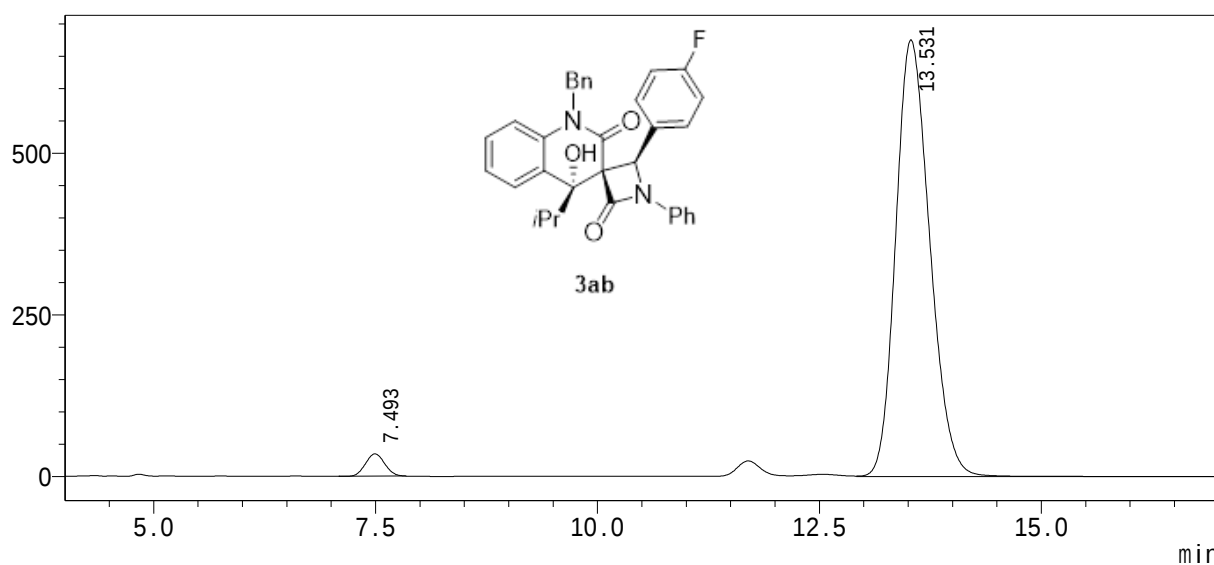
LabSolutions

HPLC Reprot

<Sample Information>

Sample name : MHWK154-B
Data name : MHWK154-B-AD20%.lcd
Acq. name : AD-20%.lcm
Location : 1-1
Sample Type : unknown
Ana. Date : 2023/6/8 11:46:22
Pro. Date : 2023/6/8 15:09:41
Analyst : System Administrator
Processor : System Administrator

mV SPD-20A 254nm



SPD-20A

Entry	RT[min]	Area	Height	Area%			
1	7.493	520781	34540	2.810		M	
2	13.531	18012705	675707	97.190		M	
Sum		18533486	710247				



SHIMADZU

LabSolutions

HPLC Reprot

<Sample Information>

Sample name : LJ-415-4-AD20%

Data name : LJ-415-4-AD20%8.lcd

Acq. name : AD-20%.lcm

Location : 1-1

: 1 uL

Sample Type : unknown

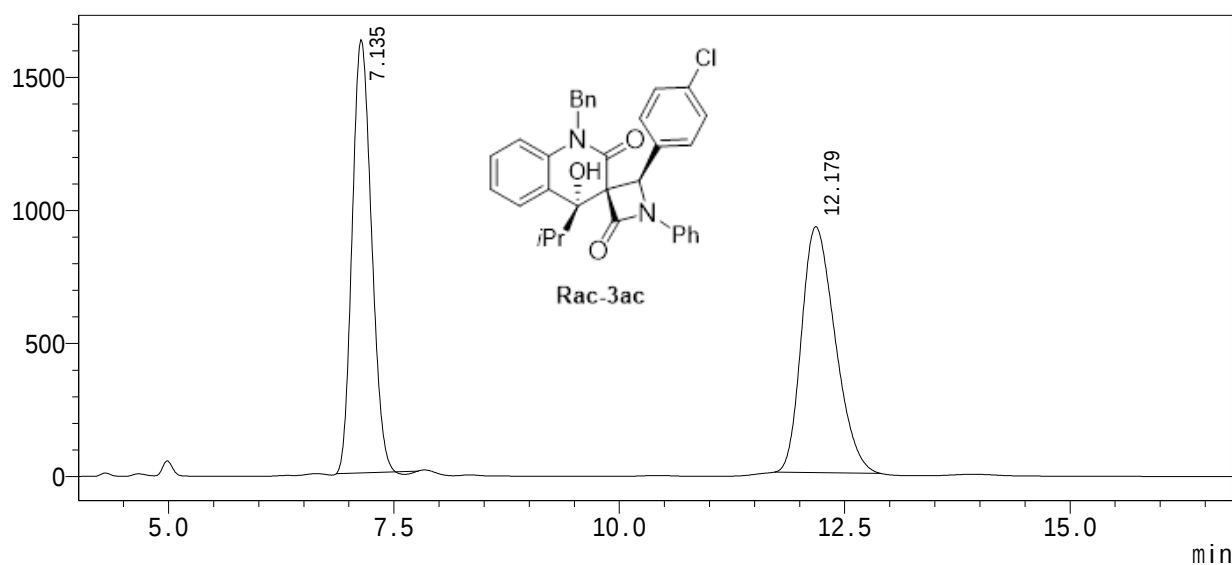
Ana. Date : 2023/4/14 20:40:50

Analyst : System Administrator

Pro. Date : 2023/6/6 23:25:03

Processor : System Administrator

mV SPD-20A 254nm



SPD-20A

Entry	RT[min]	Area	Height	Area%			
1	7.135	24181807	1628241	50.190		M	
2	12.179	23999156	923864	49.810		M	
Sum		48180963	2552104				



SHIMADZU

LabSolutions

HPLC Reprot

<Sample Information>

Sample name : LJ-415-4-CHIRAL-AD20%

Data name : LJ-415-4-CHIRAL-AD20%9.lcd

Acq. name : AD-20%.lcm

Location : 1-1
: 1 uL

Sample Type : unknown

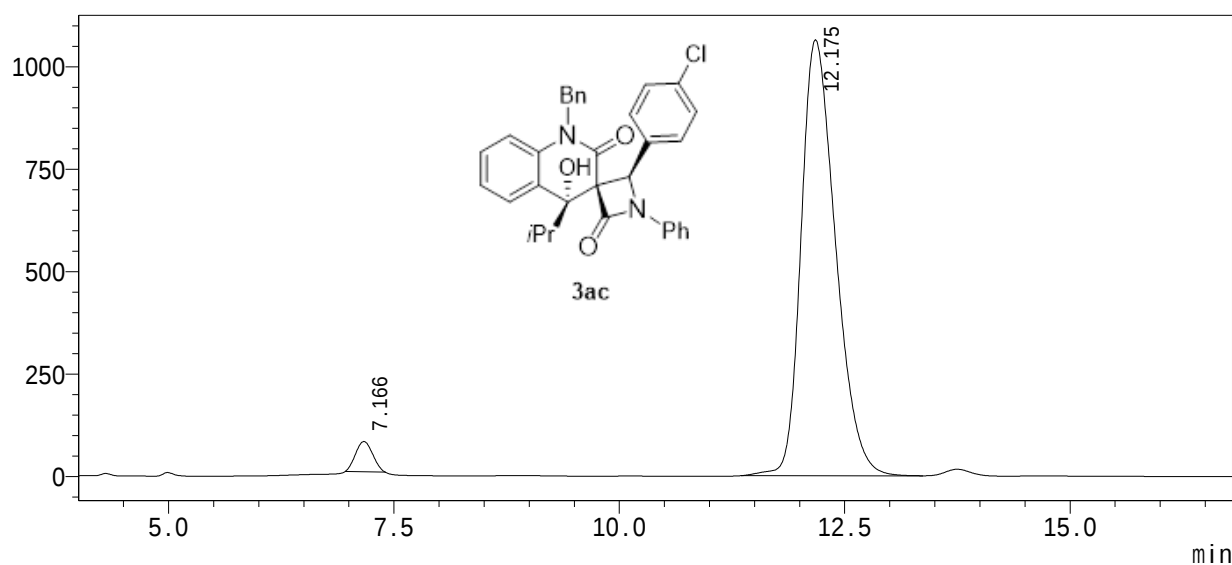
Ana. Date : 2023/4/14 21:03:14

Analyst : System Administrator

Pro. Date : 2023/6/6 23:26:50

Processor : System Administrator

mV SPD-20A 254nm



SPD-20A

Entry	RT[min]	Area	Height	Area%			
1	7.166	977370	73959	3.335		M	
2	12.175	28325357	1064576	96.665		M	
Sum		29302727	1138535				



SHIMADZU

LabSolutions

HPLC Reprot

<Sample Information>

Sample name : lj-389-1-b-ad-20%

Data name : lj-389-1-b-ad-20%1.lcd

Acq. name : AD-20%.lcm

Location : 1-1

: 1 uL

Sample Type : unknown

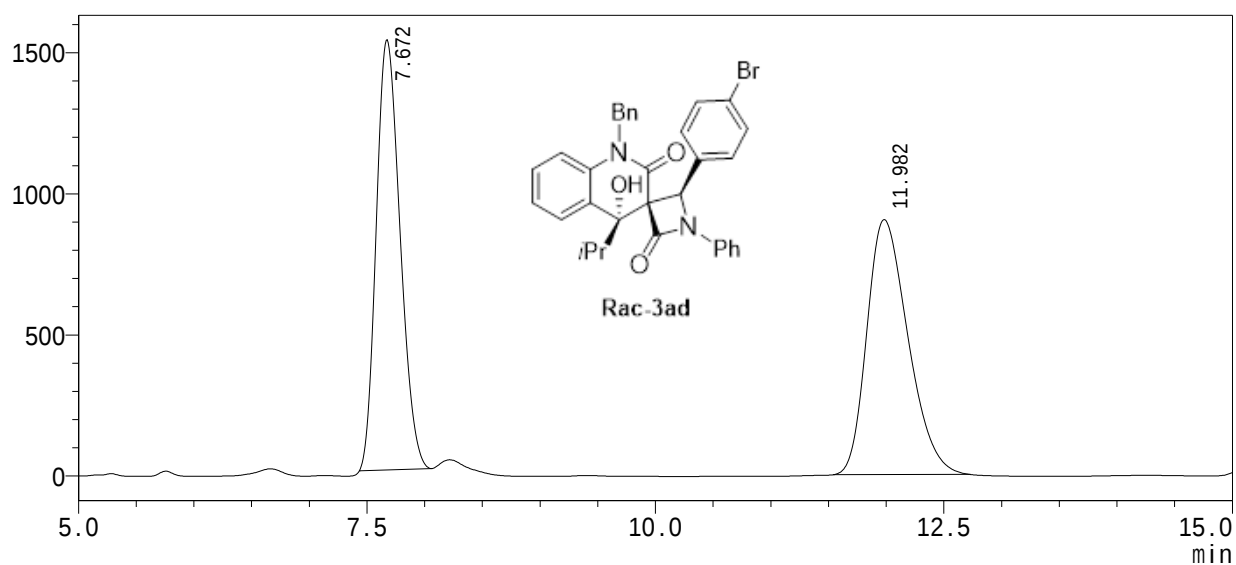
Ana. Date : 2023/3/17 19:21:16

Analyst : System Administrator

Pro. Date : 2023/6/6 23:01:48

Processor : System Administrator

mV SPD-20A 230nm



SPD-20A

Entry	RT[min]	Area	Height	Area%			
1	7.672	21916118	1524222	49.448		M	
2	11.982	22405220	903953	50.552		M	
Sum		44321337	2428175				



SHIMADZU

LabSolutions

HPLC Reprot

<Sample Information>

Sample name : lj-387-2-B-ad-10%

Data name : lj-387-2-B-ad-10%3.lcd

Acq. name : AD-10%-H.lcm

Location : 1-1
: 1 uL

Sample Type : unknown

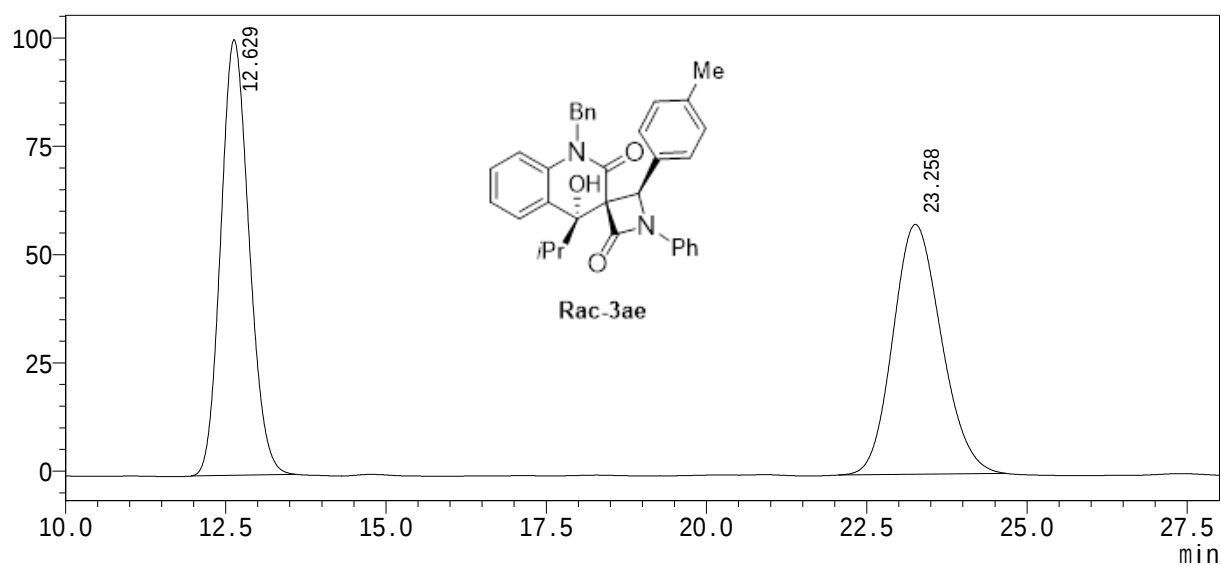
Ana. Date : 2023/3/15 18:31:49

Analyst : System Administrator

Pro. Date : 2023/6/6 23:00:09

Processor : System Administrator

mV SPD-20A 254nm



SPD-20A

Entry	RT[min]	Area	Height	Area%			
1	12.629	3091602	100570	50.497		M	
2	23.258	3030727	57691	49.503		M	
Sum		6122329	158262				



SHIMADZU

LabSolutions

HPLC Replot

<Sample Information>

Sample name : lj-387-2-B-CHIRAL--ad-10%

:

Data name : lj-387-2-B-chiral-ad-10%4.lcd

Acq. name : AD-10%-H.lcm

:

Location : 1-1

Sample Type : unknown

:

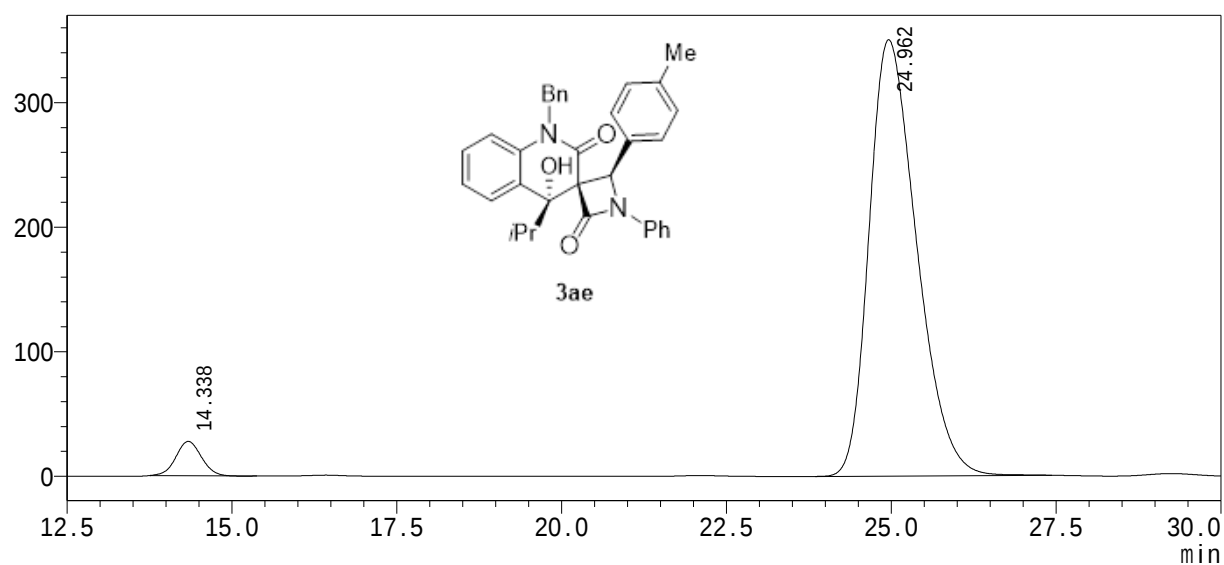
Ana. Date : 2023/3/15 19:09:00

Analyst : System Administrator

Pro. Date : 2023/6/6 23:00:41

Processor : System Administrator

mV SPD-20A 254nm



SPD-20A

Entry	RT[min]	Area	Height	Area%			
1	14.338	739161	27566	4.044		M	
2	24.962	17539218	350293	95.956		M	
Sum		18278379	377858				



