Supporting information

Photocatalytic α-Aminoalkyl Radical Addition of Amines Mediated by Benzophenone in Visible Light

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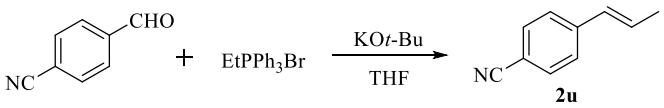
1. General Information

^{1}H NMR and ^{13}C NMR spectra were recorded on Bruker AVANCE 400 spectrometer. Chemical shifts of protons were reported in parts per million downfield from tetramethylsilane and were referenced to residual protium in the NMR solvent ($CDCl_3$: δ 7.26), (DMSO-d6: δ 2.50). Chemical shifts of carbon were referenced to the carbon resonances of the solvent ($CDCl_3$: δ 77.0), (DMSO-d_6: δ 39.5). Peaks were labeled as singlet (s), doublet (d), triplet (t), quartet (q) and multiplet (m). Melting points were measured on a WRS-2A melting point apparatus and were uncorrected. High resolution mass spectra (HRMS) were recorded on liquid chromatography-triple quadrupole mass spectrometer (LCMS-IT-TOF, Shimadzu, Japan) equipped with ESI ionization. For our light-promoted reactions, the substrates and solvent were added in quartz tube, irradiated using a 9 W 425 nm LED lamp (WATTCAS: WP-TEC-1020HSL). The tube is up on the lamp about 0.5 cm. The lamp is a kind of

light diaphragm in specific wavelength, which is mating with photoreactor (WATTCAS: WP-TEC-1020HSL). Copies of their ^{1}H NMR and ^{13}C NMR spectra were provided. Substrates of **1a-1z**, **2a-2t, 2w-2y, and 2aa-2am** were purchased from *J&K* in analysis pure.

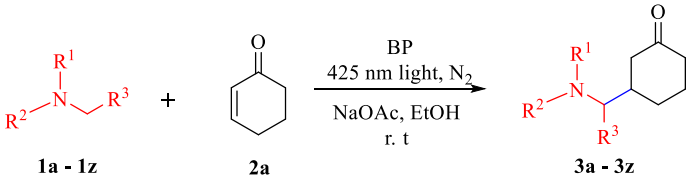
2. General Procedures

2.1 Typical procedure for preparation of substrates **2u**, **2v** and **2an.**



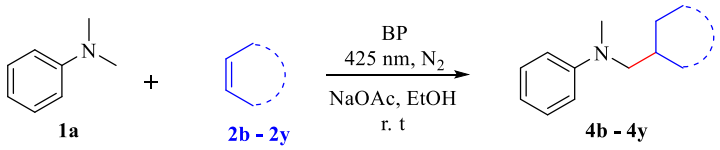
These compounds were synthesized according to a known procedure.[1] A mixture of CH_3PPh_3Br (18 mmol) and KO*t*-Bu (19.5 mmol) in dry THF (30 mL) was stirred at rt for 1 h. The reaction mixture was cooled to 0℃ and 4-formylbenzonitrile (15 mmol) was added. The reaction mixture was stirred overnight at rt. Then the solvent was evaporated under reduced pressure. The residue was purified by column chromatography to give **2u** as a colourless oil (yield: 51%).

2.2 Typical procedure for photocatalytic addition of substrates **1a-1z and 2a**.



N,*N*-dimethylaniline **1a** (72.6 mg, 0.6 mmol), cyclohexenone **2a** (28.8 mg, 0.3 mmol) and benzophenone (27.3 mg, 0.15 mmol) was added to 10 mL quartz tube containing 2 mL EtOH, the reaction mixture was stirred and irradiated using a 9 W 425 nm LED lamp (WATTCAS: WP-TEC-1020HSL) at room temperature under nitrogen atmosphere condition for 36 h. Then, the crude product was purified by flash chromatography to give a colourless oil **3a** (52.1 mg, yield: 80%).

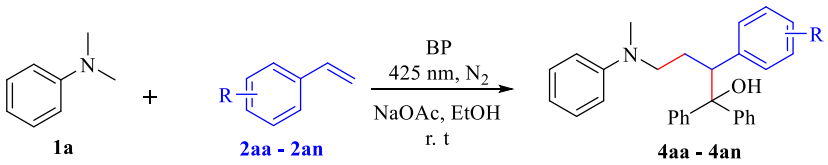
2.3 Typical procedure for photocatalytic addition of substrates **1a and 2b-2y**.



N,*N*-dimethylaniline **1a** (72.6 mg, 0.6 mmol), 4,4-dimethylcyclohex-2-en-1-one **2b** (37.2 mg, 0.3 mmol) and benzophenone (27.3 mg, 0.15 mmol) was added to 10 mL quartz tube containing 2 mL EtOH, the reaction mixture was stirred and irradiated using a 9 W 425 nm LED lamp (WATTCAS: WP-TEC-1020HSL) at room temperature under nitrogen atmosphere condition for 36 h. Then, the crude product was purified by flash chromatography to give a colourless oil **4b** (59.5 mg, yield: 81%).

2.4 Typical procedure for photocatalytic addition of N,N-dimethylaniline **1a** and

styrene derivatives **2aa-2an**.

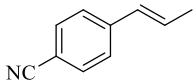


1a **2aa - 2an** **4aa - 4an**

N,*N*-dimethylaniline **1a** (72.6 mg, 0.6 mmol), styrene **2aa** (31.2 mg, 0.3 mmol) and benzophenone (54.6 mg, 0.30 mmol) was added to 10 mL quartz tube containing 2 mL EtOH, the reaction mixture was stirred and irradiated using a 9 W 425 nm LED lamp (WATTCAS: WP-TEC-1020HSL) at room temperature under nitrogen atmosphere condition for 36 h. Then, the crude product was purified by flash chromatography to give a colourless oil **4aa** (51.2 mg, yield: 42%).

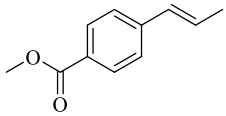
3. Characterization Data

4-(prop-1-en-1-yl)benzonitrile (2u)



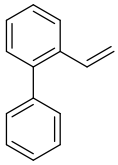
Yellow oil. 51% yield, R_f=0.4 (petroleum ether/ethyl acetate 50:1). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.63 (d, *J* = 8.2 Hz, 2H), 7.58 (d, *J* = 8.2 Hz, 2H), 7.40 (dd, *J* = 8.0, 5.8 Hz, 4H), 6.49 – 6.38 (m, 3H), 5.96 (dq, *J* = 11.8, 7.4 Hz, 1H), 1.99 – 1.88 (m, 6H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 142.4, 142.3, 132.4, 131.9, 130.2, 130.2, 129.8, 129.4, 128.5, 126.3, 119.2, 119.1, 109.9, 109.9, 18.7, 14.8. These spectroscopic data correspond to reported data.[2]

methyl-4-(prop-1-en-1-yl)benzoate (2v)



Colourless oil. 50% yield, R_f=0.5 (petroleum ether/ethyl acetate 50:1). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.02 (d, *J* = 8.4 Hz, 2H), 7.98 (d, *J* = 8.4 Hz, 2H), 7.38 (t, *J* = 7.8 Hz, 4H), 6.52 – 6.33 (m, 3H), 5.92 (dq, *J* = 11.8, 7.2 Hz, 1H), 3.93 (s, 3H), 3.92 (s, 3H), 1.97 – 1.91 (m, 6H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 167.0, 142.4, 142.3, 130.4, 129.9, 129.5, 129.1, 129.0, 128.8, 128.7, 128.2, 127.9, 125.7, 52.1, 52.0, 18.7, 14.8. These spectroscopic data correspond to reported data.[3]

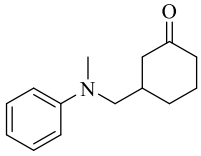
2-vinyl-1,1'-biphenyl (2an)



Colourless oil. 30% yield, R_f=0.5 (petroleum ether/ethyl acetate 100:1). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.75 – 7.70 (m, 1H), 7.52 – 7.46 (m, 2H), 7.45 – 7.35 (m, 6H), 6.80 (dd, *J* = 17.4, 11.0 Hz, 1H), 5.78 (dd, *J* = 17.4, 1.2 Hz, 1H), 5.26 (dd, *J* = 11.0, 1.2 Hz, 1H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 140.9, 135.9, 135.8, 130.2, 129.9, 128.1,

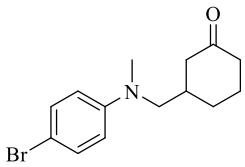
127.7, 127.5, 127.1, 125.7, 114.7. These spectroscopic data correspond to reported data.[4]

3-((methyl(phenyl)amino)methyl)cyclohexan-1-one (3a)



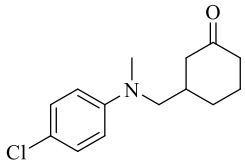
Colourless oil. 80% yield (52.1 mg), R_f=0.5 (petroleum ether/ethyl acetate 10:1). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.38 – 7.16 (m, 2H), 6.75 – 6.69 (m, 2H), 3.37 – 3.22 (m, 2H), 2.99 (s, 2H), 2.52 – 2.36 (m, 2H), 2.37 – 2.24 (m, 1H), 2.16 – 2.05 (m, 1H), 2.05 – 1.95 (m, 1H), 1.73 – 1.61 (m, 1H), 1.52 – 1.36 (m, 1H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 211.0, 149.2, 129.2, 116.3, 112.0, 58.7, 46.0, 41.5, 39.7, 38.3, 29.5, 25.2. These spectroscopic data correspond to reported data.[5]

3-(((4-bromophenyl)(methyl)amino)methyl)cyclohexan-1-one (3b)



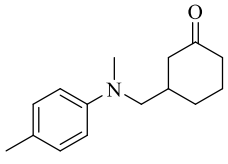
Yellow oil. 63% yield (55.9 mg), R_f=0.5(petroleum ether/ethyl acetate 10:1). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.32 – 728 (m, 2H), 6.58 – 6.50 (m, 2H), 3.32 – 3.18 (m, 2H), 2.96 (s, 3H), 2.48 – 2.35 (m, 2H), 2.35 – 2.17 (m, 2H), 2.15 – 2.03 (m, 2H), 2.00 – 1.89 (m, 1H), 1.74 – 1.64 (m, 1H), 1.47 – 1.35 (m, 1H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 210.7, 148.1, 131.8, 113.6, 108.2, 58.6, 45.91, 41.4, 39.8, 38.2, 29.4, 25.2. These spectroscopic data correspond to reported data.[5]

***N*, 3-(((4-chlorophenyl)(methyl)amino)methyl)cyclohexan-1-one (3c)**



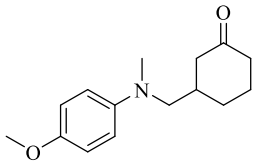
Yellow oil. 71% yield (53.6 mg), R_f=0.5(petroleum ether/ethyl acetate 10:1). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.19 – 7.15 (m, 2H), 6.61 – 6.57 (m, 2H), 3.31 – 3.20 (m, 2H), 2.96 (s, 3H), 2.47 – 2.37 (m, 2H), 2.34 – 2.22 (m, 2H), 2.16 – 2.05 (m, 2H), 2.01 – 1.88 (m, 1H), 1.69 – 1.63 (m, 1H), 1.47 – 1.33 (m, 1H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 210.8, 147.7, 128.9, 121.1, 113.1, 58.7, 45.9, 41.4, 39.8, 38.2, 29.4, 25.2. These spectroscopic data correspond to reported data.[5]

3-((methyl(*p*-tolyl)amino)methyl)cyclohexan-1-one (3d)



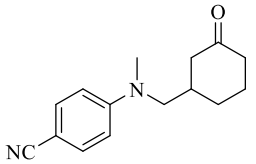
Colourless oil. 61% yield (42.3 mg), R_f=0.5(petroleum ether/ethyl acetate 15:1). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.06 (d, *J* = 8.4 Hz, 2H), 6.62 (d, *J* = 8.4 Hz, 2H), 3.32 – 3.18 (m, 2H), 2.95 (s, 3H), 2.52 – 2.37 (m, 2H), 2.35 – 2.21 (m, 5H), 2.16 – 2.04 (m, 2H), 2.03 – 1.93 (m, 1H), 1.74 – 1.62 (m, 1H), 1.47 – 1.37 (m, 1H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 211.1, 147.3, 129.7, 125.6, 112.3, 59.0, 46.0, 41.5, 39.8, 38.4, 29.5, 25.2, 20.2. These spectroscopic data correspond to reported data.[5]

3-(((4-methoxyphenyl)(methyl)amino)methyl)cyclohexan-1-one (3e)



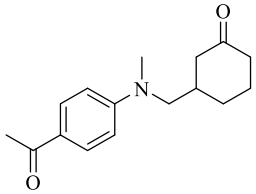
Colourless oil. 78% yield (57.8 mg), R_f=0.5(petroleum ether/ethyl acetate 5:1). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 6.90 – 6.79 (m, 2H), 6.68 (d, *J* = 8.8 Hz, 2H), 3.78 (s, 3H), 3.24 – 3.10 (m, 2H), 2.90 (s, 3H), 2.53 – 2.35 (m, 2H), 2.34 – 2.16 (m, 2H), 2.16 – 2.03 (m, 2H), 2.03 – 1.92 (m, 1H), 1.72 – 1.65 (m, 1H), 1.48 – 1.34 (m, 1H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 211.2, 151.6, 144.5, 114.8, 114.1, 59.9, 55.8, 46.1, 41.5, 40.2, 38.3, 29.6, 25.2. These spectroscopic data correspond to reported data.[5]

4-(methyl((3-oxocyclohexyl)methyl)amino)benzonitrile (3f)



Colourless oil. 70% yield (50.8 mg), R_f=0.5(petroleum ether/ethyl acetate 5:1). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.44 (d, *J* = 9.0 Hz, 2H), 6.62 (d, *J* = 9.0 Hz, 2H), 3.41 – 3.04 (m, 2H), 3.04 (s, 3H), 2.46 – 2.36 (m, 2H), 2.33 – 2.18 (m, 2H), 2.16 – 2.02 (m, 2H), 1.97 – 1.87 (m, 1H), 1.74 – 1.58 (m, 1H), 1.51 – 1.35 (m, 1H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 210.2, 151.5, 133.5, 120.5, 111.4, 97.6, 57.9, 45.7, 41.3, 39.8, 38.0, 29.3, 25.1. **HRMS (ESI)** calculated for $C_{15}H_{19}N_2O$ $(M+H)^+$: 243.1492, found: 243.1495.

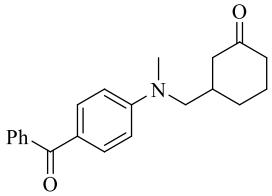
3-(((4-acetylphenyl)(methyl)amino)methyl)cyclohexan-1-one (3g)



Colourless oil. 77% yield (59.8 mg), R_f=0.5(petroleum ether/ethyl acetate 5:1). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.85 (d, *J* = 9.0 Hz, 2H), 6.62 (d, *J* = 9.0 Hz, 2H), 3.42 – 3.06 (m, 2H), 3.06 (s, 3H), 2.49 (s, 3H), 2.45 – 2.35 (m, 2H), 2.34 – 2.21 (m, 2H), 2.15 – 2.03 (m, 2H), 1.97 – 1.87 (m, 1H), 1.70 – 1.59 (m, 1H), 1.48 – 1.37 (m, 1H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 210.37, 196.28, 152.30, 130.63, 125.49, 110.50,

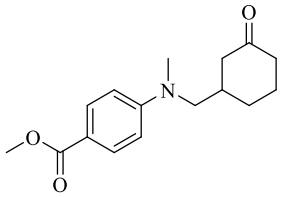
57.92, 45.76, 41.34, 39.82, 38.17, 29.30, 25.99, 25.10. **HRMS (ESI)** calculated for $C_{16}H_{22}NO_2$ $(M+H)^+$: 260.1645, found: 260.1650.

3-(((4-benzoylphenyl)(methyl)amino)methyl)cyclohexan-1-one (3h)



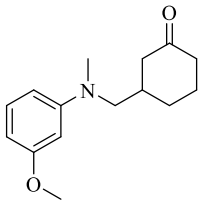
Yellow oil. 86% yield (82.8 mg), R_f=0.4(petroleum ether/ethyl acetate 15:1). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.79 (d, *J* = 9.0 Hz, 2H), 7.73 (dd, *J* = 8.2, 1.4 Hz, 2H), 7.54 (t, *J* = 7.2 Hz, 1H), 7.46 (t, *J* = 7.2 Hz, 2H), 6.66 (d, *J* = 9.0 Hz, 2H), 3.45 – 3.08 (m, 2H), 3.08 (s, 3H), 2.46 – 2.35 (m, 2H), 2.35 – 2.25 (m, 2H), 2.20 – 2.01 (m, 2H), 1.99 – 1.91 (m, 1H), 1.67 (dt, *J* = 8.2, 4.6 Hz, 1H), 1.51 – 1.37 (m, 1H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 210.4, 195.0, 152.2, 139.2, 132.8, 131.2, 129.4, 128.0, 124.9, 110.5, 58.0, 45.8, 41.4, 39.9, 38.2, 29.3, 25.1. **HRMS (ESI)** calculated for $C_{21}H_{24}NO_2$ $(M+H)^+$: 322.1802, found: 322.1806.

methyl 4-(methyl((3-oxocyclohexyl)methyl)amino)benzoate (3i)



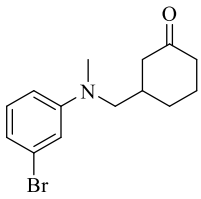
Colorless oil. 70% yield (57.7 mg), R_f=0.5(petroleum ether/ethyl acetate 2:1). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.90 (d, *J* = 9.0 Hz, 2H), 6.62 (d, *J* = 9.0 Hz, 2H), 3.86 (s, 3H), 3.42 – 3.33 (m, 2H), 3.05 (s, 3H), 2.48 – 2.36 (m, 2H), 2.34 – 2.26 (m, 2H), 2.13 – 2.06 (m, 2H), 2.00 – 1.90 (m, 1H), 1.69 – 1.58 (m, 1H), 1.49 – 1.36 (m, 1H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 210.4, 167.3, 152.2, 131.4, 117.2, 110.6, 58.0, 51.5, 45.8, 41.4, 39.8, 38.2, 29.3, 25.1. **HRMS (ESI)** calculated for $C_{16}H_{22}NO_3$ $(M+H)^+$: 276.1594, found: 276.1596.

3-(((3-methoxyphenyl)(methyl)amino)methyl)cyclohexan-1-one (3j)



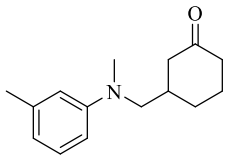
Colorless oil. 76% yield (56.3 mg), R_f=0.5(petroleum ether/ethyl acetate 5:1). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.15 (t, *J* = 8.2 Hz, 1H), 6.31 (t, *J* = 8.0 Hz, 2H), 6.23 (s, 1H), 3.81 (s, 3H), 3.32 – 3.19 (m, 2H), 2.97 (s, 3H), 2.49 – 2.36 (m, 2H), 2.33 – 2.25 (m, 2H), 2.13 – 2.04 (m, 2H), 1.99 – 1.90 (m, 1H), 1.67 (t, *J* = 4.2 Hz, 1H), 1.50 – 1.37 (m, 1H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 210.9, 160.8, 150.6, 129.9, 105.2, 100.8, 98.7, 58.6, 55.1, 46.0, 41.5, 39.8, 38.4, 29.5, 25.2. **HRMS (ESI)** calculated for $C_{15}H_{22}NO_2$ $(M+H)^+$: 248.1645, found: 248.1649.

3-(((3-bromophenyl)(methyl)amino)methyl)cyclohexan-1-one (3k)



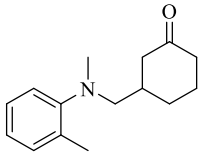
Yellow oil. 76% yield (67.5 mg), R_f=0.5(petroleum ether/ethyl acetate 10:1). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.11 – 7.03 (m, 1H), 6.84 – 6.76 (m, 2H), 6.58 (dd, *J* = 8.4, 2.4 Hz, 1H), 3.35 – 3.18 (m, 2H), 2.97 (s, 3H), 2.46 – 2.38 (m, 2H), 2.36 – 2.18 (m, 2H), 2.17 – 2.02 (m, 2H), 2.01 – 1.88 (m, 1H), 1.72 – 1.62 (m, 1H), 1.48 – 1.34 (m, 1H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 210.7, 150.3, 130.4, 123.5, 119.0, 114.6, 110.5, 58.3, 45.9, 41.4, 39.7, 38.2, 29.4, 25.2. **HRMS (ESI)** calculated for $C_{14}H_{19}BrNO$ $(M+H)^+$: 296.0645, found: 296.0650.

3-((methyl(*m*-tolyl)amino)methyl)cyclohexan-1-one (3l)



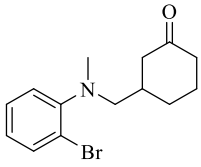
Colorless oil. 63% yield (43.6 mg), R_f=0.5(petroleum ether/ethyl acetate 15:1). **^{1}HMR** (400 MHz, $CDCl_3$) δ 7.19 – 7.06 (m, 1H), 6.56 (d, *J* = 7.4 Hz, 1H), 6.51 (d, *J* = 6.4 Hz, 2H), 3.27 (d, *J* = 7.4 Hz, 2H), 2.98 (s, 3H), 2.55 – 2.38 (m, 2H), 2.34 (s, 3H), 2.32 – 2.26 (m, 1H), 2.13 – 2.06 (m, 2H), 2.00 (dd, *J* = 13.2, 1.6 Hz, 1H), 1.76 – 1.53 (m, 2H), 1.48 – 1.38 (m, 1H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 211.1, 149.3, 138.9, 129.1, 117.3, 112.7, 109.2, 58.7, 46.0, 41.5, 39.8, 38.4, 29.5, 25.2, 21.9. These spectroscopic data correspond to reported data.[5]

3-((methyl(*o*-tolyl)amino)methyl)cyclohexan-1-one (3m)



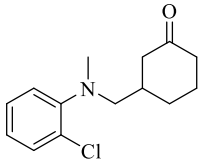
Colorless oil. 67% yield (46.4 mg), R_f=0.5(petroleum ether/ethyl acetate 15:1). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.23 – 7.14 (m, 2H), 7.07 (d, *J* = 7.4 Hz, 1H), 7.00 (t, *J* = 7.4 Hz, 1H), 2.94 (dd, *J* = 12.4, 6.4 Hz, 1H), 2.83 (dd, *J* = 12.4, 6.4 Hz, 1H), 2.61 (s, 3H), 2.57 (d, *J* = 10.0 Hz, 1H), 2.44 – 2.35 (m, 1H), 2.32 (s, 3H), 2.31 – 2.24 (m, 1H), 2.12 – 1.99 (m, 4H), 1.71 – 1.65 (m, 1H), 1.42 – 1.28 (m, 1H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 211.8, 152.2, 133.7, 131.1, 126.5, 123.4, 120.4, 61.6, 46.3, 43.1, 41.7, 37.3, 29.6, 25.1, 18.2. These spectroscopic data correspond to reported data.[5]

3-(((2-bromophenyl)(methyl)amino)methyl)cyclohexan-1-one (3n)



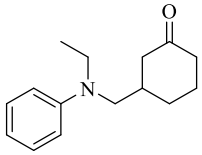
Yellow oil, 75% yield (66.6 mg), R_f=0.5(petroleum ether/ethyl acetate 10:1). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.57 (dd, *J* = 8.0, 1.4 Hz, 1H), 7.34 – 7.23 (m, 1H), 7.11 (dd, *J* = 8.0, 1.4 Hz, 1H), 6.93 (td, *J* = 7.8, 1.6 Hz, 1H), 3.02 – 2.91 (m, 2H), 2.72 (s, 3H), 2.65 – 2.48 (m, 1H), 2.41 – 2.32 (m, 1H), 2.33 – 2.22 (m, 1H), 2.15 – 1.97 (m, 4H), 1.70 – 1.61 (m, 1H), 1.47 – 1.34 (m, 1H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 211.7, 151.3, 133.9, 128.1, 124.7, 122.6, 121.1, 61.1, 46.1, 42.9, 41.7, 37.4, 29.4, 25.1. **HRMS (ESI)** calculated for $C_{14}H_{19}BrNO$ $(M+H)^+$: 296.0645, found: 296.0651.

3-(((2-chlorophenyl)(methyl)amino)methyl)cyclohexan-1-one (3o)



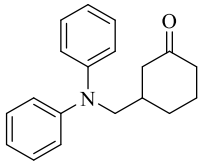
Yellow oil, 73% yield (54.9 mg), R_f=0.5(petroleum ether/ethyl acetate 10:1). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.36 (dd, *J* = 8.0, 1.6 Hz, 1H), 7.25 – 7.17 (m, 1H), 7.10 (d, *J* = 8.0 Hz, 1H), 6.98 (td, *J* = 7.8, 1.6 Hz, 1H), 3.05 – 2.93 (m, 2H), 2.75 (s, 3H), 2.60 – 2.49 (m, 1H), 2.41 – 2.35 (m, 1H), 2.34 – 2.22 (m, 1H), 2.17 – 1.99 (m, 4H), 1.67 – 1.62 (m, 1H), 1.46 – 1.32 (m, 1H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 211.7, 149.9, 130.7, 129.6, 127.4, 123.8, 122.0, 60.9, 46.1, 42.1, 41.7, 37.4, 29.4, 25.1. **HRMS (ESI)** calculated for $C_{14}H_{19}ClNO$ $(M+H)^+$: 252.1150, found: 252.1154.

3-((ethyl(phenyl)amino)methyl)cyclohexan-1-one (3p)



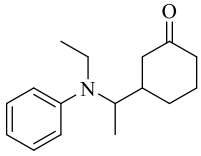
Colorless oil, 69% yield (47.8 mg), R_f=0.4(petroleum ether/ethyl acetate 10:1). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.23 (t, *J* = 8.0 Hz, 2H), 6.69 (t, *J* = 7.8 Hz, 3H), 3.47 – 3.34 (m, 2H), 3.30 – 3.15 (m, 2H), 2.49 (dd, *J* = 8.4, 6.8 Hz, 1H), 2.45 – 2.37 (m, 1H), 2.36 – 2.20 (m, 2H), 2.16 – 1.97 (m, 3H), 1.71 – 1.64 (m, 1H), 1.49 – 1.37 (m, 1H), 1.15 (t, *J* = 7.0 Hz, 3H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 211.1, 147.9, 129.3, 116.0, 112.3, 56.2, 46.2, 46.0, 41.6, 38.2, 29.5, 25.2, 11.7. **HRMS (ESI)** calculated for $C_{15}H_{22}NO$ $(M+H)^+$: 232.1700, found: 232.1704.

3-((diphenylamino)methyl)cyclohexan-1-one (3q)



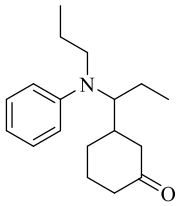
Colorless oil. 59% yield (49.4 mg), R_f=0.4(petroleum ether/ethyl acetate 15:1). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.38 – 7.22 (m, 4H), 7.18 – 6.85 (m, 6H), 3.76 – 3.63 (m, 2H), 2.62 – 2.50 (m, 1H), 2.38 – 2.36 (m, 1H), 2.33 – 2.28 (m, 2H), 2.13 – 2.06 (m, 3H), 1.67 – 1.60 (m, 1H), 1.48 – 1.37 (m, 1H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 210.9, 148.5, 129.4, 121.6, 121.2, 58.2, 46.0, 41.5, 38.2, 29.6, 25.1. These spectroscopic data correspond to reported data.[5]

3-(1-(ethyl(phenyl)amino)ethyl)cyclohexan-1-one (3r)



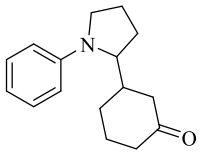
Colorless oil. 72% yield (52.9 mg), R_f=0.4(petroleum ether/ethyl acetate 20:1). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.23 (q, *J* = 8.0 Hz, 2H), 6.78 (t, *J* = 8.8 Hz, 2H), 6.70 (t, *J* = 7.2 Hz, 1H), 3.81 – 3.61 (m, 1H), 3.27 – 3.22 (m, 2H), 2.53 (d, *J* = 12.0 Hz, 1H), 2.41 – 2.38 (m, 1H), 2.31 – 2.27 (m, 1H), 2.17 – 1.98 (m, 4H), 1.66 – 1.56 (m, 1H), 1.42 – 1.14 (m, 7H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 211.5, 148.6, 129.2, 116.3, 113.7, 58.9, 45.9, 43.7, 41.4, 38.1, 29.3, 29.1, 25.1, 15.7, 13.9. **HRMS (ESI)** calculated for $C_{16}H_{24}NO$ $(M+H)^+$: 246.1853, found: 246.1856.

3-(1-(phenyl(propyl)amino)propyl)cyclohexan-1-one (3s)



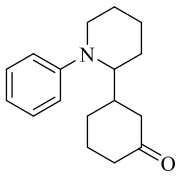
Colorless oil. 47% yield (38.5 mg), R_f=0.5(petroleum ether/ethyl acetate 50:1). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.20 – 7.18 (m, 1H), 7.13 (t, *J* = 7.8 Hz, 1H), 6.79 (d, *J* = 7.6 Hz, 1H), 6.60 – 6.54 (m, 2H), 3.53 – 3.45 (m, 1H), 3.11 – 2.98 (m, 2H), 2.48 – 2.40 (m, 1H), 2.30 – 2.20 (m, 2H), 2.06 – 1.94 (m, 1H), 1.78 – 1.67 (m, 3H), 1.64 – 1.57 (m, 5H), 1.39 – 1.35 (m, 1H), 0.99 (t, *J* = 7.4 Hz, 3H), 0.92 (t, *J* = 7.5 Hz, 3H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 211.5, 150.0, 129.1, 115.8, 113.0, 65.4, 46.4, 45.7, 43.5, 41.4, 29.5, 25.1, 23.4, 20.6, 11.6, 11.5. **HRMS (ESI)** calculated for $C_{18}H_{28}NO$ $(M+H)^+$: 274.2166, found: 274.2170.

3-(1-phenylpyrrolidin-2-yl)cyclohexan-1-one (3t)



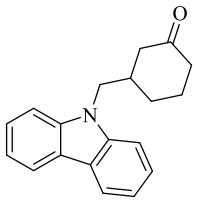
Colorless oil. 85% yield (61.9 mg), R_f=0.4(petroleum ether/ethyl acetate 10:1). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.30 – 7.19 (m, 2.75H), 6.71 (t, *J* = 7.2 Hz, 1.35H), 6.62 (t, *J* = 7.4 Hz, 2.64H), 3.85 – 3.82 (m, 1H), 3.72 – 3.69 (m, 0.35H), 3.51– 3.59 (m, 1.37H), 3.25 – 3.16 (m, 1.38H), 2.44 – 2.35 (m, 2.86H), 2.33 – 2.21 (m, 2.87H), 2.19 – 2.08 (m, 2.79H), 2.05 – 1.78 (m, 6.70H), 1.68 – 1.60 (m, 1.40H), 1.58 – 1.39 (m, 1.47H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 211.5, 211.4, 147.8, 147.6, 129.2, 129.1, 115.9, 112.4, 112.3, 61.8, 61.7, 49.6, 49.5, 45.6, 43.5, 41.7, 41.6, 41.6, 41.4, 28.8, 26.8, 26.6, 26.1, 25.5, 25.5, 24.3, 24.2. **HRMS (ESI)** calculated for $C_{11}H_{22}NO$ $(M+H)^+$: 244.1696, found: 244.1699.

3-(1-phenylpiperidin-2-yl)cyclohexan-1-one (3u)



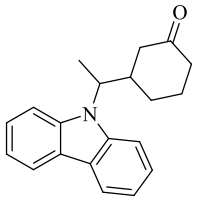
Yellow oil. 59% yield (45.5 mg), R_f=0.5(petroleum ether/ethyl acetate 10:1). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.23 – 7.17 (m, 2H), 6.85 (t, *J* = 8.8 Hz, 2H), 6.71 (t, *J* = 7.2 Hz, 1H), 3.61– 3.57 (m, 1H), 3.48 (d, *J* = 14.0 Hz, 1H), 3.07 – 3.00 (m, 1H), 2.49 – 2.31 (m, 3H), 2.31 – 2.20 (m, 1H), 2.14– 2.08 (m, 1H), 2.04 – 1.93 (m, 2H), 1.74 – 1.56 (m, 7H), 1.44 – 1.30 (m, 1H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 212.1, 151.1, 129.3, 117.6, 115.7, 60.5, 45.7, 43.9, 41.4, 38.2, 28.9, 25.5, 25.2, 24.2, 20.2. **HRMS (ESI)** calculated for $C_{17}H_{24}NO$ $(M+H)^+$: 258.1873, found: 258.1879.

3-((9H-carbazol-9-yl)methyl)cyclohexan-1-one (3v)



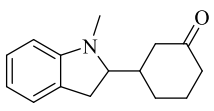
Yellow oil, 74% yield (61.5 mg), R_f=0.5(petroleum ether/ethyl acetate 5:1). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.13 (d, *J* = 7.8 Hz, 2H), 7.49 (ddd, *J* = 8.2, 7.0, 1.2 Hz, 2H), 7.40 (d, *J* = 8.2 Hz, 2H), 7.31 – 7.21 (m, 2H), 4.40 – 4.16 (m, 2H), 2.64 – 2.45 (m, 2H), 2.42 – 2.23 (m, 3H), 2.09 – 2.03 (m, 1H), 1.89 – 1.86 (m, 1H), 1.61 – 1.45 (m, 2H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 210.1, 140.6, 125.8, 122.9, 120.5, 119.2, 108.7, 48.4, 46.1, 41.3, 39.6, 29.8, 25.0. **HRMS (ESI)** calculated for $C_{19}H_{20}NO$ $(M+H)^+$: 278.1540, found: 278.1546.

3-(1-(9H-carbazol-9-yl)ethyl)cyclohexan-1-one (3w)



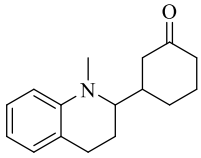
Yellow oil. 58% yield (50.6 mg), R_f=0.5(petroleum ether/ethyl acetate 10:1). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.15 (d, *J* = 7.6 Hz, 2H), 7.47 (s, 4H), 7.29 – 7.25 (m, 2H), 4.60 – 4.53 (m, 1H), 2.91 – 2.77 (m, 2H), 2.44 – 2.35 (m, 1H), 2.32 – 2.23 (m, 2H), 1.94 – 1.80 (m, 1H), 1.71 (d, *J* = 7.0 Hz, 3H), 1.51 – 1.42 (m, 1H), 1.41 – 1.34 (m, 1H), 1.33 – 1.21 (m, 1H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 210.6, 125.6, 120.4, 118.9, 111.5, 108.6, 55.7, 46.1, 43.1, 41.2, 28.6, 24.7, 16.8. **HRMS (ESI)** calculated for $C_{20}H_{22}NO$ $(M+H)^+$: 292.1700, found: 292.1704.

3-(1-methylindolin-2-yl)cyclohexan-1-one (3x)



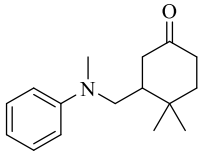
Yellow oil. 64% yield (43.9 mg), R_f=0.6(petroleum ether/ethyl acetate 5:1). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.18 – 7.02 (m, 4H), 6.74 – 6.63 (m, 2H), 6.49 (dd, *J* = 7.8, 3.6 Hz, 2H), 3.53 – 3.47 (m, 1H), 3.41 – 3.33 (m, 1H), 3.02 – 2.94 (m, 2H), 2.92 – 2.83 (m, 2H), 2.77 (s, 3H), 2.73 (s, 3H), 2.48 – 2.37 (m, 4H), 2.36 – 2.16 (m, 8H), 1.97 – 1.83 (m, 2H), 1.75 – 1.63 (m, 2H), 1.59 – 1.45 (m, 2H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 211.9, 211.3, 153.5, 153.4, 128.1, 128.1, 127.6, 127.3, 124.5, 124.2, 117.8, 107.3, 107.2, 70.0, 69.9, 45.0, 41.8, 41.7, 41.7, 40.7, 39.9, 34.9, 34.5, 30.2, 29.9, 28.4, 25.7, 25.3, 25.1. **HRMS (ESI)** calculated for $C_{15}H_{20}NO$ $(M+H)^+$: 278.1540, found: 278.1543.