SHIMADZU

LabSolutions

HPLC Reprot

<Sample Information>

Sample name : lj-389-2-b-ad-20%

Data name : lj-389-2-b-ad-20%1.lcd

Acq. name : AD-20%.lcm

Location : 1-1

: 1 uL

Sample Type : unknown

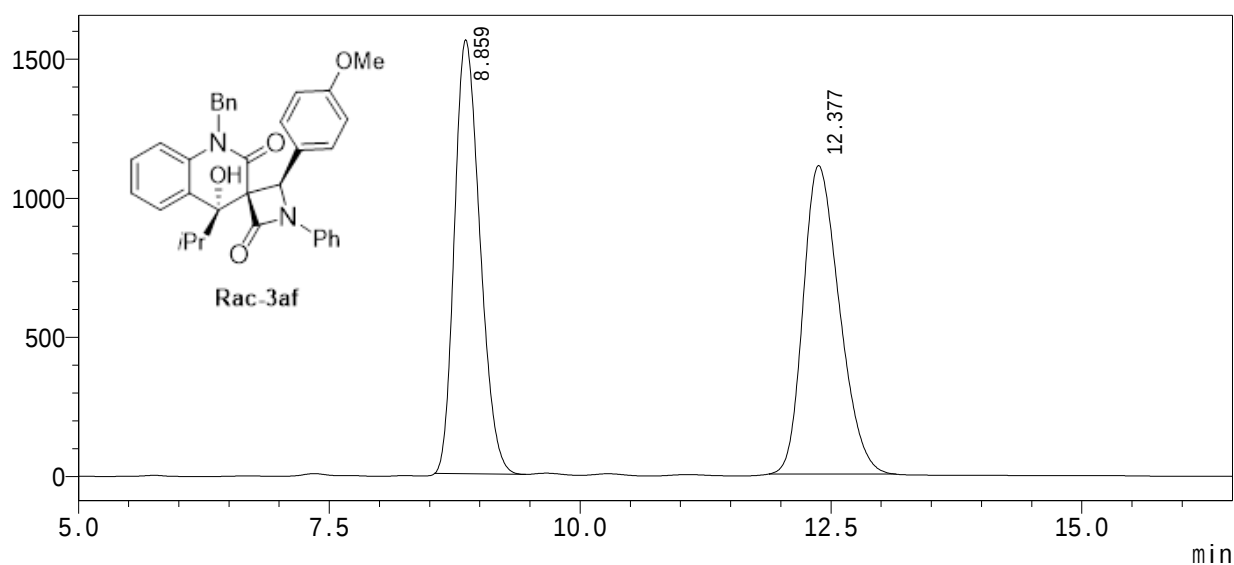
Ana. Date : 2023/3/17 20:48:06

Analyst : System Administrator

Pro. Date : 2023/6/6 23:04:02

Processor : System Administrator

mV SPD-20A 230nm



SPD-20A

Entry	RT[min]	Area	Height	Area%			
1	8.859	27526741	1560229	49.700		M	
2	12.377	27858822	1108833	50.300		M	
Sum		55385564	2669062				



SHIMADZU

LabSolutions

HPLC Reprot

<Sample Information>

Sample name : lj-389-2-b-chiral-ad-20%

Data name : lj-389-2-b-chiral-ad-20%2.lcd

Acq. name : AD-20%.lcm

Location : 1-1
: 1 uL

Sample Type : unknown

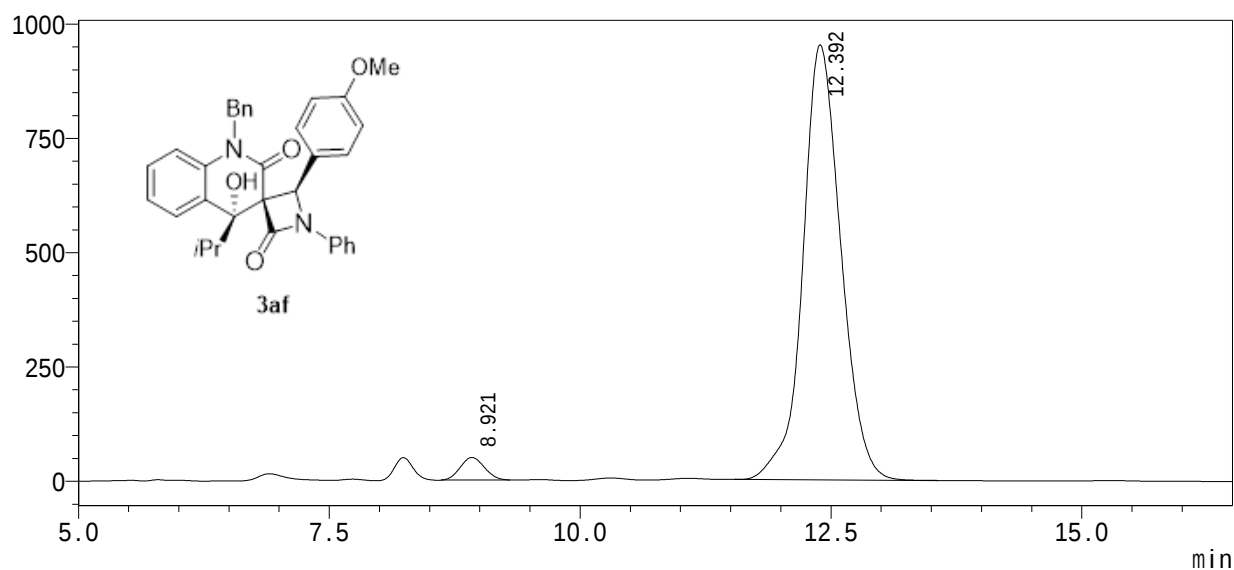
Ana. Date : 2023/3/17 21:07:58

Analyst : System Administrator

Pro. Date : 2023/6/6 23:04:57

Processor : System Administrator

mV SPD-20A 230nm



SPD-20A

Entry	RT[min]	Area	Height	Area%			
1	8.921	824521	49431	3.180		M	
2	12.392	25106420	951833	96.820		M	
Sum		25930941	1001264				



SHIMADZU

LabSolutions

HPLC Reprot

<Sample Information>

Sample name : MHWK102-2

:

Data name : MHWK102-2-AD-H-20%10.lcd

Acq. name : AD-20%.lcm

:

Location : 1-1

: 1 uL

Ana. Date : 2023/4/24 20:39:03

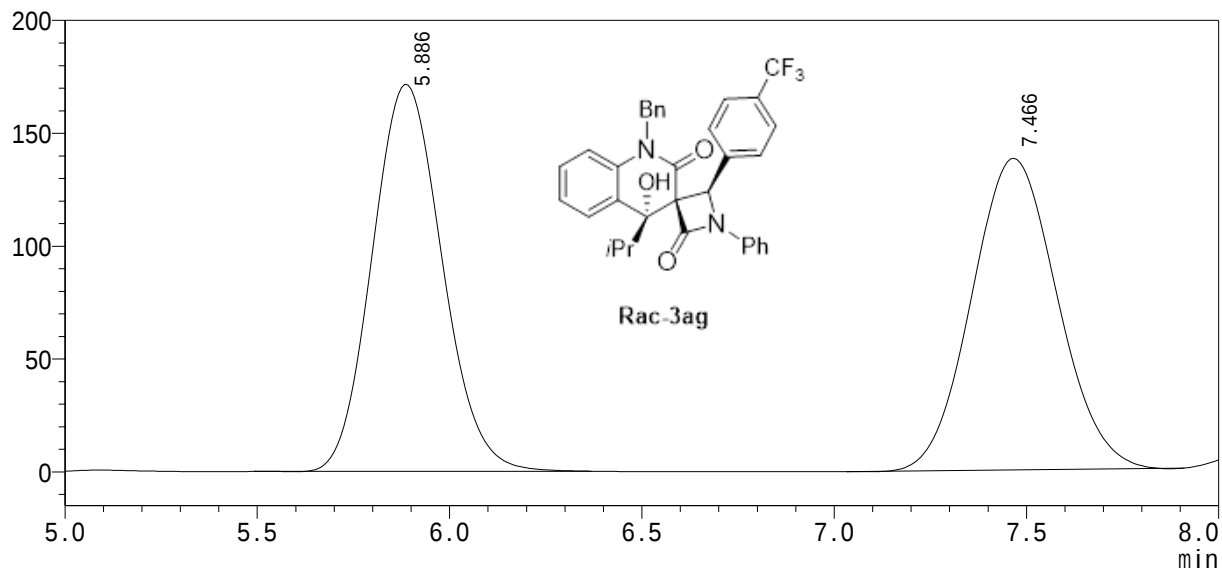
Pro. Date : 2023/4/24 20:52:39

Sample Type : unknown

Analyst : System Administrator

Processor : System Administrator

mV SPD-20A 254nm



SPD-20A

Entry	RT[min]	Area	Height	Area%			
1	5.886	2169014	171404	50.422		M	
2	7.466	2132721	138132	49.578		M	
Sum		4301735	309536				



SHIMADZU

LabSolutions

HPLC Reprot

<Sample Information>

Sample name : MHWK105-B

Data name : MHWK105-B-AD-H-20%12.lcd

Acq. name : AD-20%.lcm

Location : 1-1

Sample Type : unknown

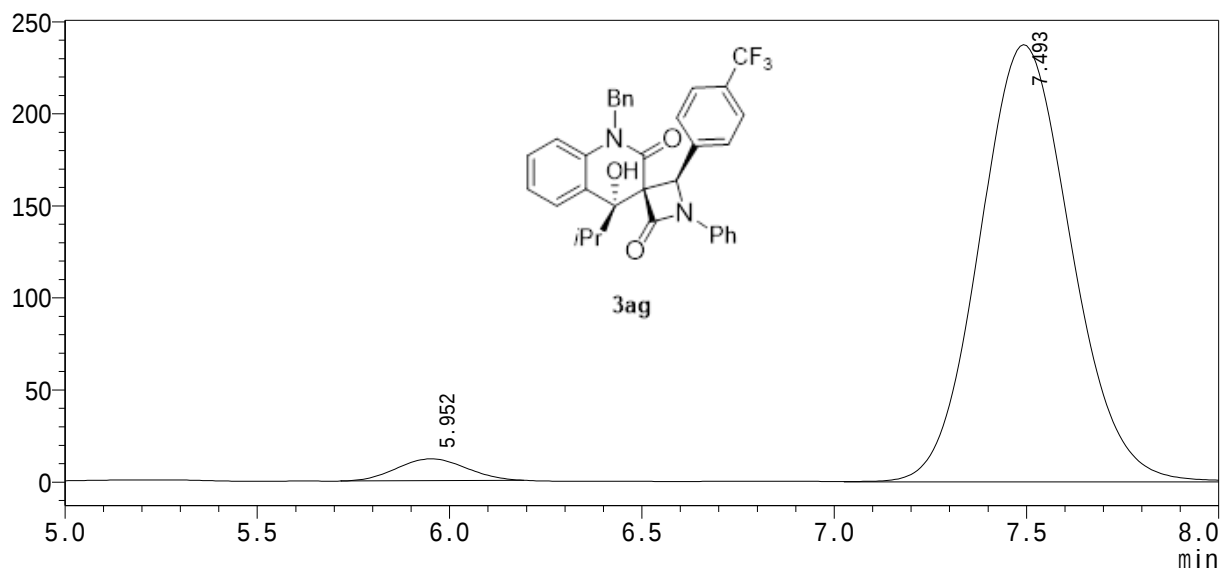
Ana. Date : 2023/4/25 15:10:01

Pro. Date : 2023/4/25 15:24:17

Analyst : System Administrator

Processor : System Administrator

mV SPD-20A 254nm



SPD-20A

Entry	RT[min]	Area	Height	Area%			
1	5.952	149491	11847	3.663		M	
2	7.493	3931775	237511	96.337			
Sum		4081266	249358				



SHIMADZU

LabSolutions

HPLC Reprot

<Sample Information>

Sample name : LJ-462-ad20%

Data name : LJ-462-ad20%1.lcd

Acq. name : AD-20%.lcm

Location : 1-1

: 1 uL

Ana. Date : 2023/5/24 15:42:17

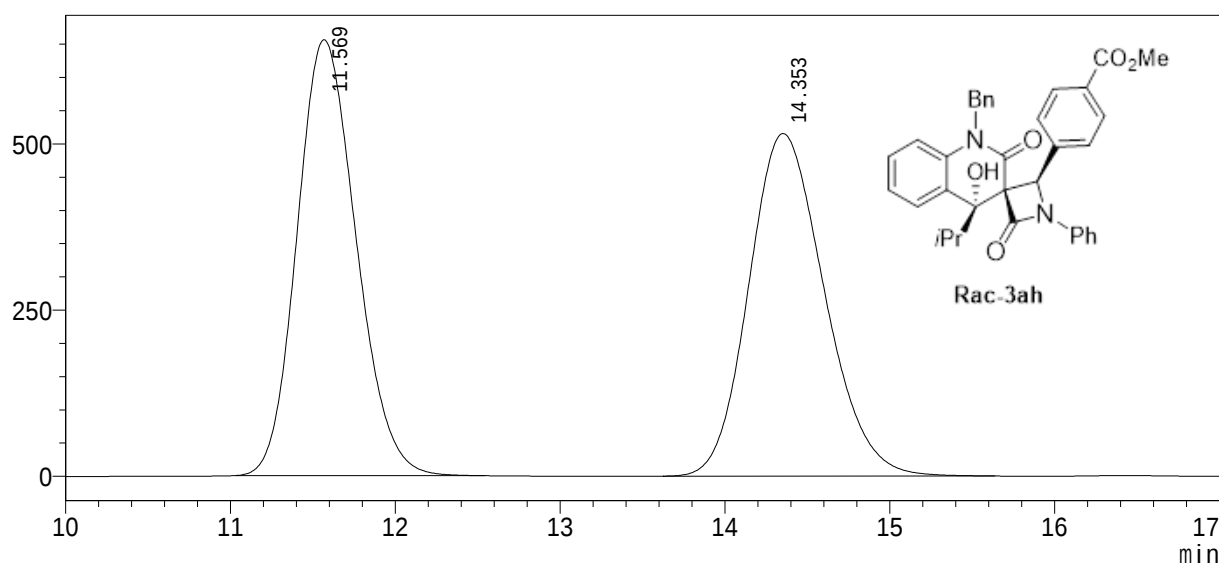
Pro. Date : 2023/6/6 23:44:18

Sample Type : unknown

Analyst : System Administrator

Processor : System Administrator

mV SPD-20A 254nm



SPD-20A

Entry	RT[min]	Area	Height	Area%			
1	11.569	16340200	655751	49.874		M	
2	14.353	16422774	515395	50.126		M	
Sum		32762974	1171146				



SHIMADZU

LabSolutions

HPLC Reprot

<Sample Information>

Sample name : LJ-462-chiral-ad20%

Data name : LJ-462-chiral-ad20%3.lcd

Acq. name : AD-20%.lcm

Location : 1-1
: 1 uL

Sample Type : unknown

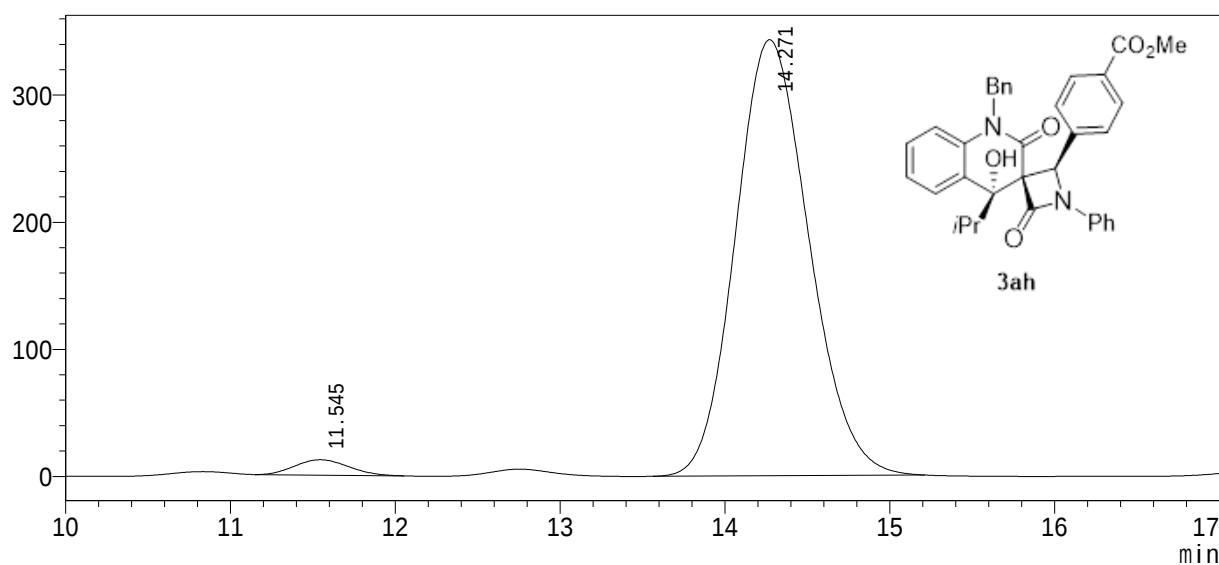
Ana. Date : 2023/5/24 18:24:57

Analyst : System Administrator

Pro. Date : 2023/6/6 23:46:12

Processor : System Administrator

mV SPD-20A 254nm



SPD-20A

Entry	RT[min]	Area	Height	Area%			
1	11.545	274934	12093	2.524		M	
2	14.271	10618833	343012	97.476		M	
Sum		10893767	355104				



SHIMADZU

LabSolutions

HPLC Reprot

<Sample Information>

Sample name : lj-460-ic20%

Data name : lj-460-ic20%2.lcd

Acq. name : AD-20%.lcm

Location : 1-1

: 1 uL

Ana. Date : 2023/5/19 15:17:47

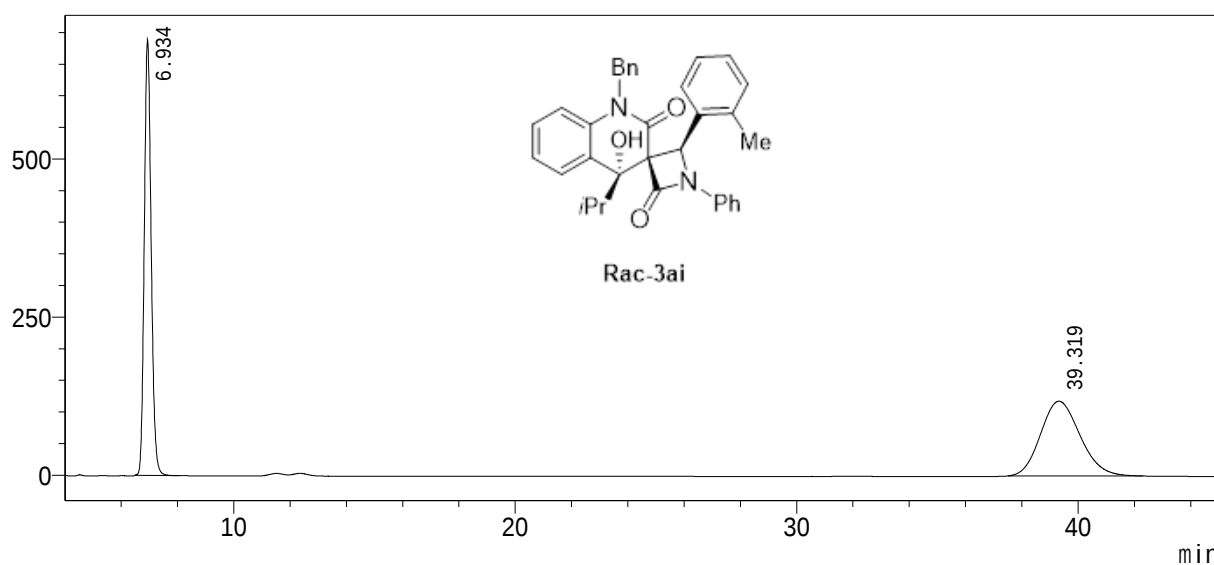
Pro. Date : 2023/6/6 23:43:10

Sample Type : unknown

Analyst : System Administrator

Processor : System Administrator

mV SPD-20A 254nm



SPD-20A

Entry	RT[min]	Area	Height	Area%			
1	6.934	11727827	689068	50.474		M	
2	39.319	11507760	118222	49.526		M	
Sum		23235587	807290				



SHIMADZU

LabSolutions

HPLC Reprot

<Sample Information>

Sample name : MHWL003-1-IC-20

Data name : MHWL003-1-IC20%.lcd

Acq. name : IC-H-20%.lcm

Location : 1-1

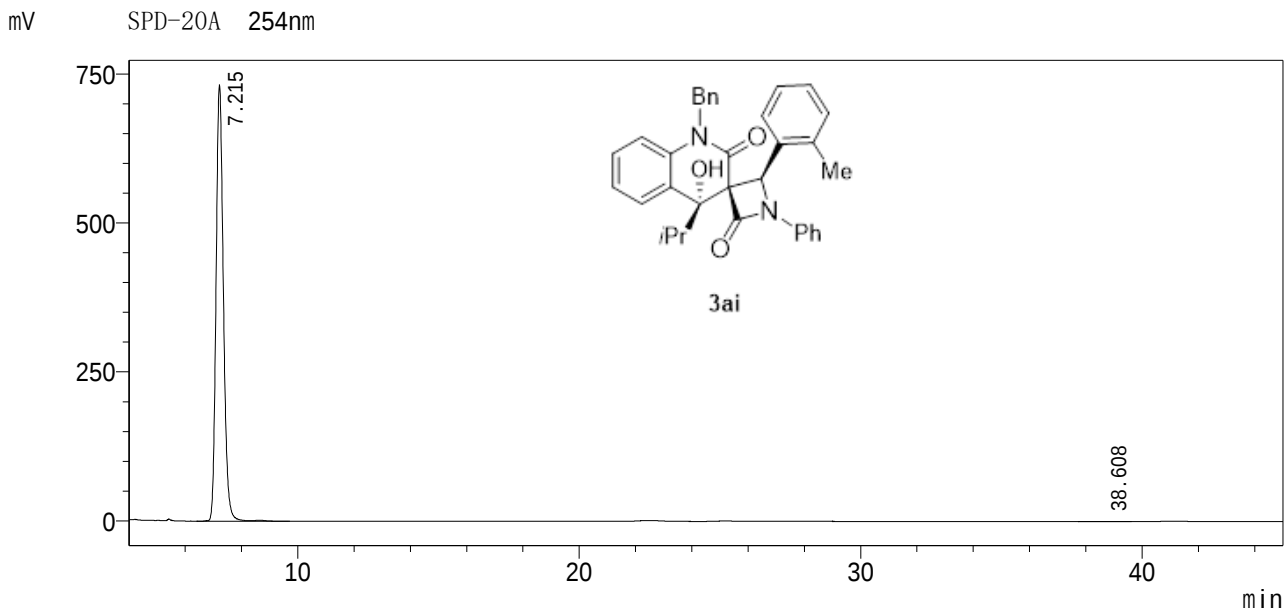
Ana. Date : 2023/6/10 10:16:46

Pro. Date : 2023/6/10 23:06:51

Sample Type : unknown

Analyst : System Administrator

Processor : System Administrator



SPD-20A

Entry	RT[min]	Area	Height	Area%			
1	7.215	13286264	732654	99.987			
2	38.608	1725	31	0.013		M	
Sum		13287988	732685				



SHIMADZU

LabSolutions

HPLC Reprot

<Sample Information>

Sample name : LJ-392-3B-AD10%

Data name : LJ-392-3B-AD10%4.lcd

Acq. name : AD-10%-H.lcm

Location : 1-1
: 1 uL

Sample Type : unknown

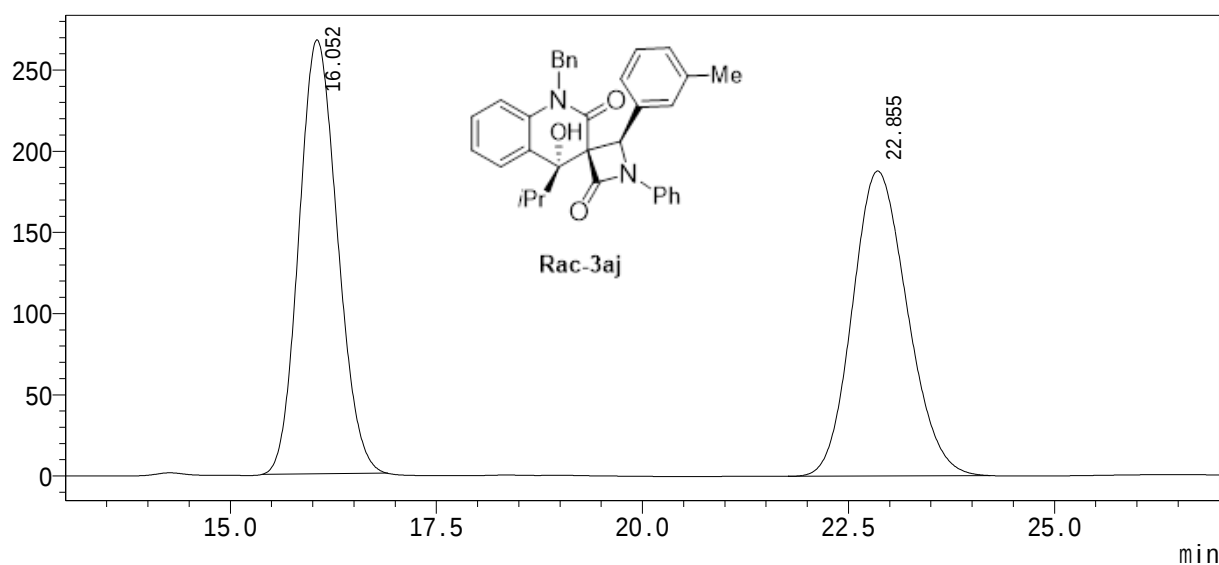
Ana. Date : 2023/4/5 18:32:28

Analyst : System Administrator

Pro. Date : 2023/6/6 23:08:32

Processor : System Administrator

mV SPD-20A 254nm



SPD-20A

Entry	RT[min]	Area	Height	Area%			
1	16.052	8687574	267275	49.972		M	
2	22.855	8697142	187815	50.028		M	
Sum		17384715	455090				



SHIMADZU

LabSolutions

HPLC Reprot

<Sample Information>

Sample name : LJ-392-3B-CHIRAL-AD10%

Data name : LJ-392-3B-CHIRAL-AD10%5.lcd

Acq. name : AD-10%-H.lcm

Location : 1-1

: 1 uL

Sample Type : unknown

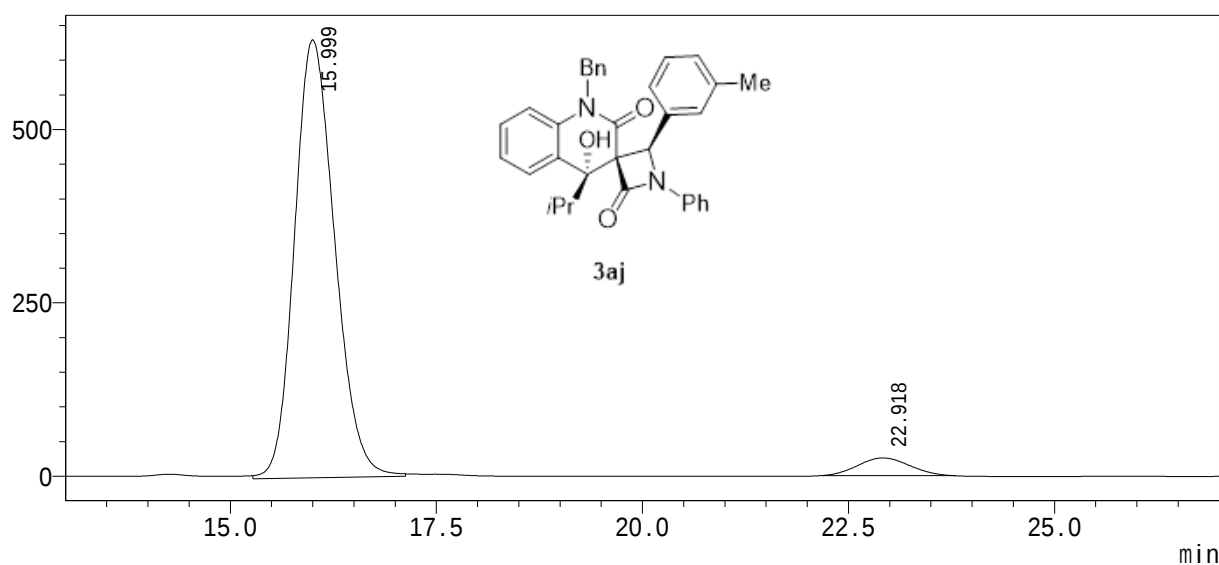
Ana. Date : 2023/4/5 19:03:11

Analyst : System Administrator

Pro. Date : 2023/6/6 23:09:29

Processor : System Administrator

mV SPD-20A 254nm



SPD-20A

Entry	RT[min]	Area	Height	Area%			
1	15.999	21450493	631886	95.041		M	
2	22.918	1119125	25511	4.959		M	
Sum		22569618	657397				



SHIMADZU

LabSolutions

HPLC Reprot

<Sample Information>

Sample name : lj-387-1-b-ad--20%

Data name : lj-387-1-b-ad--20%1.lcd

Acq. name : AD-20%.lcm

Location : 1-1
: 1 uL

Sample Type : unknown

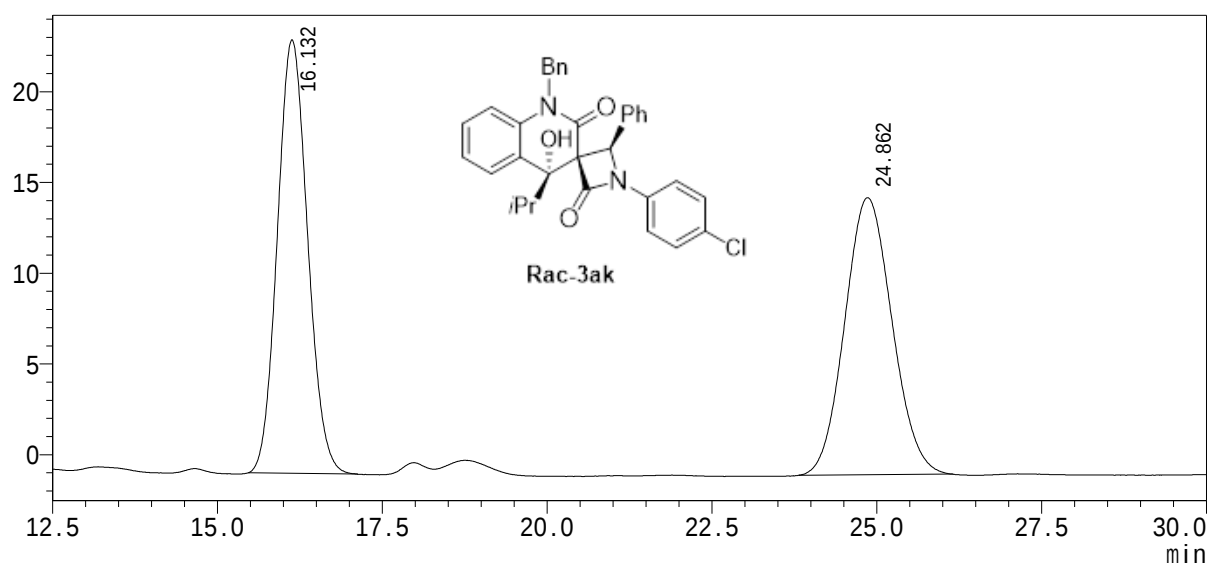
Ana. Date : 2023/3/15 15:04:19

Analyst : System Administrator

Pro. Date : 2023/6/6 22:58:44

Processor : System Administrator

mV SPD-20A 230nm



SPD-20A

Entry	RT[min]	Area	Height	Area%			
1	16.132	761857	23881	50.012		M	
2	24.862	761497	15267	49.988		M	
Sum		1523354	39148				