3-(1-methyl-1,2,3,4-tetrahydroquinolin-2-yl)cyclohexan-1-one (3y)



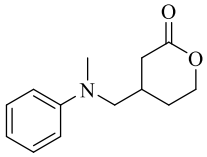
Yellow oil. 59% yield (43.0 mg), R_f=0.4(petroleum ether/ethyl acetate 10:1). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.11 (t, *J* = 8.0 Hz, 2H), 7.02 – 6.95 (m, 2H), 6.63 (t, *J* = 7.2 Hz, 2H), 6.58 (d, *J* = 8.2 Hz, 2H), 3.15 – 3.09 (m, 2H), 3.08 (d, *J* = 5.8 Hz, 3H), 3.03 (s, 3H), 2.84 – 2.62 (m, 4H), 2.50 – 2.35 (m, 4H), 2.34 – 2.26 (m, 2H), 2.25 – 2.16 (m, 2H), 2.15 – 1.98 (m, 7H), 1.97 – 1.80 (m, 4H), 1.58 – 1.37 (m, 3H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 211.5, 211.3, 145.1, 144.9, 128.9, 128.8, 127.2, 127.1, 121.8, 121.7, 115.8, 115.7, 111.9, 111.5, 63.9, 63.5, 46.0, 44.4, 41.9, 41.8, 41.4, 41.3, 41.2, 41.0, 29.3, 27.3, 25.4, 25.1, 23.9, 23.7, 22.7, 22.2. **HRMS (ESI)** calculated for $C_{16}H_{22}NO$ $(M+H)^+$: 244.1696, found: 244.1699.

4,4-dimethyl-3-((methyl(phenyl)amino)methyl)cyclohexan-1-one (4b)



Colorless oil. 81% yield (59.5 mg), R_f=0.4(petroleum ether/ethyl acetate 10:1). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.24 (t, *J* = 8.0 Hz, 2H), 6.74 – 6.68 (m, 3H), 3.65 (dd, *J* = 14.6, 3.6 Hz, 1H), 3.05 (dd, *J* = 14.6, 10.6 Hz, 1H), 2.94 (s, 3H), 2.54 – 2.37 (m, 2H), 2.37 – 2.16 (m, 2H), 2.13 – 2.08 (m, 1H), 1.77 – 1.63 (m, 2H), 1.21 (s, 3H), 1.15 (s, 3H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 211.3, 149.2, 129.2, 116.3, 112.1, 54.3, 44.6, 41.9, 40.6, 39.9, 38.2, 32.3, 28.7, 19.7. **HRMS (ESI)** calculated for $C_{16}H_{24}NO$ $(M+H)^+$: 246.1853, found: 246.1857.

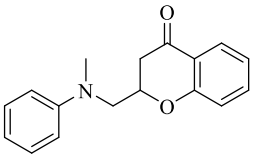
4-((methyl(phenyl)amino)methyl)tetrahydro-2H-pyran-2-one (4c)



Colorless oil. 75% yield (49.3 mg), R_f=0.5(petroleum ether/ethyl acetate 2:1). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.36 – 7.21 (m, 2H), 6.86 – 6.67 (m, 3H), 4.47 (ddd, *J* = 11.2, 4.8, 3.6 Hz, 1H), 4.27 (td, *J* = 11.2, 3.6 Hz, 1H), 3.40 – 3.21 (m, 2H), 3.01 (s,

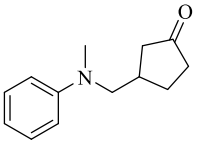
3H), 2.76 – 2.67 (m, 1H), 2.52 – 2.48 (m, 1H), 2.29 – 2.22 (m, 1H), 2.09 – 1.95 (m, 1H), 1.66 – 1.60 (m, 1H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 170.7, 149.1, 129.4, 117.0, 112.4, 68.4, 58.1, 39.8, 34.2, 30.8, 27.1. These spectroscopic data correspond to reported data.[5]

2-((methyl(phenyl)amino)methyl)chroman-4-one (4d)



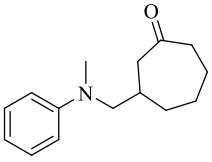
Colorless oil, 52% yield (41.6 mg), R_f=0.3(petroleum ether/ethyl acetate 5:1). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.90 (dd, *J* = 8.0, 1.8 Hz, 1H), 7.49 (ddd, *J* = 8.8, 7.2, 1.8 Hz, 1H), 7.32 – 7.22 (m, 2H), 7.04 (t, *J* = 7.4 Hz, 1H), 6.99 (d, *J* = 8.4 Hz, 1H), 6.84 – 6.70 (m, 3H), 4.82 – 4.75 (m, 1H), 3.75 (qd, *J* = 15.6, 5.6 Hz, 2H), 3.12 (s, 3H), 2.86 – 2.71 (m, 2H). **^{13}C NMR** (100MHz, $CDCl_3$) δ 191.7, 161.2, 148.8, 136.1, 129.3, 126.9, 121.5, 120.9, 118.0, 117.1, 112.3, 76.3, 56.5, 40.9, 39.9. These spectroscopic data correspond to reported data.[5]

3-((methyl(phenyl)amino)methyl)cyclopentan-1-one (4e)



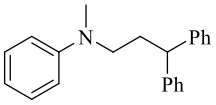
Yellow oil, 82% yield (49.9 mg), R_f=0.4(petroleum ether/ethyl acetate 10:1). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.28 – 7.25 (m, 2H), 6.74 (d, *J* = 7.2 Hz, 3H), 3.42 (d, *J* = 7.2 Hz, 2H), 3.01 (s, 3H), 2.75 – 2.57 (m, 1H), 2.47 – 2.26 (m, 2H), 2.24 – 2.13 (m, 2H), 2.00 – 1.93 (m, 1H), 1.70 – 1.62 (m, 1H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 218.6, 149.2, 129.3, 116.6, 112.2, 57.3, 43.4, 39.5, 38.1, 36.0, 27.6. These spectroscopic data correspond to reported data.[5]

3-((methyl(phenyl)amino)methyl)cycloheptan-1-one (4f)



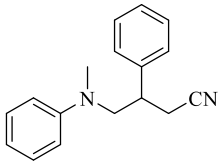
Yellow oil, 69% yield (47.8 mg), R_f=0.4(petroleum ether/ethyl acetate 10:1). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.23 (t, *J* = 8.0 Hz, 2H), 6.70 (t, *J* = 9.0 Hz, 3H), 3.17 (d, *J* = 7.6 Hz, 2H), 2.95 (s, 3H), 2.57 – 2.46 (m, 3H), 2.42 – 2.36 (m, 1H), 2.16 – 2.08 (m, 1H), 2.05 – 1.87 (m, 3H), 1.67 – 1.60 (m, 1H), 1.44 – 1.32 (m, 1H), 1.27 – 1.18 (m, 1H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 213.8, 149.4, 129.2, 116.3, 112.1, 59.3, 47.6, 43.9, 39.5, 35.4, 34.5, 28.7, 24.5. **HRMS (ESI)** calculated for $C_{15}H_{22}NO$ $(M+H)^+$: 232.1696, found: 232.1699.

***N*-(3,3-diphenylpropyl)-N-methylaniline (4g)**



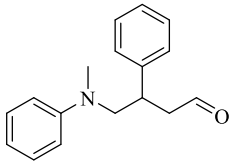
Yellow oil, 42% yield (37.9 mg), R_f=0.6(petroleum ether/ethyl acetate 50:1). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.38 – 7.27 (m, 8H), 7.25 – 7.20 (m, 4H), 6.72 (d, *J* = 5.6 Hz, 1H), 6.62 (d, *J* = 6.4 Hz, 2H), 3.97 (t, *J* = 7.8 Hz, 1H), 3.39 – 3.25 (m, 2H), 2.91 (s, 3H), 2.36 (dd, *J* = 15.0, 7.8 Hz, 2H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 149.1, 144.5, 129.2, 128.6, 127.7, 126.4, 116.1, 112.3, 51.3, 49.0, 38.3, 32.1. These spectroscopic data correspond to reported data.[6]

4-(methyl(phenyl)amino)-3-phenylbutanenitrile (4h)



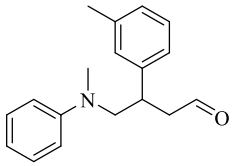
Yellow oil. 58% yield (43.5 mg), R_f=0.4(petroleum ether/ethyl acetate 15:1). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.40 – 7.36 (m, 2H), 7.35 –7.31 (m, 1H), 7.31 – 7.21 (m, 4H), 6.78 (t, *J* = 7.4 Hz, 1H), 6.65 – 6.56 (m, 2H), 3.69 (dd, *J* = 15.0, 5.8 Hz, 1H), 3.58 (dd, *J* = 15.0, 8.6 Hz, 1H), 3.26 – 3.14 (m, 1H), 3.11 (s, 3H), 3.00 – 2.88 (m, 2H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 147.9, 136.4, 129.4, 128.9, 128.9, 127.5, 121.2, 117.5, 112.3, 54.7, 39.7, 36.2, 32.2. These spectroscopic data correspond to reported data.[7]

4-(methyl(phenyl)amino)-3-phenylbutanal (4i)



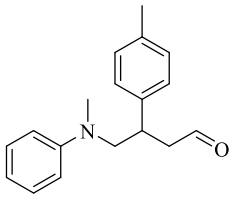
Yellow oil. 41% yield (31.1 mg), R_f=0.3(petroleum ether/ethyl acetate 25:1). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 9.59 (t, *J* = 2.0 Hz, 1H), 7.36 (t, *J* = 7.8 Hz, 2H), 7.31 – 7.25 (m, 5H), 6.78 (d, *J* = 6.4 Hz, 3H), 3.85 – 3.69 (m, 1H), 3.55 (dd, *J* = 14.6, 8.4 Hz, 1H), 3.45 (dd, *J* = 14.6, 6.8 Hz, 1H), 2.83 (t, *J* = 8.4 Hz, 2H), 2.77 (s, 3H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 200.6, 148.9, 141.5, 129.3, 128.8, 127.6, 127.1, 116.9, 112.6, 59.8, 47.5, 39.9, 39.1. These spectroscopic data correspond to reported data.[8]

4-(methyl(phenyl)amino)-3-(*m*-tolyl)butanal (4j)



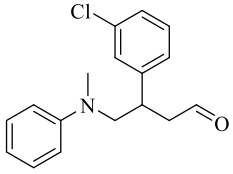
Yellow oil. 42% yield (33.6 mg), R_f=0.4(petroleum ether/ethyl acetate 25:1). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 9.57 (t, *J* = 2.0 Hz, 1H), 7.36 – 7.20 (m, 3H), 7.11 – 7.06 (m, 3H), 6.83 – 6.65 (m, 3H), 3.81 – 3.67 (m, 1H), 3.49 (qd, *J* = 14.6, 7.8 Hz, 2H), 2.90 – 2.71 (m, 5H), 2.38 (s, 3H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 200.8, 149.1, 141.5, 138.5, 129.3, 128.7, 128.4, 127.9, 124.6, 116.9, 112.5, 59.7, 47.6, 39.9, 39.2, 21.5. **HRMS (ESI)** calculated for $C_{18}H_{22}NO$ $(M+H)^+$: 268.1696, found: 268.1698.

4-(methyl(phenyl)amino)-3-(*p*-tolyl)butanal (4k)



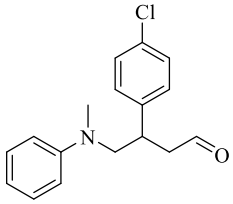
Yellow oil. 45% yield (36.0 mg), R_f=0.4(petroleum ether/ethyl acetate 25:1). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 9.57 (t, *J* = 1.8 Hz, 1H), 7.31 – 7.27 (m, 2H), 7.22 – 7.10 (m, 4H), 6.79 (s, 3H), 3.83 – 3.65 (m, 1H), 3.48 (qd, *J* = 14.6, 7.8 Hz, 2H), 2.89 – 2.67 (m, 5H), 2.36 (s, 3H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 200.7, 148.9, 138.4, 136.8, 129.5, 129.3, 127.4, 117.0, 112.6, 59.8, 47.6, 40.0, 38.7, 21.1. **HRMS (ESI)** calculated for $C_{18}H_{22}NO$ $(M+H)^+$: 268.1696, found: 268.1699.

3-(3-chlorophenyl)-4-(methyl(phenyl)amino)butanal (4l)



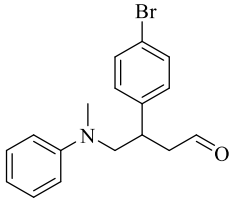
Yellow oil. 38% yield (32.7 mg), R_f=0.3(petroleum ether/ethyl acetate 25:1). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 9.61 (t, *J* = 1.8 Hz, 1H), 7.44 – 7.18 (m, 5H), 7.14 – 7.12 (m, 1H), 6.80 – 6.75 (m, 3H), 3.82 – 3.64 (m, 1H), 3.54 (dd, *J* = 14.6, 8.4 Hz, 1H), 3.42 (dd, *J* = 14.6, 6.8 Hz, 1H), 2.84 – 2.79 (m, 2H), 2.77 (s, 3H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 199.9, 148.9, 143.8, 134.6, 130.1, 129.3, 127.7, 127.3, 125.9, 117.2, 112.6, 59.5, 47.3, 39.9, 38.8. **HRMS (ESI)** calculated for $C_{17}H_{19}ClNO$ $(M+H)^+$: 288.1150, found: 288.1154.

3-(4-chlorophenyl)-4-(methyl(phenyl)amino)butanal (4m)



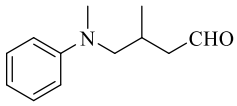
Yellow oil. 44% yield (37.9 mg), R_f=0.3(petroleum ether/ethyl acetate 25:1). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 9.61 (t, *J* = 1.8 Hz, 1H), 7.34 – 7.24 (m, 4H), 7.23 – 7.11 (m, 2H), 6.77 (dd, *J* = 15.2, 7.8 Hz, 3H), 3.84 – 3.67 (m, 1H), 3.55 (dd, *J* = 14.8, 8.0 Hz, 1H), 3.38 (dd, *J* = 14.6, 7.2 Hz, 1H), 2.92 – 2.77 (m, 2H), 2.76 – 2.68 (m, 3H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 200.1, 148.8, 140.1, 132.9, 129.3, 129.0, 128.9, 117.1, 112.5, 59.6, 47.4, 39.9, 38.3. **HRMS (ESI)** calculated for $C_{17}H_{19}ClNO$ $(M+H)^+$: 288.1150, found: 288.1153.

3-(4-bromophenyl)-4-(methyl(phenyl)amino)butanal (4n)



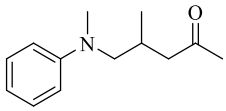
Yellow oil. 40% yield (39.8 mg), R_f=0.3(petroleum ether/ethyl acetate 25:1). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 9.61 (t, *J* = 1.8 Hz, 1H), 7.52 – 7.43 (m, 2H), 7.28 (t, *J* = 8.0 Hz, 2H), 7.19 – 7.08 (m, 2H), 6.80 – 6.73 (m, 3H), 3.81 – 3.67 (m, 1H), 3.55 (dd, *J* = 14.6, 8.2 Hz, 1H), 3.38 (dd, *J* = 14.6, 7.2 Hz, 1H), 2.84 – 2.78 (m, 2H), 2.74 (s, 3H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 200.1, 148.8, 140.7, 131.9, 129.4, 129.3, 120.9, 117.1, 112.5, 59.5, 47.3, 39.9, 38.4. **HRMS (ESI)** calculated for $C_{17}H_{19}BrNO$ $(M+H)^+$: 332.0645, found: 332.0648.

3-methyl-4-(methyl(phenyl)amino)butanal (4o)



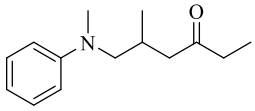
Yellow oil. 68% yield (39.0 mg), R_f=0.6(petroleum ether/ethyl acetate 10:1). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 9.61 (t, *J* = 2.2 Hz, 1H), 7.24 (t, *J* = 8.0 Hz, 2H), 6.72 (d, *J* = 7.2 Hz, 3H), 3.21 (dd, *J* = 14.4, 6.8 Hz, 1H), 3.10 (dd, *J* = 14.4, 8.6 Hz, 1H), 2.90 (s, 3H), 2.67 – 2.58 (m, 1H), 2.48 – 2.42 (m, 1H), 2.32 – 2.25 (m, 1H), 1.01 (d, *J* = 6.8 Hz, 3H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 201.7, 149.5, 129.2, 116.8, 112.5, 59.5, 49.2, 39.7, 28.2, 17.9. These spectroscopic data correspond to reported data.[8]

4-methyl-5-(methyl(phenyl)amino)pentan-2-one (4p)



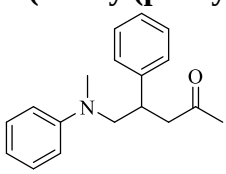
Yellow oil. 86% yield (52.9 mg), R_f=0.6(petroleum ether/ethyl acetate 10:1). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.25 (t, *J* = 8.6 Hz, 2H), 6.88 – 6.51 (m, 3H), 3.27 – 3.20 (m, 1H), 3.09 (dd, *J* = 14.4, 6.8 Hz, 1H), 2.93 (s, 3H), 2.56 – 2.49 (m, 2H), 2.37 – 2.22 (m, 1H), 2.09 (s, 3H), 0.98 (d, *J* = 6.8 Hz, 3H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 208.2, 149.7, 129.2, 116.3, 112.2, 59.0, 48.6, 39.2, 30.4, 28.8, 18.0. These spectroscopic data correspond to reported data.[9]

5-methyl-6-(methyl(phenyl)amino)hexan-3-one (4q)



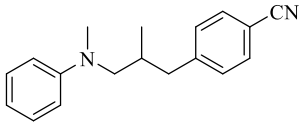
Yellow oil. 82% yield (53.9 mg), R_f=0.6(petroleum ether/ethyl acetate 25:1). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.23 (t, *J* = 8.0 Hz, 2H), 6.79 – 6.60 (m, 3H), 3.31 – 3.17 (m, 1H), 3.10 – 3.00 (m, 1H), 2.91 (s, 3H), 2.56 – 2.46 (m, 1H), 2.35 (q, *J* = 7.2 Hz, 2H), 2.26 (dd, *J* = 16.0, 7.2 Hz, 1H), 1.04 – 0.99 (m, 4H), 0.95 (d, *J* = 6.6 Hz, 3H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 210.9, 149.7, 129.2, 116.2, 112.2, 59.0, 47.3, 39.2, 36.4, 28.8, 18.1, 7.7. **HRMS (ESI)** calculated for $C_{14}H_{22}NO$ $(M+H)^+$: 220.1696, found: 220.1699.

5-(methyl(phenyl)amino)-4-phenylpentan-2-one (4r)



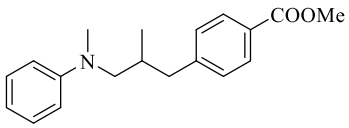
Yellow oil. 61% yield (48.9 mg), R_f=0.5(petroleum ether/ethyl acetate 20:1. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.42 – 7.19 (m, 7H), 6.78 – 6.72 (m, 3H), 3.72 – 3.65 (m, 2H), 3.37 – 3.23 (m, 1H), 2.93 – 2.79 (m, 2H), 2.70 (s, 3H), 2.04 (s, 3H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 207.2, 149.2, 142.5, 129.2, 128.7, 127.7, 126.9, 116.4, 112.2, 59.3, 47.2, 39.8, 39.3, 30.5. These spectroscopic data correspond to reported data.[5]

4-(2-methyl-3-(methyl(phenyl)amino)propyl)benzonitrile (4u)



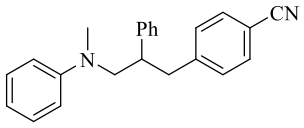
Yellow oil. 67% yield (53.1 mg), R_f=0.5(petroleum ether/ethyl acetate 25:1. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.59 (d, *J* = 8.4 Hz, 2H), 7.28 – 7.23(m, 4H), 6.72 – 6.68 (m, 3H), 3.29 (dd, *J* = 14.6, 7.2 Hz, 1H), 3.17 (dd, *J* = 14.6, 7.2 Hz, 1H), 2.99 (s, 3H), 2.88 (dd, *J* = 13.2, 4.6 Hz, 1H), 2.42 (dd, *J* = 13.2, 9.2 Hz, 1H), 2.28 – 2.21 (m, 1H), 0.90 (d, *J* = 6.6 Hz, 3H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 149.5, 146.6, 132.1, 129.8, 129.2, 119.1, 116.2, 112.1, 109.8, 59.4, 41.4, 39.6, 34.4, 17.6. **HRMS (ESI)** calculated for $C_{18}H_{21}N_2$ $(M+H)^+$: 265.1699, found: 265.1695.

methyl 4-(2-methyl-3-(methyl(phenyl)amino)propyl)benzoate (4v)



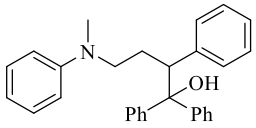
Colourless oil. 57% yield (50.8 mg), R_f=0.6(petroleum ether/ethyl acetate 25:1. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.98 (d, *J* = 8.2 Hz, 2H), 7.25 (t, *J* = 7.4 Hz, 4H), 6.72 – 6.66 (m, 3H), 3.93 (s, 3H), 3.31 (dd, *J* = 14.6, 6.8 Hz, 1H), 3.15 (dd, *J* = 14.6, 7.8 Hz, 1H), 2.99 (s, 3H), 2.85 (dd, *J* = 13.0, 4.8 Hz, 1H), 2.44 (dd, *J* = 13.2, 9.0 Hz, 1H), 2.34 – 2.18 (m, 1H), 0.90 (d, *J* = 6.6 Hz, 3H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 167.2, 149.5, 146.5, 129.6, 129.2, 129.1, 127.9, 116.0, 112.0, 59.4, 52.0, 41.4, 39.6, 34.4, 17.7. **HRMS (ESI)** calculated for $C_{19}H_{24}NO_2$ $(M+H)^+$: 298.1802, found: 298.1805.

4-(3-(methyl(phenyl)amino)-2-phenylpropyl)benzonitrile (4y)



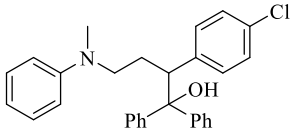
Yellow oil. 70% yield (68.5 mg), R_f=0.4(petroleum ether/ethyl acetate 50:1). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.47 (d, *J* = 8.2 Hz, 2H), 7.29 – 7.27 (m, 2H), 7.27 – 7.24 (m, 3H), 7.16 – 7.08 (m, 4H), 6.75 (t, *J* = 7.0 Hz, 1H), 6.64 (d, *J* = 6.8 Hz, 2H), 3.74 (dd, *J* = 14.6, 7.0 Hz, 1H), 3.49 (dd, *J* = 14.6, 7.2 Hz, 1H), 3.36 – 3.28 (m,1H), 3.18 (dd, *J* = 13.6, 5.4 Hz, 1H), 2.99 (dd, *J* = 13.6, 9.6 Hz, 1H), 2.77 (s, 3H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 148.8, 145.9, 141.9, 131.9, 129.8, 129.3, 128.6, 127.9, 126.9, 119.1, 116.4, 112.0, 109.8, 59.3, 46.2, 40.1, 39.7. **HRMS (ESI)** calculated for $C_{23}H_{23}N_2$ $(M+H)^+$: 327.1856, found: 327.1855.

4-(methyl(phenyl)amino)-1,1,2-triphenylbutan-1-ol (4aa)



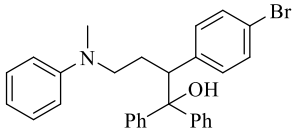
Colourless oil. 42% yield (51.2 mg), R_f=0.5(petroleum ether/ethyl acetate 25:1). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.56 (d, *J* = 7.2 Hz, 2H), 7.32 (t, *J* = 7.8 Hz, 2H), 7.28 – 7.25 (m, 1H), 7.23 – 7.14 (m, 9H), 7.10 (t, *J* = 7.4 Hz, 2H), 7.05 (d, *J* = 7.2 Hz, 1H), 6.72 (t, *J* = 7.2 Hz, 1H), 6.58 (d, *J* = 7.8 Hz, 2H), 3.81 (d, *J* = 11.4 Hz, 1H), 3.18 (dd, *J* = 7.8, 6.4 Hz, 2H), 2.81 (s, 3H), 2.55 (s, 1H), 2.29 – 2.14 (m, 1H), 2.12 – 2.04 (m, 1H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 149.3, 146.1, 145.7, 139.4, 130.2, 129.1, 128.2, 127.9, 127.6, 126.8, 126.7, 126.3, 126.2, 125.7, 116.3, 112.5, 80.9, 51.7, 51.3, 38.6, 27.6. **HRMS (ESI)** calculated for $C_{29}H_{30}NO$ $(M+H)^+$: 408.2322, found: 408.2325.

2-(4-chlorophenyl)-4-(methyl(phenyl)amino)-1,1-diphenylbutan-1-ol (4ab)



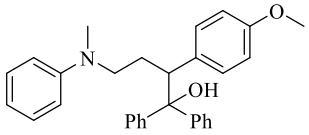
Colourless oil. 59% yield (78.1 mg), R_f=0.4(petroleum ether/ethyl acetate 25:1). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.51 (d, *J* = 7.4 Hz, 2H), 7.32 (t, *J* = 7.8 Hz, 2H), 7.25 – 7.24 (m, 1H), 7.24 – 7.18 (m, 2H), 7.18 – 7.12 (m, 4H), 7.09 (t, *J* = 7.8 Hz, 4H), 7.06 – 7.01 (m, 1H), 6.74 (s, 1H), 6.58 (s, 2H), 3.77 (d, *J* = 10.6 Hz, 1H), 3.16 (t, *J* = 7.8 Hz, 2H), 2.80 (s, 3H), 2.50 (s, 1H), 2.28 – 2.16 (m, 1H), 2.10 – 1.93 (m, 1H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 149.2, 145.7, 145.6, 138.2, 132.4, 131.5, 129.1, 128.3, 127.9, 127.7, 127.0, 126.4, 126.2, 125.6, 116.5, 112.5, 80.9, 51.1, 38.7, 27.8. **HRMS (ESI)** calculated for $C_{29}H_{29}ClNO$ $(M+H)^+$: 442.1932, found: 442.1935.

2-(4-bromophenyl)-4-(methyl(phenyl)amino)-1,1-diphenylbutan-1-ol (4ac)



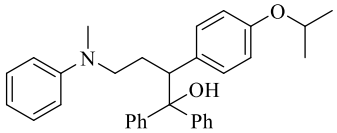
Colourless oil. 52% yield (75.8 mg), R_f=0.4(petroleum ether/ethyl acetate 25:1). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.51 (d, *J* = 7.6 Hz, 2H), 7.37 – 7.29 (m, 4H), 7.26 (d, *J* = 7.2 Hz, 1H), 7.21 (d, *J* = 7.8 Hz, 2H), 7.18 – 7.13 (m, 2H), 7.10 (t, *J* = 7.4 Hz, 2H), 7.04 (t, *J* = 7.6 Hz, 3H), 6.80 – 6.68 (m, 1H), 6.59 (s, 2H), 3.75 (d, *J* = 9.8 Hz, 1H), 3.16 (t, *J* = 7.8 Hz, 2H), 2.80 (s, 3H), 2.50 (s, 1H), 2.29 – 2.14 (m, 1H), 2.04 – 1.96 (m, 1H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 149.2, 145.7, 145.6, 138.8, 131.9, 130.8, 129.2, 128.3, 127.8, 127.0, 126.4, 126.2, 125.6, 120.6, 116.5, 112.6, 80.8, 51.2, 51.1, 38.8, 27.8. **HRMS (ESI)** calculated for $C_{29}H_{29}BrNO$ $(M+H)^+$: 486.1427, found: 486.1425.

2-(4-methoxyphenyl)-4-(methyl(phenyl)amino)-1,1-diphenylbutan-1-ol (4ad)



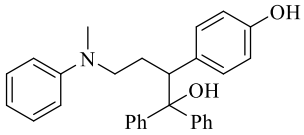
Colourless oil. 32% yield (41.9 mg), R_f=0.4(petroleum ether/ethyl acetate 15:1). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.53 (d, *J* = 7.4 Hz, 2H), 7.32 (t, *J* = 7.4 Hz, 2H), 7.25 (d, *J* = 7.2 Hz, 1H), 7.22 – 7.17 (m, 4H), 7.12 (t, *J* = 7.8 Hz, 2H), 7.06 (d, *J* = 8.6 Hz, 3H), 6.78 – 6.67 (m, 3H), 6.58 (d, *J* = 6.2 Hz, 2H), 3.81 – 3.75 (m, 4H), 3.17 (t, *J* = 7.8 Hz, 2H), 2.80 (s, 3H), 2.51 (s, 1H), 2.25 – 2.13 (m, 1H), 2.06 – 1.93 (m, 1H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 158.3, 149.3, 146.2, 145.7, 131.2, 131.1, 129.1, 128.2, 127.7, 126.8, 126.3, 126.2, 125.8, 116.2, 113.3, 112.5, 80.9, 55.2, 51.2, 50.8, 38.6, 27.7. **HRMS (ESI)** calculated for $C_{30}H_{32}NO_2$ $(M+H)^+$: 438.2428, found: 438.2431.

2-(4-isopropoxyphenyl)-4-(methyl(phenyl)amino)-1,1-diphenylbutan-1-ol (4ae)



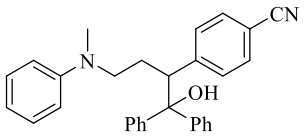
Colourless oil. 33% yield (46.0 mg), R_f=0.5 (petroleum ether/ethyl acetate 15:1). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.53 (d, *J* = 7.2 Hz, 2H), 7.31 (t, *J* = 7.5 Hz, 2H), 7.25 (d, *J* = 7.4 Hz, 1H), 7.23 – 7.16 (m, 4H), 7.11 (t, *J* = 7.4 Hz, 2H), 7.07 – 7.00 (m, 3H), 6.78 – 6.68 (m, 3H), 6.58 (s, 2H), 4.51 (dt, *J* = 12.0, 6.0 Hz, 1H), 3.75 (d, *J* = 11.0 Hz, 1H), 3.18 (dd, *J* = 8.0, 6.2 Hz, 2H), 2.80 (s, 3H), 2.51 (s, 1H), 2.26 – 2.11 (m, 1H), 2.08 – 1.92 (m, 1H), 1.34 (d, *J* = 4.6 Hz, 3H), 1.33 (d, *J* = 4.6 Hz, 3H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 156.6, 149.3, 146.3, 145.6, 131.1, 130.9, 129.1, 128.2, 127.6, 126.8, 126.3, 126.2, 125.8, 116.2, 115.4, 112.4, 80.9, 69.8, 51.2, 50.8, 38.6, 27.6, 22.1, 22.0. **HRMS (ESI)** calculated for $C_{32}H_{36}NO_2$ $(M+H)^+$: 466.2741, found: 466.2745.

4-(1-hydroxy-4-(methyl(phenyl)amino)-1,1-diphenylbutan-2-yl)phenol (4af)



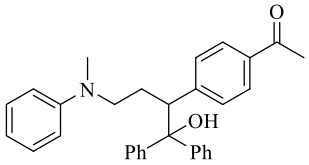
Colourless oil. 39% yield (49.5 mg), R_f=0.3 (petroleum ether/ethyl acetate 5:1). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.52 (d, *J* = 7.4 Hz, 2H), 7.31 (t, *J* = 7.4 Hz, 2H), 7.27 – 7.16 (m, 5H), 7.11 (t, *J* = 7.4 Hz, 2H), 7.05 (d, *J* = 8.0 Hz, 1H), 7.00 (d, *J* = 8.4 Hz, 2H), 6.73 (s, 1H), 6.65 (d, *J* = 8.4 Hz, 2H), 6.61 (s, 2H), 5.03 (s, 1H), 3.75 (d, *J* = 11.0 Hz, 1H), 3.17 (t, *J* = 7.8 Hz, 2H), 2.80 (s, 3H), 2.53 (s, 1H), 2.25 – 2.13 (m, 1H), 2.06 – 1.93 (m, 1H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 154.3, 149.1, 146.1, 145.6, 131.3, 131.2, 129.1, 128.2, 127.7, 126.8, 126.3, 126.2, 125.8, 116.4, 114.8, 112.6, 81.0, 51.3, 50.8, 38.7, 27.6. **HRMS (ESI)** calculated for $C_{29}H_{30}NO_2$ $(M+H)^+$: 424.2271, found: 424.2275.

4-(1-hydroxy-4-(methyl(phenyl)amino)-1,1-diphenylbutan-2-yl)benzonitrile (4ag)



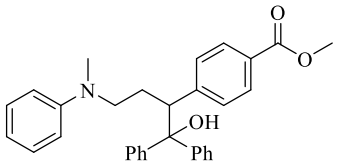
Yellow oil. 37% yield (47.9 mg), R_f=0.4 (petroleum ether/ethyl acetate 10:1). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.51 (d, *J* = 7.4 Hz, 2H), 7.44 (d, *J* = 8.2 Hz, 2H), 7.34 (t, *J* = 7.4 Hz, 2H), 7.29 – 7.25(m, 3H), 7.21 (t, *J* = 7.8 Hz, 2H), 7.13 – 7.01 (m, 5H), 6.75 (s, 1H), 6.58 (s, 2H), 3.82 (d, *J* = 11.0 Hz, 1H), 3.16 (t, *J* = 6.8 Hz, 2H), 2.80 (s, 3H), 2.60 (s, 1H), 2.31 – 2.24 (m, 1H), 2.12 – 1.99 (m, 1H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 149.0, 145.9, 145.4, 145.3, 131.3, 131.0, 129.2, 128.5, 127.8, 127.3, 126.5, 126.2, 125.5, 119.1, 116.8, 112.7, 110.3, 80.9, 51.9, 50.9, 38.9, 27.8. **HRMS (ESI)** calculated for $C_{30}H_{29}N_2O$ $(M+H)^+$: 433.2275, found: 433.2271.

1-(4-(1-hydroxy-4-(methyl(phenyl)amino)-1,1-diphenylbutan-2-yl)phenyl)ethan-1-one (4ah)



Colourless oil. 39% yield (52.5 mg), R_f=0.5 (petroleum ether/ethyl acetate 5:1). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.77 (d, *J* = 8.4 Hz, 2H), 7.53 (d, *J* = 7.4 Hz, 2H), 7.33 (t, *J* = 7.4 Hz, 2H), 7.30 – 7.25 (m, 3H), 7.20 (t, *J* = 7.8 Hz, 2H), 7.16 (d, *J* = 7.2 Hz, 2H), 7.07 (t, *J* = 7.4 Hz, 2H), 7.02 – 6.99 (m, 1H), 6.75 (s, 1H), 6.60 (s, 2H), 3.87 (d, *J* = 12.2 Hz, 1H), 3.15 (t, *J* = 7.8 Hz, 2H), 2.80 (s, 3H), 2.64 (s, 1H), 2.57 (s, 3H), 2.31 – 2.19 (m, 1H), 2.14 – 2.06 (m, 1H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 198.1, 149.1, 145.9, 145.6, 135.5, 130.5, 129.2, 128.4, 127.8, 127.7, 127.1, 126.4, 126.2, 125.6, 122.4, 116.6, 112.6, 80.9, 51.8, 51.1, 38.8, 27.8, 26.6. **HRMS (ESI)** calculated for $C_{31}H_{32}NO_2$ $(M+H)^+$: 450.2428, found: 450.2432.

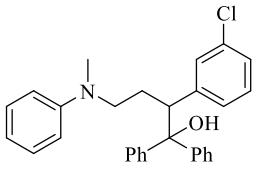
methyl 4-(1-hydroxy-4-(methyl(phenyl)amino)-1,1-diphenylbutan-2-yl)benzoate (4ai)



Colourless oil. 41% yield (57.1 mg), R_f=0.3 (petroleum ether/ethyl acetate 10:1). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.87 (d, *J* = 8.4 Hz, 2H), 7.54 (d, *J* = 7.4 Hz, 2H), 7.34 (t, *J* = 7.4 Hz, 2H), 7.30 – 7.25 (m, 3H), 7.25 – 7.18 (m, 2H), 7.18 – 7.13 (m, 2H), 7.07 (t, *J* = 7.4 Hz, 2H), 7.03 (d, *J* = 7.0 Hz, 1H), 6.74 (t, *J* = 7.0 Hz, 1H), 6.58 (d, *J* = 7.6 Hz, 2H), 3.91 (s, 3H), 3.86 (d, *J* = 10.6 Hz, 1H), 3.16 (t, *J* = 7.0 Hz, 2H), 2.80 (s, 3H), 2.63 (s, 1H), 2.30 – 2.22 (m, 1H), 2.14 – 2.06 (m, 1H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 167.2, 149.2, 145.7, 145.6, 145.6, 130.3, 129.2, 128.9, 128.4, 128.3, 127.7, 127.1,

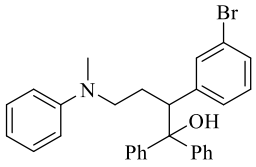
126.4, 126.2, 125.6, 116.5, 112.6, 80.9, 52.1, 51.8, 51.1, 38.8, 27.8. **HRMS (ESI)** calculated for $C_{31}H_{32}NO_3$ $(M+H)^+$: 466.2377, found: 466.2381.