SHIMADZU

LabSolutions

HPLC Reprot

<Sample Information>

Sample name : LJ-D23-2-CHIRAL-AD20%

Data name : LJ-D23-2-CHIRAL-AD20%.lcd

Acq. name : AD-20%.lcm

Location : 1-1
: 1 uL

Sample Type : unknown

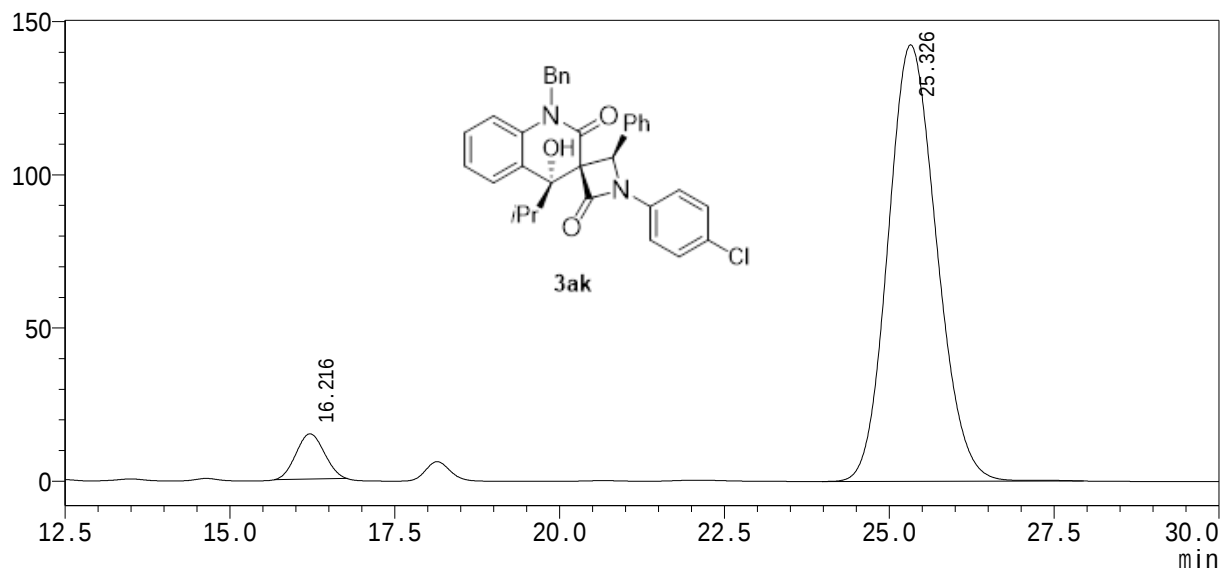
Ana. Date : 2023/6/11 11:20:11

Analyst : System Administrator

Pro. Date : 2023/6/11 11:54:47

Processor : System Administrator

mV SPD-20A 254nm



SPD-20A

Entry	RT[min]	Area	Height	Area%			
1	16.216	442954	14800	5.719		M	
2	25.326	7302287	142476	94.281		M	
Sum		7745241	157276				



SHIMADZU

LabSolutions

HPLC Reprot

<Sample Information>

Sample name : LJ-392-1B-AD-20%

Data name : LJ-392-1B-AD-20%1.lcd

Acq. name : AD-20%.lcm

Location : 1-1

: 1 uL

Sample Type : unknown

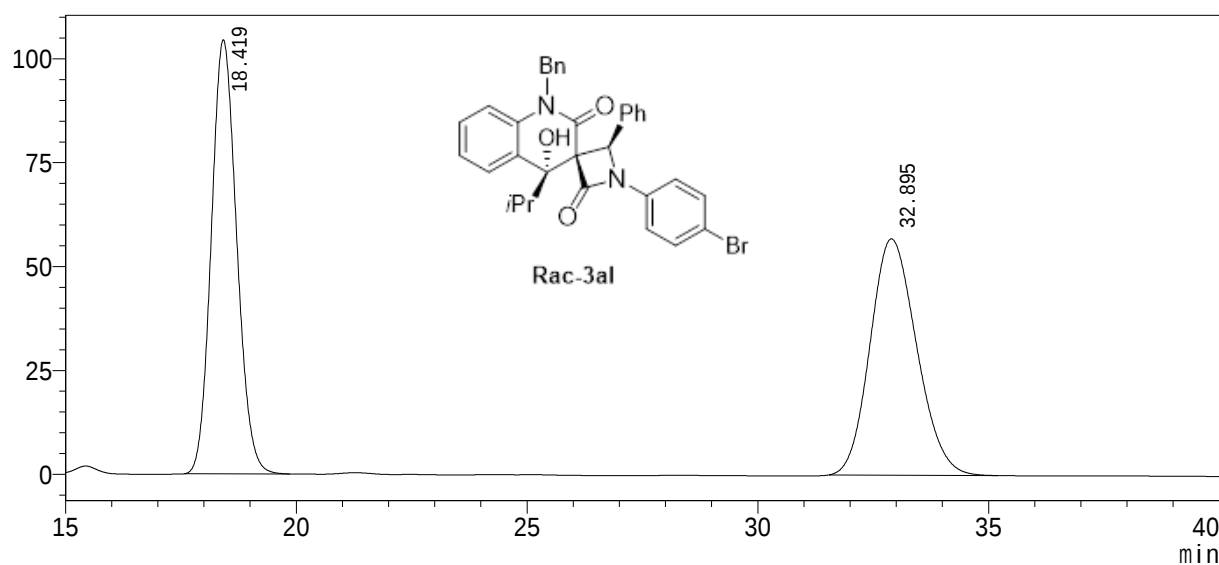
Ana. Date : 2023/4/3 16:27:16

Pro. Date : 2023/6/6 23:05:47

Analyst : System Administrator

Processor : System Administrator

mV SPD-20A 230nm



SPD-20A

Entry	RT[min]	Area	Height	Area%			
1	18.419	3998703	104470	50.138		M	
2	32.895	3976767	56868	49.862		M	
Sum		7975470	161338				



SHIMADZU

LabSolutions

HPLC Reprot

<Sample Information>

Sample name : LJ-392-1B-CHIRAL-AD-20%

Data name : LJ-392-1B-CHIRAL-AD-20%2.lcd

Acq. name : AD-20%.lcm

Location : 1-1

: 1 uL

Sample Type : unknown

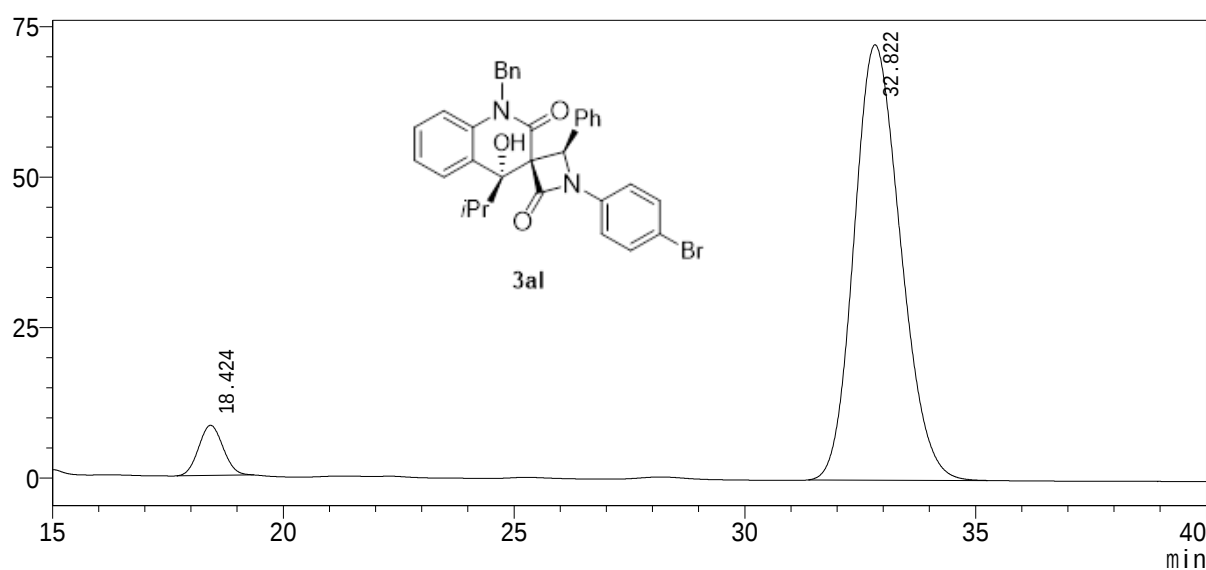
Ana. Date : 2023/4/3 17:15:04

Analyst : System Administrator

Pro. Date : 2023/6/6 23:06:37

Processor : System Administrator

mV SPD-20A 230nm



SPD-20A

Entry	RT[min]	Area	Height	Area%			
1	18.424	306270	8327	5.703		M	
2	32.822	5063822	72317	94.297		M	
Sum		5370092	80643				



SHIMADZU

LabSolutions

HPLC Reprot

<Sample Information>

Sample name : LJ-392-2B-AD-20%

Data name : LJ-392-2B-AD-20%3.lcd

Acq. name : AD-20%.lcm

Location : 1-1

: 1 uL

Sample Type : unknown

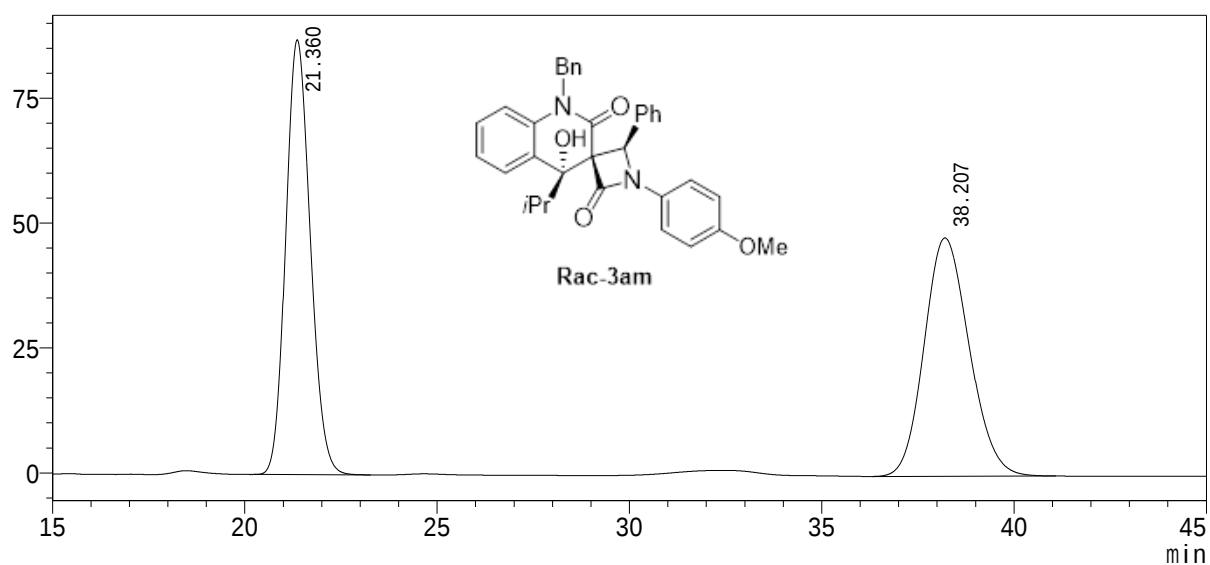
Ana. Date : 2023/4/3 18:00:56

Analyst : System Administrator

Pro. Date : 2023/6/6 23:07:09

Processor : System Administrator

mV SPD-20A 230nm



SPD-20A

Entry	RT[min]	Area	Height	Area%			
1	21.360	3854218	87058	49.811			
2	38.207	3883426	47717	50.189			
Sum		7737644	134775				



SHIMADZU

LabSolutions

HPLC Reprot

<Sample Information>

Sample name : LJ-392-2B-CHIRAL-AD-20%

Data name : LJ-392-2B-CHIRAL-AD-20%5.lcd

Acq. name : AD-20%.lcm

Location : 1-1
: 1 uL

Sample Type : unknown

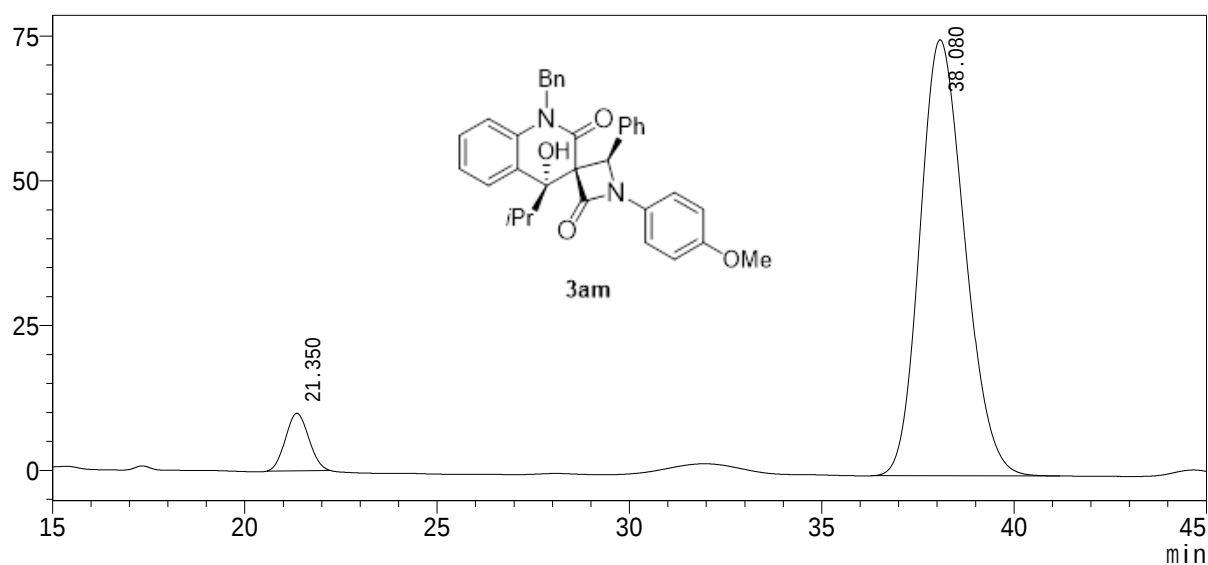
Ana. Date : 2023/4/3 19:45:11

Analyst : System Administrator

Pro. Date : 2023/4/3 21:04:57

Processor : System Administrator

mV SPD-20A 230nm



SPD-20A

Entry	RT[min]	Area	Height	Area%			
1	21.350	415719	9911	6.377		M	
2	38.080	6103191	75320	93.623		M	
Sum		6518910	85231				



SHIMADZU

LabSolutions

HPLC Reprot

<Sample Information>

Sample name : LJ-415-1-AD20%

Data name : LJ-415-1-AD20%1.lcd

Acq. name : AD-20%.lcm

Location : 1-1

: 1 uL

Ana. Date : 2023/4/14 17:13:58

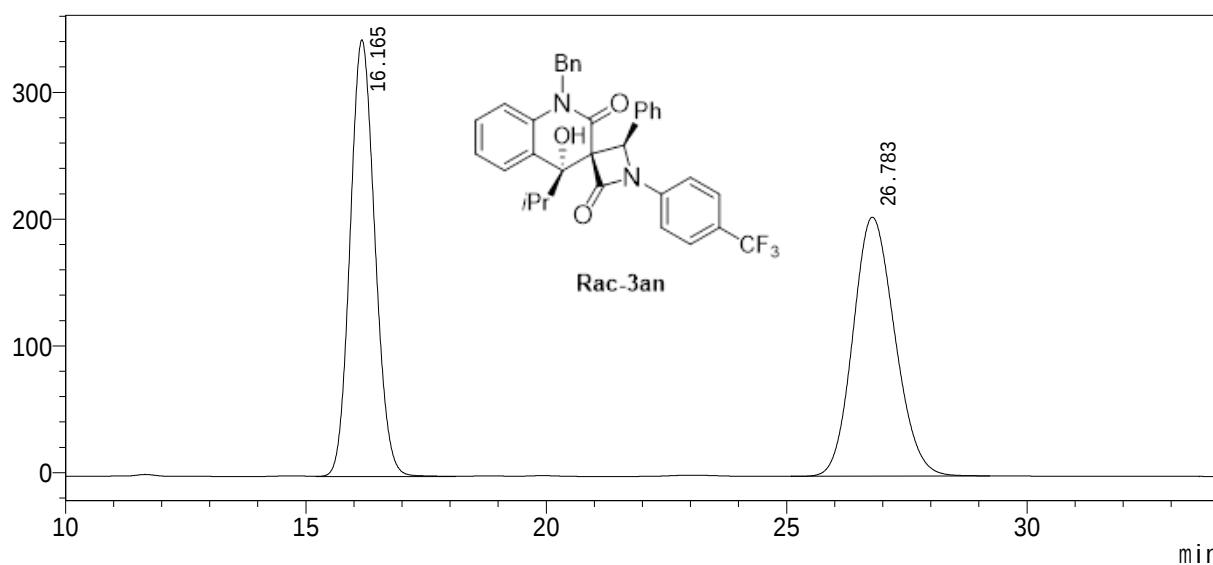
Pro. Date : 2023/6/6 23:23:28

Sample Type : unknown

Analyst : System Administrator

Processor : System Administrator

mV SPD-20A 254nm



SPD-20A

Entry	RT[min]	Area	Height	Area%			
1	16.165	12325208	344482	49.970			
2	26.783	12340249	204266	50.030			
Sum		24665458	548748				