2-(3-chlorophenyl)-4-(methyl(phenyl)amino)-1,1-diphenylbutan-1-ol (4aj)



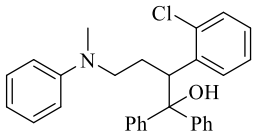
Colourless oil. 53% yield (70.1 mg), R_f=0.4 (petroleum ether/ethyl acetate 25:1). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.51 (d, *J* = 7.4 Hz, 2H), 7.38 – 7.25 (m, 5H), 7.25 – 7.19 (m, 2H), 7.17 – 7.08 (m, 4H), 7.07 – 7.00 (m, 3H), 6.74 (s, 1H), 6.59 (s, 2H), 3.74 (d, *J* = 11.2 Hz, 1H), 3.17 (dd, *J* = 8.0, 6.2 Hz, 2H), 2.81 (s, 3H), 2.52 (s, 1H), 2.27 – 2.13 (m, 1H), 2.09 – 1.92 (m, 1H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 149.1, 145.6, 145.5, 142.2, 133.2, 129.7, 129.2, 129.1, 129.0, 128.4, 127.7, 127.1, 126.4, 126.2, 125.6, 121.9, 116.5, 112.6, 80.9, 51.5, 51.0, 38.8, 27.7. **HRMS (ESI)** calculated for $C_{29}H_{29}ClNO$ $(M+H)^+$: 442.1932, found: 442.1930.

2-(3-bromophenyl)-4-(methyl(phenyl)amino)-1,1-diphenylbutan-1-ol (4ak)



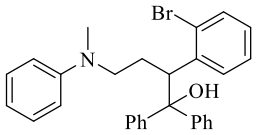
Colourless oil. 47% yield (68.5 mg), R_f=0.4 (petroleum ether/ethyl acetate 25:1). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.51 (d, *J* = 7.4 Hz, 2H), 7.32 (t, *J* = 7.4 Hz, 2H), 7.29 – 7.18 (m, 4H), 7.15 (d, *J* = 7.2 Hz, 3H), 7.13 – 7.07 (m, 3H), 7.06 – 6.98 (m, 2H), 6.75 (s, 1H), 6.60 (s, 2H), 3.75 (d, *J* = 11.0 Hz, 1H), 3.17 (t, *J* = 7.8 Hz, 2H), 2.82 (s, 3H), 2.53 (s, 1H), 2.26 – 2.17 (m, 1H), 2.06 – 1.92 (m, 1H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 149.1, 145.6, 145.5, 141.9, 133.6, 130.2, 129.2, 128.9, 128.6, 128.4, 127.7, 127.0, 126.8, 126.4, 126.2, 125.6, 116.5, 112.6, 80.9, 51.5, 51.1, 38.8, 27.7. **HRMS (ESI)** calculated for $C_{29}H_{29}BrNO$ $(M+H)^+$: 486.1427, found: 486.1429.

2-(2-chlorophenyl)-4-(methyl(phenyl)amino)-1,1-diphenylbutan-1-ol (4al)



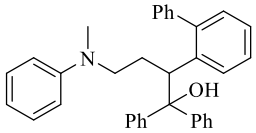
Colourless oil. 46% yield (60.8 mg), R_f=0.4 (petroleum ether/ethyl acetate 25:1). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.79 (d, *J* = 7.8 Hz, 1H), 7.61 (d, *J* = 7.4 Hz, 2H), 7.38 (t, *J* = 7.6 Hz, 2H), 7.30 (d, *J* = 7.2 Hz, 1H), 7.24 – 7.16 (m, 6H), 7.14 – 7.10 (m, 1H), 7.09 – 7.02 (m, 3H), 6.73 (t, *J* = 7.0 Hz, 1H), 6.57 (d, *J* = 7.0 Hz, 2H), 4.60 (dd, *J* = 11.0, 2.6 Hz, 1H), 3.31 – 3.23 (m, 1H), 3.15 – 3.08 (m, 1H), 2.92 (s, 1H), 2.80 (s, 3H), 2.26 – 2.12 (m, 1H), 2.08 – 1.94 (m, 1H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 148.8, 146.3, 145.4, 138.4, 135.7, 130.4, 129.1, 128.9, 128.4, 127.8, 127.4, 127.1, 126.6, 126.4, 126.3, 125.9, 116.8, 112.9, 81.3, 50.9, 45.7, 39.1, 28.6. **HRMS (ESI)** calculated for $C_{29}H_{29}ClNO$ $(M+H)^+$: 442.1932, found: 442.1936.

2-(2-bromophenyl)-4-(methyl(phenyl)amino)-1,1-diphenylbutan-1-ol (4am)



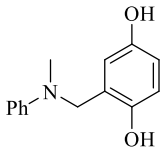
Colourless oil. 42% yield (61.2 mg), R_f=0.4 (petroleum ether/ethyl acetate 25:1). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.79 (dd, *J* = 8.0, 1.2 Hz, 1H), 7.62 (d, *J* = 7.6 Hz, 2H), 7.40 (t, *J* = 8.0 Hz, 3H), 7.31 (d, *J* = 7.2 Hz, 1H), 7.25 (dd, *J* = 8.6, 7.2 Hz, 3H), 7.18 (t, *J* = 7.8 Hz, 2H), 7.10 – 7.01 (m, 4H), 6.72 (s, 1H), 6.56 (s, 2H), 4.58 (dd, *J* = 10.8, 2.6 Hz, 1H), 3.38 – 3.25 (m, 1H), 3.14 – 3.06 (m, 1H), 2.94 (s, 1H), 2.79 (s, 3H), 2.20 – 2.14 (m, 1H), 2.09 – 1.94 (m, 1H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 148.8, 146.4, 145.3, 140.1, 132.4, 130.6, 129.1, 128.4, 128.1, 127.5, 127.4, 127.2, 127.1, 126.4, 126.3, 126.1, 116.8, 112.9, 81.4, 50.9, 48.7, 39.1, 28.8. **HRMS (ESI)** calculated for $C_{29}H_{29}BrNO$ $(M+H)^+$: 486.1427, found: 486.1426.

2-([1,1'-biphenyl]-2-yl)-4-(methyl(phenyl)amino)-1,1-diphenylbutan-1-ol (4an)



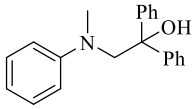
Colourless oil. 25% yield (36.2 mg), R_f=0.4 (petroleum ether/ethyl acetate 25:1). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.88 (d, *J* = 7.8 Hz, 1H), 7.44 (t, *J* = 7.0 Hz, 2H), 7.38 – 7.28 (m, 9H), 7.17 (t, *J* = 7.8 Hz, 2H), 7.13 – 7.06 (m, 2H), 7.04 – 7.00 (m, 3H), 6.79 (d, *J* = 7.8 Hz, 2H), 6.73 – 6.66 (m, 1H), 6.50 (d, *J* = 6.8 Hz, 2H), 3.97 (dd, *J* = 11.0, 2.6 Hz, 1H), 3.23 – 3.17 (m, 2H), 2.76 (s, 3H), 2.68 (s, 1H), 2.19 – 2.07 (m, 1H), 2.05 – 1.94 (m, 1H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 148.9, 145.9, 145.5, 144.2, 141.7, 137.6, 129.9, 129.8, 129.1, 128.9, 128.2, 127.6, 127.4, 127.1, 127.0, 126.9, 126.8, 126.6, 126.5, 126.4, 116.4, 112.5, 81.6, 51.6, 45.9, 38.3, 28.7. **HRMS (ESI)** calculated for $C_{35}H_{34}NO$ $(M+H)^+$: 484.2635, found: 484.2639.

2-((methyl(phenyl)amino)methyl)benzene-1,4-diol (5a)



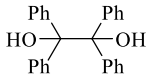
Yellow oil. 38% yield (26.1 mg), R_f=0.3(petroleum ether/ethyl acetate 5:1). **^{1}H NMR** (400 MHz, DMSO) δ 8.82 (s, 1H), 8.54 (s, 1H), 7.17 – 7.09 (m, 2H), 6.63 (d, *J* = 8.4 Hz, 3H), 6.58 (t, *J* = 7.2 Hz, 1H), 6.43 (dd, *J* = 8.4, 3.0 Hz, 1H), 6.34 (d, *J* = 3.0 Hz, 1H), 4.39 (s, 2H), 3.01 (s, 3H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 150.7, 148.7, 129.3, 123.0, 122.3, 118.7, 116.9, 115.5, 115.4, 59.1, 40.3. **HRMS (ESI)** calculated for $C_{14}H_{16}NO_2$ $(M+H)^+$: 230.1176, found: 230.1175.

2-(methyl(phenyl)amino)-1,1-diphenylethan-1-ol (6a)



Yellow oil. 18% yield (16.4 mg), R_f=0.6(petroleum ether/ethyl acetate 10:1). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.62 – 7.53 (m, 4H), 7.41 – 7.34 (m, 4H), 7.31 – 7.23 (m, 4H), 6.97 (d, *J* = 8.6 Hz, 2H), 6.84 (t, *J* = 7.2 Hz, 1H), 4.19 (s, 2H), 3.70 (s, 1H), 2.48 (s, 3H).**^{13}C NMR** (100 MHz, $CDCl_3$) δ 152.0, 146.1, 137.6, 132.4, 130.1, 129.1, 128.3, 128.3, 127.0, 125.9, 118.7, 114.5, 76.6, 66.2, 39.6. These spectroscopic data correspond to reported data.[10]

1,1,2,2-tetraphenylethane-1,2-diol (7a)



Yellow oil. 10% yield (10.9 mg), R_f=0.5(petroleum ether/ethyl acetate 10:1). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.39 – 7.25 (m, 8H), 7.24 – 7.08 (m, 12H), 3.04 (s, 2H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 144.2, 128.6, 127.3, 126.9, 83.0. These spectroscopic data correspond to reported data.[11]

4. References

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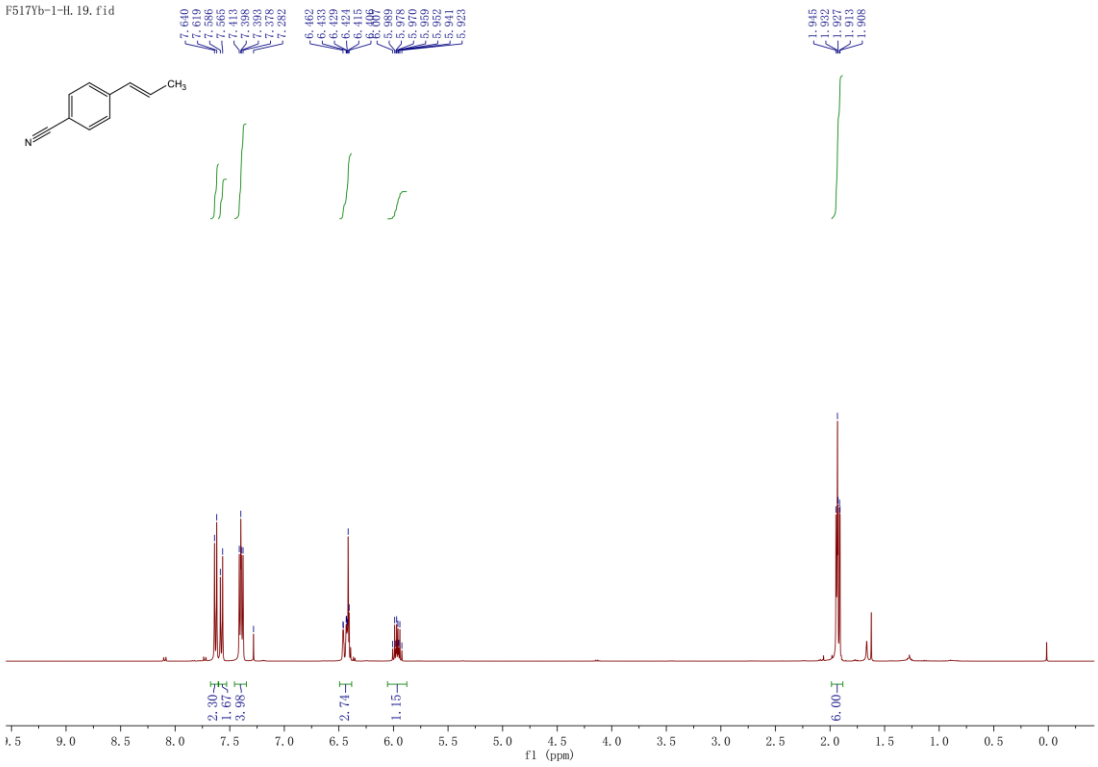
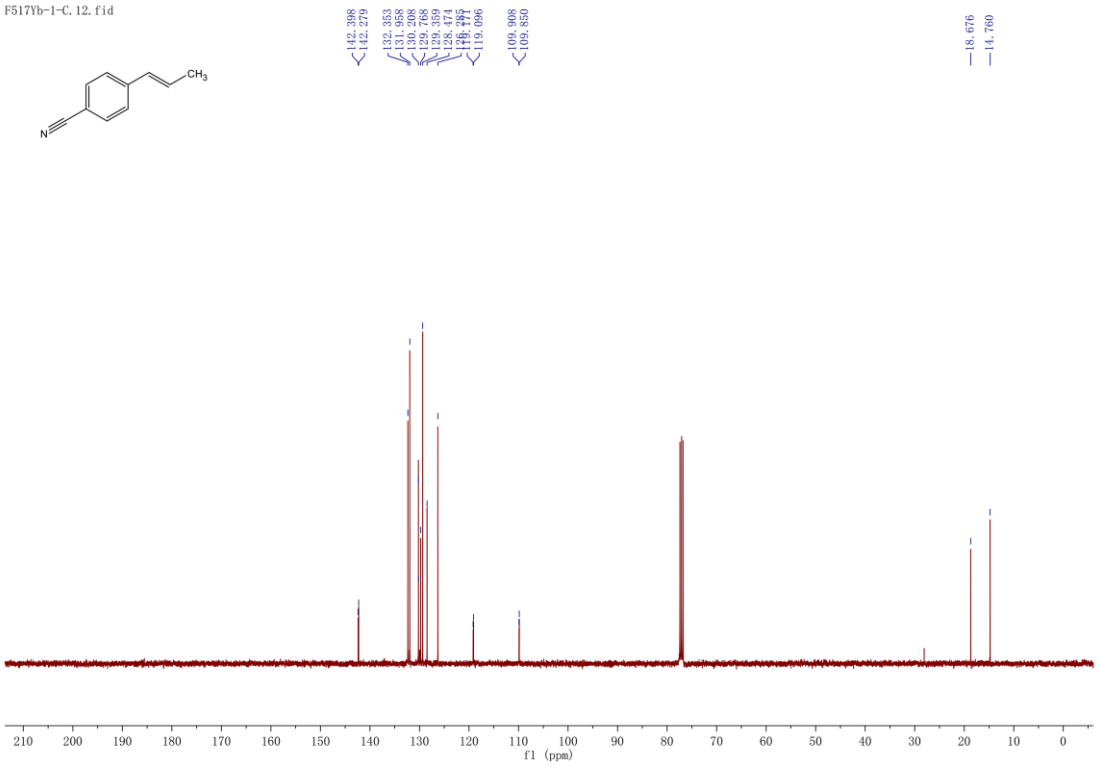
5. ^{1}H and ^{13}C NMR Spectra

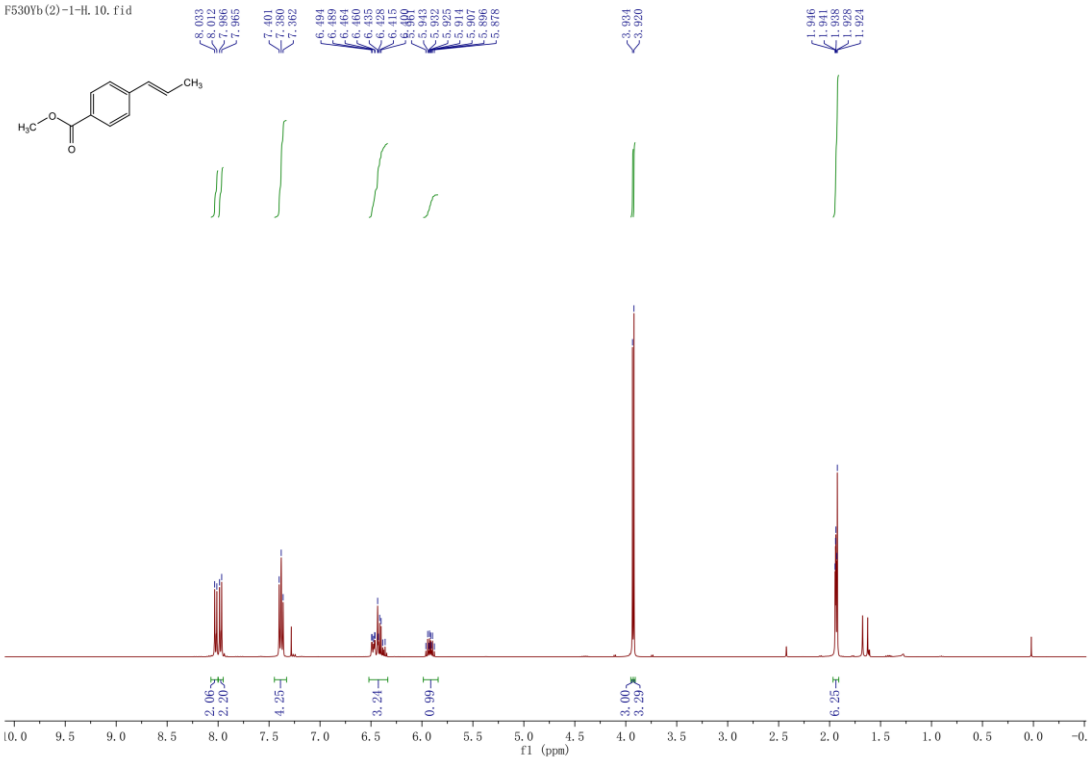
^{1}H NMR (400 MHz, $CDCl_3$) of compound **2u**



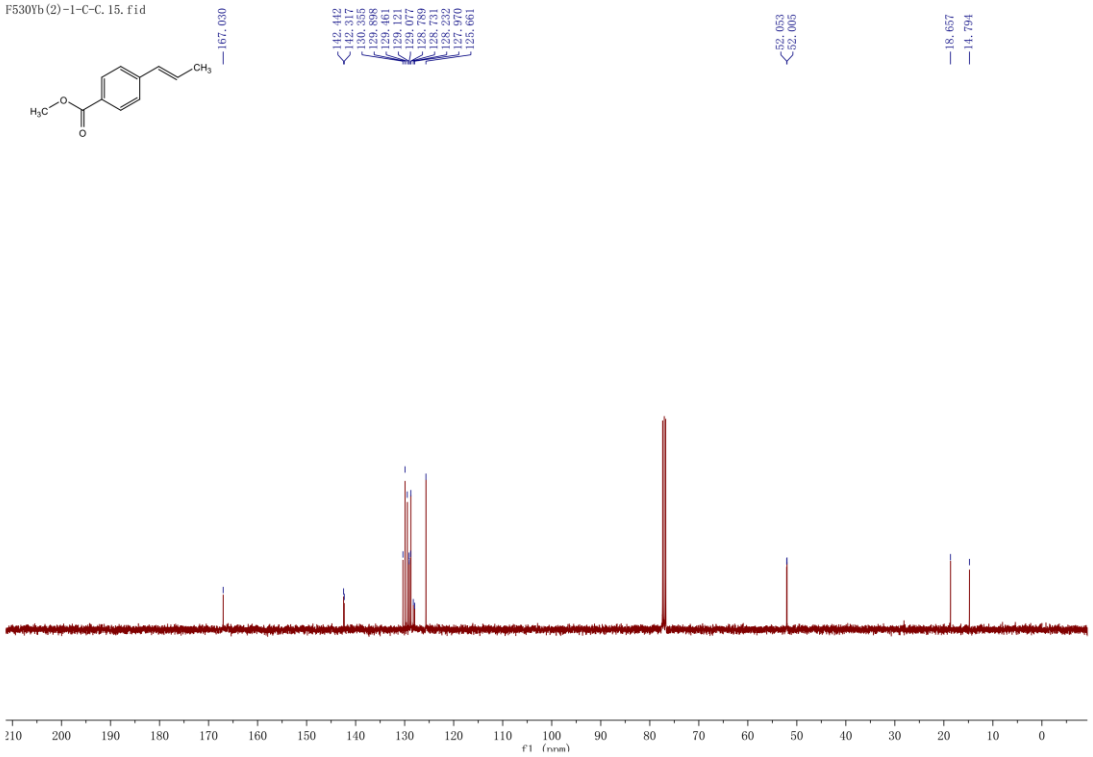
^{13}C NMR (100 MHz, $CDCl_3$) of compound **2u**



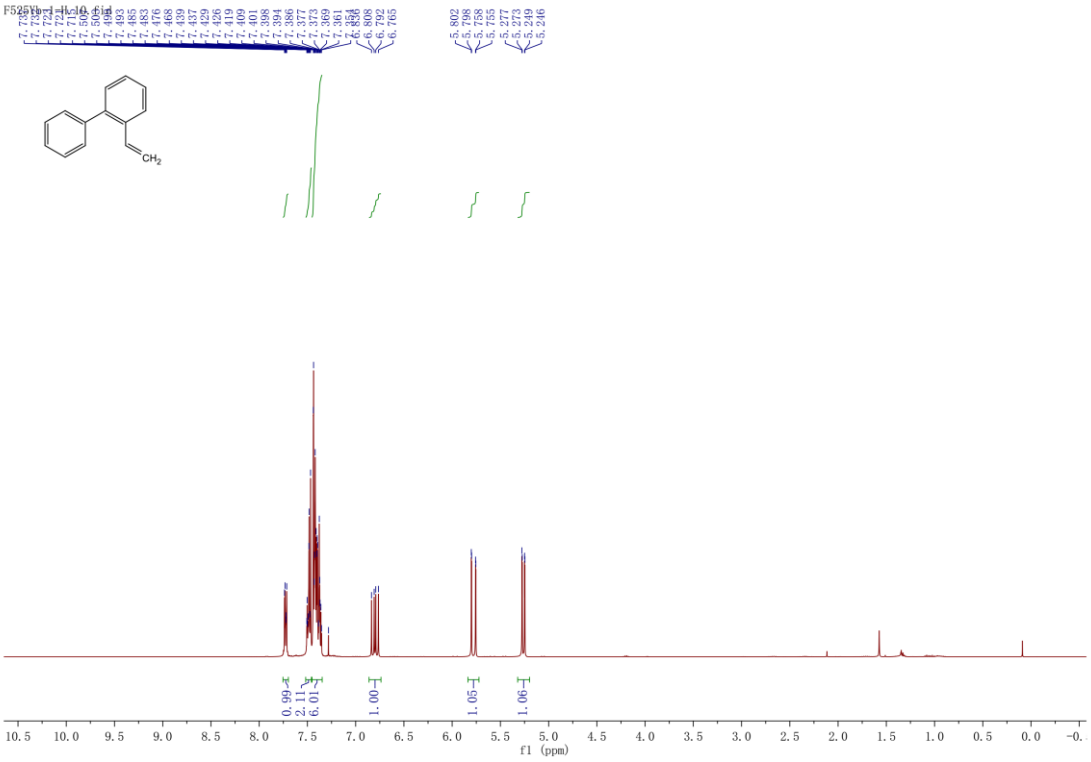
^{1}H NMR (400 MHz, $CDCl_3$) of compound **2v**



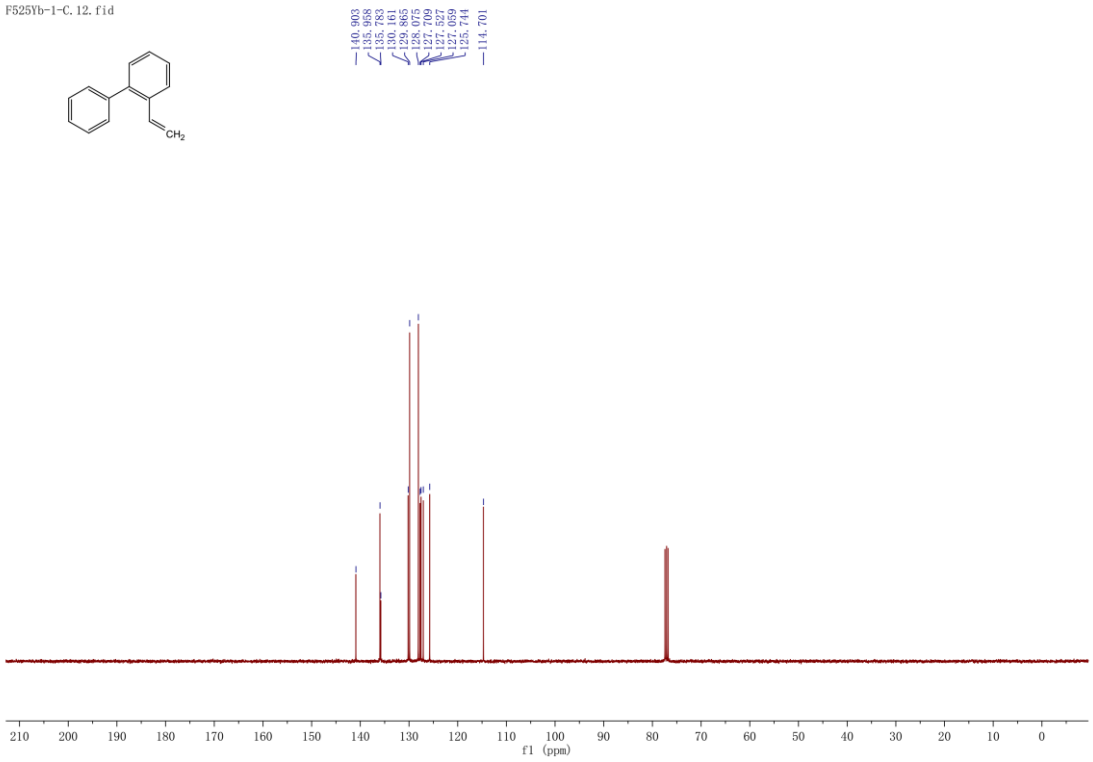
^{13}C NMR (100 MHz, $CDCl_3$) of compound **2v**



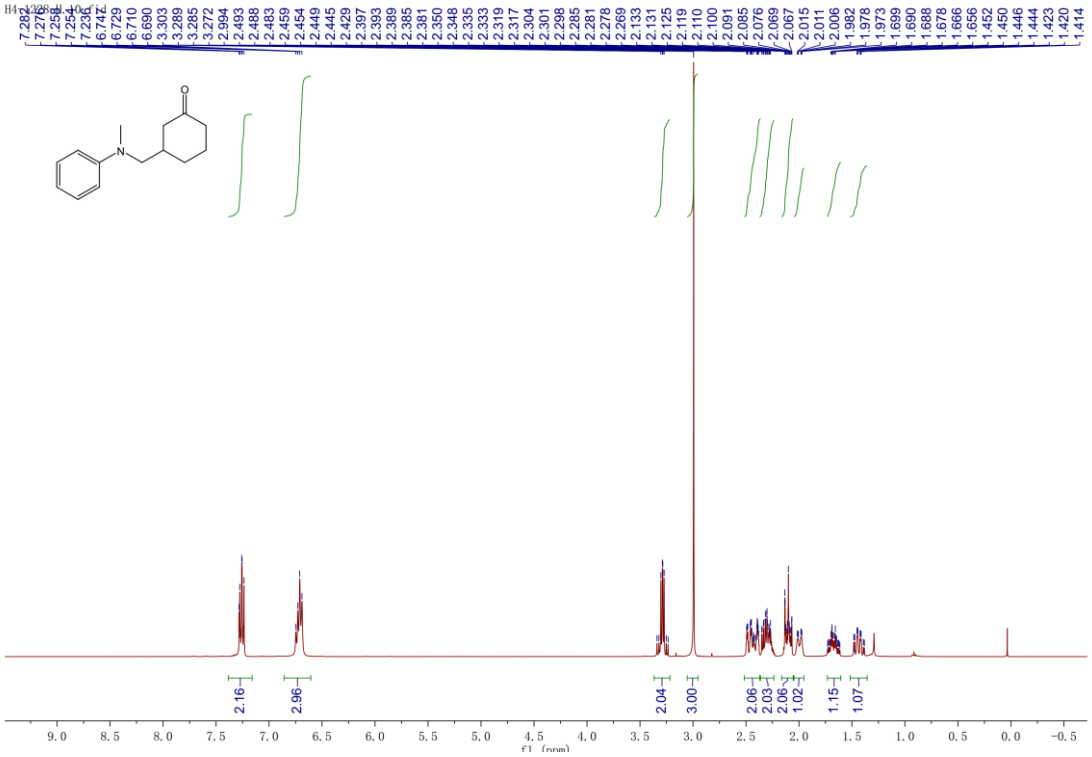
^{1}H NMR (400 MHz, $CDCl_3$) of compound **2an**



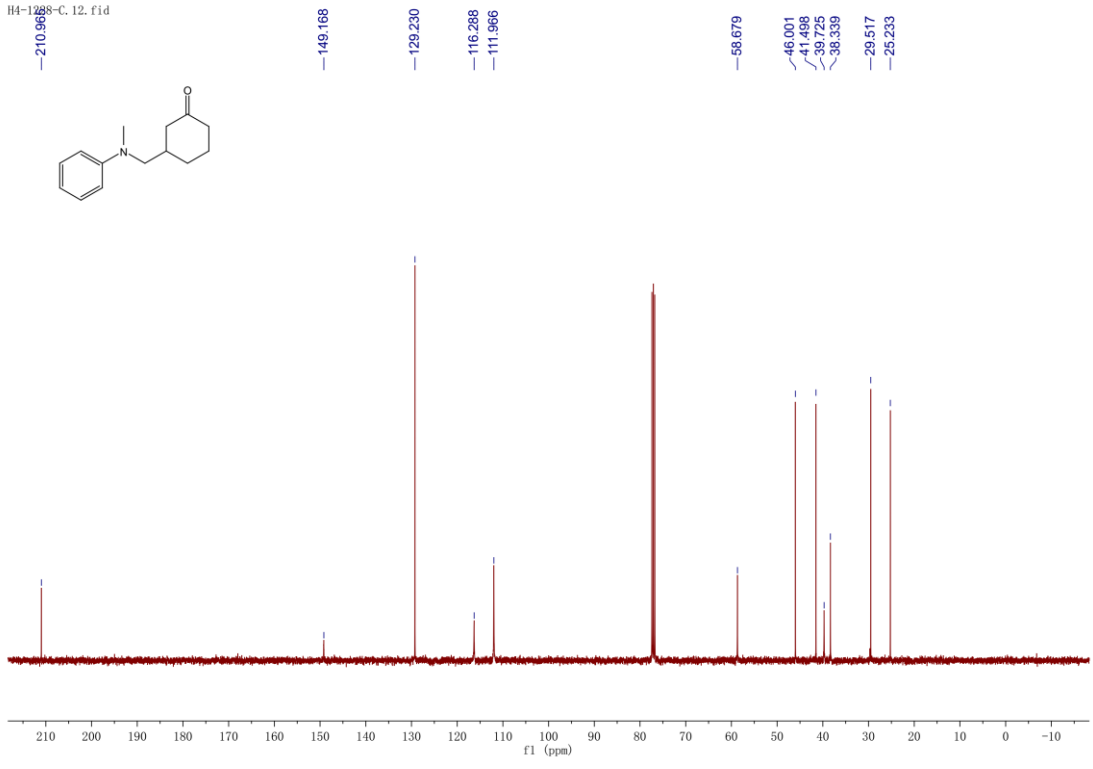
^{13}C NMR (100 MHz, $CDCl_3$) of compound **2an**



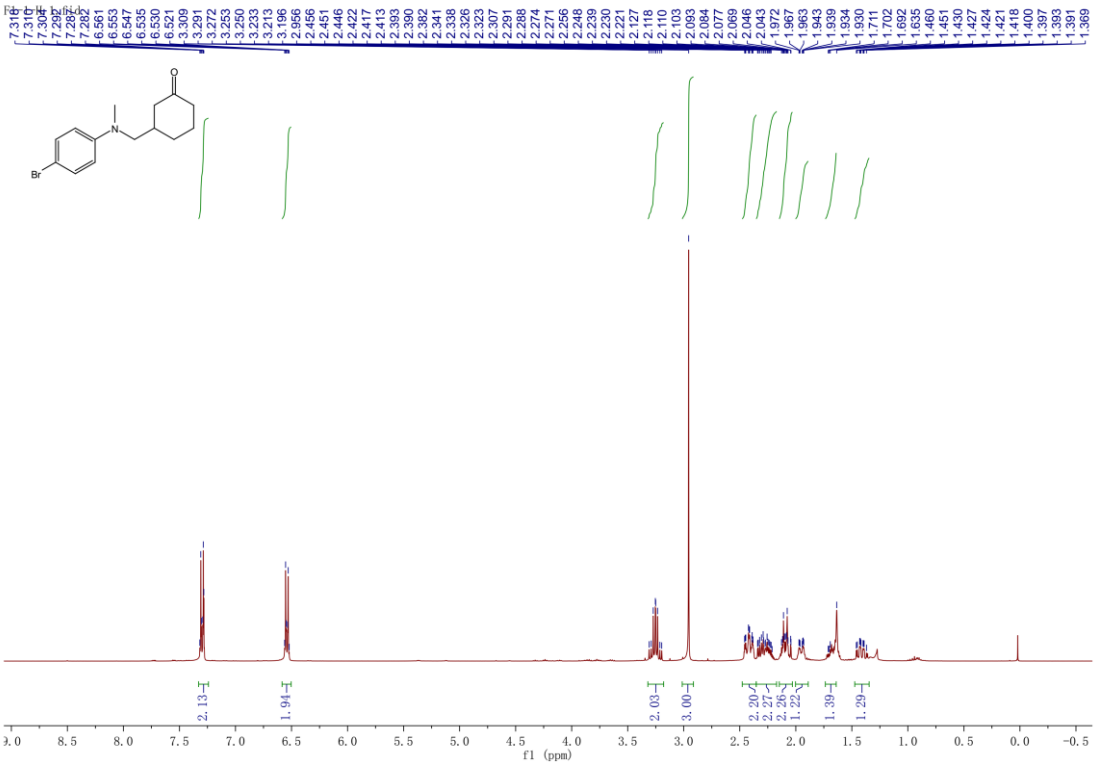
^{1}H NMR (400 MHz, $CDCl_3$) of compound **3a**



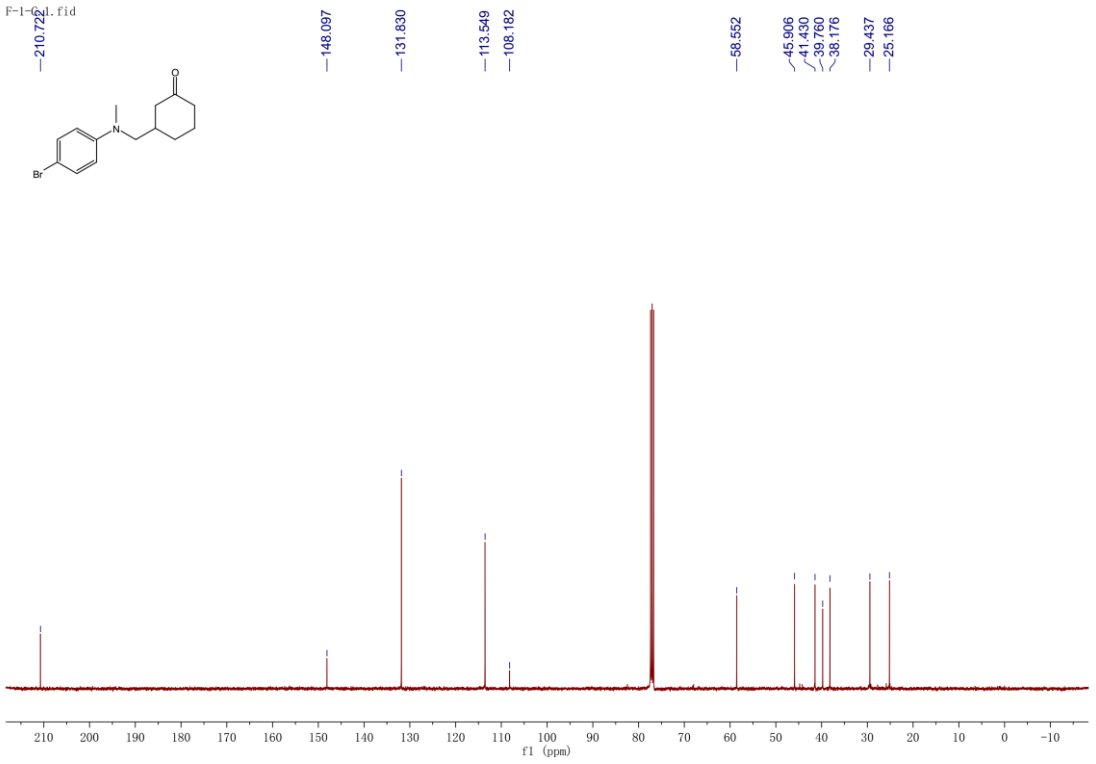
^{13}C NMR (100 MHz, $CDCl_3$) of compound **3a**