SHIMADZU

LabSolutions

HPLC Reprot

<Sample Information>

Sample name : LJ-415-1-CHIRAL-AD20%

Data name : LJ-415-1-CHIRAL-AD20%2.lcd

Acq. name : AD-20%.lcm

Location : 1-1
: 1 uL

Sample Type : unknown

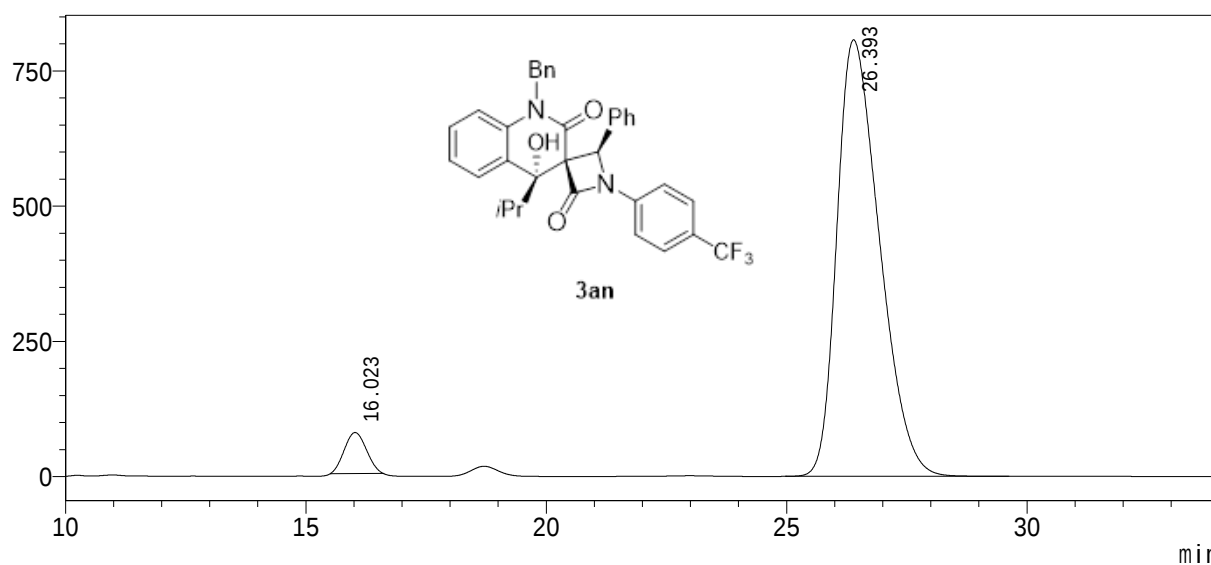
Ana. Date : 2023/4/14 17:50:24

Analyst : System Administrator

Pro. Date : 2023/6/6 23:24:11

Processor : System Administrator

mV SPD-20A 254nm



SPD-20A

Entry	RT[min]	Area	Height	Area%		
1	16.023	2426649	75866	4.650		M
2	26.393	49760257	807202	95.350		M
Sum		52186906	883068			



SHIMADZU

LabSolutions

HPLC Reprot

<Sample Information>

Sample name : LJ-409-2-AD20%

Data name : LJ-409-2-AD20%3.lcd

Acq. name : AD-20%.lcm

Location : 1-1

: 1 uL

Sample Type : unknown

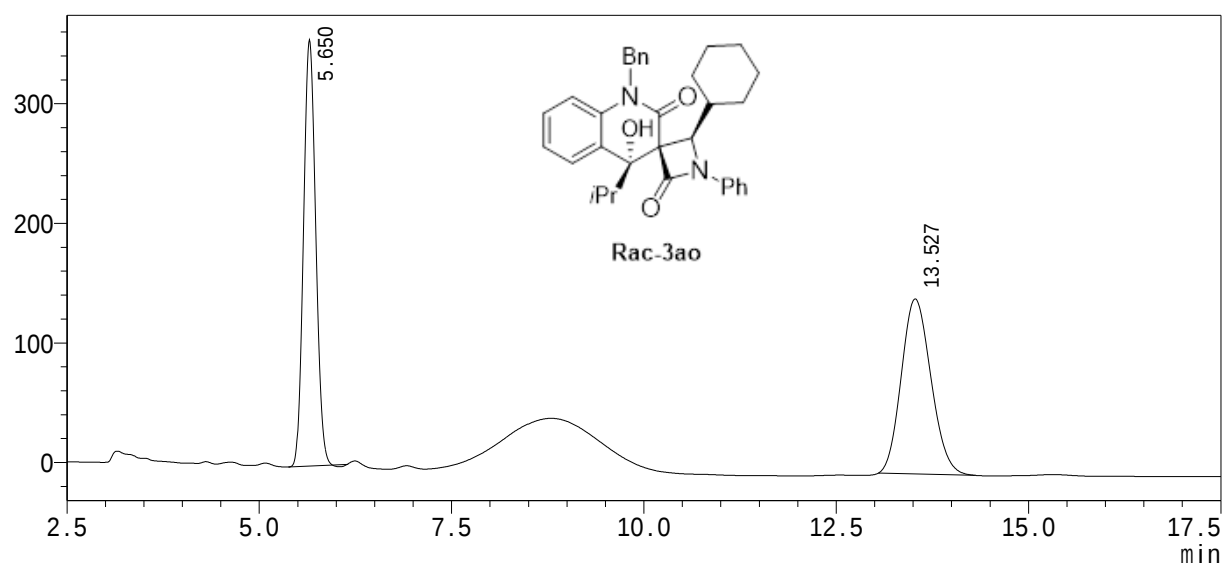
Ana. Date : 2023/4/15 15:31:04

Analyst : System Administrator

Pro. Date : 2023/6/6 23:21:22

Processor : System Administrator

mV SPD-20A 254nm



SPD-20A

Entry	RT[min]	Area	Height	Area%			
1	5.650	3932921	356524	50.004		M	
2	13.527	3932298	146407	49.996		M	
Sum		7865219	502930				



SHIMADZU

LabSolutions

HPLC Reprot

<Sample Information>

Sample name : LJ-D16-2-CHIRAL-AD20%

Data name : LJ-D16-2-CHIRAL-AD20%.lcd

Acq. name : AD-20%.lcm

Location : 1-1
: 1 uL

Sample Type : unknown

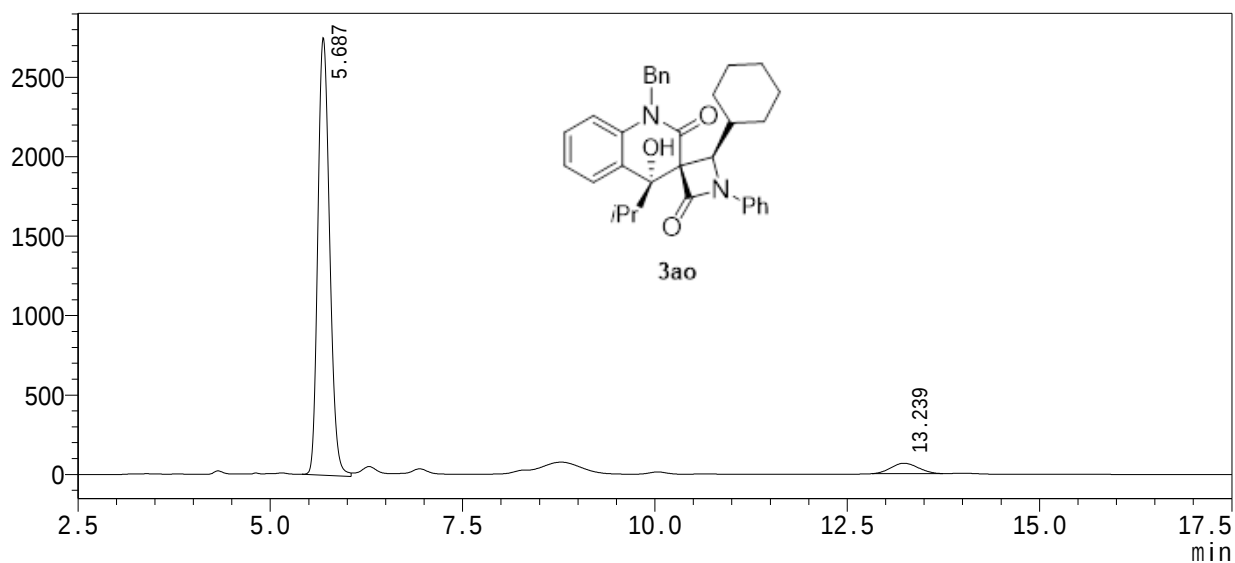
Ana. Date : 2023/6/9 17:20:15

Analyst : System Administrator

Pro. Date : 2023/6/9 17:38:38

Processor : System Administrator

mV SPD-20A 254nm



SPD-20A

Entry	RT[min]	Area	Height	Area%			
1	5.687	29414456	2753299	94.825		M	
2	13.239	1605158	65219	5.175		M	
Sum		31019614	2818518				



SHIMADZU

LabSolutions

HPLC Reprot

<Sample Information>

Sample name : LJ-D17-1-RAC-ad20%

Data name : LJ-D17-1-RAC-ad20%.lcd

Acq. name : AD-20%.lcm

Location : 1-1
: 1 uL

Sample Type : unknown

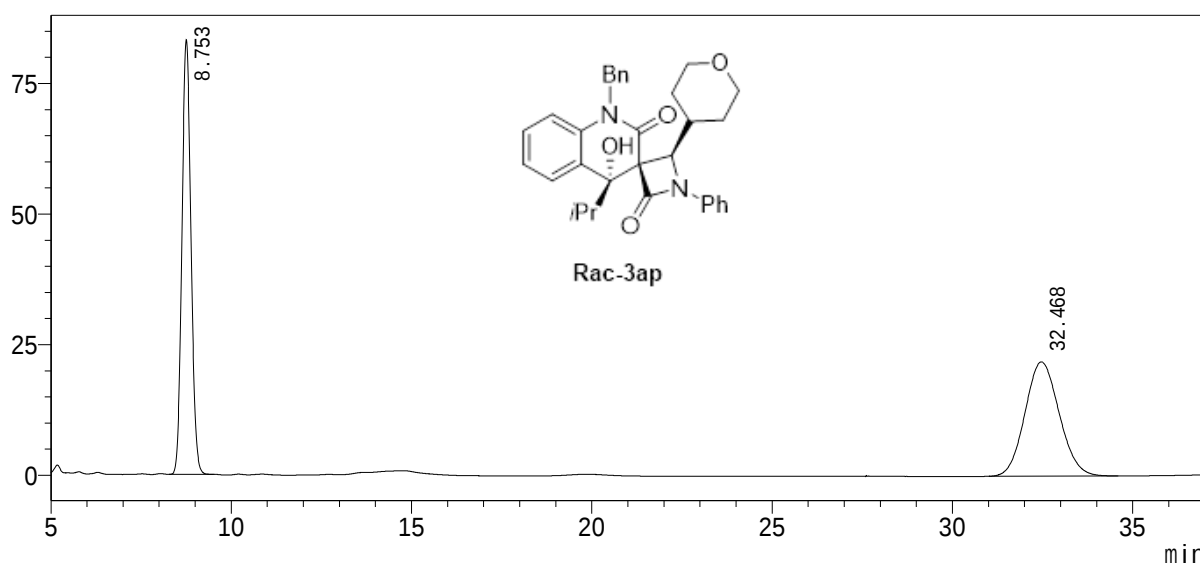
Ana. Date : 2023/6/9 20:24:12

Analyst : System Administrator

Pro. Date : 2023/6/9 21:07:55

Processor : System Administrator

mV SPD-20A 254nm



SPD-20A

Entry	RT[min]	Area	Height	Area%			
1	8.753	1451571	83179	50.131		M	
2	32.468	1443957	21884	49.869		M	
Sum		2895528	105063				



SHIMADZU

LabSolutions

HPLC Reprot

<Sample Information>

Sample name : LJ-D27-2-CHIRAL-AD20%

Data name : LJ-D27-2-CHIRAL-AD20%.lcd

Acq. name : AD-20%.lcm

Location : 1-1

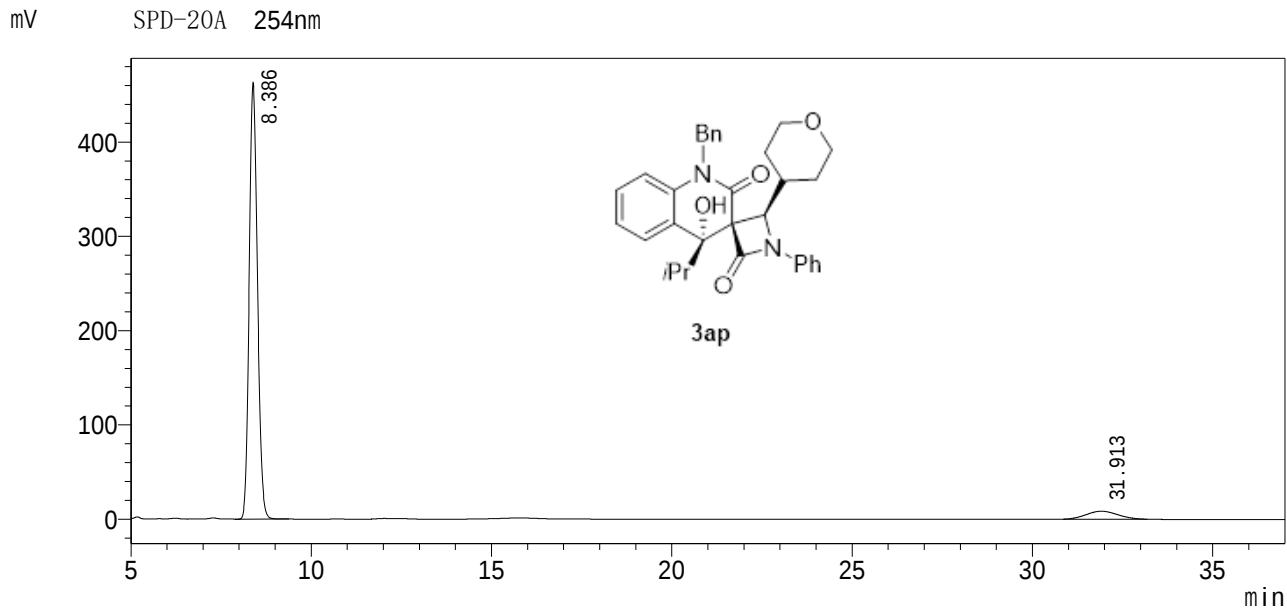
Ana. Date : 2023/6/12 16:01:33

Pro. Date : 2023/6/12 17:31:24

Sample Type : unknown

Analyst : System Administrator

Processor : System Administrator



SPD-20A

Entry	RT[min]	Area	Height	Area%			
1	8.386	7375065	462730	93.470		M	
2	31.913	515257	8468	6.530		M	
Sum		7890322	471198				



SHIMADZU

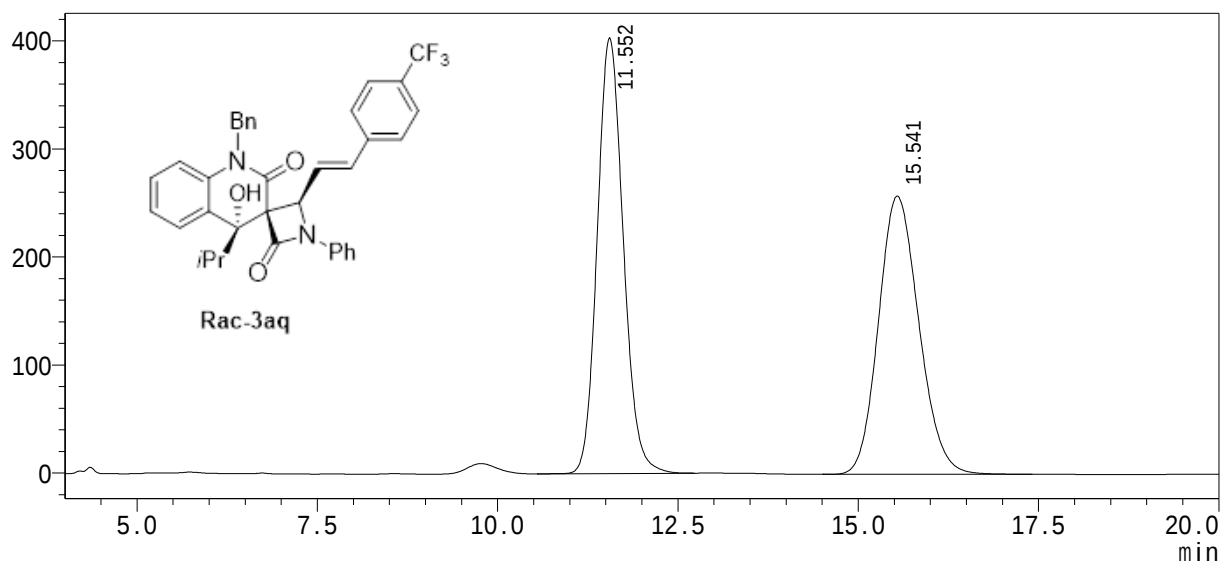
LabSolutions

HPLC Reprot

<Sample Information>

Sample name : MHWK099RAC
Data name : MHWK099RAC-AD-H-20%3.lcd
Acq. name : AD-20%.lcm
Location : 1-1
Sample Type : unknown
Ana. Date : 2023/4/22 21:16:44
Pro. Date : 2023/4/22 21:37:34
Analyst : System Administrator
Processor : System Administrator

mV SPD-20A 254nm



SPD-20A

Entry	RT[min]	Area	Height	Area%			
1	11.552	10117065	403390	50.208			
2	15.541	10033357	257539	49.792			
Sum		20150422	660929				