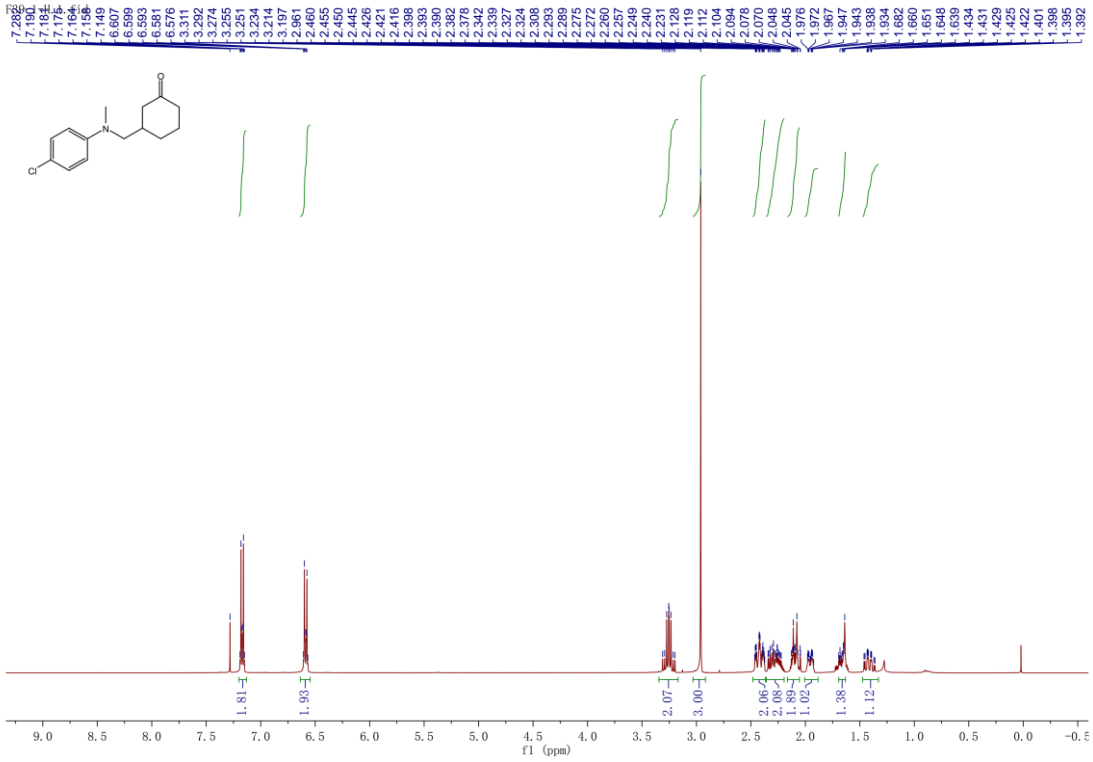
^{1}H NMR (400 MHz, $CDCl_3$) of compound **3b**



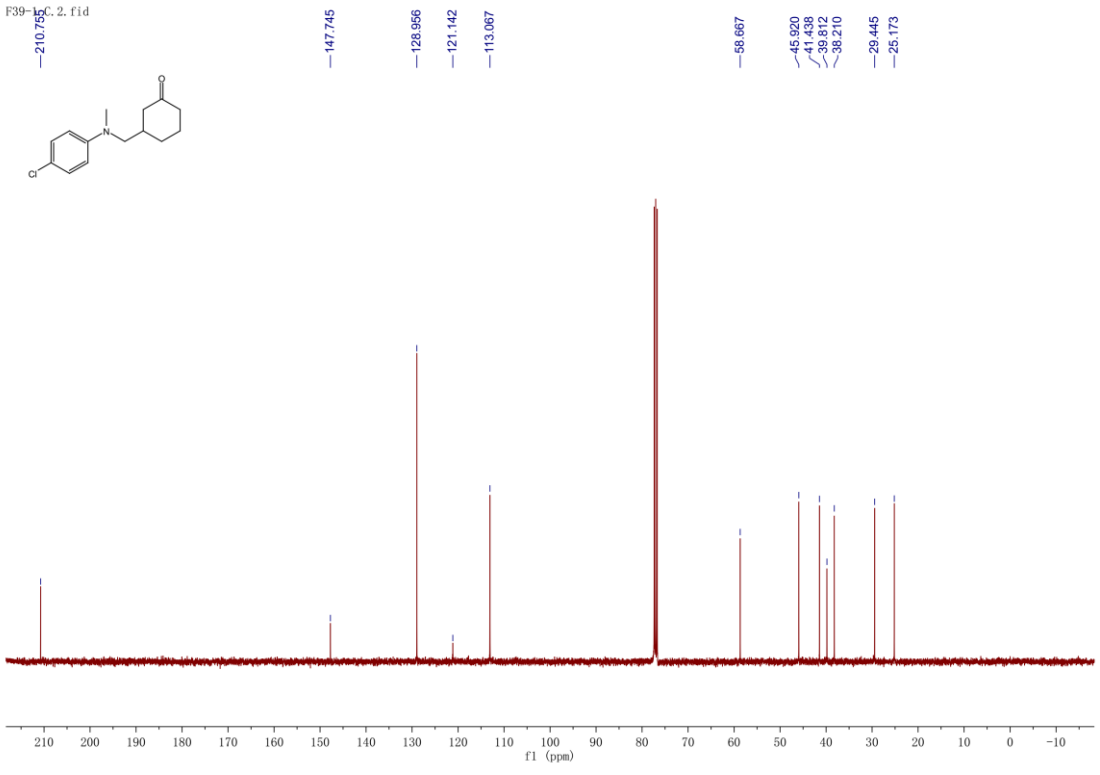
^{13}C NMR (100 MHz, $CDCl_3$) of compound **3b**



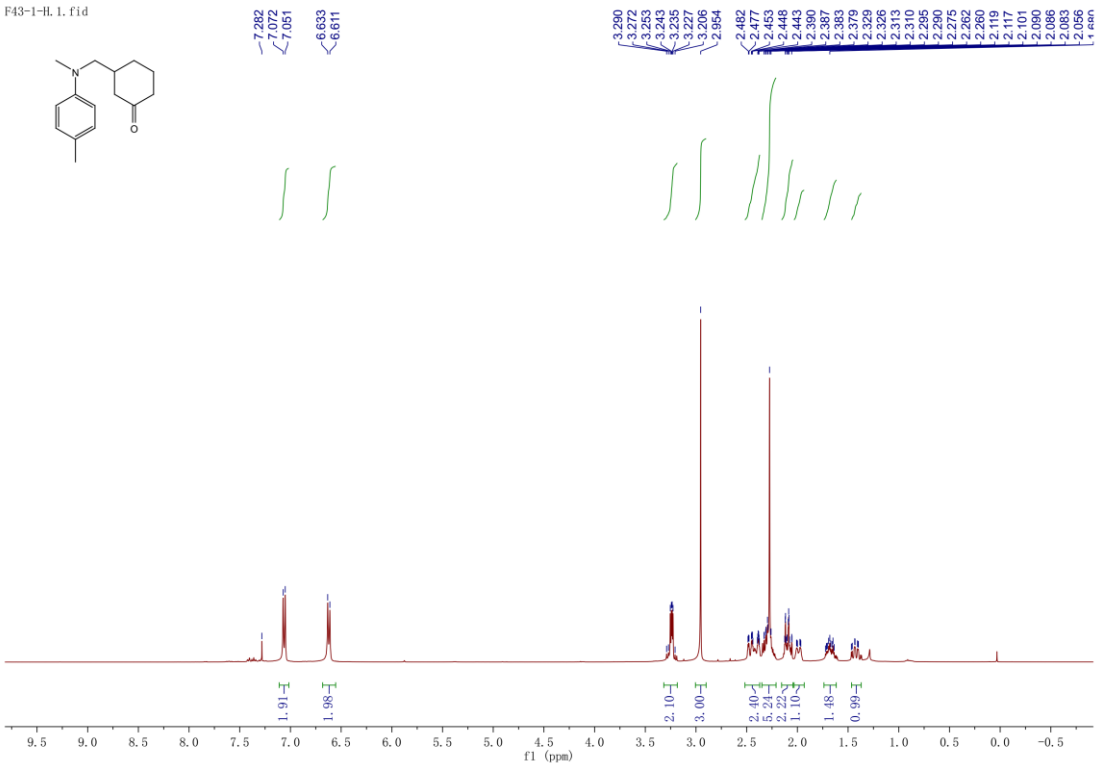
^{1}H NMR (400 MHz, $CDCl_3$) of compound **3c**



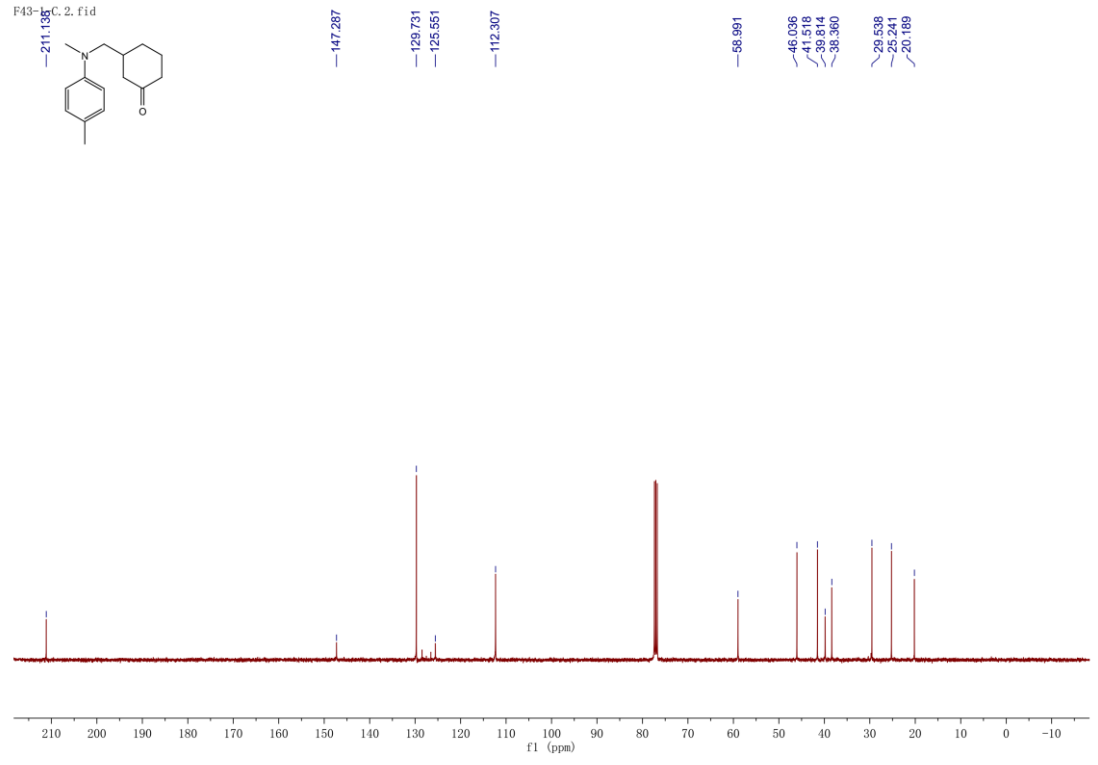
^{13}C NMR (100 MHz, $CDCl_3$) of compound **3c**



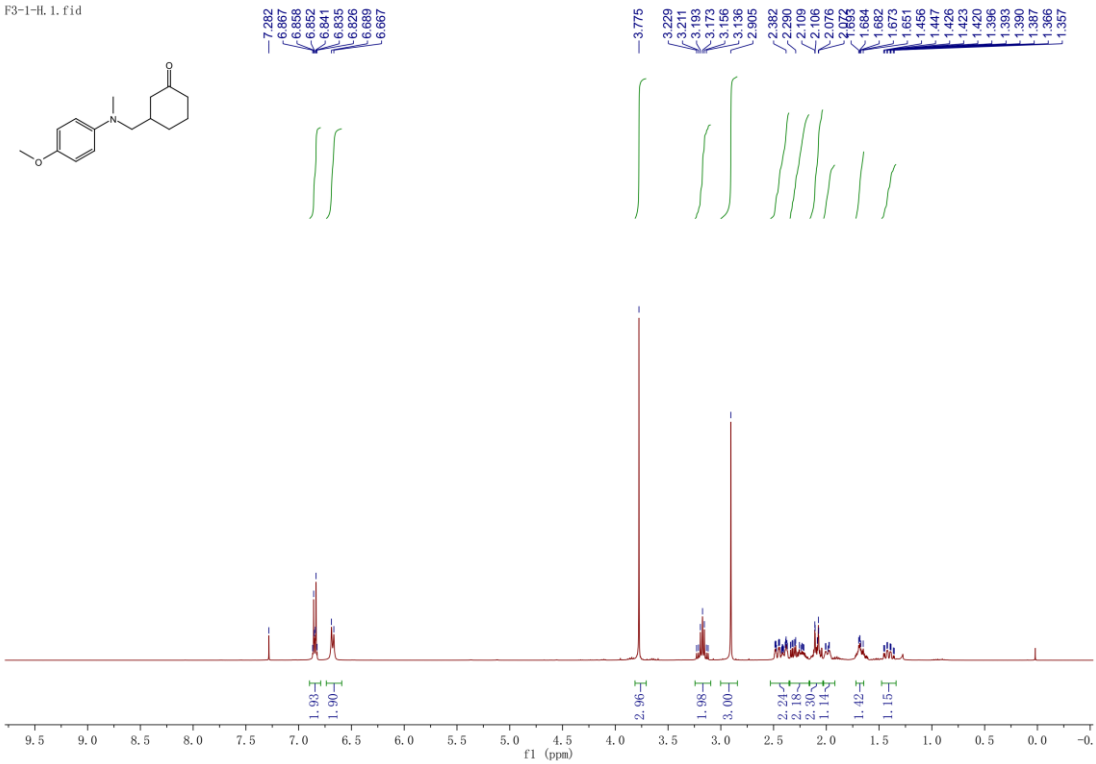
^{1}H NMR (400 MHz, $CDCl_3$) of compound **3d**



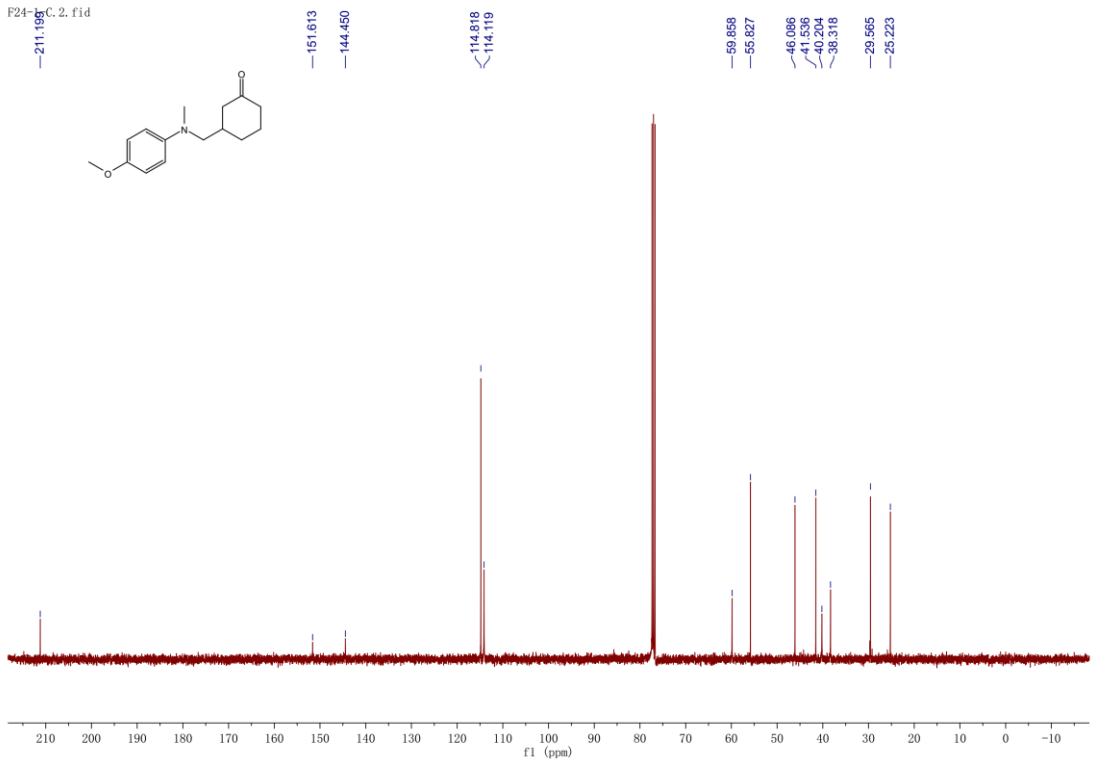
^{13}C NMR (100 MHz, $CDCl_3$) of compound **3d**



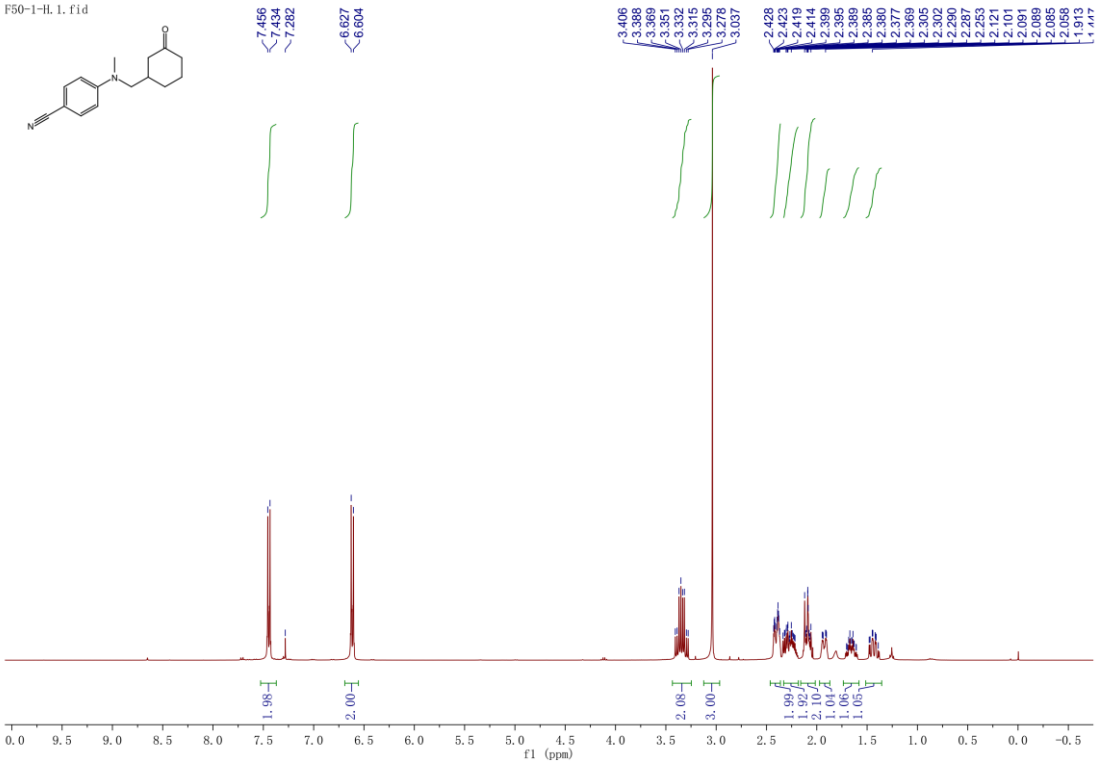
^{1}H NMR (400 MHz, $CDCl_3$) of compound **3e**



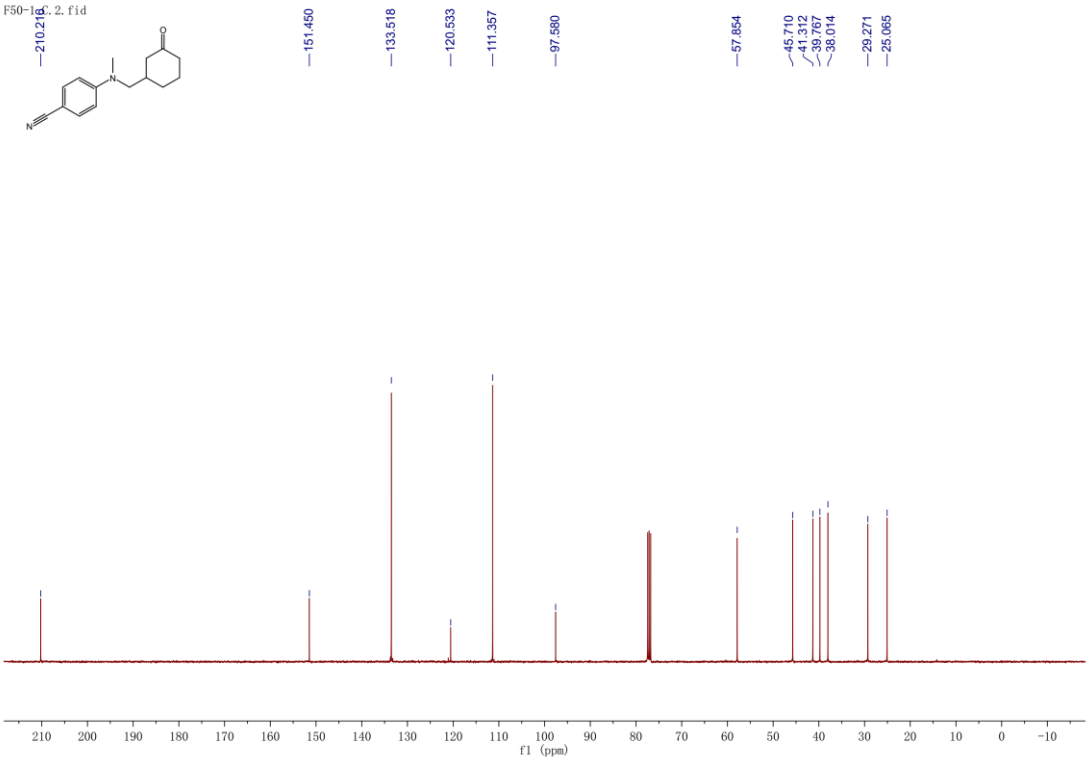
^{13}C NMR (100 MHz, $CDCl_3$) of compound **3e**



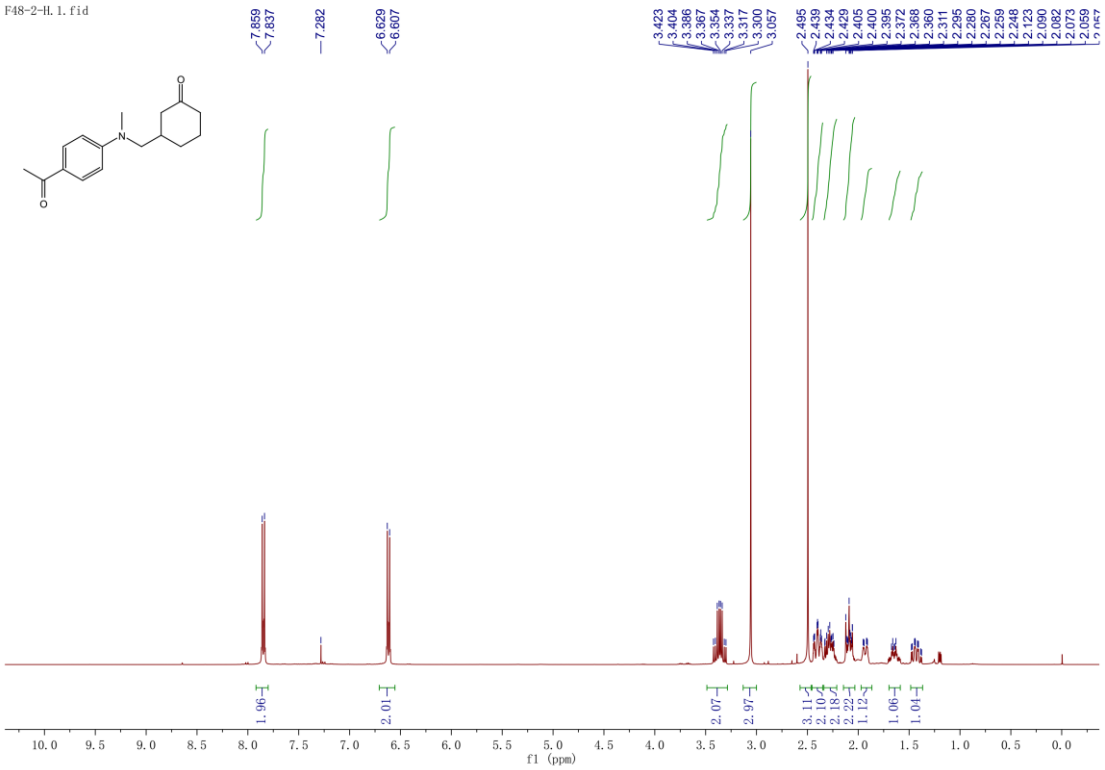
^{1}H NMR (400 MHz, $CDCl_3$) of compound **3f**



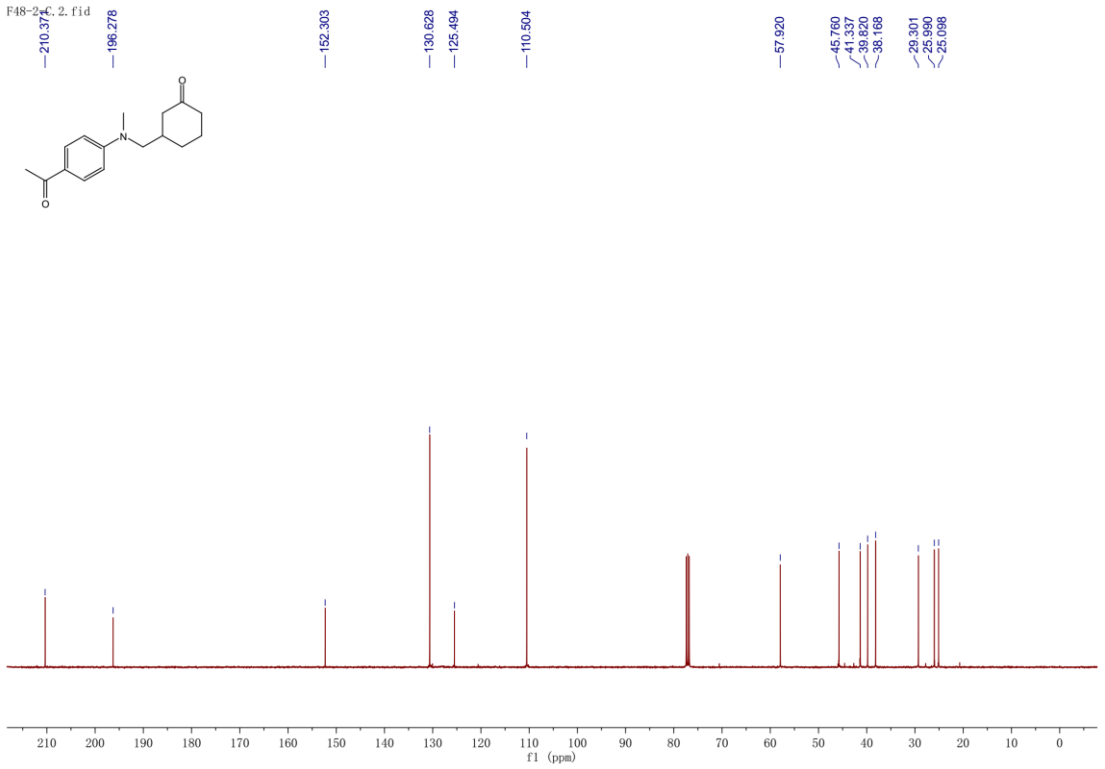
^{13}C NMR (100 MHz, $CDCl_3$) of compound **3f**



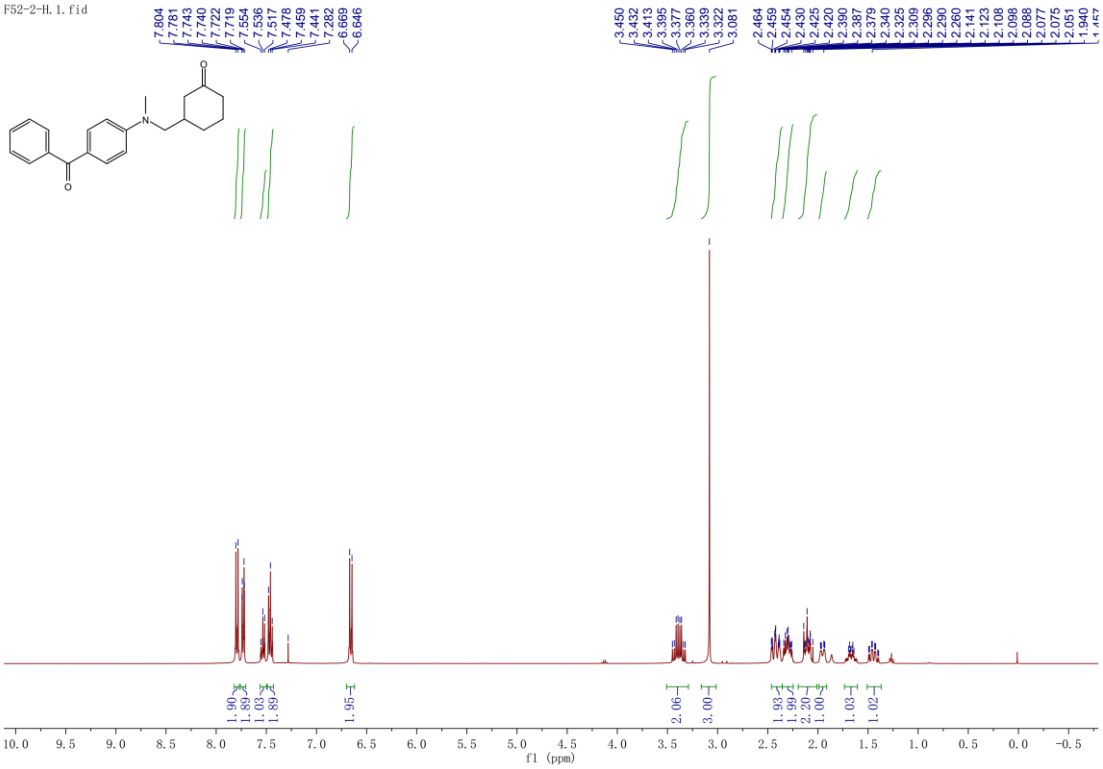
^{1}H NMR (400 MHz, $CDCl_3$) of compound **3g**



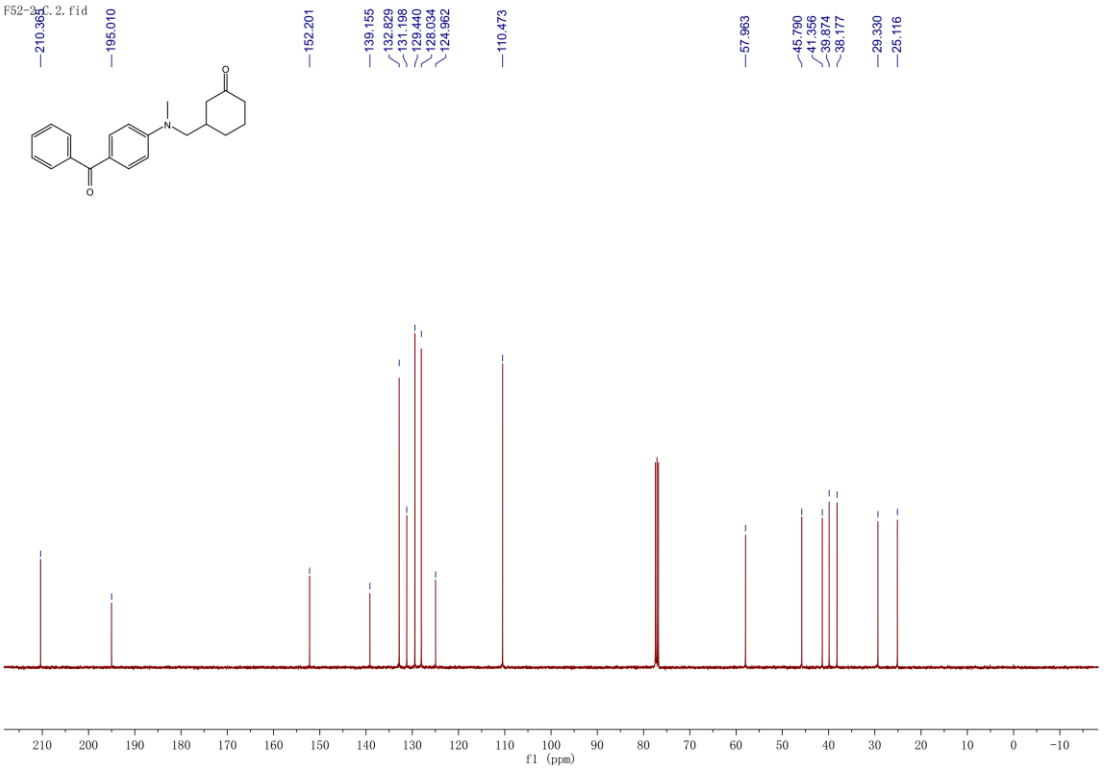
^{13}C NMR (100 MHz, $CDCl_3$) of compound **3g**



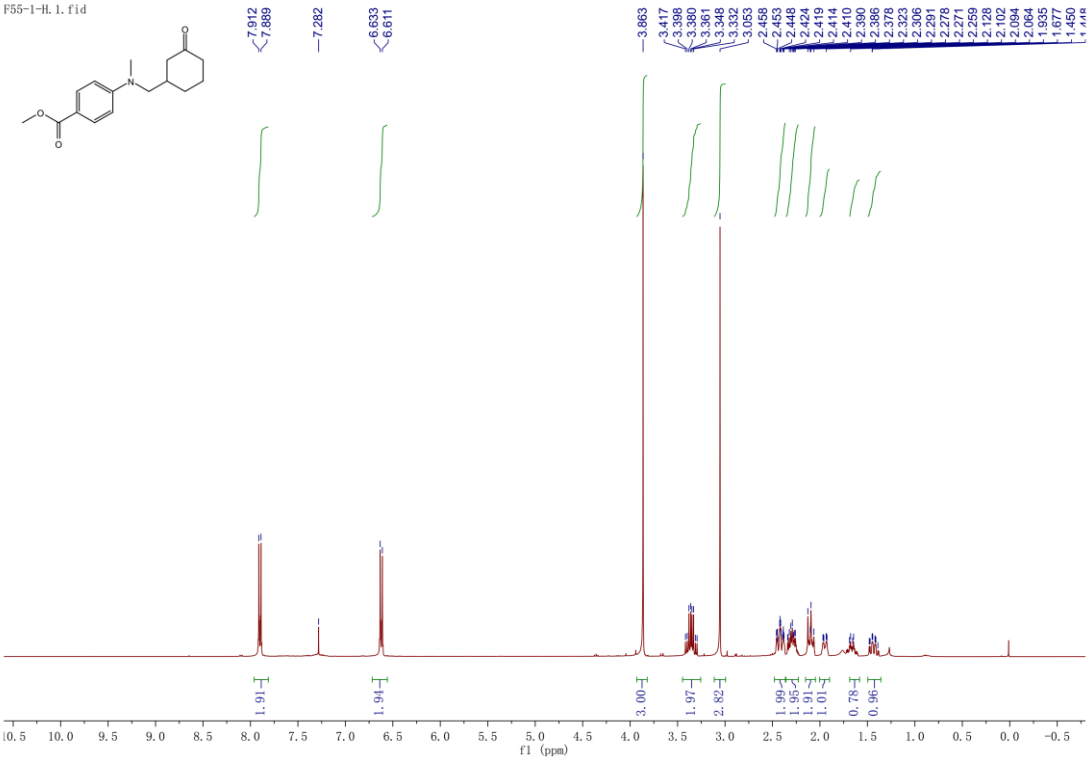
^{1}H NMR (400 MHz, $CDCl_3$) of compound **3h**



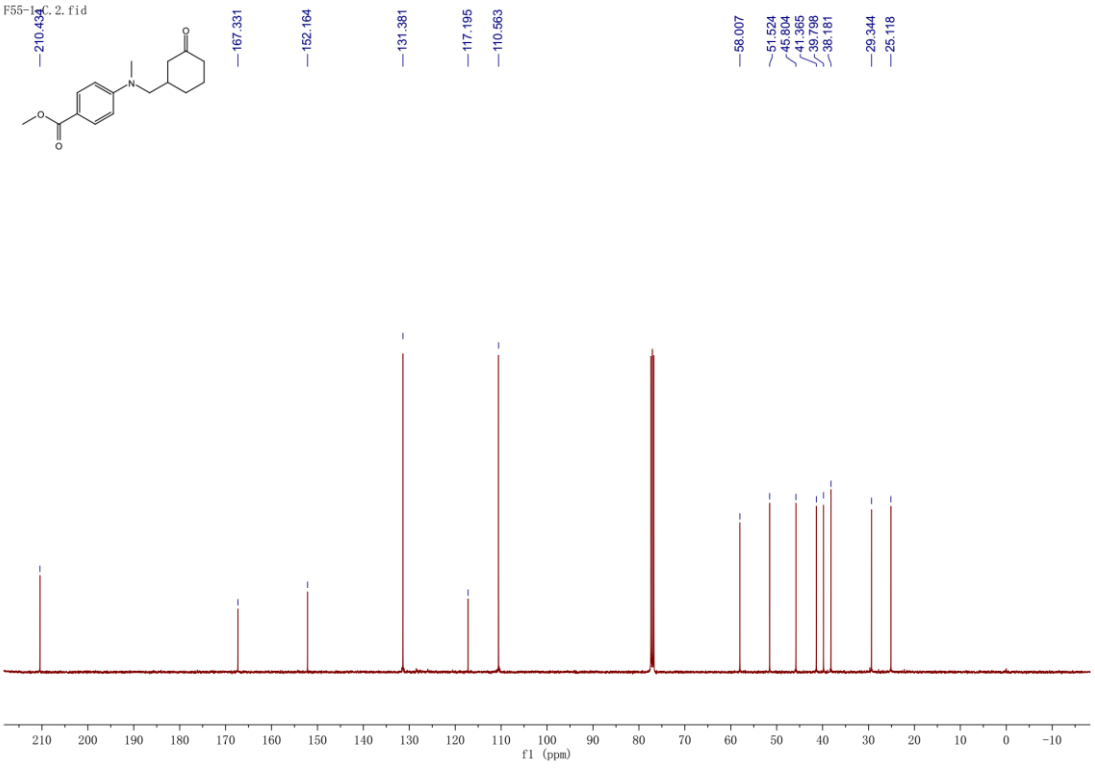
^{13}C NMR (100 MHz, $CDCl_3$) of compound **3h**