SHIMADZU

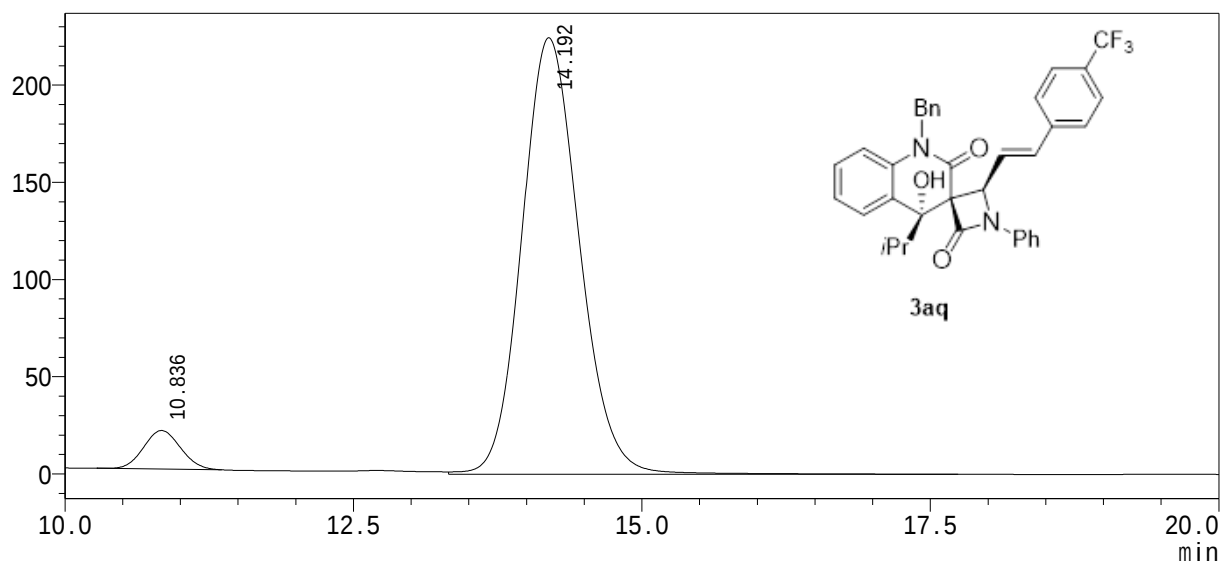
LabSolutions

HPLC Reprot

<Sample Information>

Sample name : MHWL008
Data name : MHWL008-AD-20%1.lcd
Acq. name : AD-20%.lcm
Location : 1-1
Sample Type : unknown
Ana. Date : 2023/6/12 10:02:52
Pro. Date : 2023/6/12 14:34:58
Analyst : System Administrator
Processor : System Administrator

mV SPD-20A 254nm



SPD-20A

Entry	RT[min]	Area	Height	Area%			
1	10.836	443067	19845	5.396		M	
2	14.192	7768277	224538	94.604			
Sum		8211344	244383				



SHIMADZU

LabSolutions

HPLC Reprot

<Sample Information>

Sample name : MHWL009-2RAC

Data name : MHWL009-2RAC-AD20%.lcd

Acq. name : AD-20%.lcm

Location : 1-1
: 1 uL

Sample Type : unknown

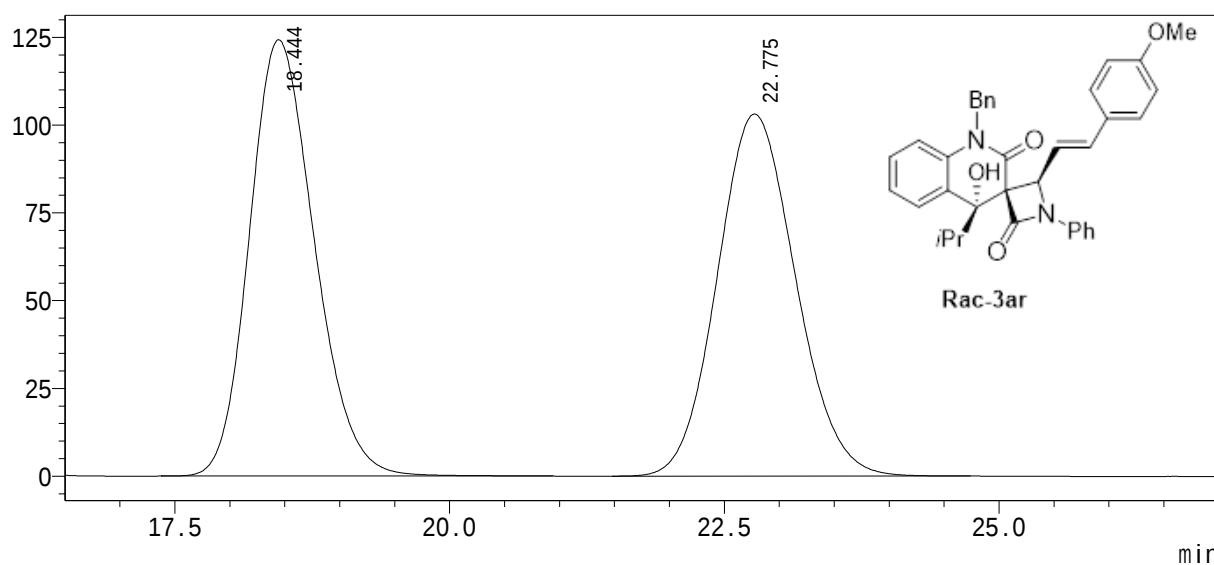
Ana. Date : 2023/6/12 20:57:58

Analyst : System Administrator

Pro. Date : 2023/6/13 11:24:12

Processor : System Administrator

mV SPD-20A 254nm



SPD-20A

Entry	RT[min]	Area	Height	Area%			
1	18.444	5109884	124278	50.001			
2	22.775	5109596	103139	49.999			
Sum		10219481	227416				



SHIMADZU

LabSolutions

HPLC Reprot

<Sample Information>

Sample name : MHWL009-2-CHIRAL

Data name : MHWL009-2-CHIRAL-AD20%.lcd

Acq. name : AD-20%.lcm

Location : 1-1
: 1 uL

Sample Type : unknown

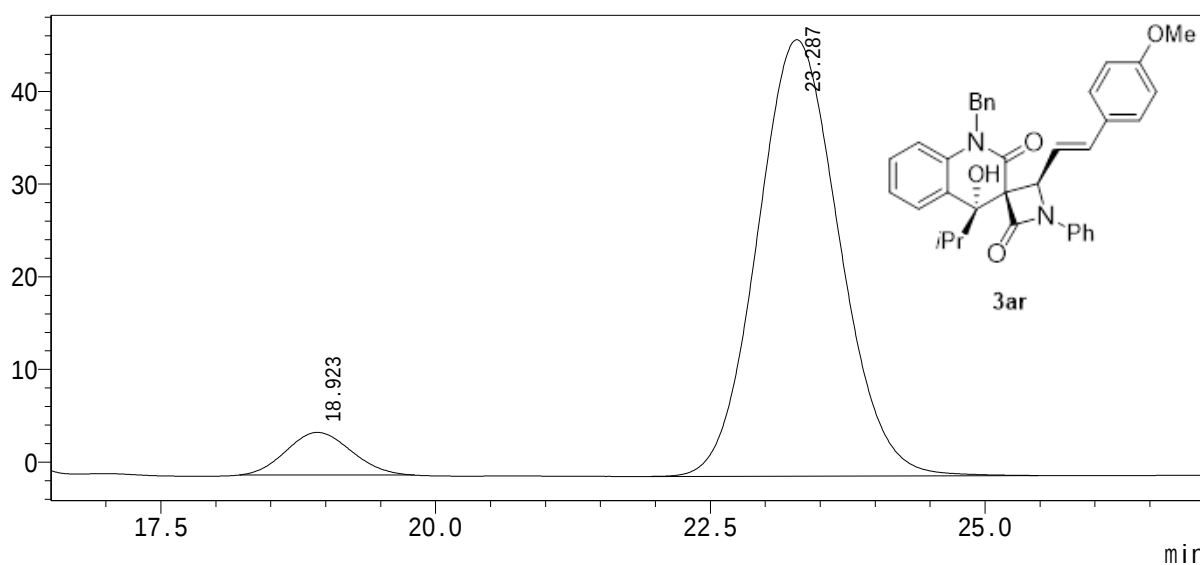
Ana. Date : 2023/6/13 9:32:41

Analyst : System Administrator

Pro. Date : 2023/6/13 11:24:09

Processor : System Administrator

mV SPD-20A 254nm



SPD-20A

Entry	RT[min]	Area	Height	Area%			
1	18.923	189677	4599	7.218		M	
2	23.287	2438012	47094	92.782			
Sum		2627689	51693				



SHIMADZU

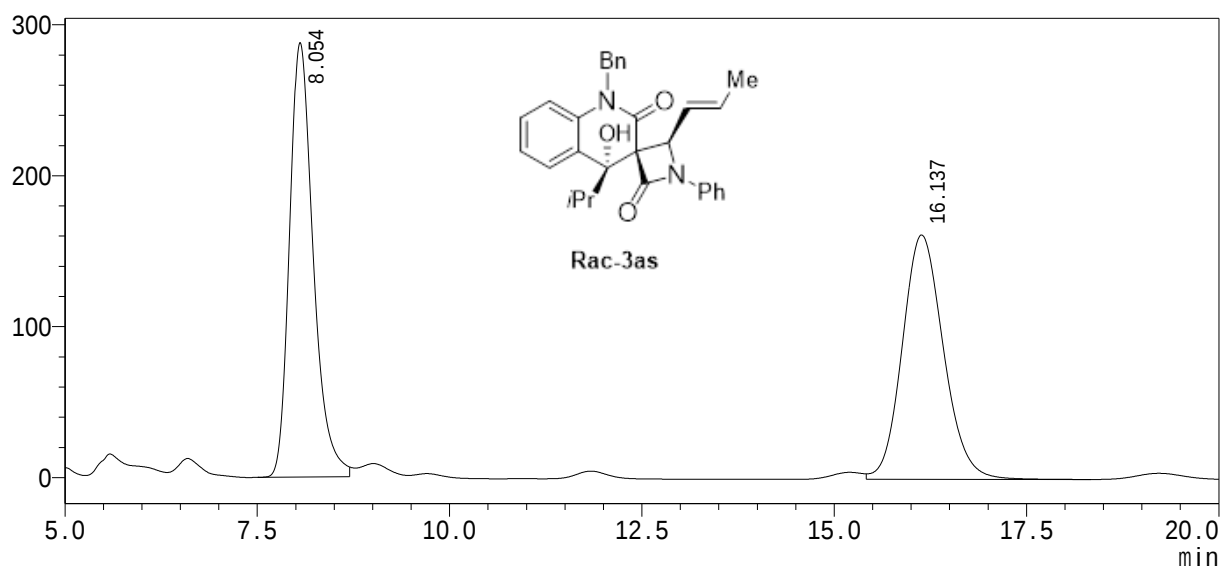
LabSolutions

HPLC Reprot

<Sample Information>

Sample name : MHWL010RAC
Data name : MHWL010RAC-IC20%.lcd
Acq. name : IC-20%.lcm
Location : 1-1
Sample Type : unknown
Ana. Date : 2023/6/13 16:27:43
Pro. Date : 2023/6/13 19:56:05
Analyst : System Administrator
Processor : System Administrator

mV SPD-20A 254nm



SPD-20A

Entry	RT[min]	Area	Height	Area%			
1	8.054	6139685	287659	50.383		M	
2	16.137	6046364	162013	49.617			
Sum		12186049	449671				



SHIMADZU

LabSolutions

HPLC Reprot

<Sample Information>

Sample name : MHWL010CHIRAL

Data name : MHWL010CHIRAL-IC20%.lcd

Acq. name : IC-20%.lcm

Location : 1-1
: 1 uL

Sample Tyle : unknown

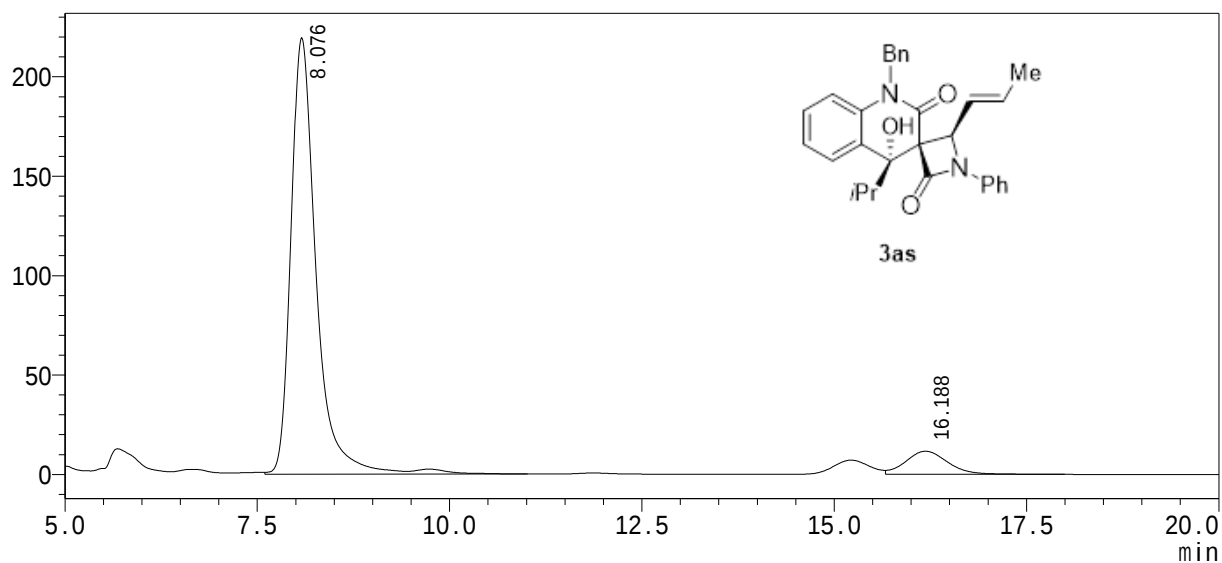
Ana. Date : 2023/6/13 17:30:05

Analyst : System Administrator

Pro. Date : 2023/6/14 10:30:28

Processor : System Administrator

mV SPD-20A 254nm



SPD-20A

Entry	RT[min]	Area	Height	Area%			
1	8.076	5007557	219511	91.841			
2	16.188	444889	11632	8.159			
Sum		5452447	231142				



SHIMADZU

LabSolutions

HPLC Reprot

<Sample Information>

Sample name : LJ-480-AD20%

Data name : LJ-480-AD20%1.lcd

Acq. name : AD-20%.lcm

Location : 1-1
: 1 uL

Sample Type : unknown

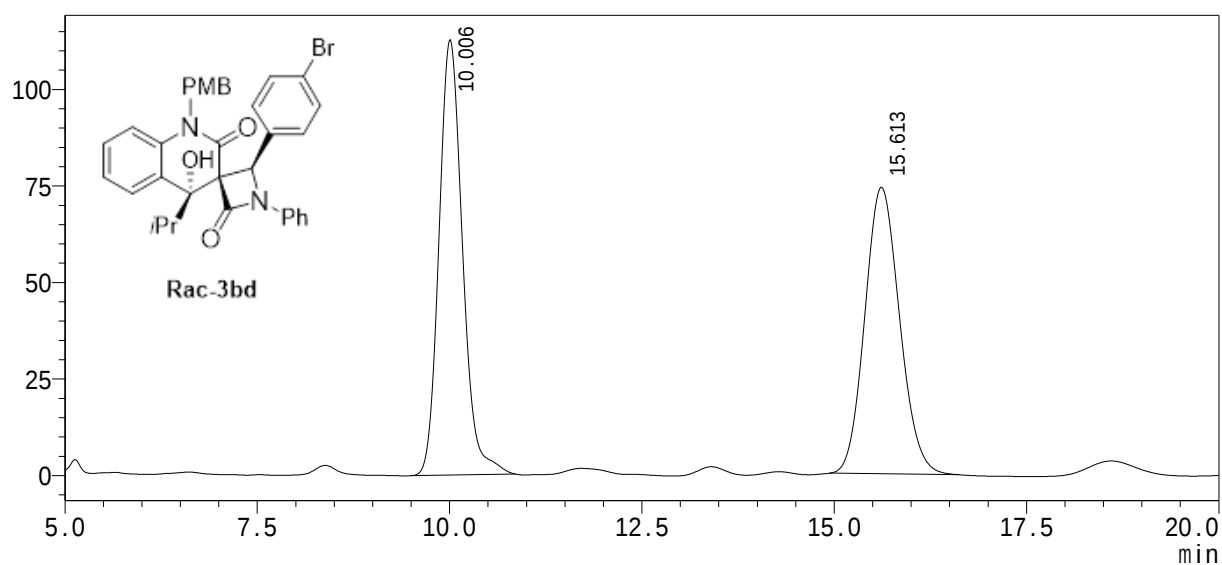
Ana. Date : 2023/5/28 20:52:44

Analyst : System Administrator

Pro. Date : 2023/6/6 23:48:21

Processor : System Administrator

mV SPD-20A 254nm



SPD-20A

Entry	RT[min]	Area	Height	Area%			
1	10.006	2399172	112738	50.671		M	
2	15.613	2335671	74203	49.329		M	
Sum		4734843	186941				