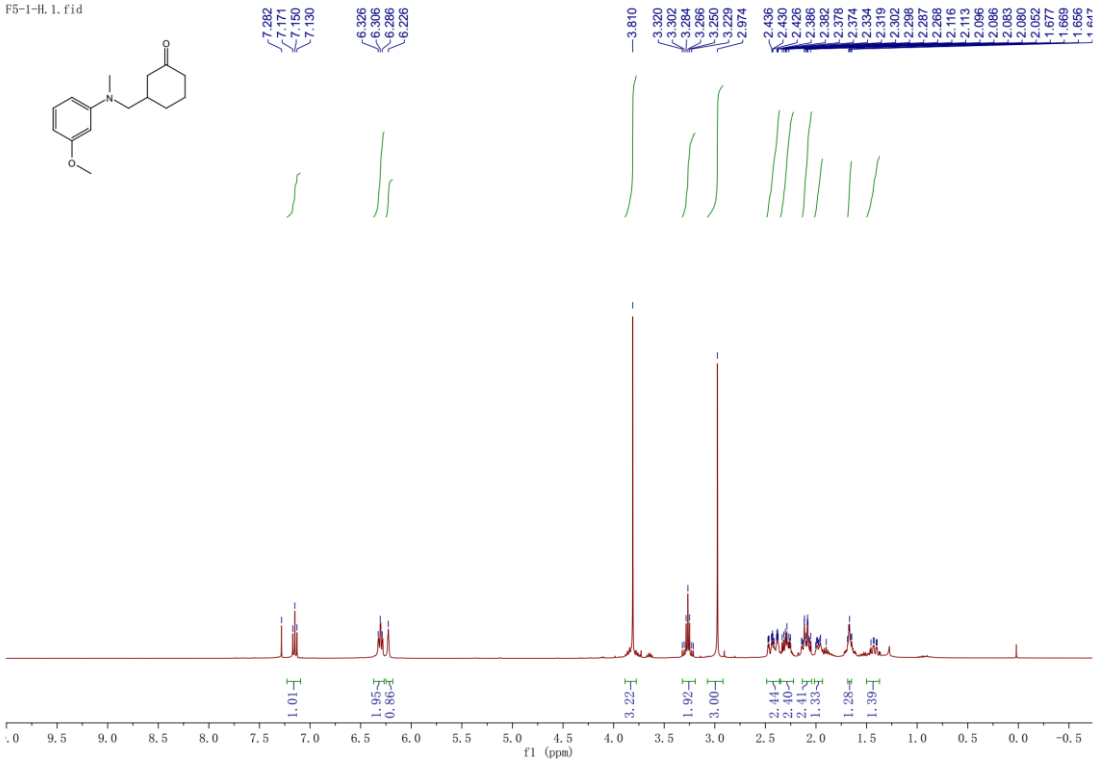
^{1}H NMR (400 MHz, $CDCl_3$) of compound **3i**



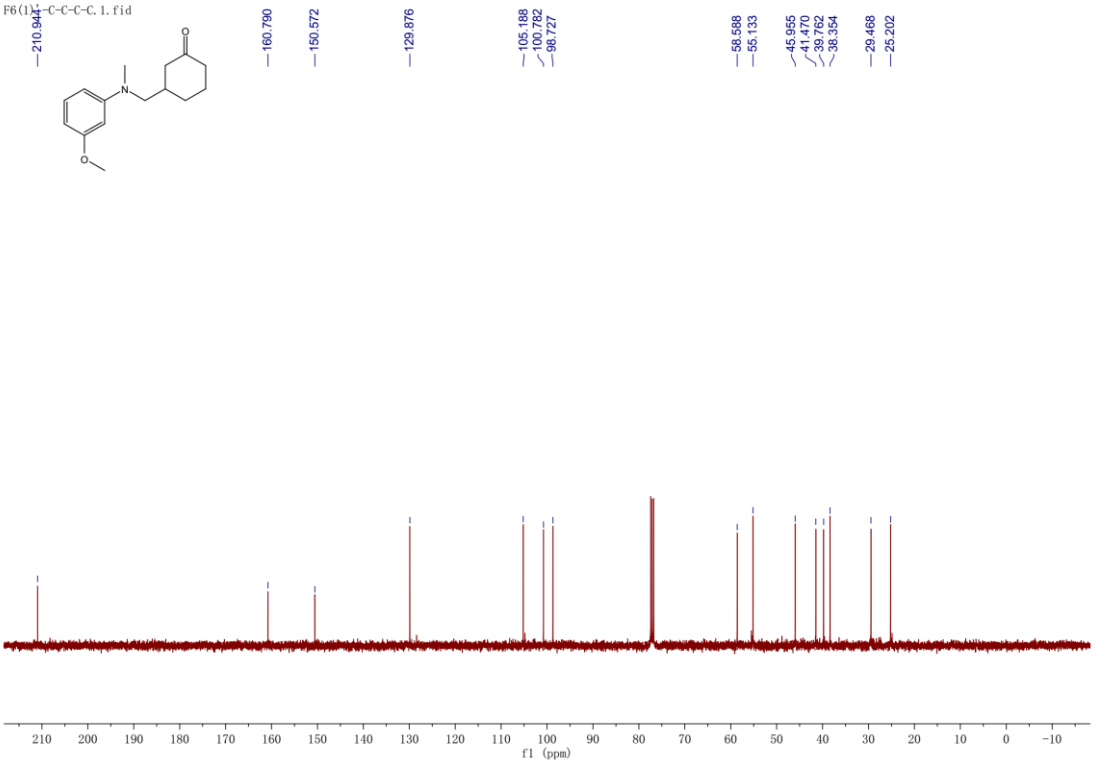
^{13}C NMR (100 MHz, $CDCl_3$) of compound **3i**



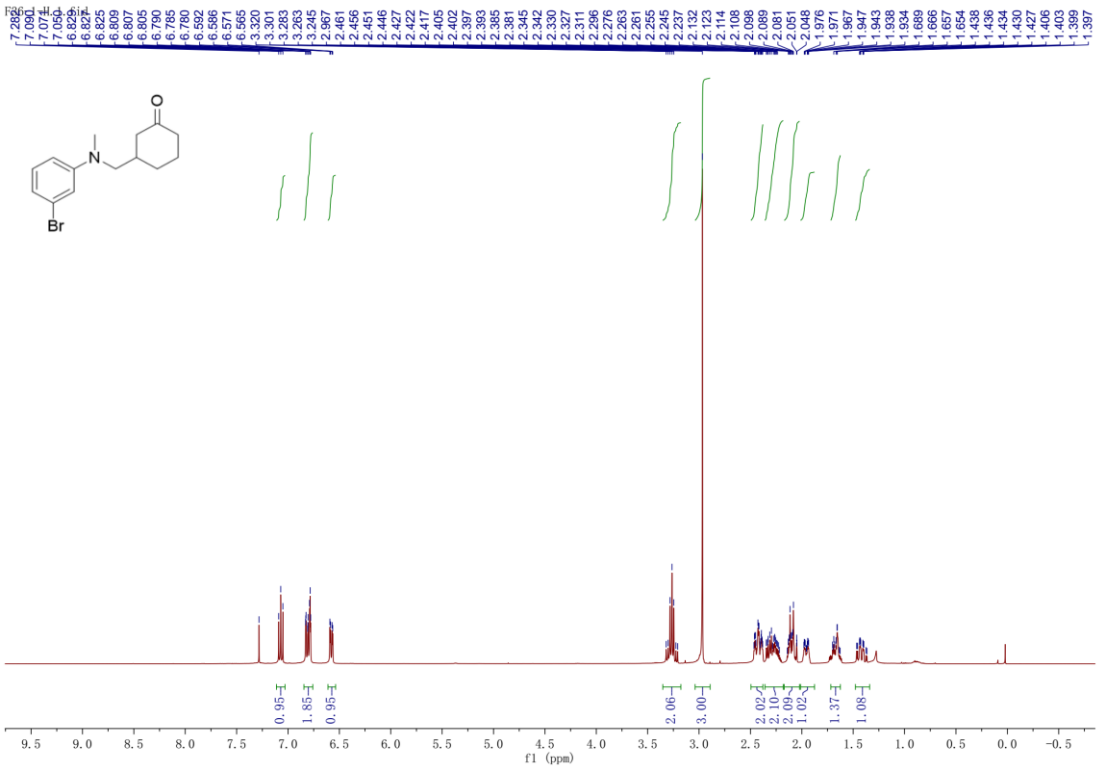
^{1}H NMR (400 MHz, $CDCl_3$) of compound **3j**



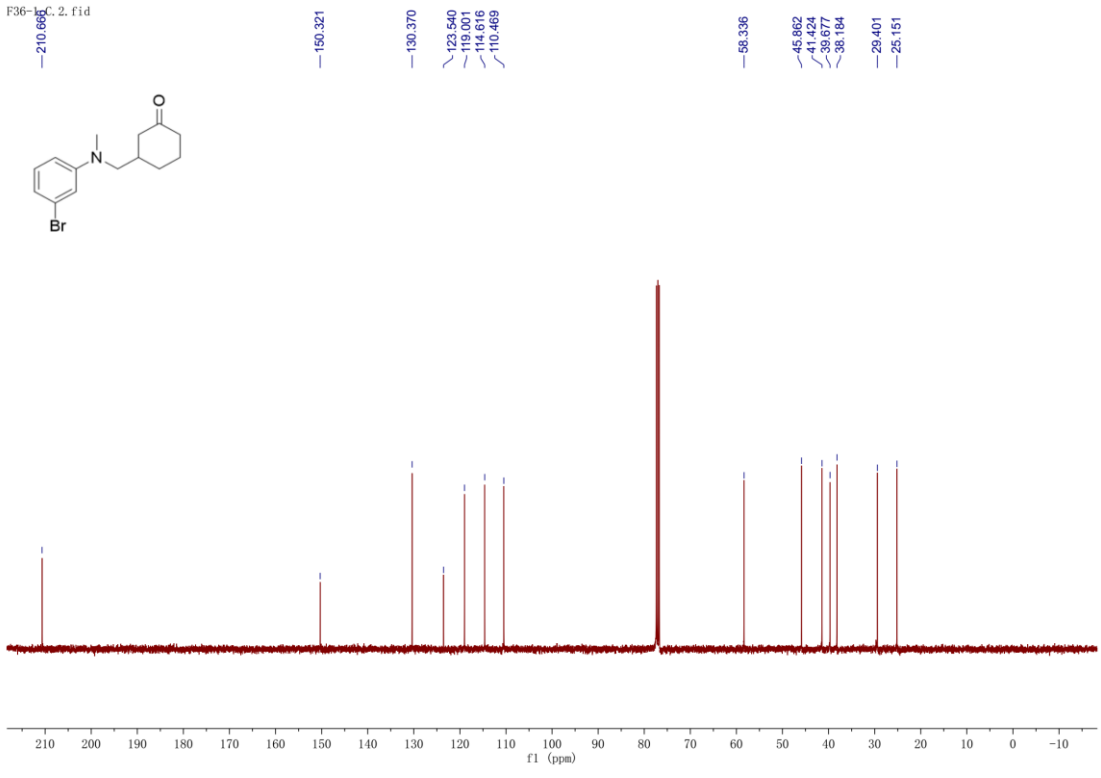
^{13}C NMR (100 MHz, $CDCl_3$) of compound **3j**



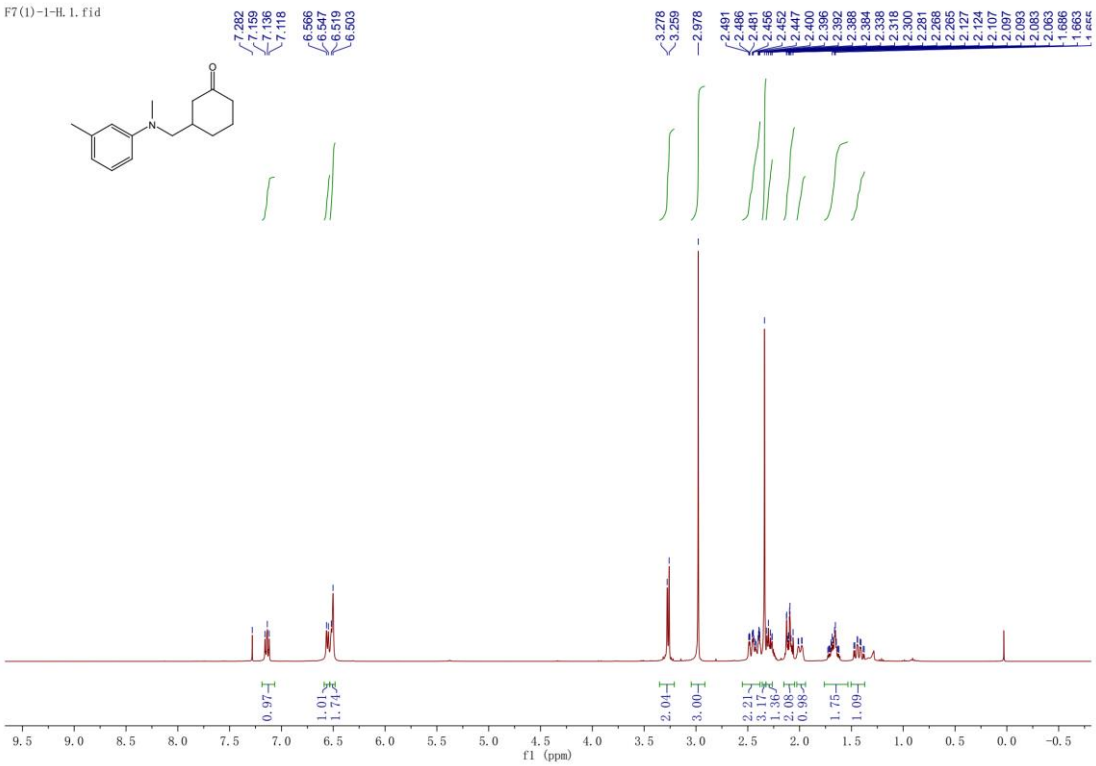
^{1}H NMR (400 MHz, $CDCl_3$) of compound **3k**



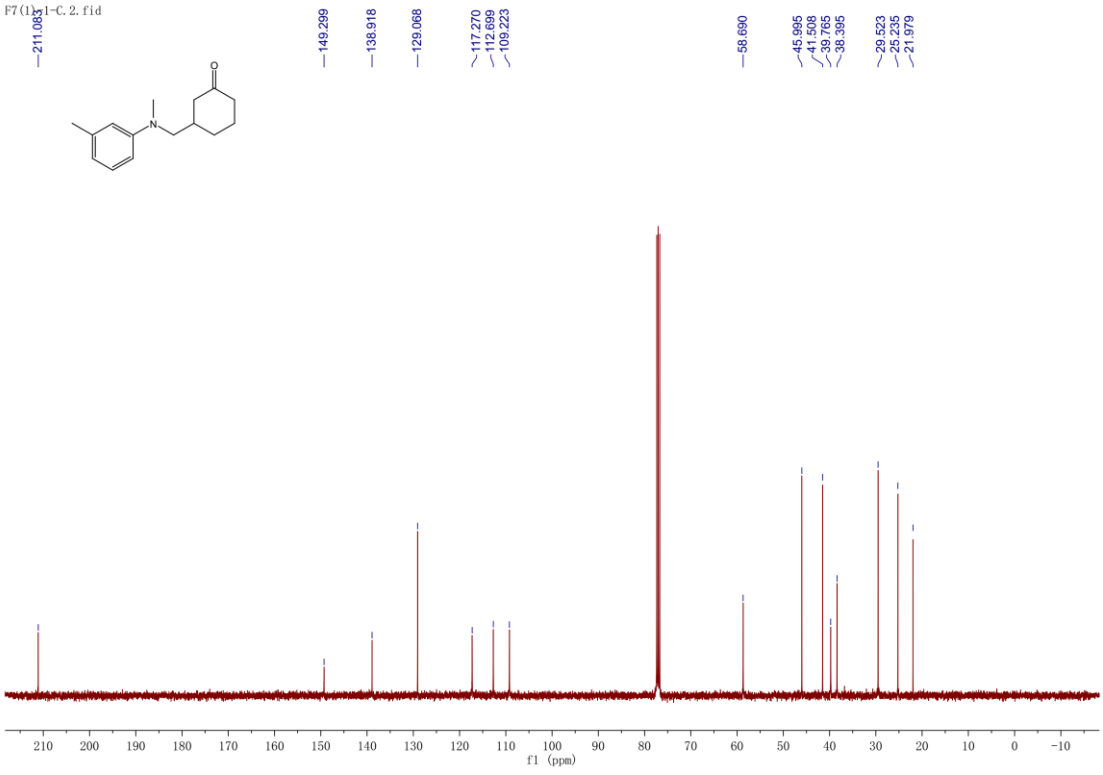
^{13}C NMR (100 MHz, $CDCl_3$) of compound **3k**



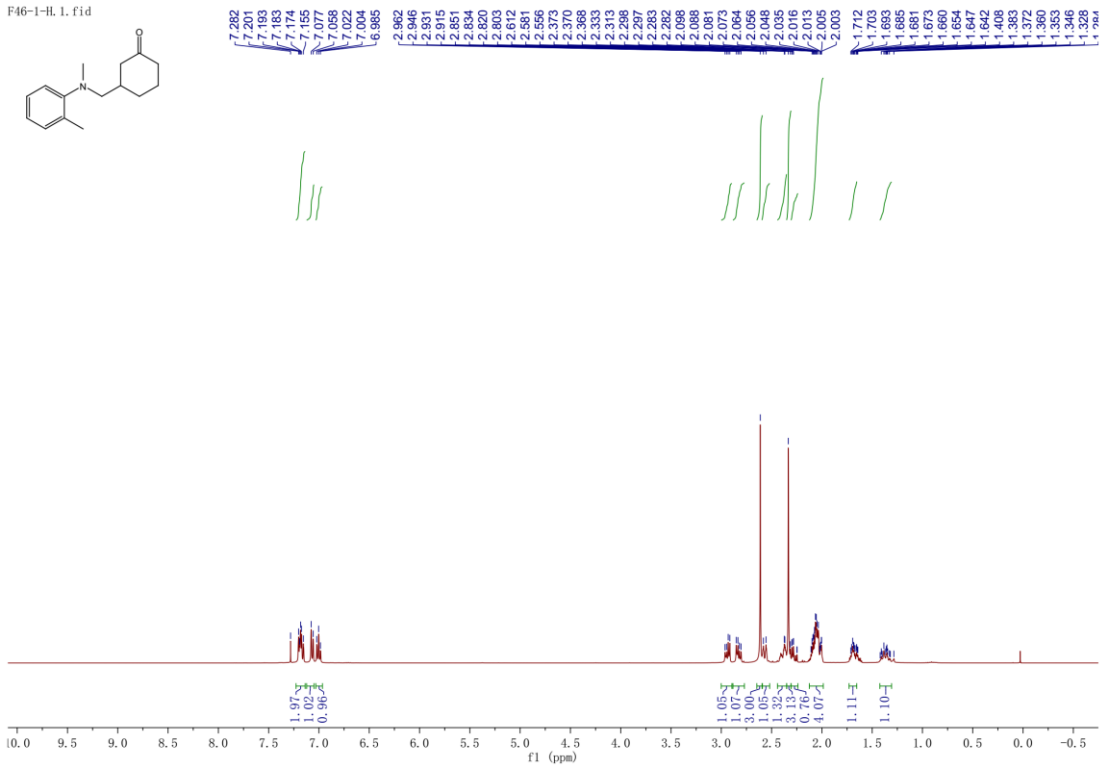
^{1}H NMR (400 MHz, $CDCl_3$) of compound **3l**



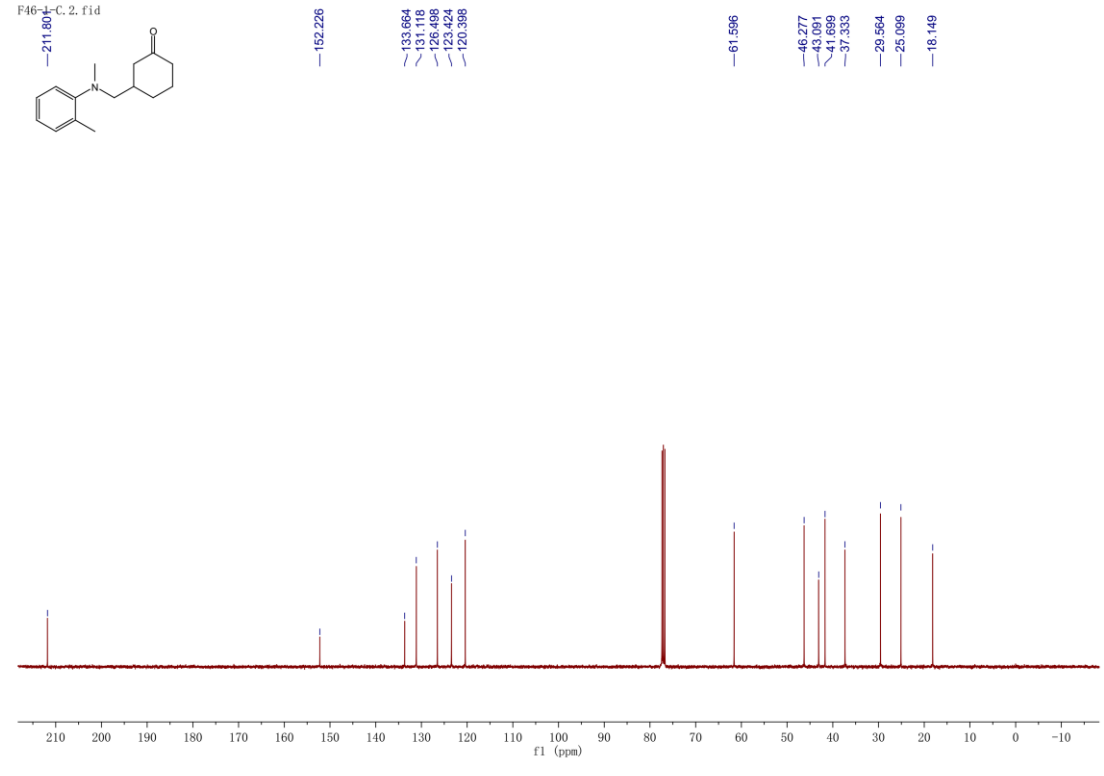
^{13}C NMR (100 MHz, $CDCl_3$) of compound **3l**



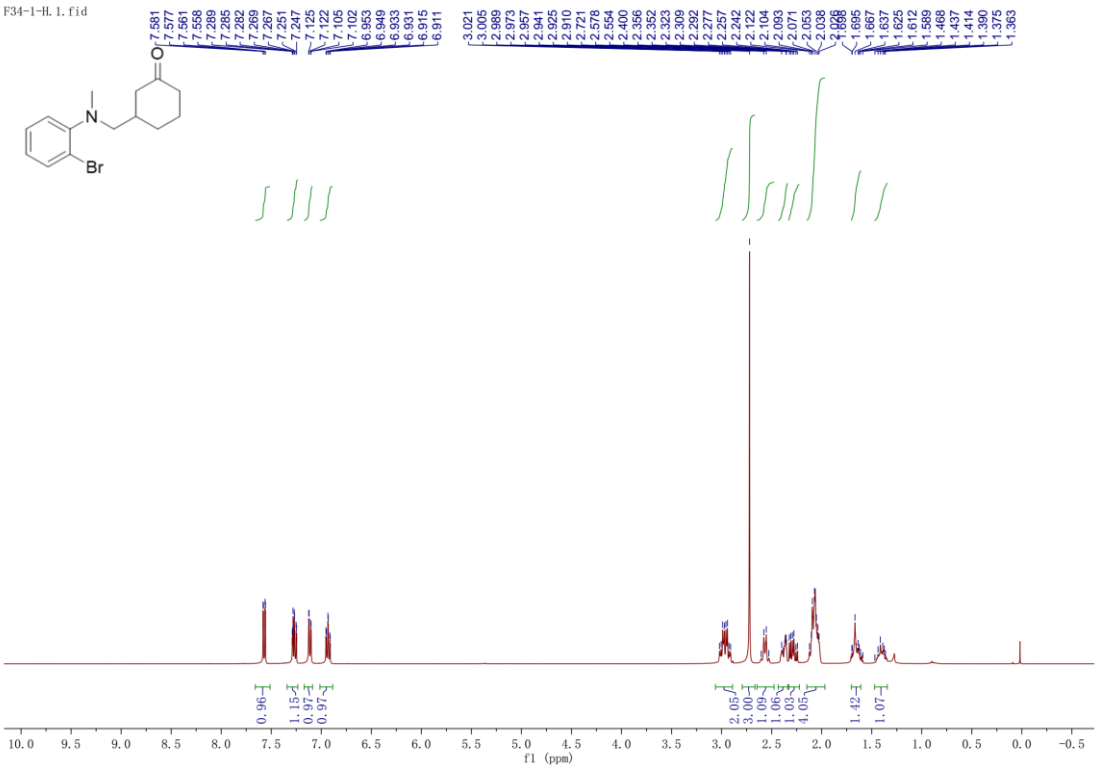
^{1}H NMR (400 MHz, $CDCl_3$) of compound **3m**



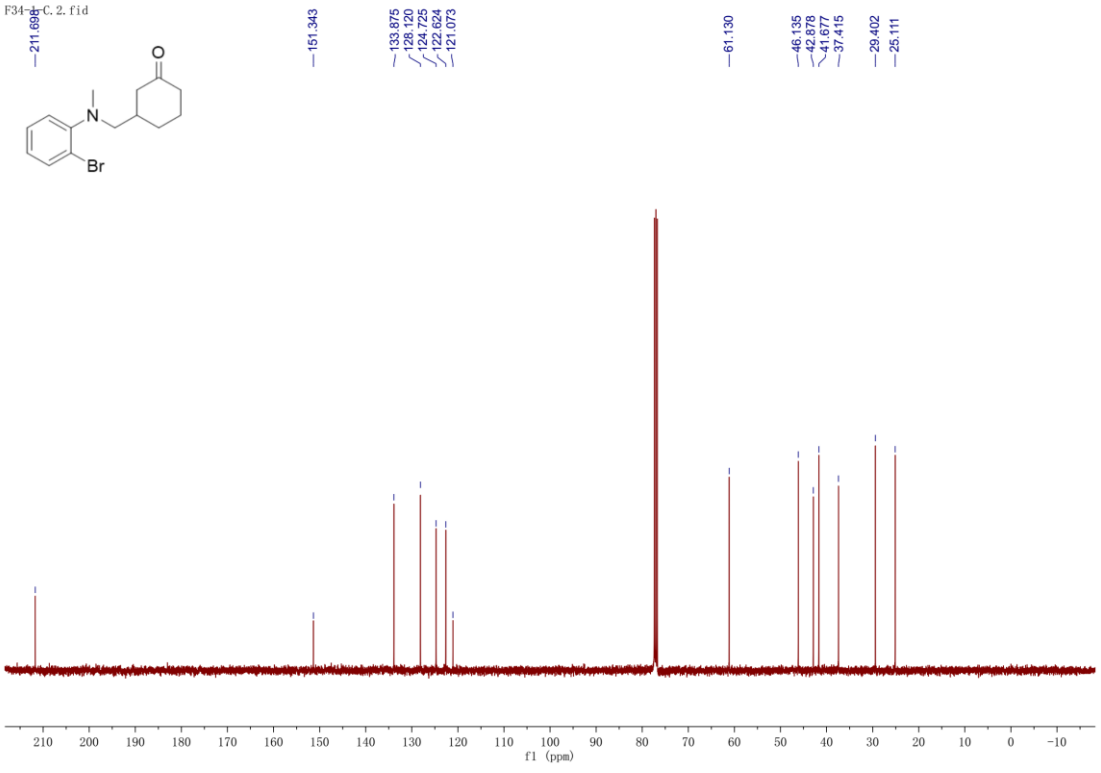
^{13}C NMR (100 MHz, $CDCl_3$) of compound **3m**



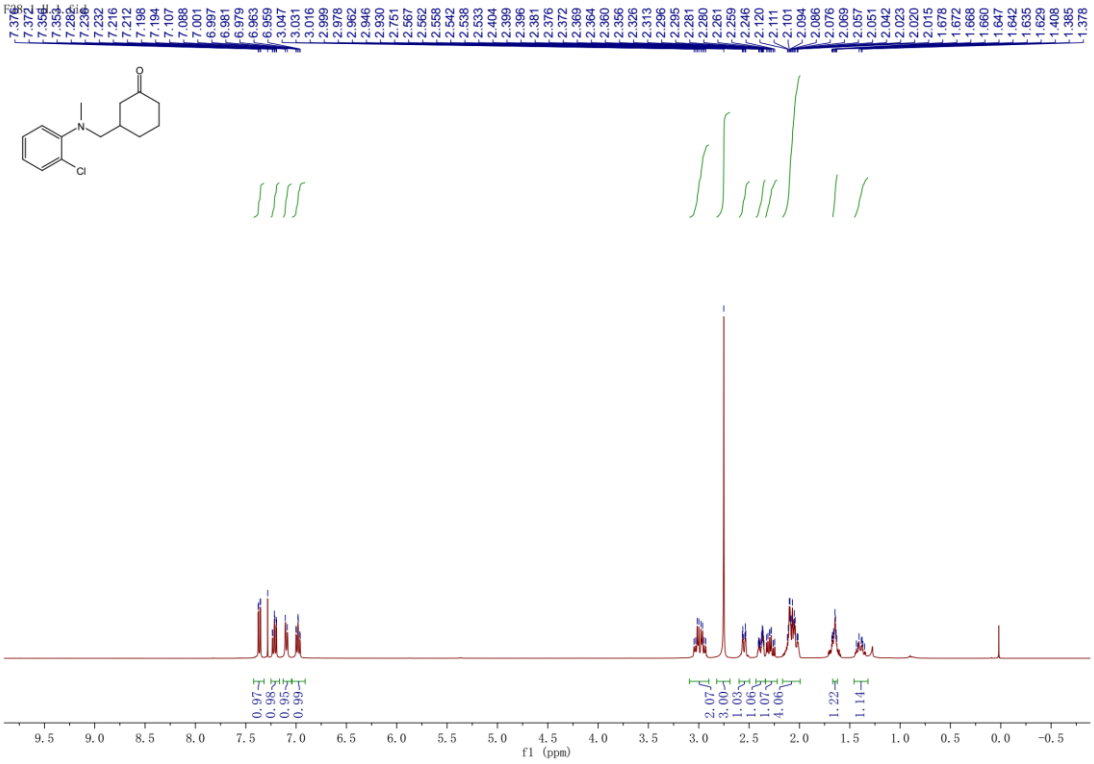
^{1}H NMR (400 MHz, $CDCl_3$) of compound **3n**



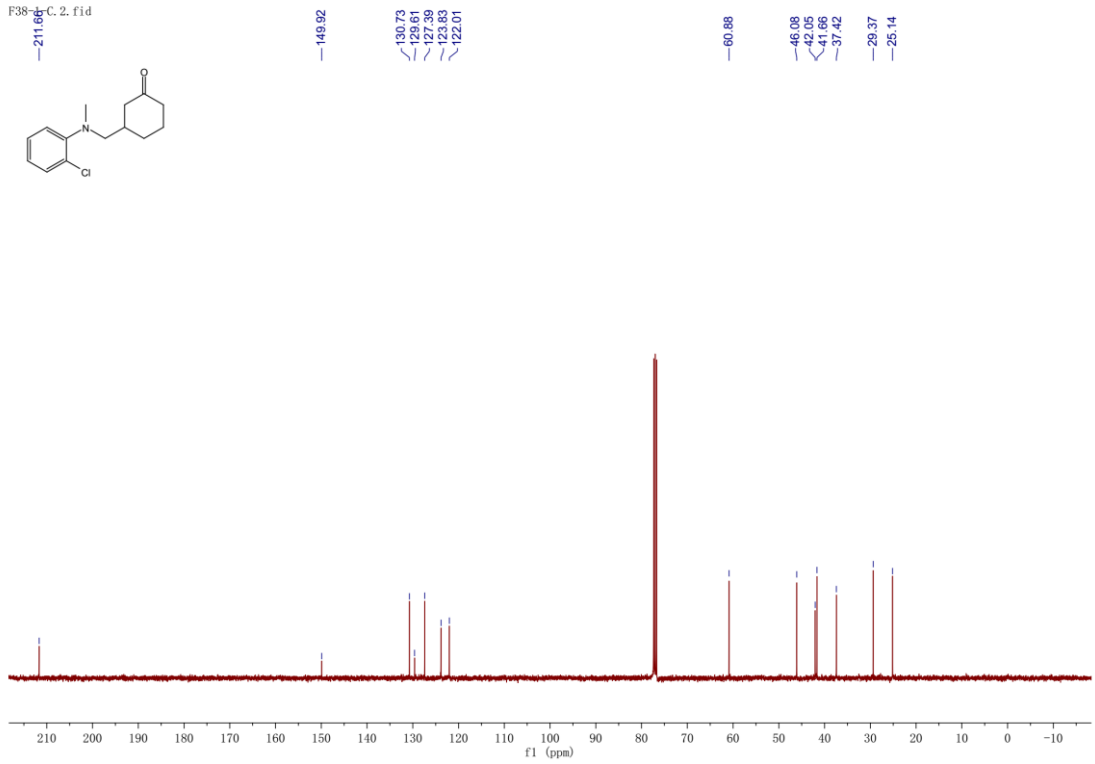
^{13}C NMR (100 MHz, $CDCl_3$) of compound **3n**



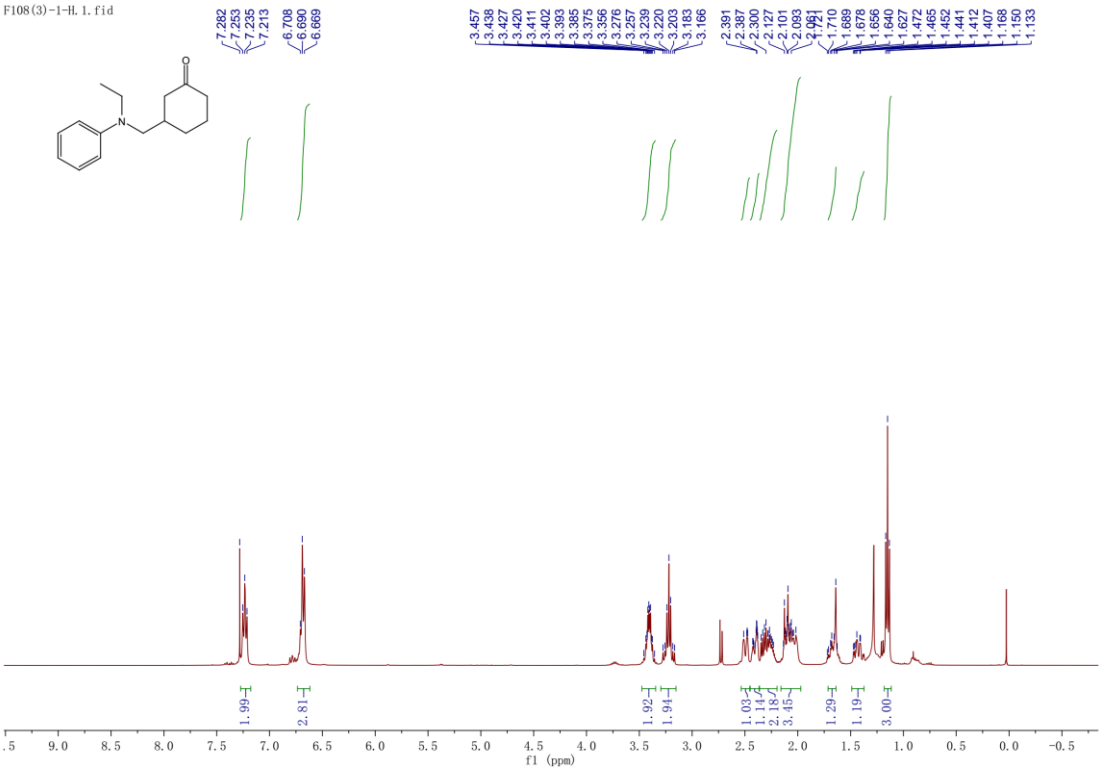
^{1}H NMR (400 MHz, $CDCl_3$) of compound **3o**