SHIMADZU

LabSolutions

HPLC Reprot

<Sample Information>

Sample name : LJ-480-0530-AD20%

Data name : LJ-480-0530-AD20%2.lcd

Acq. name : AD-20%.lcm

Location : 1-1
: 1 uL

Sample Type : unknown

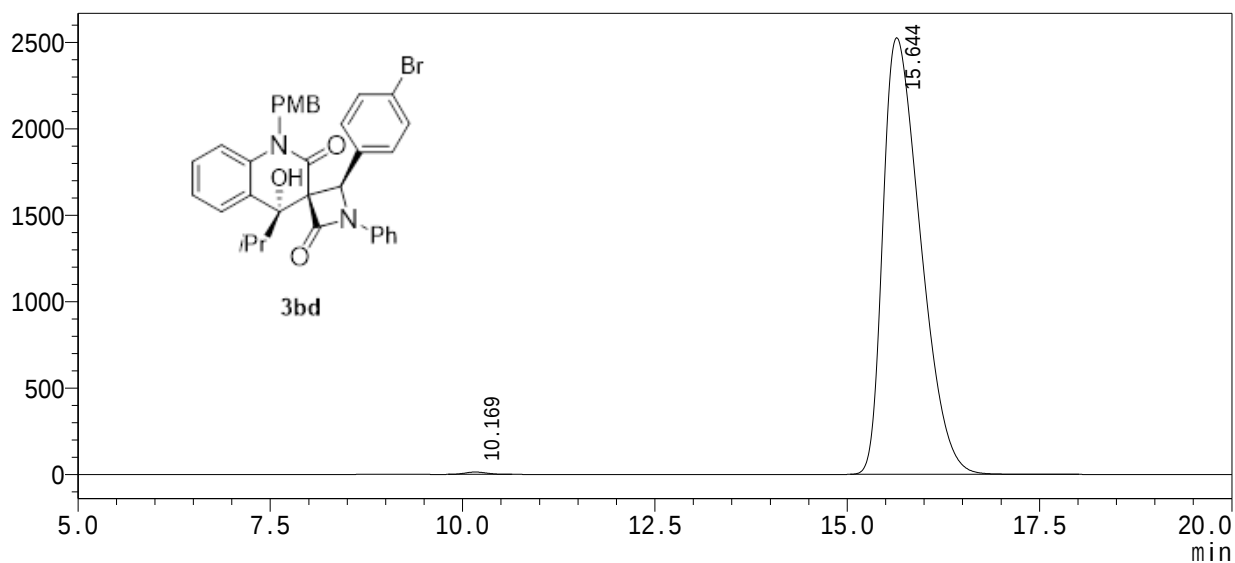
Ana. Date : 2023/5/30 16:39:12

Analyst : System Administrator

Pro. Date : 2023/6/6 23:49:31

Processor : System Administrator

mV SPD-20A 254nm



SPD-20A

Entry	RT[min]	Area	Height	Area%		
1	10.169	266745	13677	0.309	M	
2	15.644	85993492	2526813	99.691	M	
Sum		86260238	2540490			



SHIMADZU

LabSolutions

HPLC Reprot

<Sample Information>

Sample name : LJ-487-AD20%

Data name : LJ-487-AD20%1.lcd

Acq. name : AD-20%.lcm

Location : 1-1

: 1 uL

Ana. Date : 2023/6/3 13:23:56

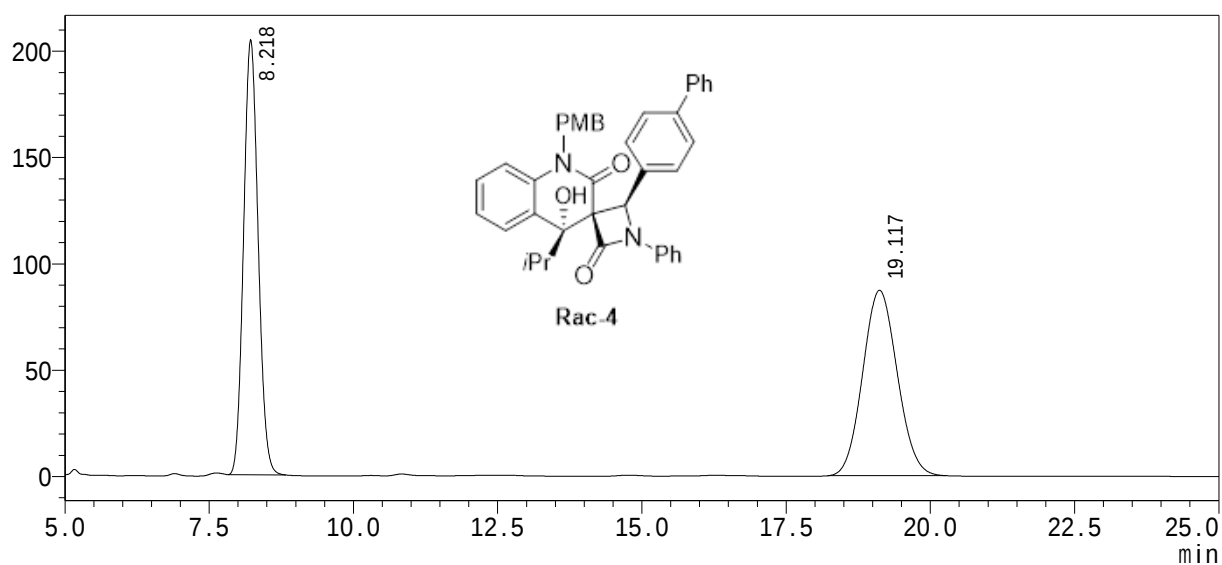
Pro. Date : 2023/6/6 23:50:23

Sample Type : unknown

Analyst : System Administrator

Processor : System Administrator

mV SPD-20A 254nm



SPD-20A

Entry	RT[min]	Area	Height	Area%			
1	8.218	3591850	204523	49.744		M	
2	19.117	3628892	87216	50.256		M	
Sum		7220742	291739				



SHIMADZU

LabSolutions

HPLC Reprot

<Sample Information>

Sample name : LJ-487-CHIRAL-AD20%

Data name : LJ-487-CHIRAL-AD20%2.lcd

Acq. name : AD-20%.lcm

Location : 1-1
: 1 uL

Sample Type : unknown

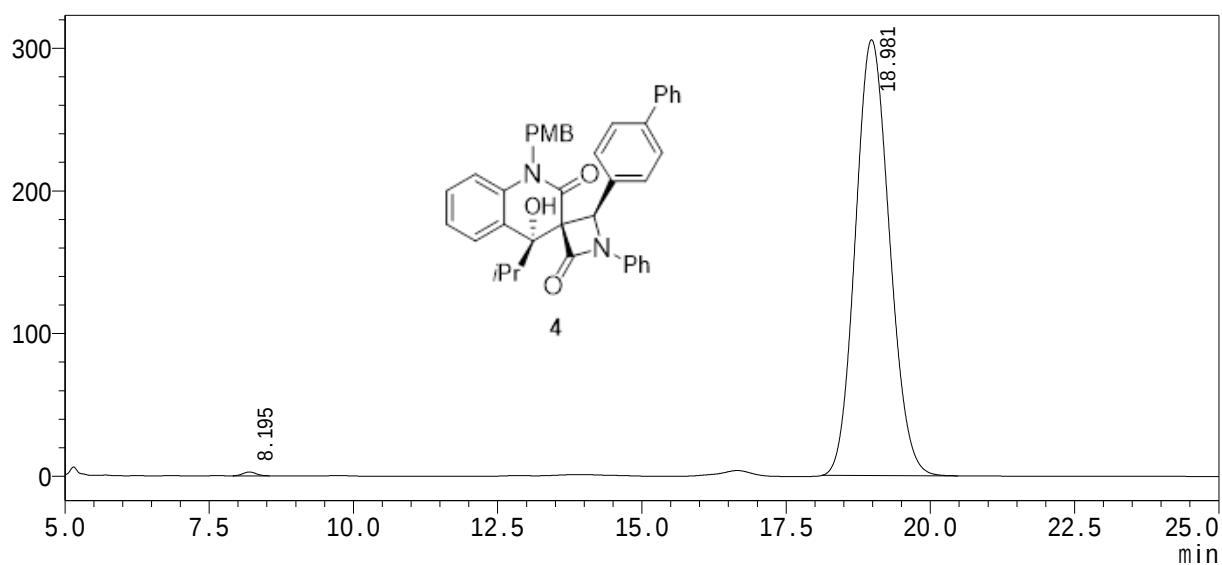
Ana. Date : 2023/6/3 13:52:05

Analyst : System Administrator

Pro. Date : 2023/6/6 23:50:57

Processor : System Administrator

mV SPD-20A 254nm



SPD-20A

Entry	RT[min]	Area	Height	Area%			
1	8.195	43365	2679	0.345		M	
2	18.981	12523985	305485	99.655		M	
Sum		12567350	308164				



SHIMADZU

LabSolutions

HPLC Reprot

<Sample Information>

Sample name : LJ-D001L-AD10%

Data name : LJ-D001-AD10%1.lcd

Acq. name : AD-10%-H.lcm

Location : 1-1
: 1 uL

Sample Type : unknown

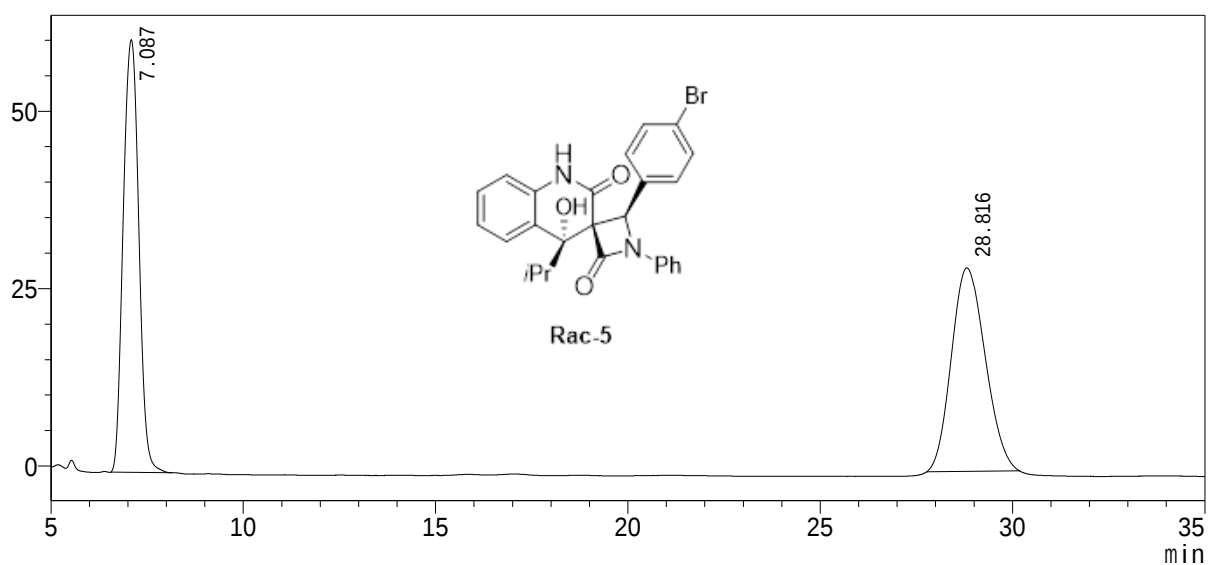
Ana. Date : 2023/6/3 18:05:46

Analyst : System Administrator

Pro. Date : 2023/6/6 23:51:41

Processor : System Administrator

mV SPD-20A 254nm



SPD-20A

Entry	RT[min]	Area	Height	Area%			
1	7.087	1720851	60939	49.666		M	
2	28.816	1743993	28651	50.334		M	
Sum		3464844	89590				



SHIMADZU

LabSolutions

HPLC Reprot

<Sample Information>

Sample name : LJ-D001-CHIRAL-AD10%

Data name : LJ-D001-CHIRAL-AD10%2.lcd

Acq. name : AD-10%-H.lcm

Location : 1-1
: 1 uL

Sample Type : unknown

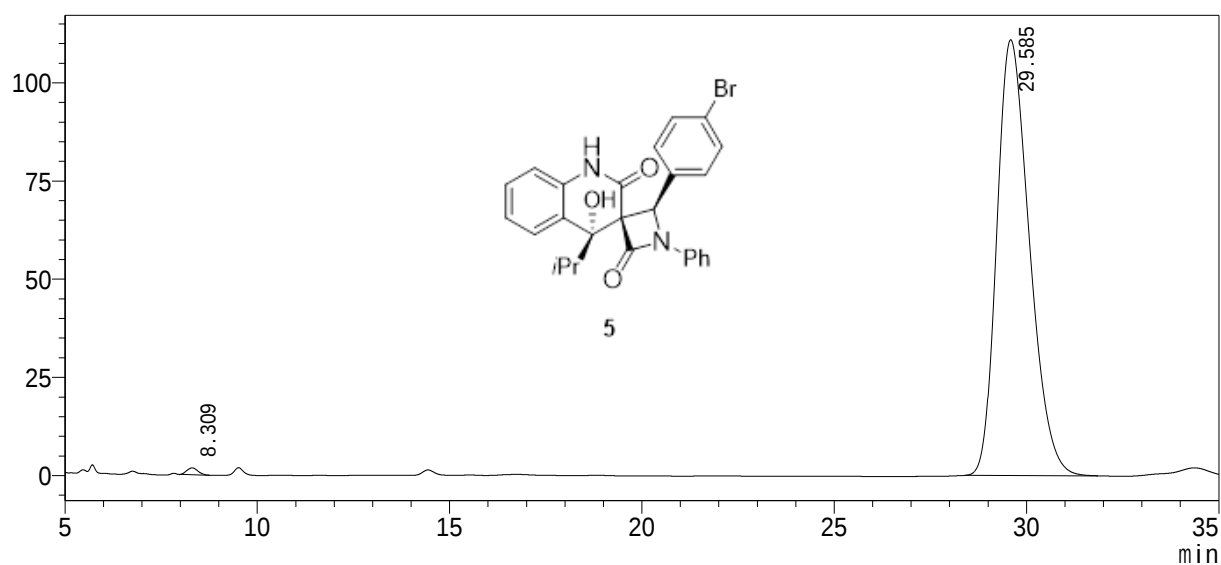
Ana. Date : 2023/6/3 19:01:36

Analyst : System Administrator

Pro. Date : 2023/6/6 23:52:02

Processor : System Administrator

mV SPD-20A 254nm



SPD-20A

Entry	RT[min]	Area	Height	Area%			
1	8.309	34670	1740	0.527		M	
2	29.585	6540724	110947	99.473		M	
Sum		6575394	112687				