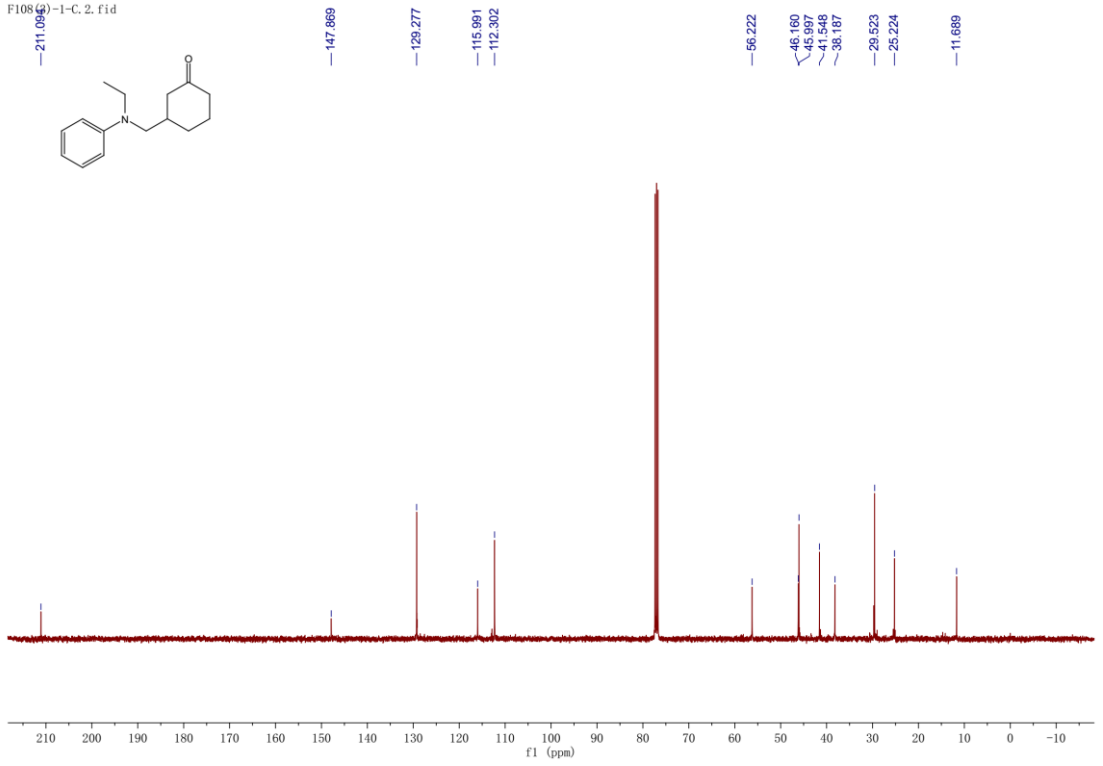
^{13}C NMR (100 MHz, $CDCl_3$) of compound **3o**



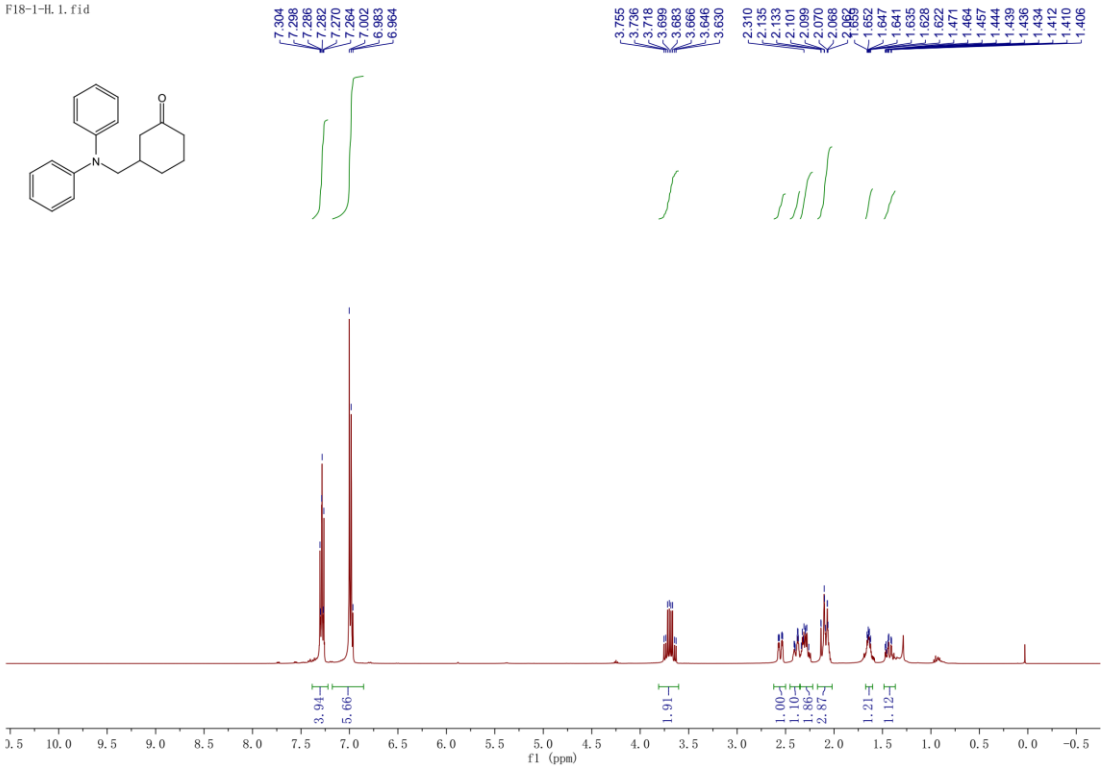
^{1}H NMR (400 MHz, $CDCl_3$) of compound **3p**



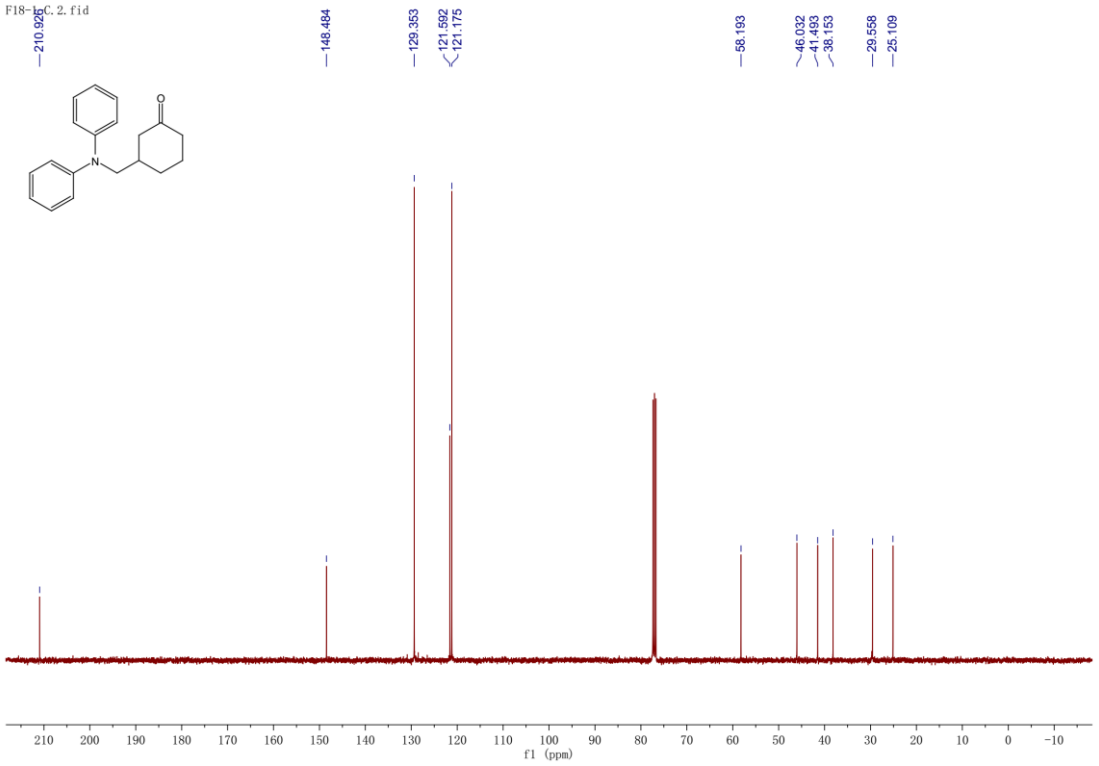
^{13}C NMR (100 MHz, $CDCl_3$) of compound **3p**



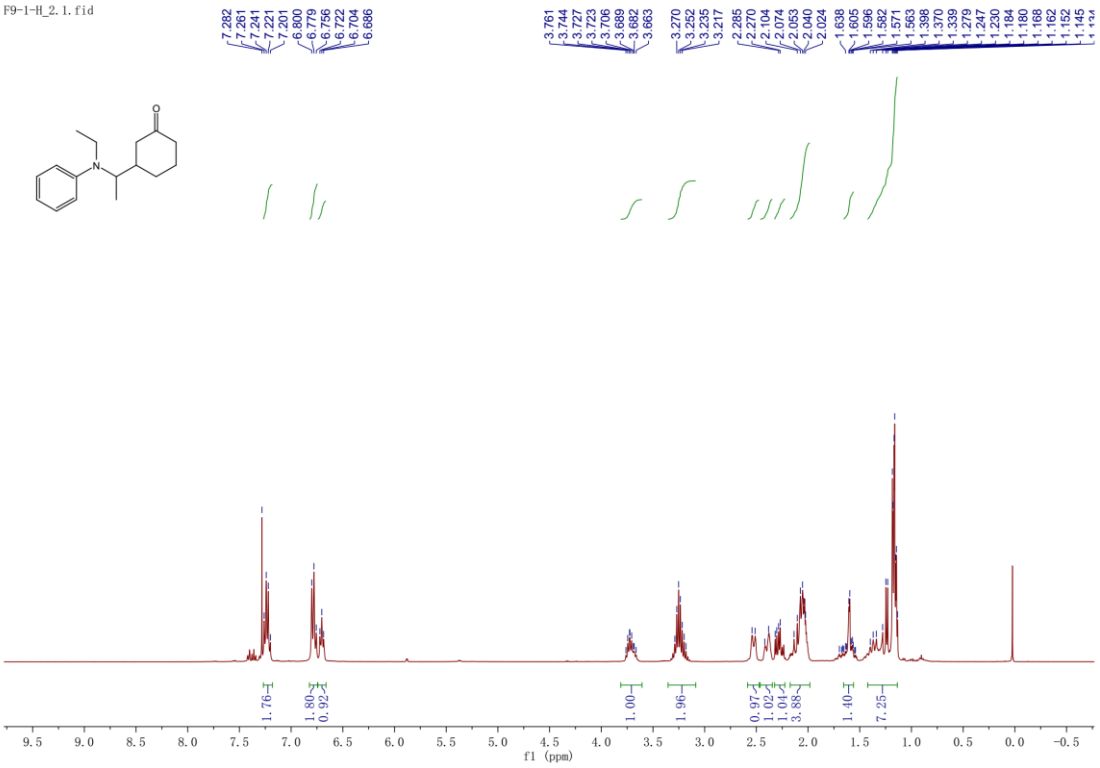
^{1}H NMR (400 MHz, $CDCl_3$) of compound **3q**



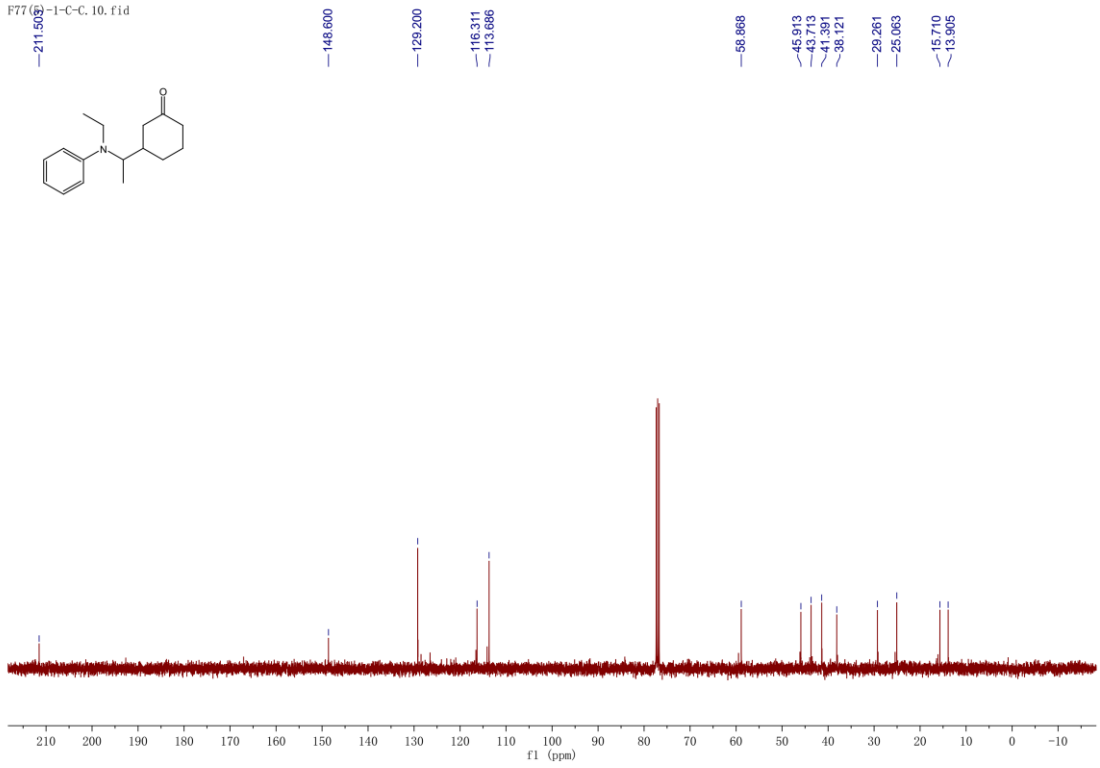
^{13}C NMR (100 MHz, $CDCl_3$) of compound **3q**



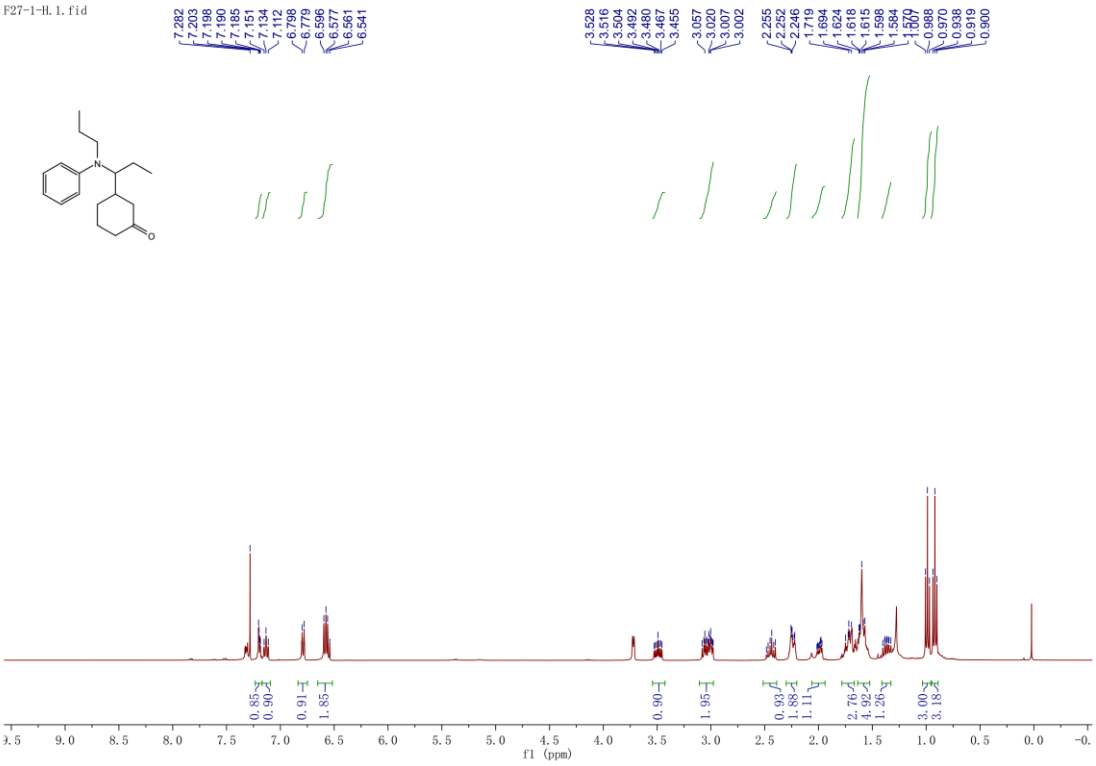
^{1}H NMR (400 MHz, $CDCl_3$) of compound **3r**



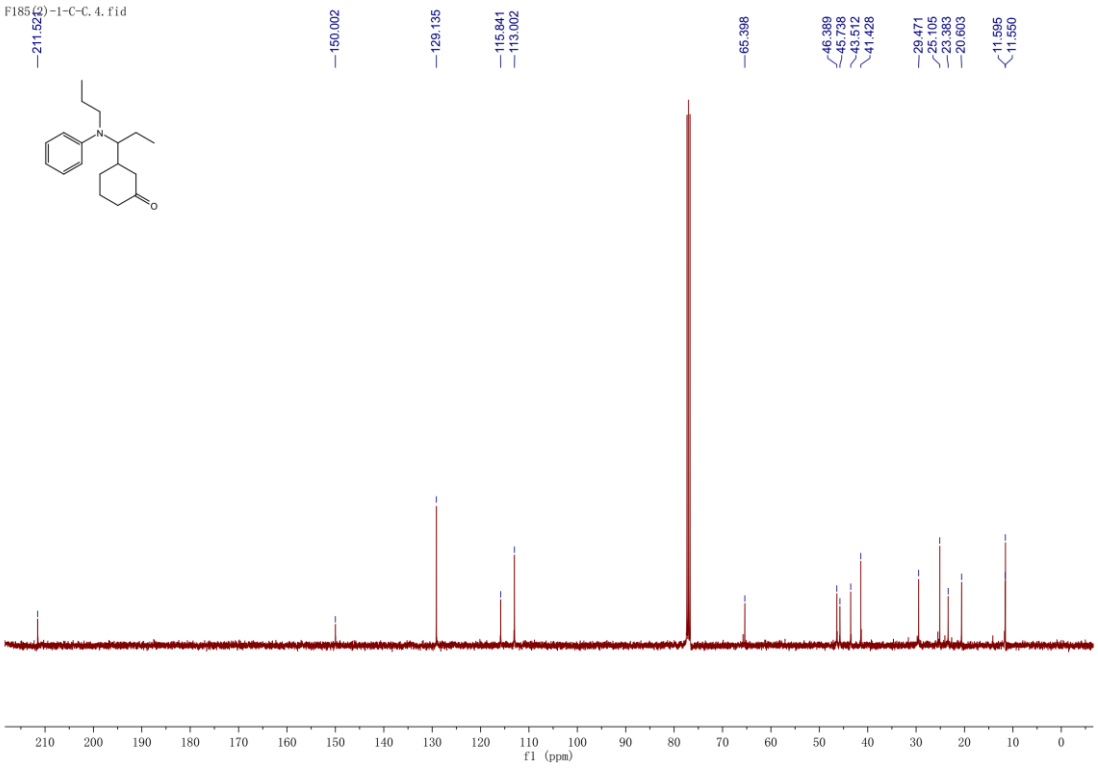
^{13}C NMR (100 MHz, $CDCl_3$) of compound **3r**



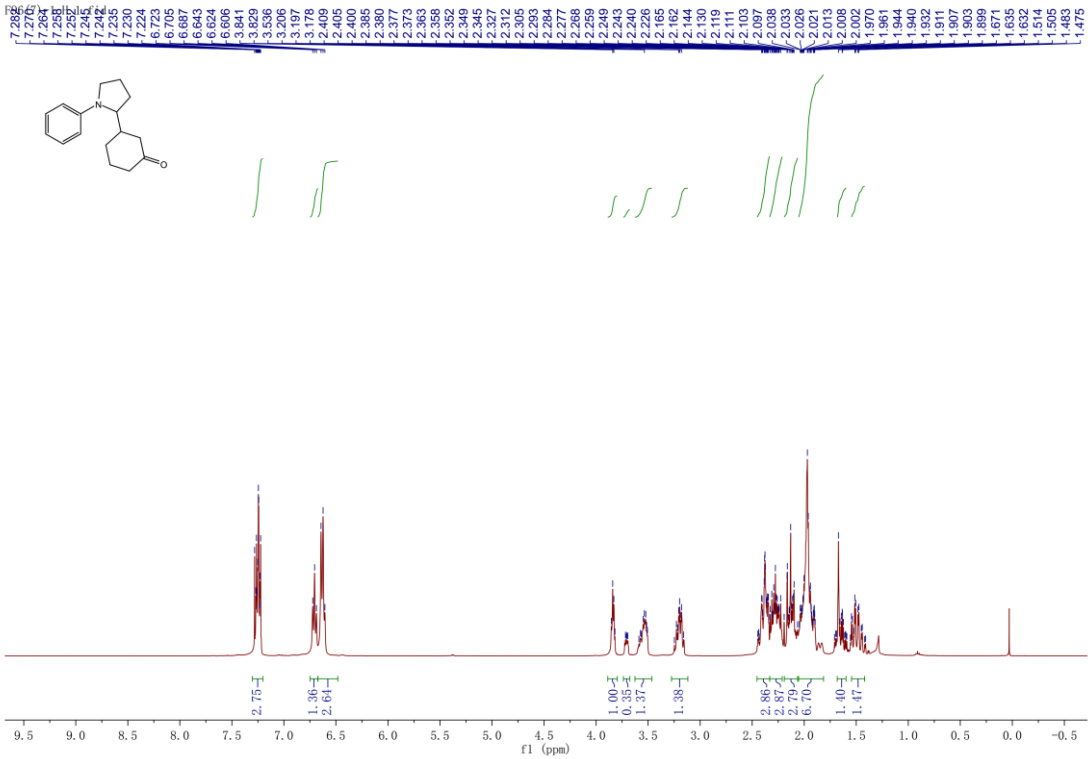
^{1}H NMR (400 MHz, $CDCl_3$) of compound **3s**



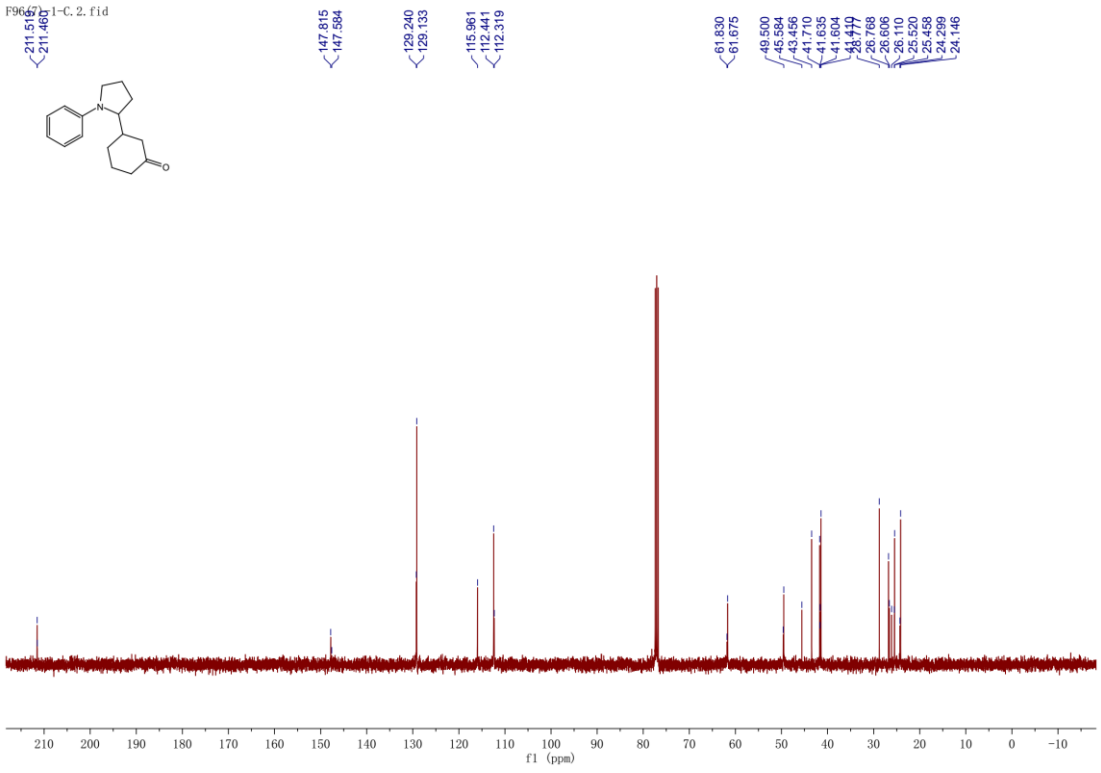
^{13}C NMR (100 MHz, $CDCl_3$) of compound **3s**



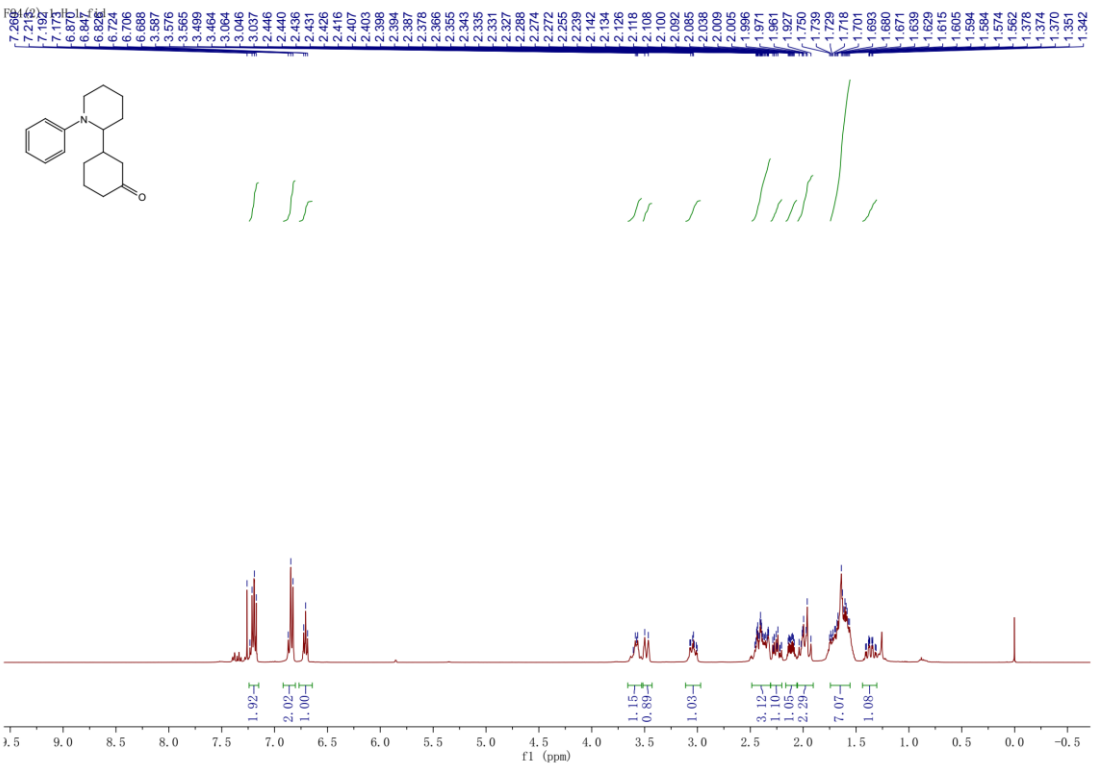
^{1}H NMR (400 MHz, $CDCl_3$) of compound **3t**



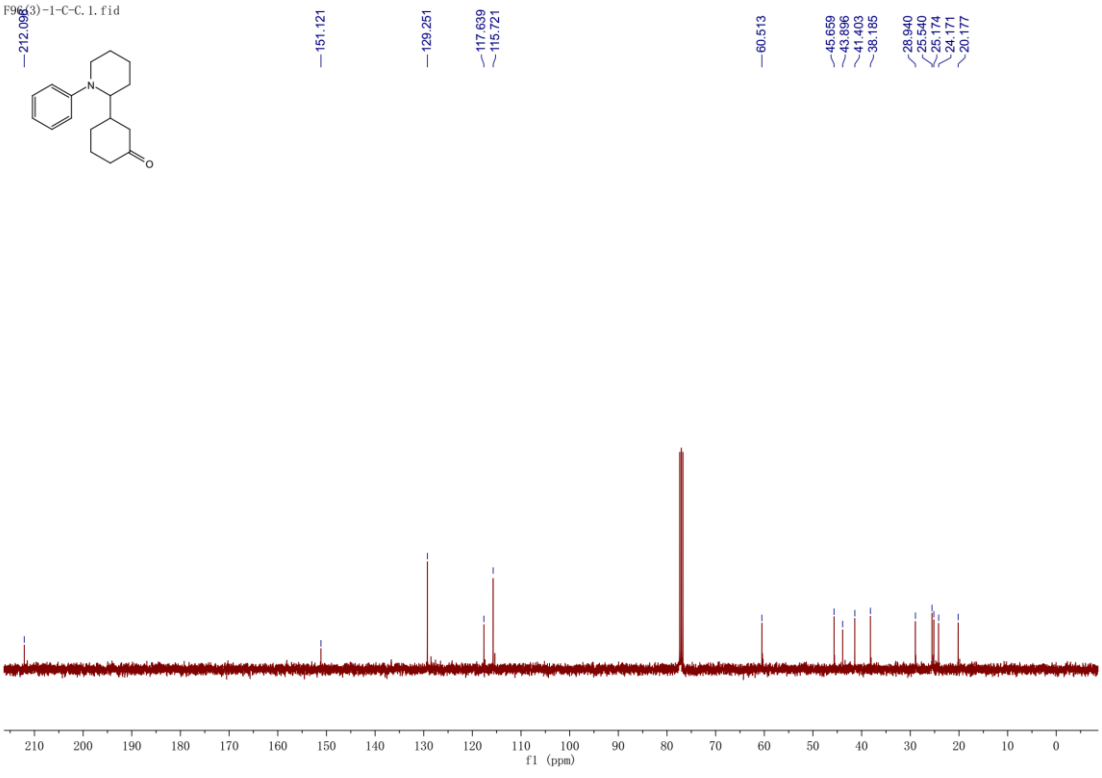
^{13}C NMR (100 MHz, $CDCl_3$) of compound **3t**



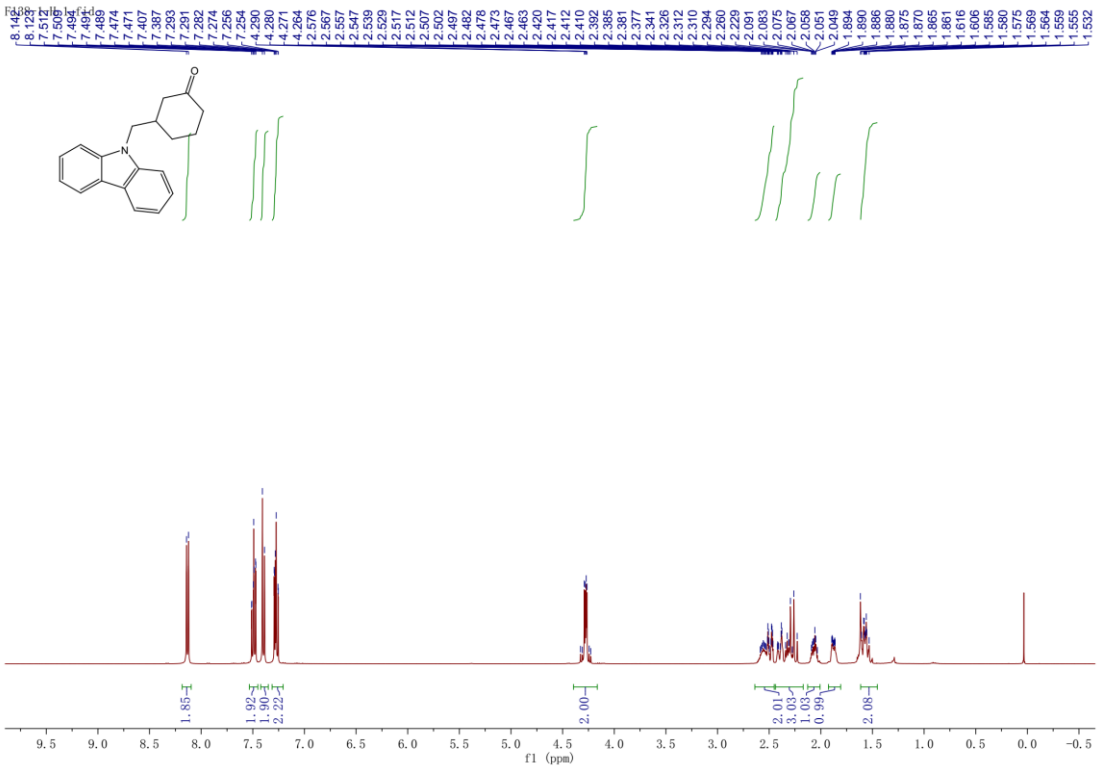
^{1}H NMR (400 MHz, $CDCl_3$) of compound **3u**



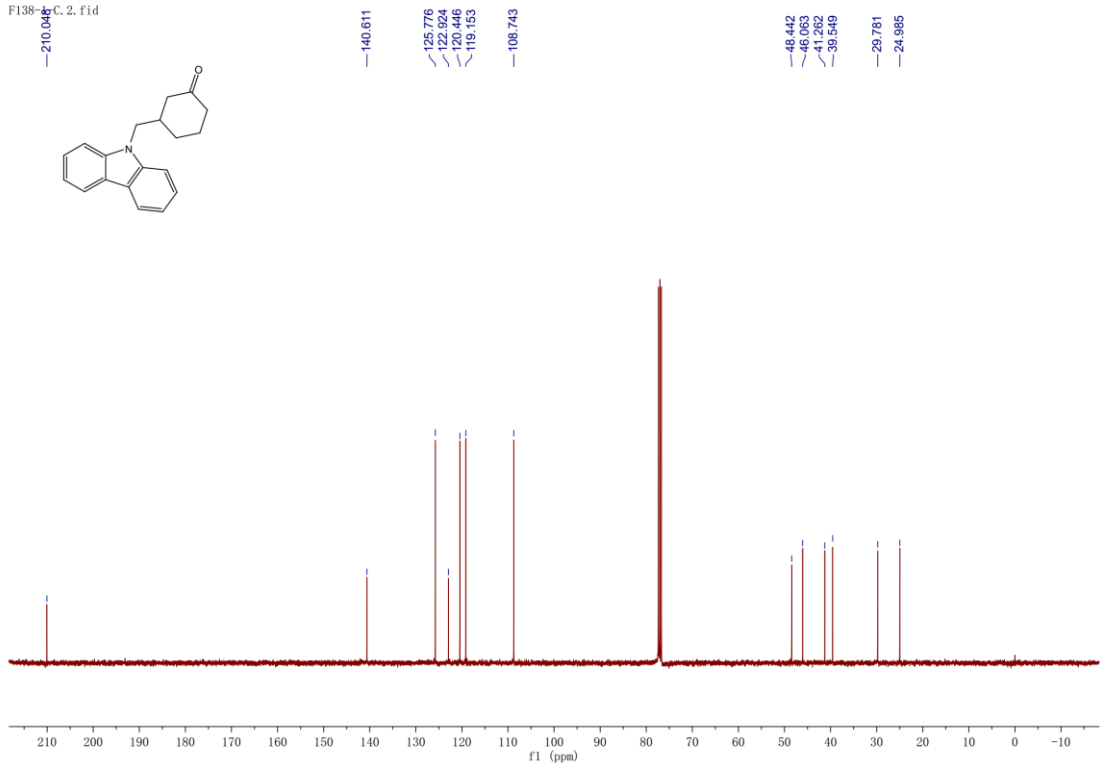
^{13}C NMR (100 MHz, $CDCl_3$) of compound **3u**