SHIMADZU

LabSolutions

HPLC Reprot

<Sample Information>

Sample name : LJ-D31-RAC-AD20%

Data name : LJ-D31-RAC-AD20%.lcd

Acq. name : AD-20%.lcm

Location : 1-1

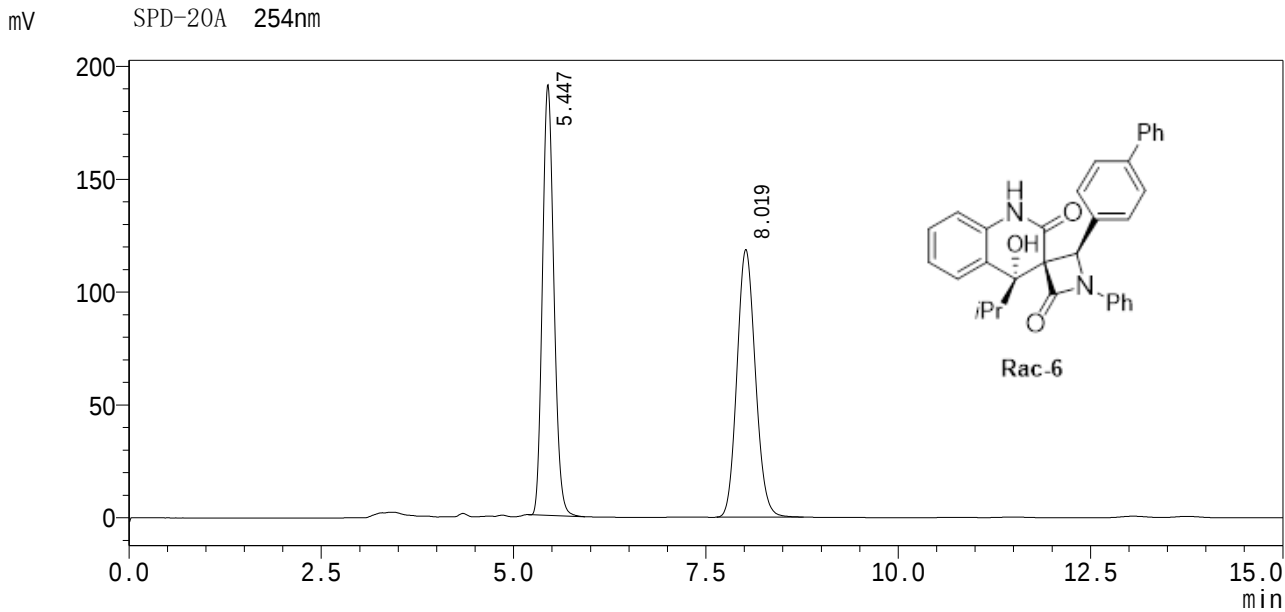
Ana. Date : 2023/6/13 10:37:14

Pro. Date : 2023/6/13 11:02:23

Sample Type : unknown

Analyst : System Administrator

Processor : System Administrator



SPD-20A

Entry	RT[min]	Area	Height	Area%			
1	5.447	1977739	190739	50.029		M	
2	8.019	1975421	118607	49.971		M	
Sum		3953161	309345				



SHIMADZU

LabSolutions

HPLC Reprot

<Sample Information>

Sample name : LJ-D31-CHIRAL-AD20%

Data name : LJ-D31-CHIRAL-AD20%.lcd

Acq. name : AD-20%.lcm

Location : 1-1
: 1 uL

Sample Type : unknown

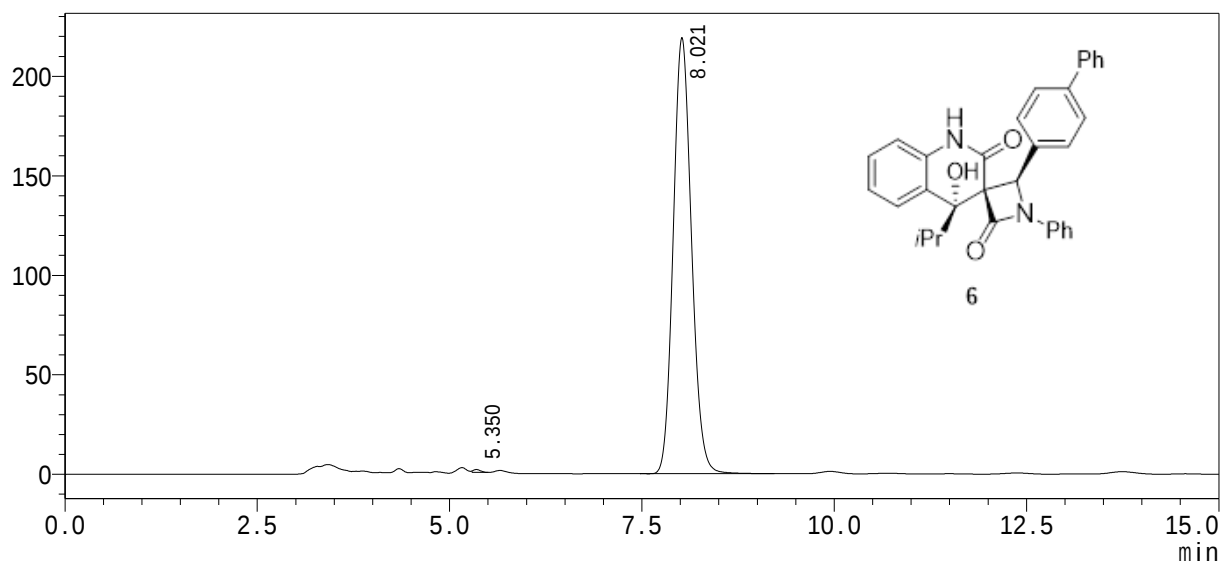
Ana. Date : 2023/6/13 11:01:43

Analyst : System Administrator

Pro. Date : 2023/6/13 11:26:51

Processor : System Administrator

mV SPD-20A 254nm



SPD-20A

Entry	RT[min]	Area	Height	Area%			
1	5.350	8554	1354	0.236		M	
2	8.021	3622476	219036	99.764		M	
Sum		3631030	220390				



SHIMADZU

LabSolutions

HPLC Reprot

<Sample Information>

Sample name : MHWK132

Data name : MHWK132-ad20%2.lcd

Acq. name : AD-20%.lcm

Location : 1-1
: 1 uL

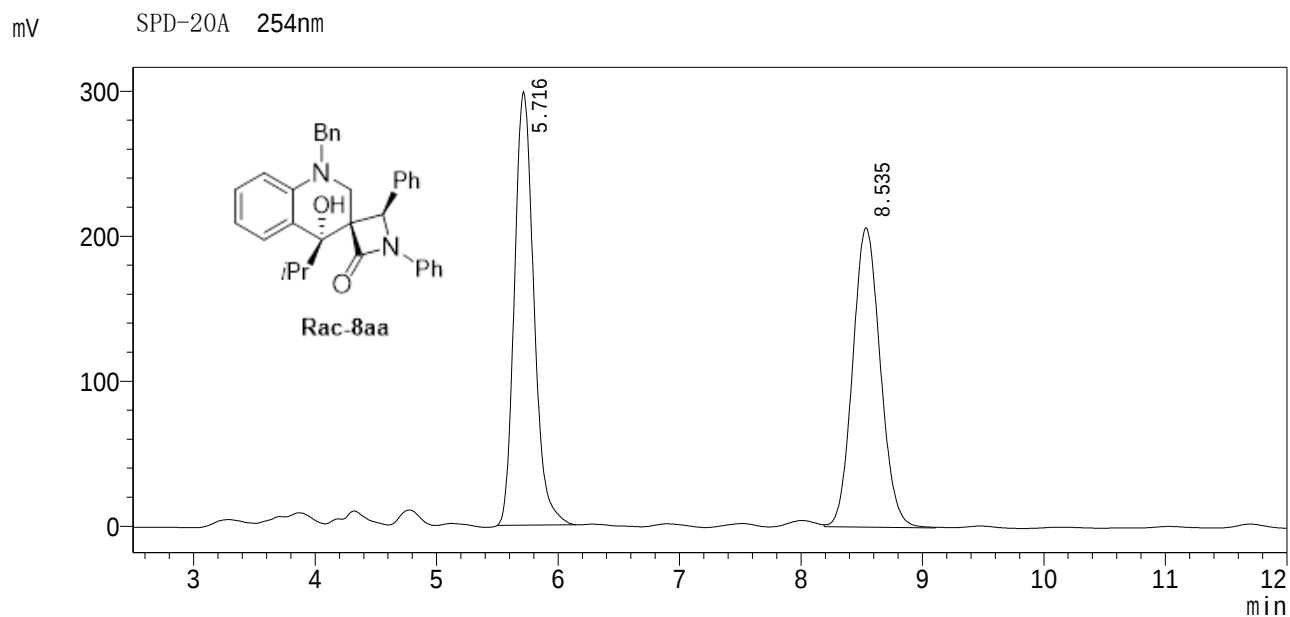
Sample Type : unknown

Ana. Date : 2023/5/25 21:46:57

Analyst : System Administrator

Pro. Date : 2023/5/25 22:02:39

Processor : System Administrator



SPD-20A

Entry	RT[min]	Area	Height	Area%			
1	5.716	3321705	298945	50.432		M	
2	8.535	3264798	206563	49.568		M	
Sum		6586503	505508				



SHIMADZU

LabSolutions

HPLC Reprot

<Sample Information>

Sample name : MHWK138-1

Data name : MHWK138-1-ad20%3.lcd

Acq. name : AD-20%.lcm

Location : 1-1
: 1 uL

Sample Type : unknown

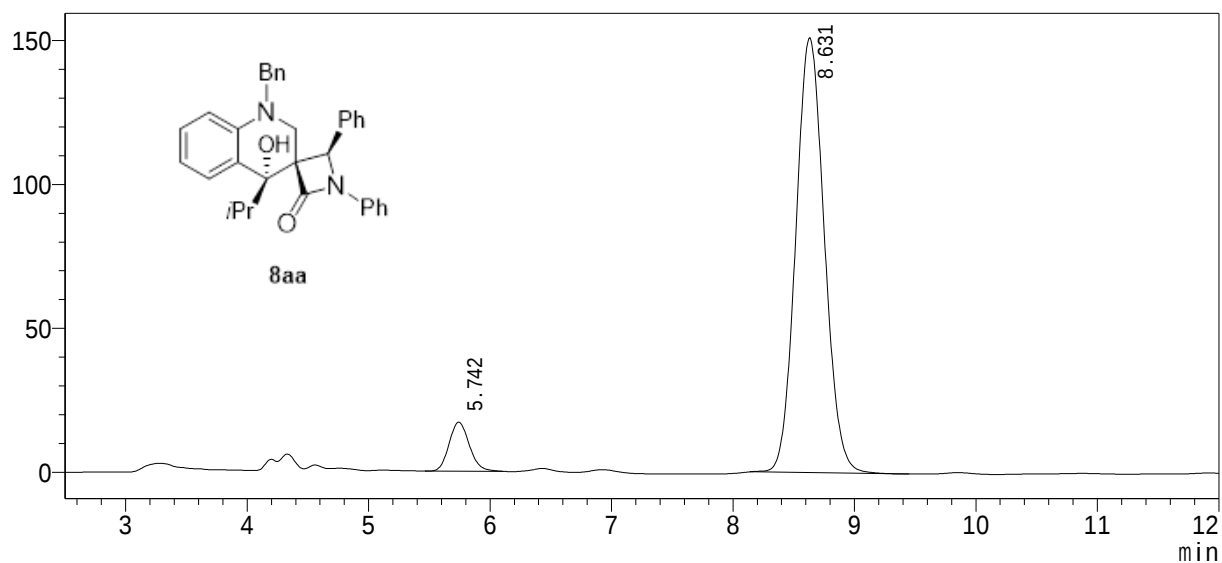
Ana. Date : 2023/5/26 9:21:19

Analyst : System Administrator

Pro. Date : 2023/5/31 15:12:58

Processor : System Administrator

mV SPD-20A 254nm



SPD-20A

Entry	RT[min]	Area	Height	Area%			
1	5.742	197383	17018	7.401		M	
2	8.631	2469769	151142	92.599		M	
Sum		2667152	168159				



SHIMADZU

LabSolutions

HPLC Reprot

<Sample Information>

Sample name : MHWK132-2-RAC

Data name : MHWK132-2-RAC-IC20%4.lcd

Acq. name : IC-H-20%.lcm

Location : 1-1
: 1 uL

Sample Type : unknown

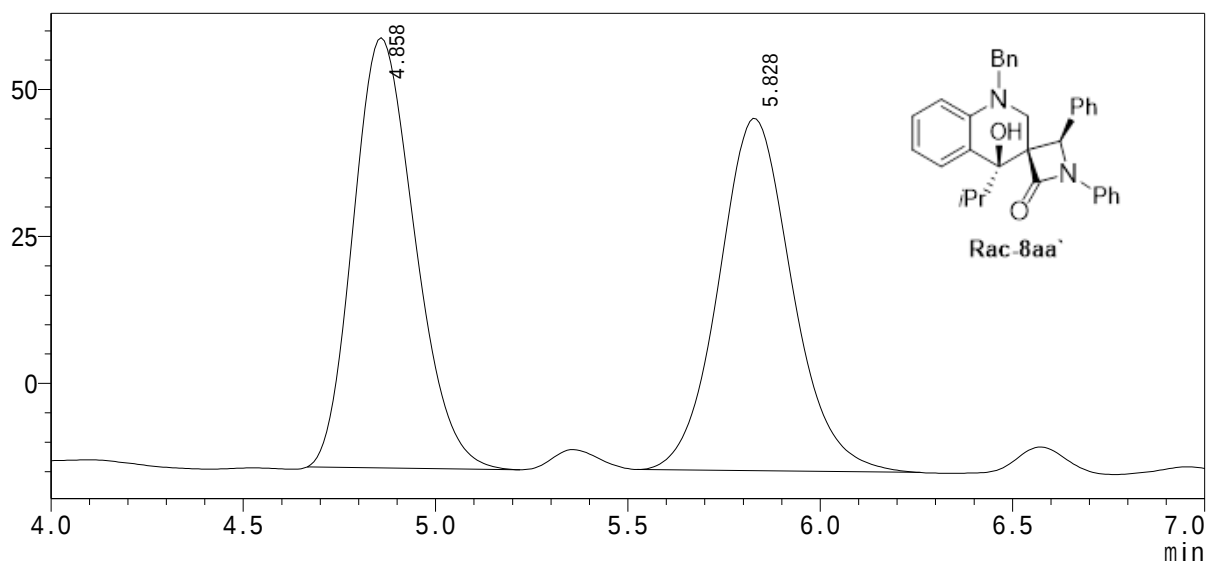
Ana. Date : 2023/5/31 9:37:36

Analyst : System Administrator

Pro. Date : 2023/5/31 15:13:12

Processor : System Administrator

mV SPD-20A 254nm



SPD-20A

Entry	RT[min]	Area	Height	Area%			
1	4.858	814402	73179	50.645		M	
2	5.828	793649	59945	49.355		M	
Sum		1608051	133124				



SHIMADZU

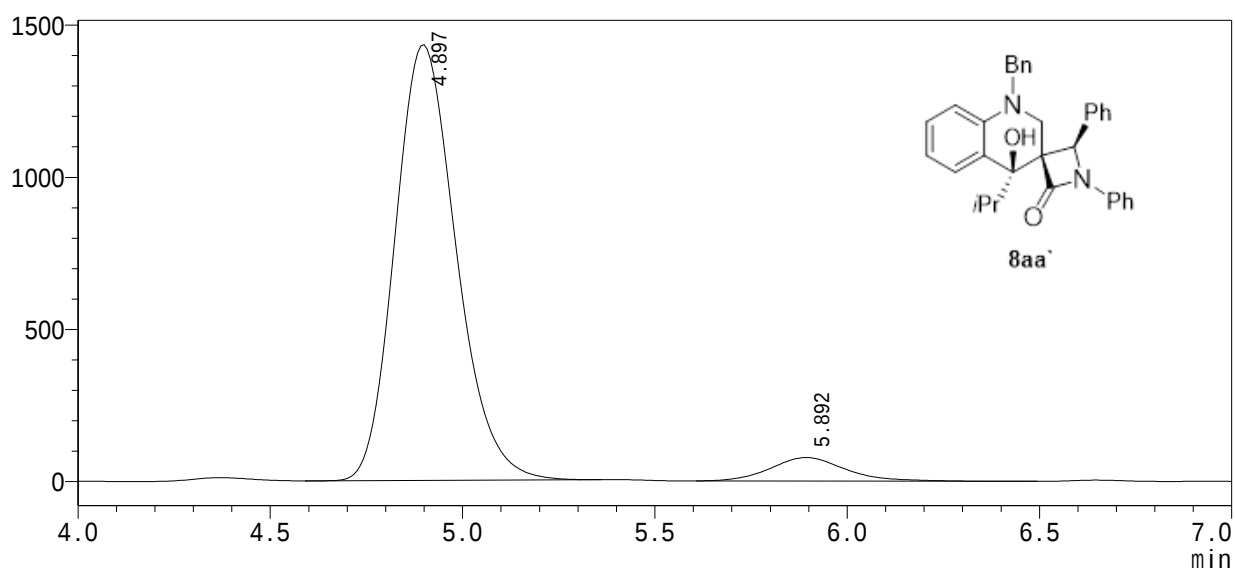
LabSolutions

HPLC Reprot

<Sample Information>

Sample name : MHWK138-2B
Data name : MHWK138-2B-IC20%3.lcd
Acq. name : IC-H-20%.lcm
Location : 1-1
Sample Type : unknown
Ana. Date : 2023/5/30 17:14:52
Pro. Date : 2023/5/31 15:13:14
Analyst : System Administrator
Processor : System Administrator

mV SPD-20A 254nm



SPD-20A

Entry	RT[min]	Area	Height	Area%			
1	4.897	15863580	1432014	93.775		M	
2	5.892	1053150	77284	6.225		M	
Sum		16916729	1509298				