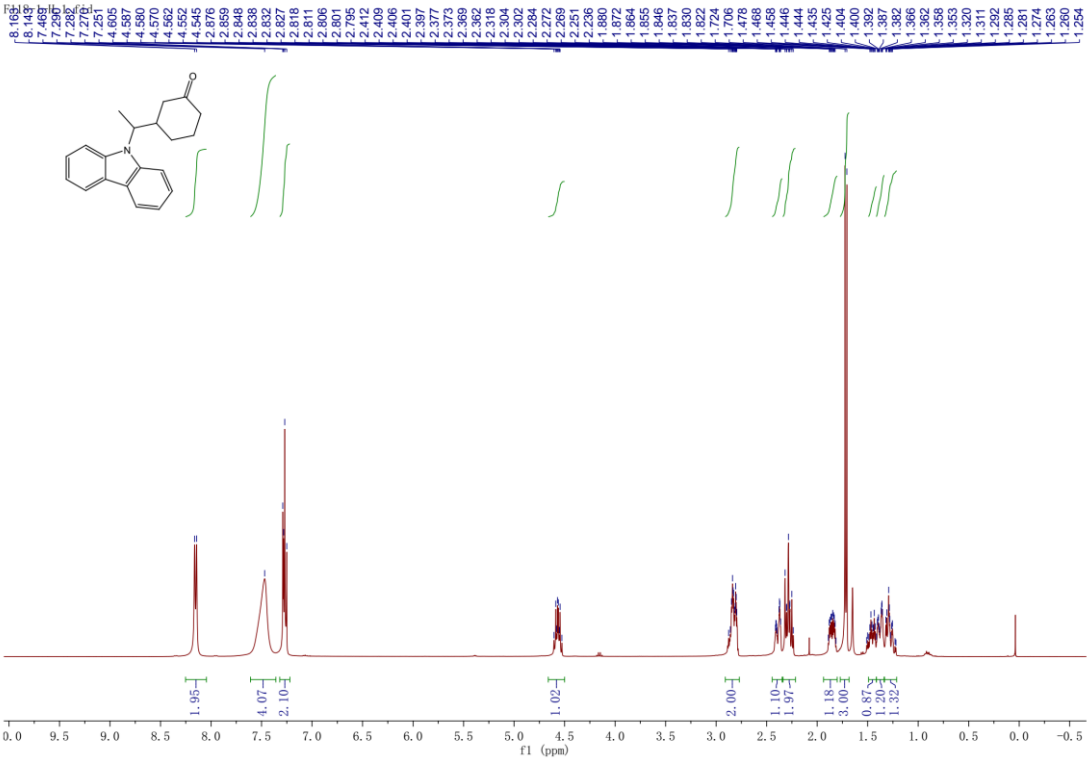
^{1}H NMR (400 MHz, $CDCl_3$) of compound **3v**



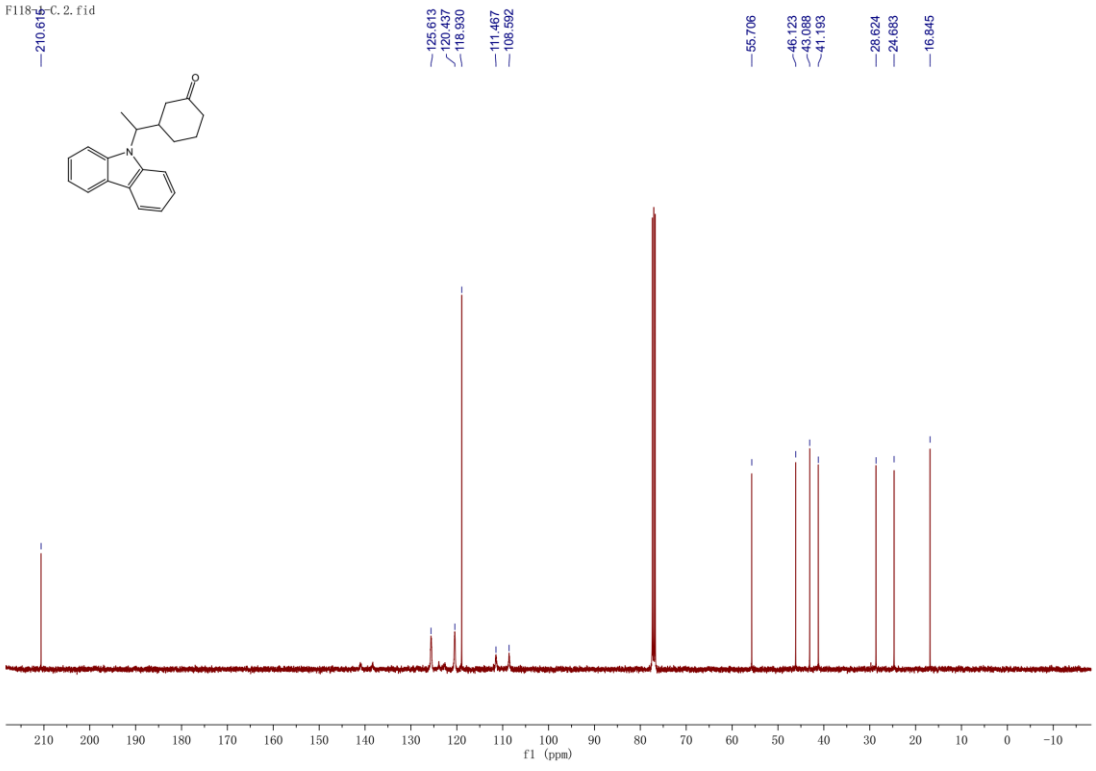
^{13}C NMR (100 MHz, $CDCl_3$) of compound **3v**



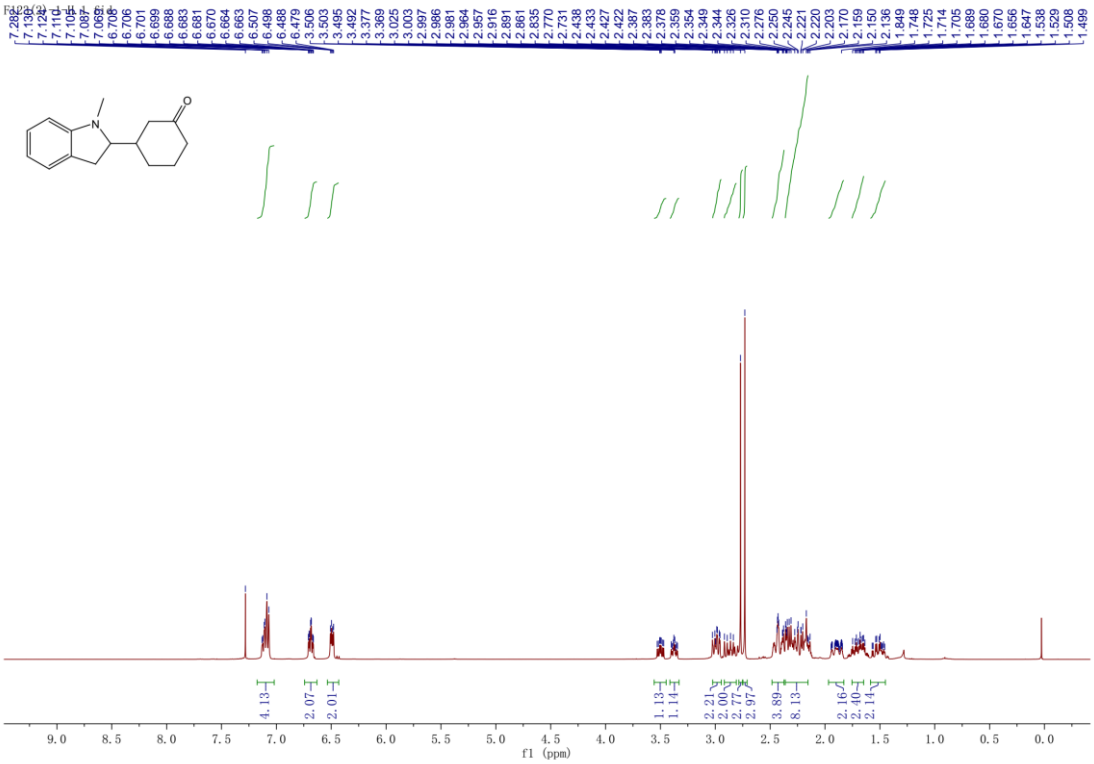
^{1}H NMR (400 MHz, $CDCl_3$) of compound **3w**



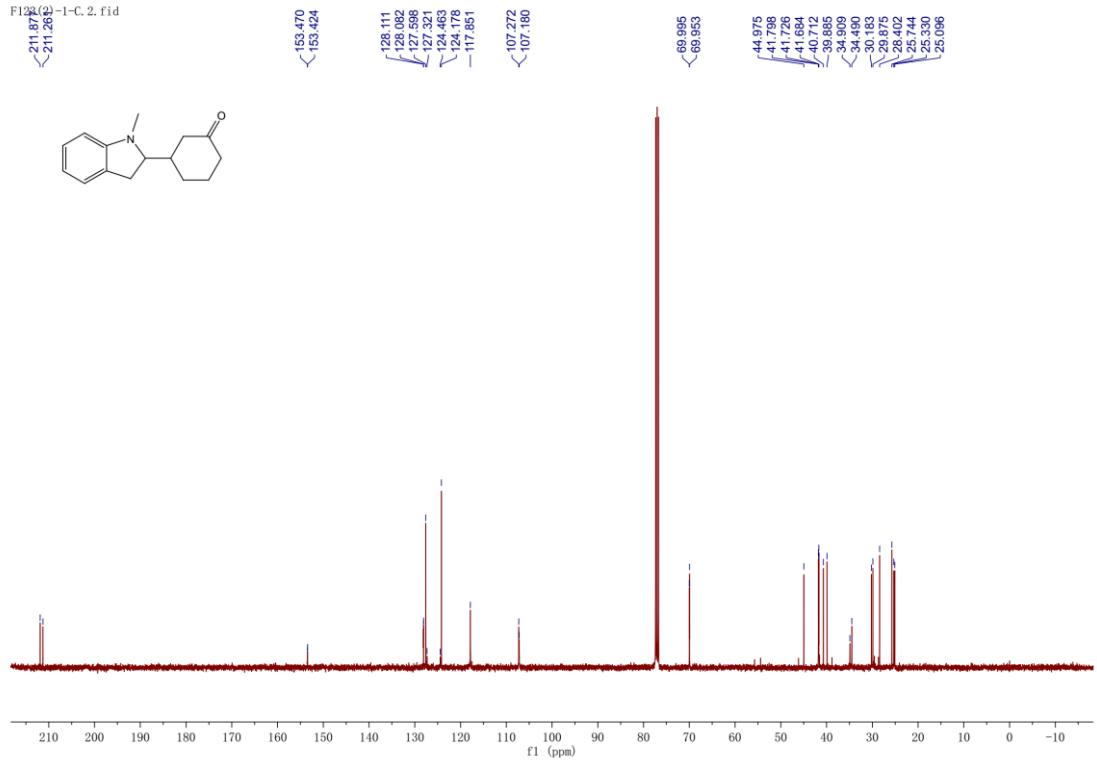
^{13}C NMR (100 MHz, $CDCl_3$) of compound **3w**



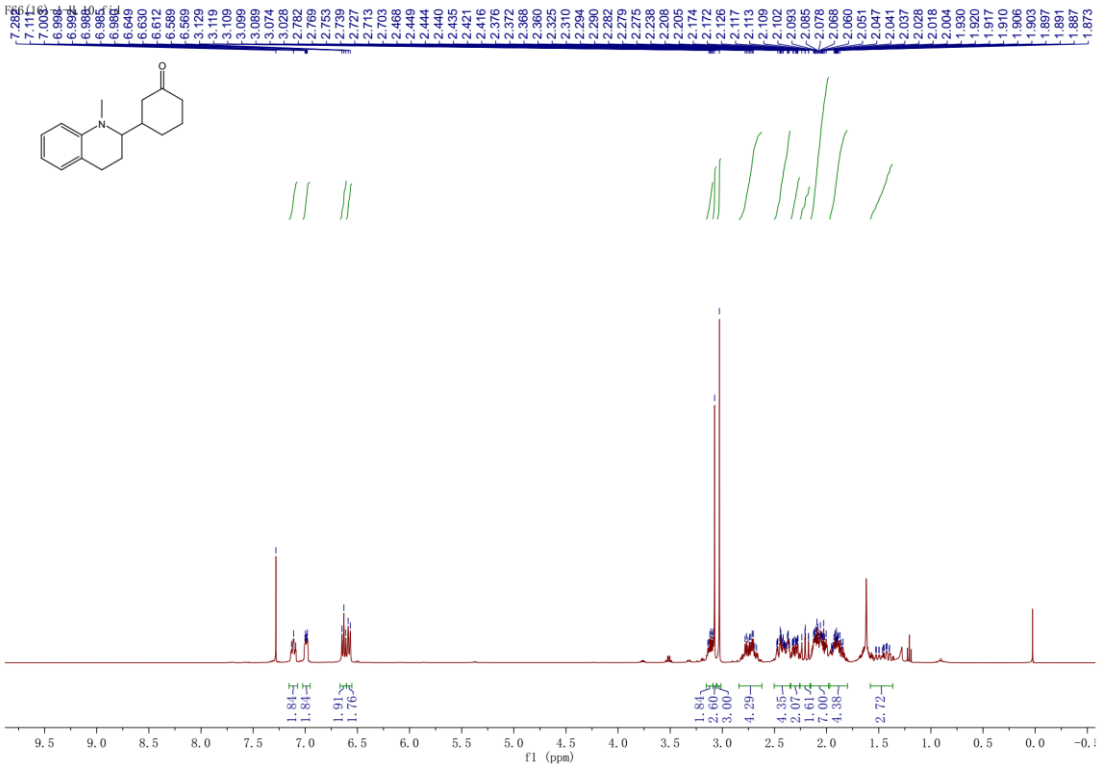
^{1}H NMR (400 MHz, $CDCl_3$) of compound **3x**



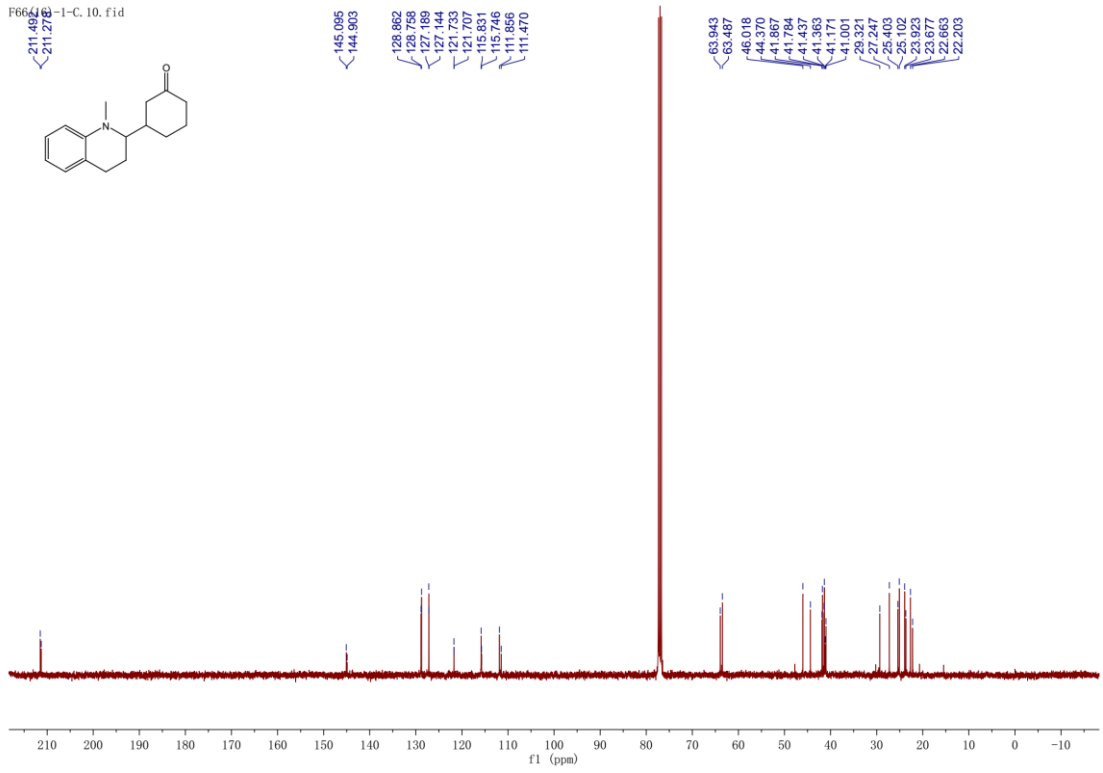
^{13}C NMR (100 MHz, $CDCl_3$) of compound **3x**



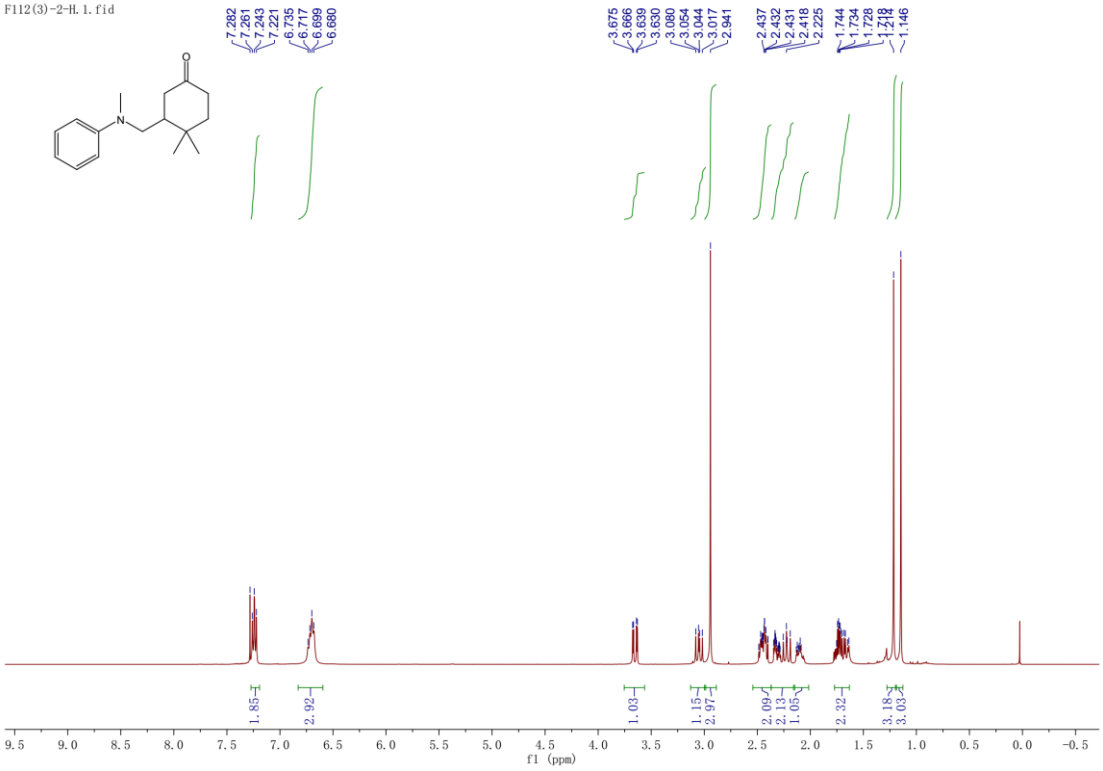
^{1}H NMR (400 MHz, $CDCl_3$) of compound **3y**



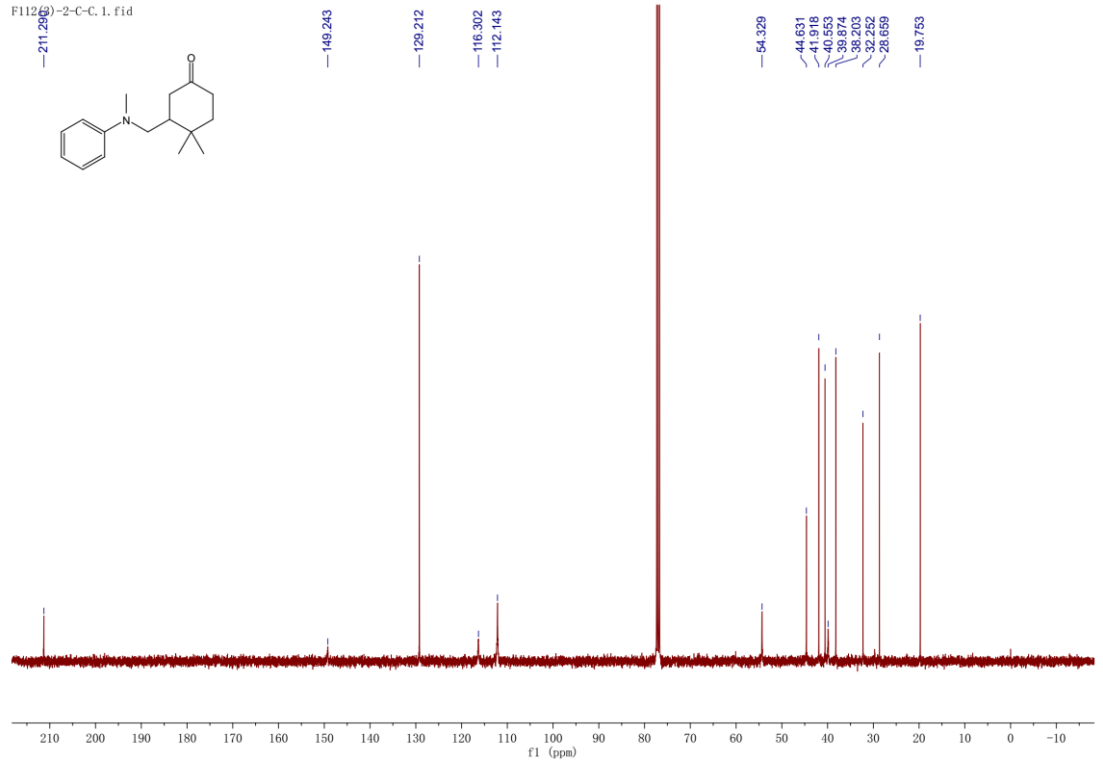
^{13}C NMR (100 MHz, $CDCl_3$) of compound **3y**



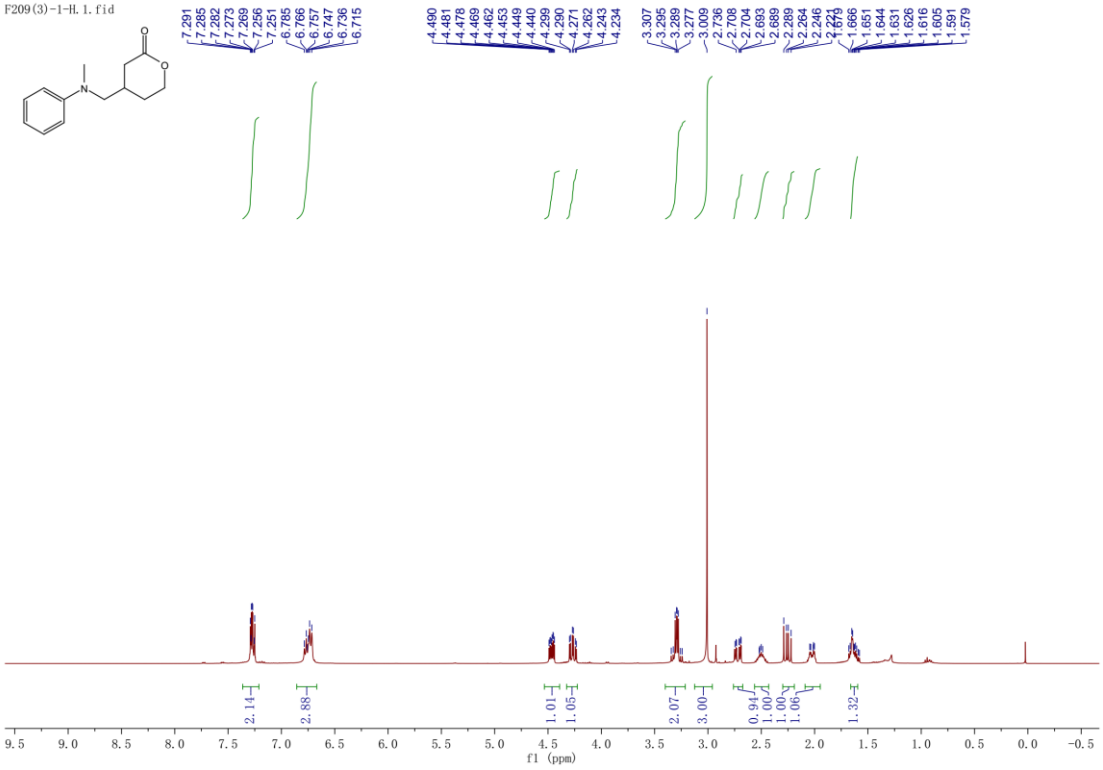
^{1}H NMR (400 MHz, $CDCl_3$) of compound **4b**



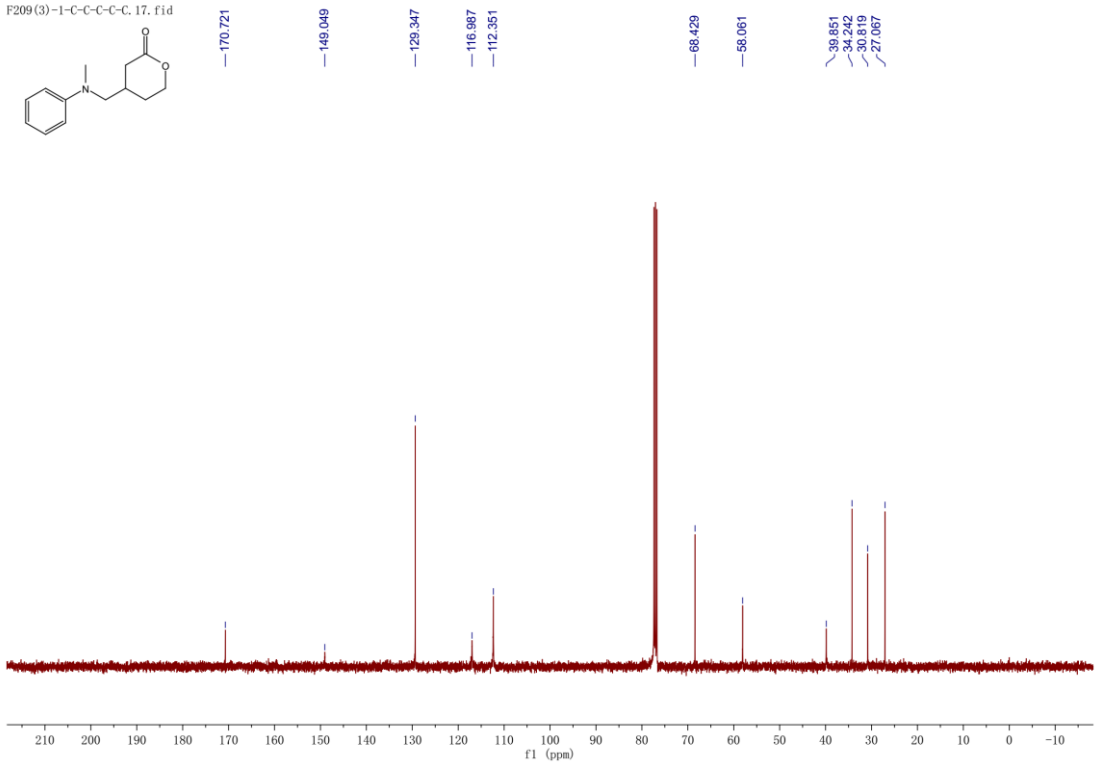
^{13}C NMR (100 MHz, $CDCl_3$) of compound **4b**



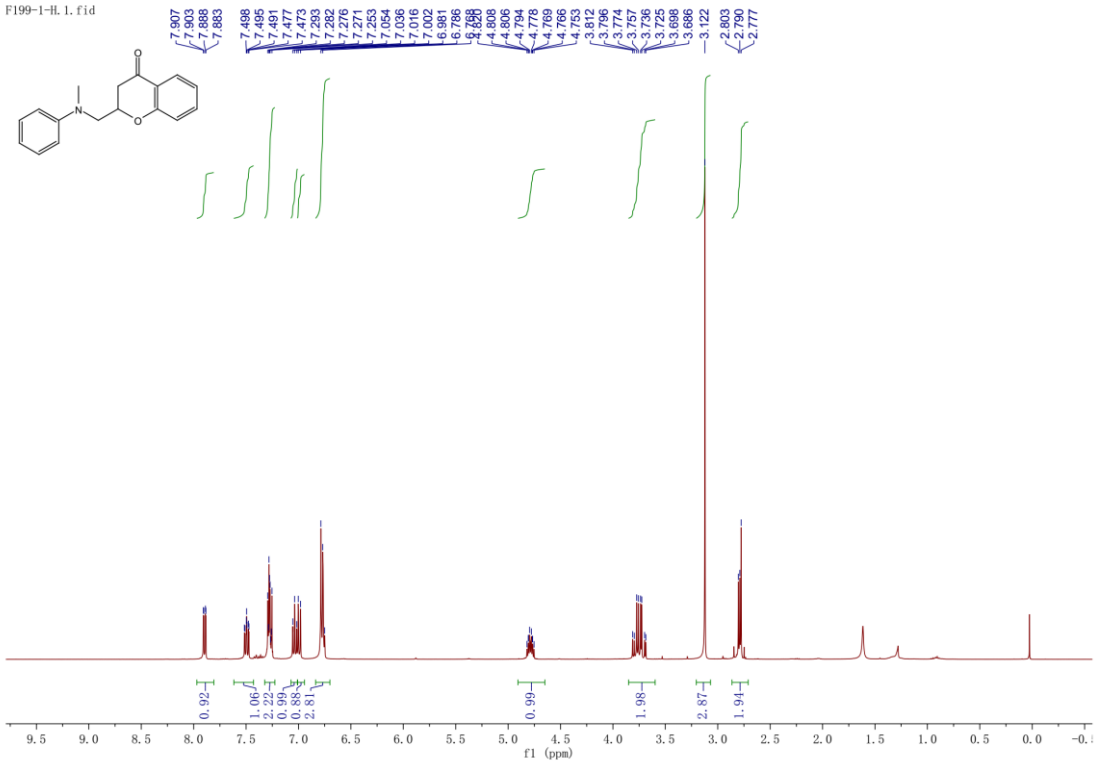
^{1}H NMR (400 MHz, $CDCl_3$) of compound **4c**



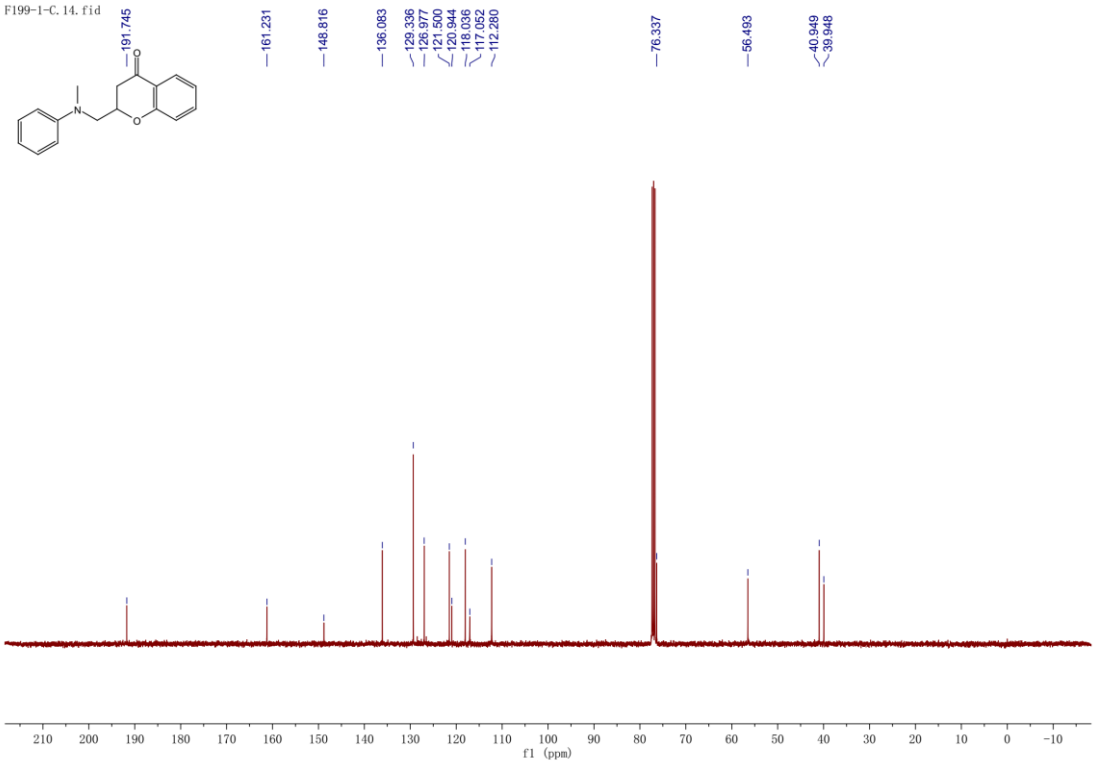
^{13}C NMR (100 MHz, $CDCl_3$) of compound **4c**



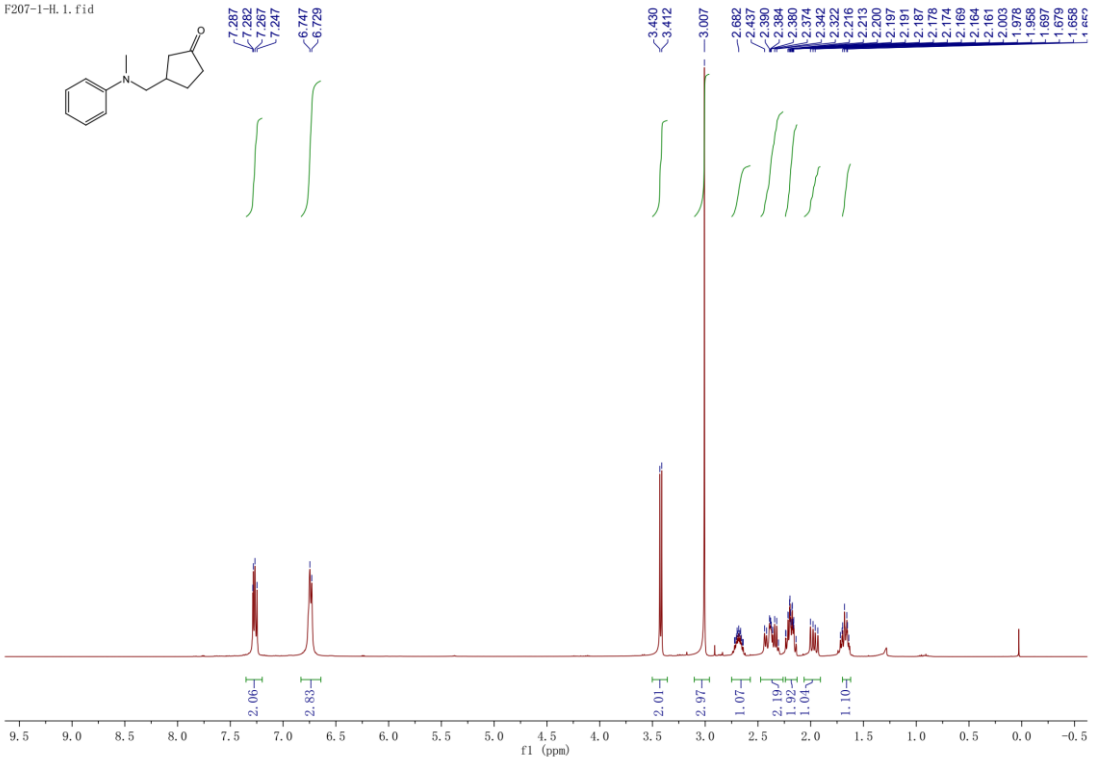
^{1}H NMR (400 MHz, $CDCl_3$) of compound **4d**



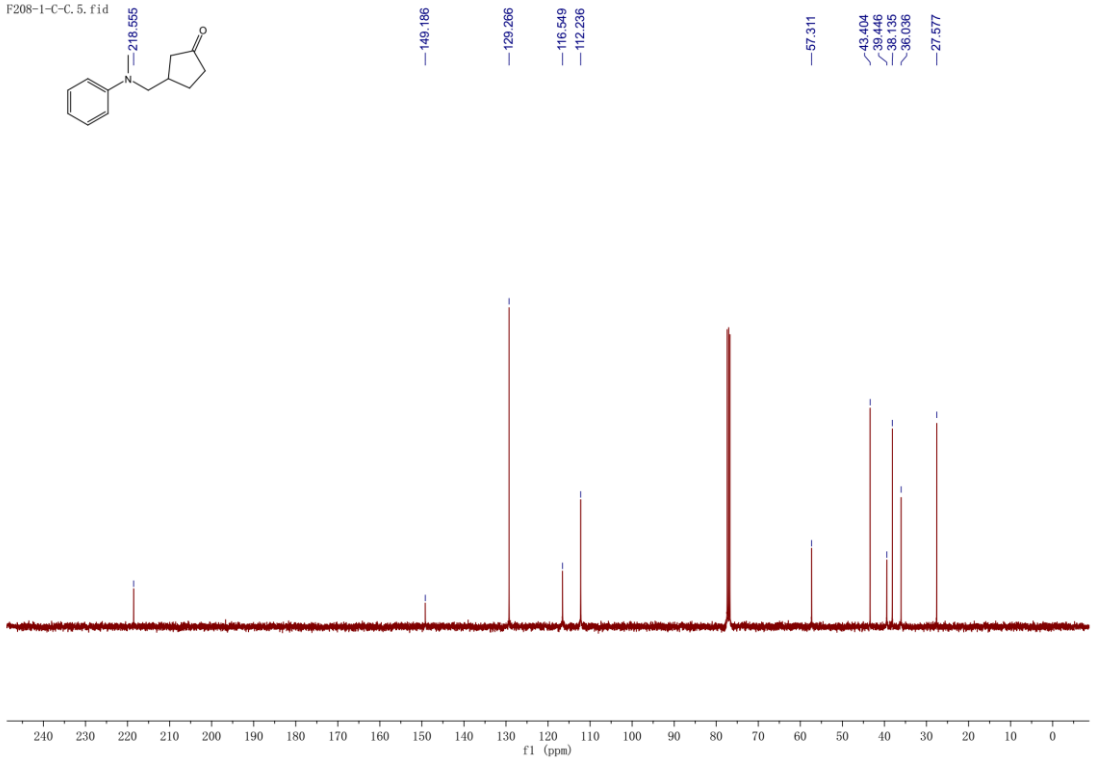
^{13}C NMR (100 MHz, $CDCl_3$) of compound **4d**



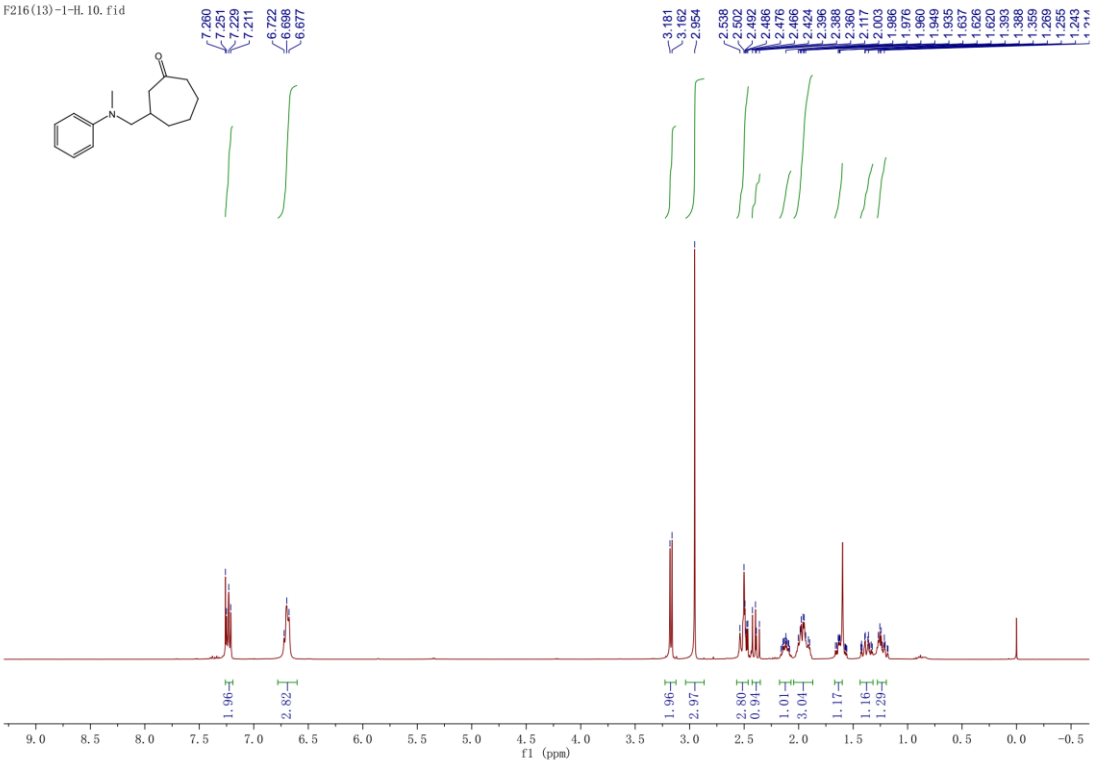
^{1}H NMR (400 MHz, $CDCl_3$) of compound **4e**



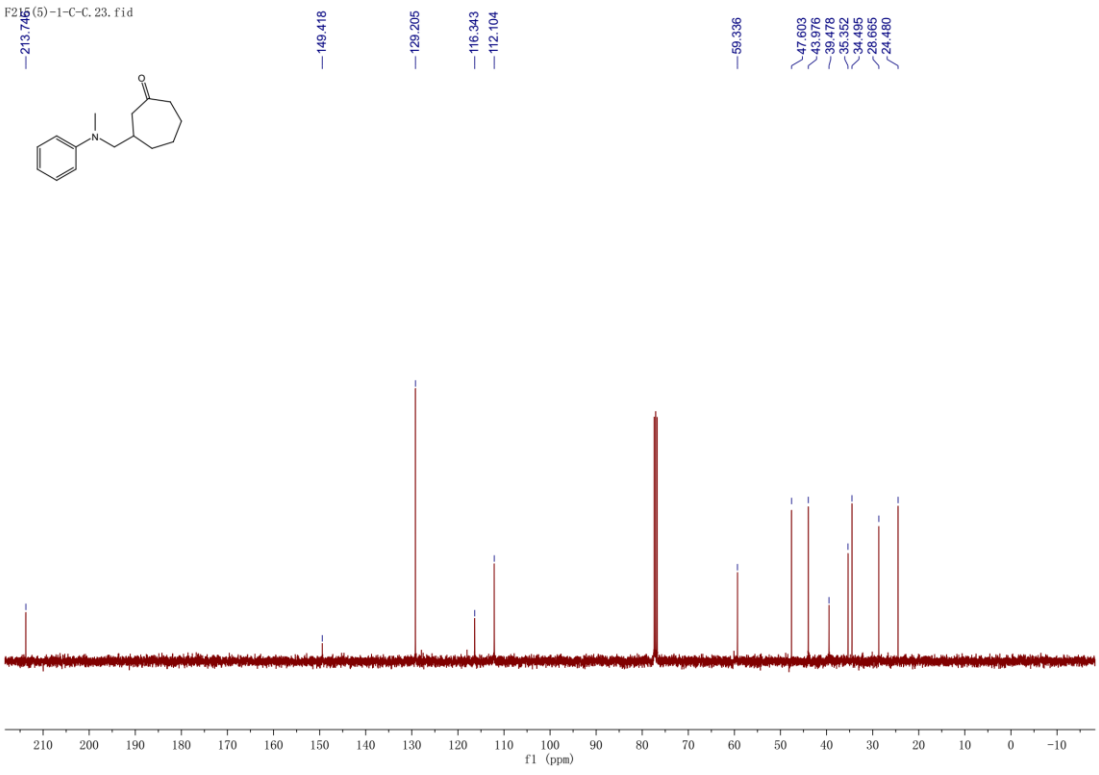
^{13}C NMR (100 MHz, $CDCl_3$) of compound **4e**



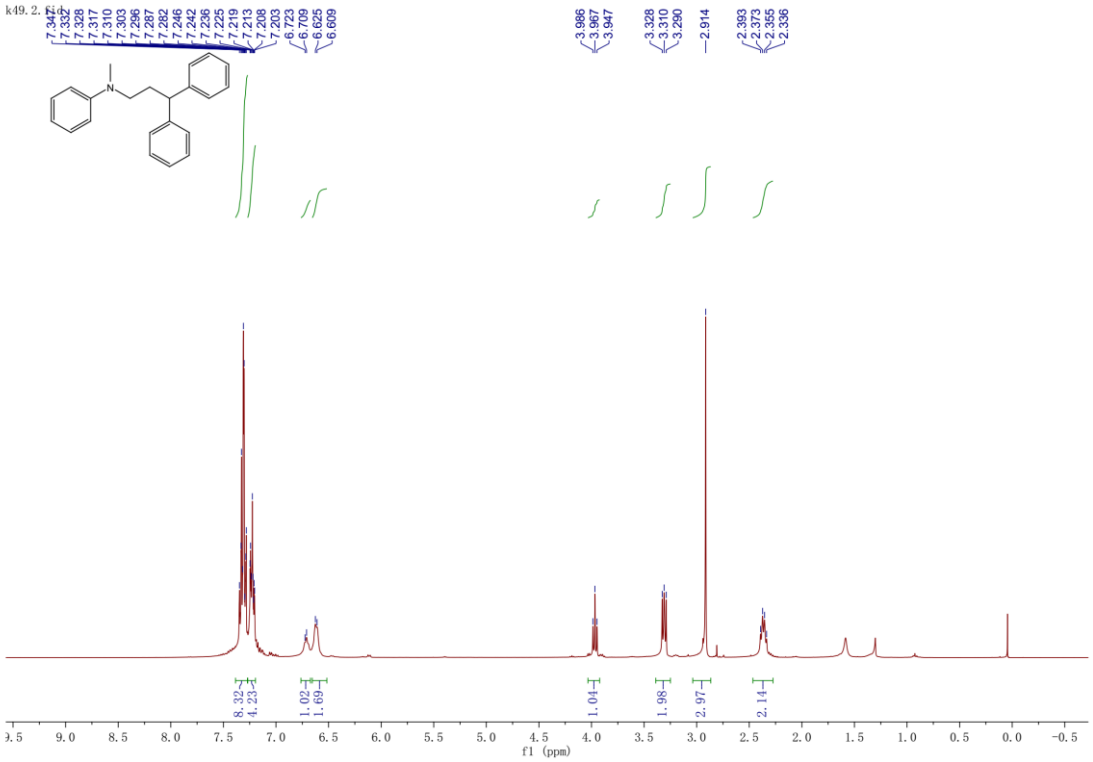
^{1}H NMR (400 MHz, $CDCl_3$) of compound **4f**



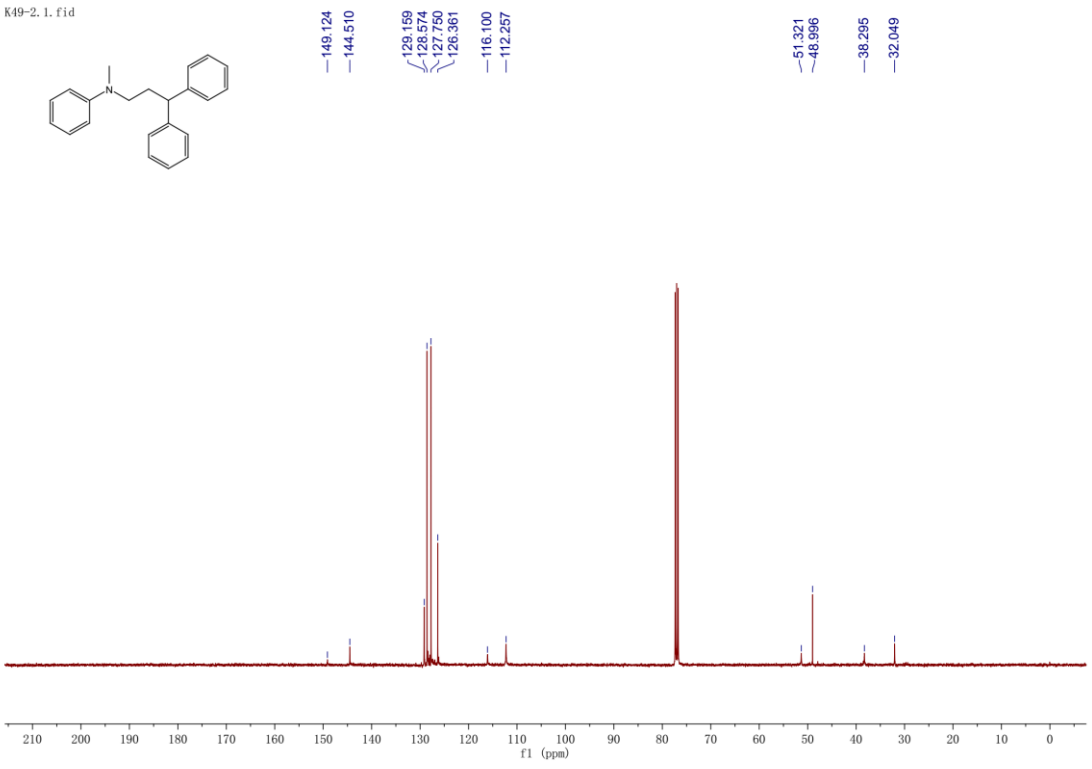
^{13}C NMR (100 MHz, $CDCl_3$) of compound **4f**



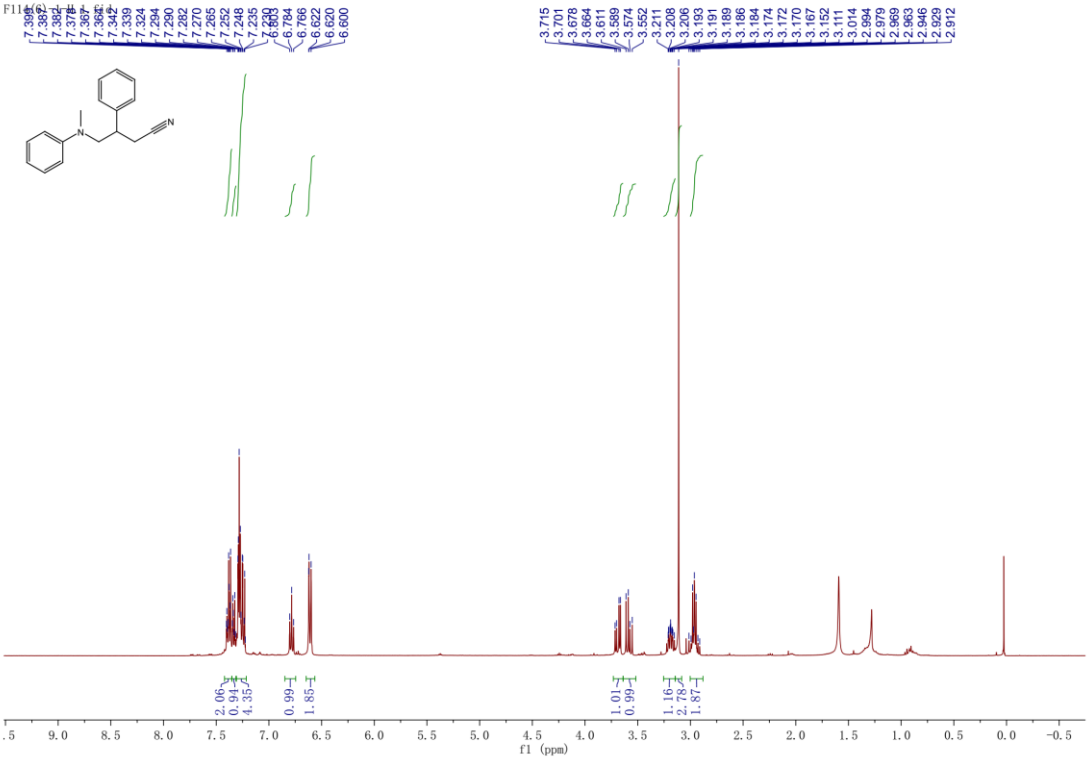
^{1}H NMR (400 MHz, $CDCl_3$) of compound **4g**



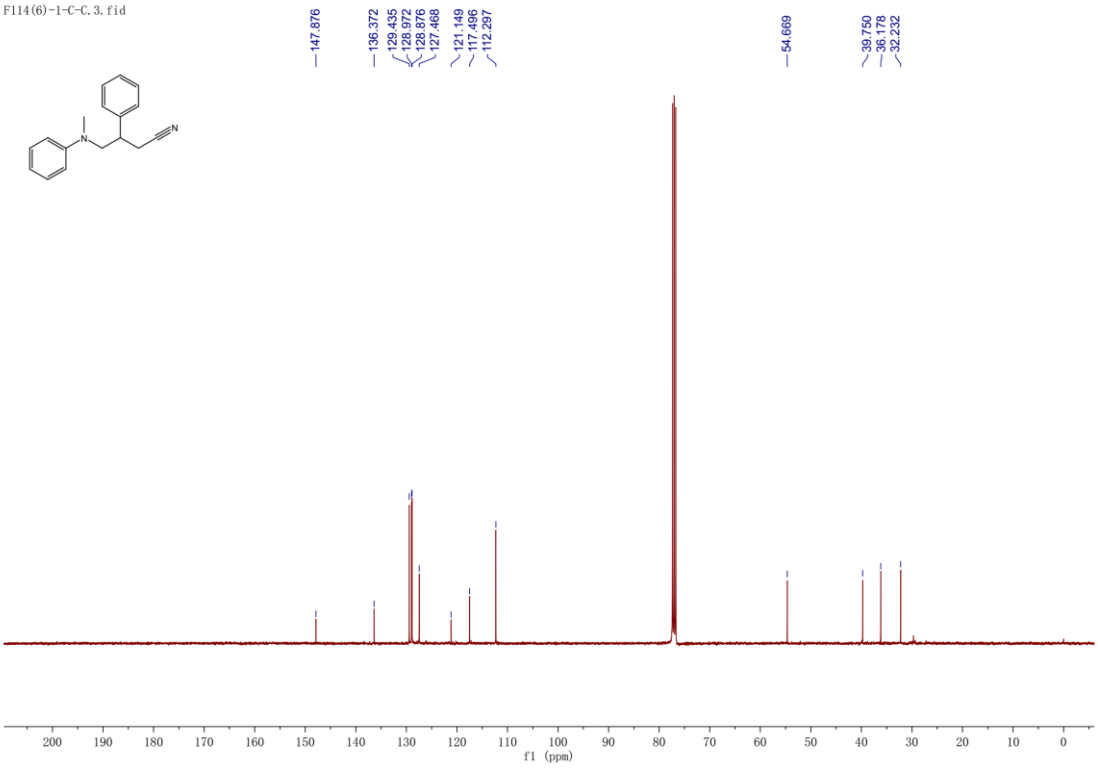
^{13}C NMR (100 MHz, $CDCl_3$) of compound **4g**



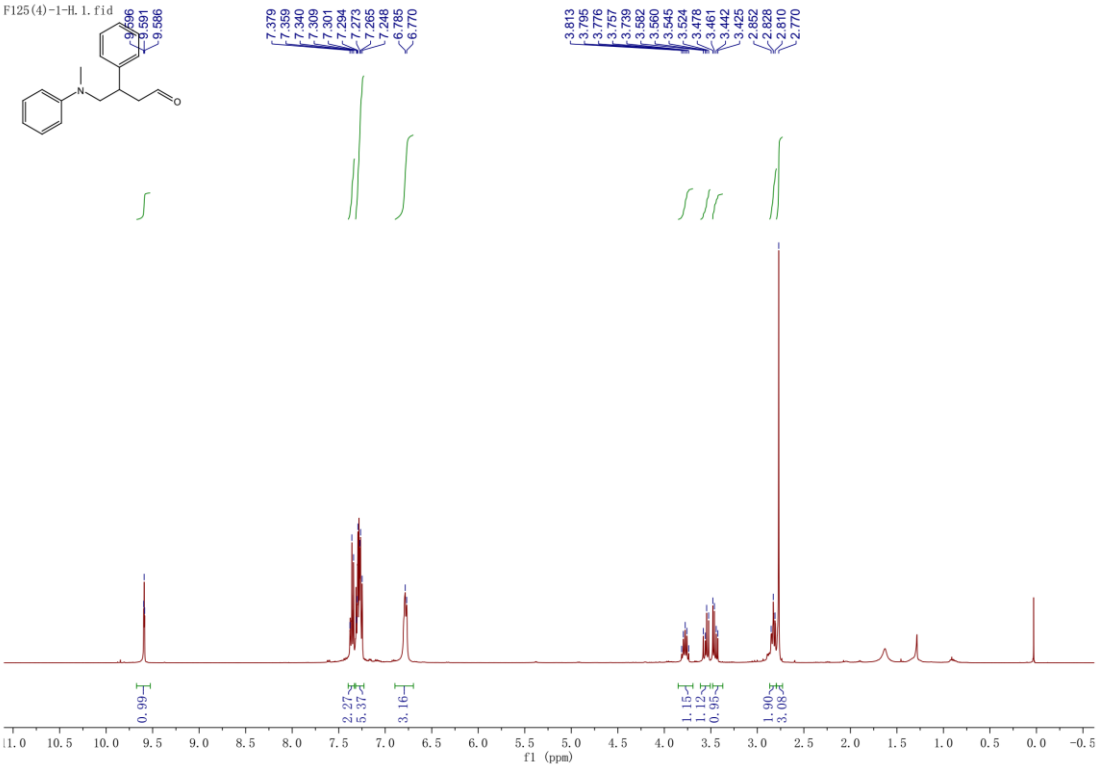
^{1}H NMR (400 MHz, $CDCl_3$) of compound **4h**



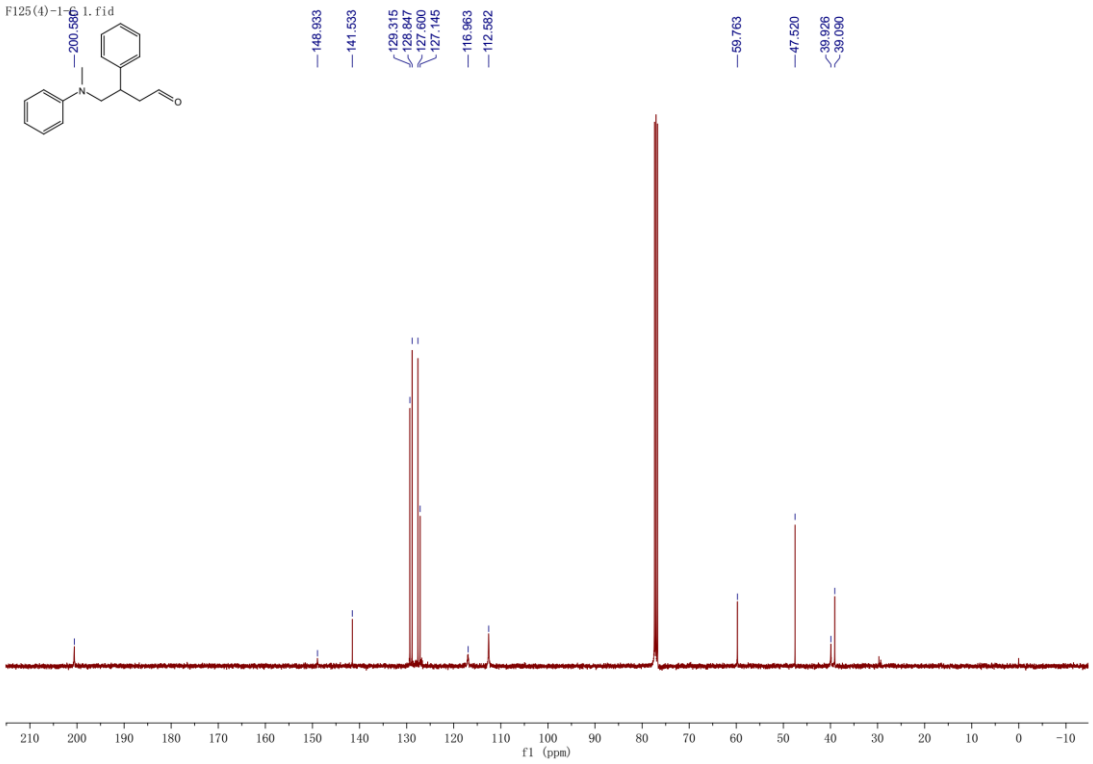
^{13}C NMR (100 MHz, $CDCl_3$) of compound **4h**



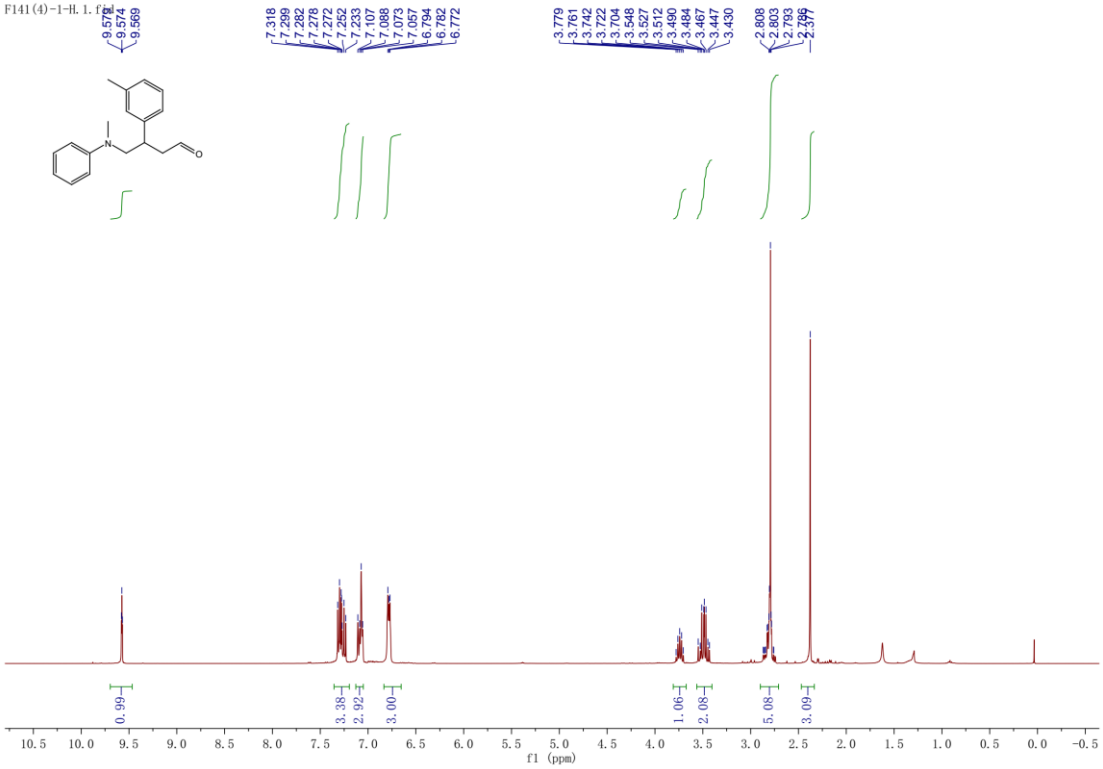
^{1}H NMR (400 MHz, $CDCl_3$) of compound **4i**



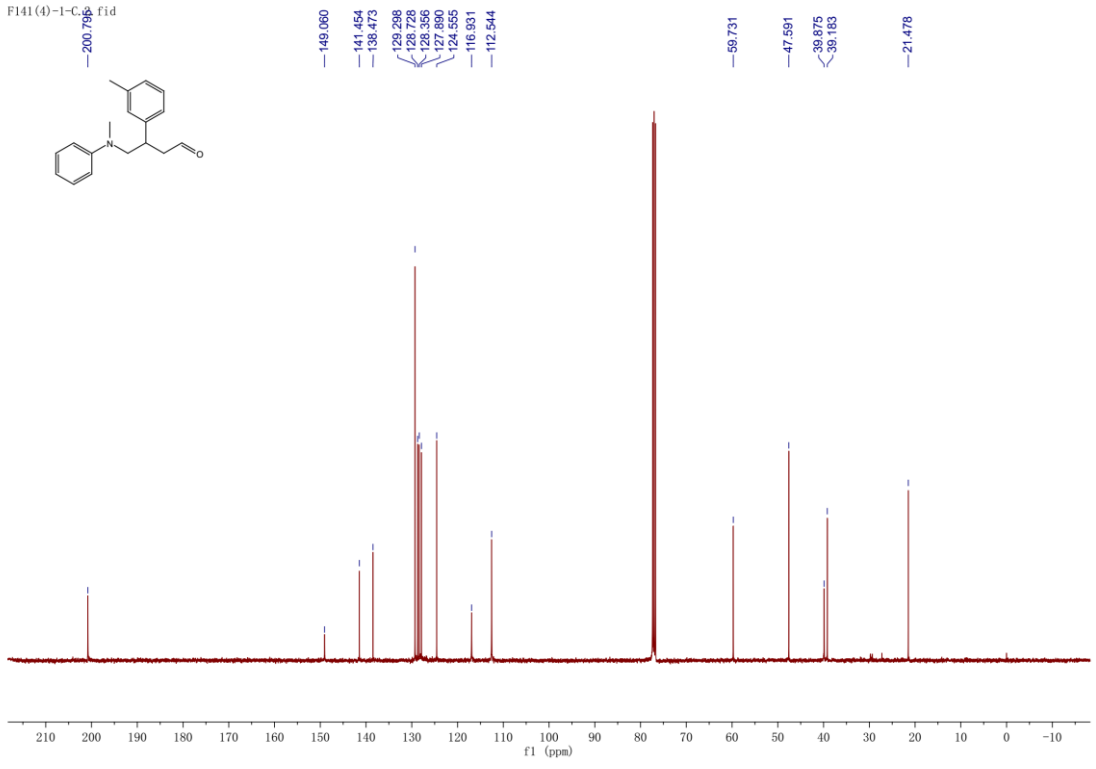
^{13}C NMR (100 MHz, $CDCl_3$) of compound **4i**



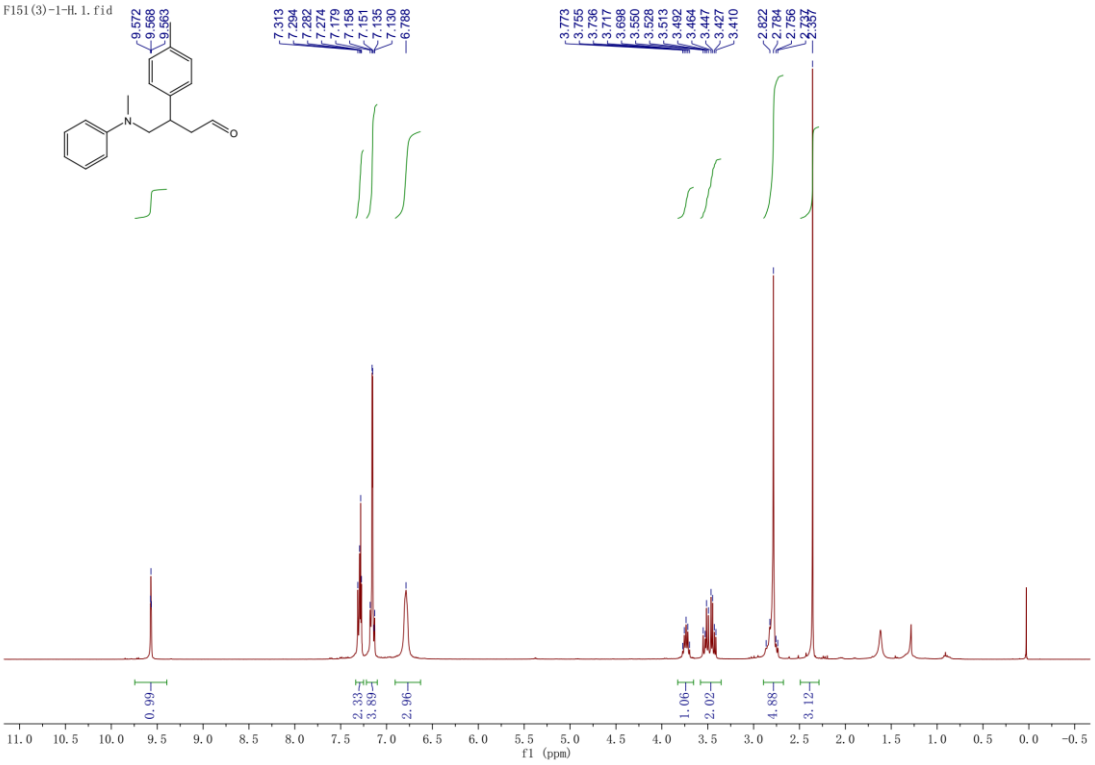
^{1}H NMR (400 MHz, $CDCl_3$) of compound **4j**



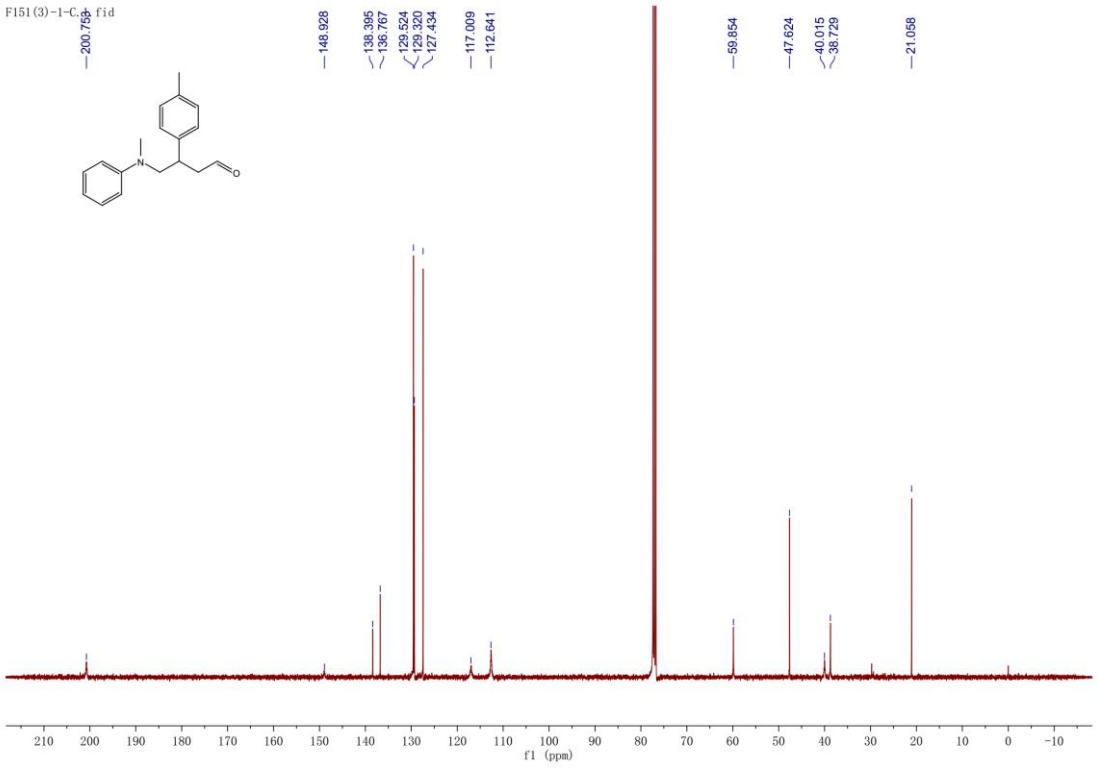
^{13}C NMR (100 MHz, $CDCl_3$) of compound **4j**



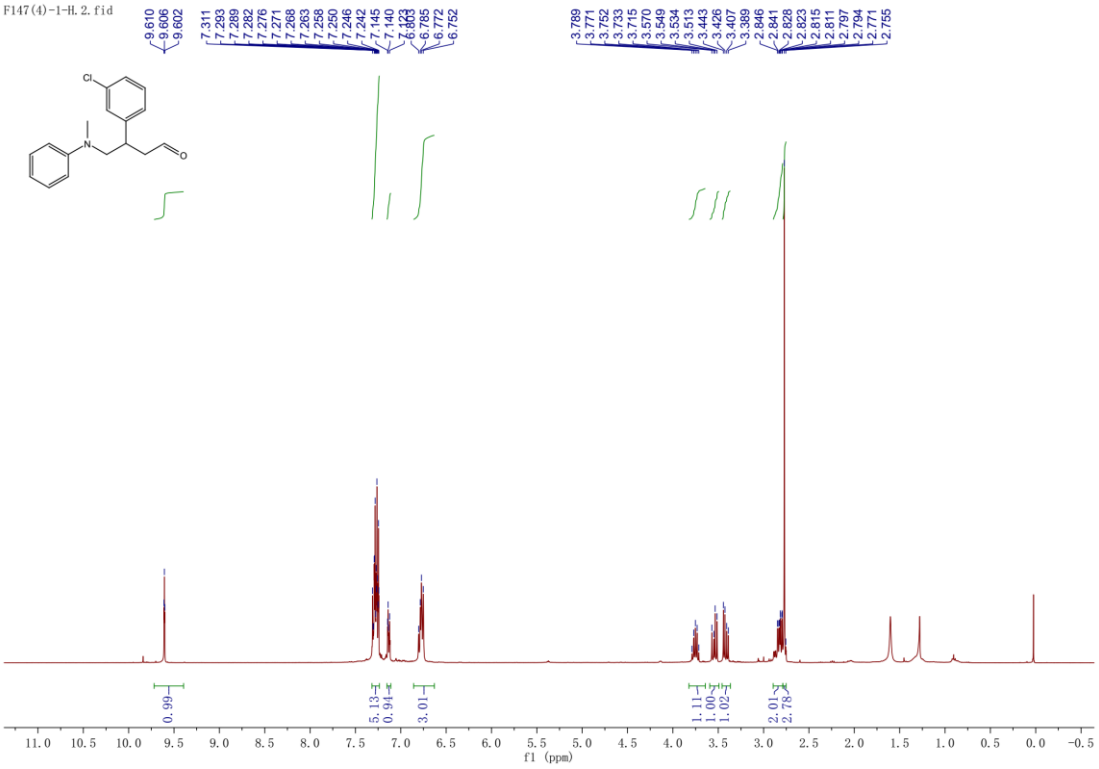
^{1}H NMR (400 MHz, $CDCl_3$) of compound **4k**



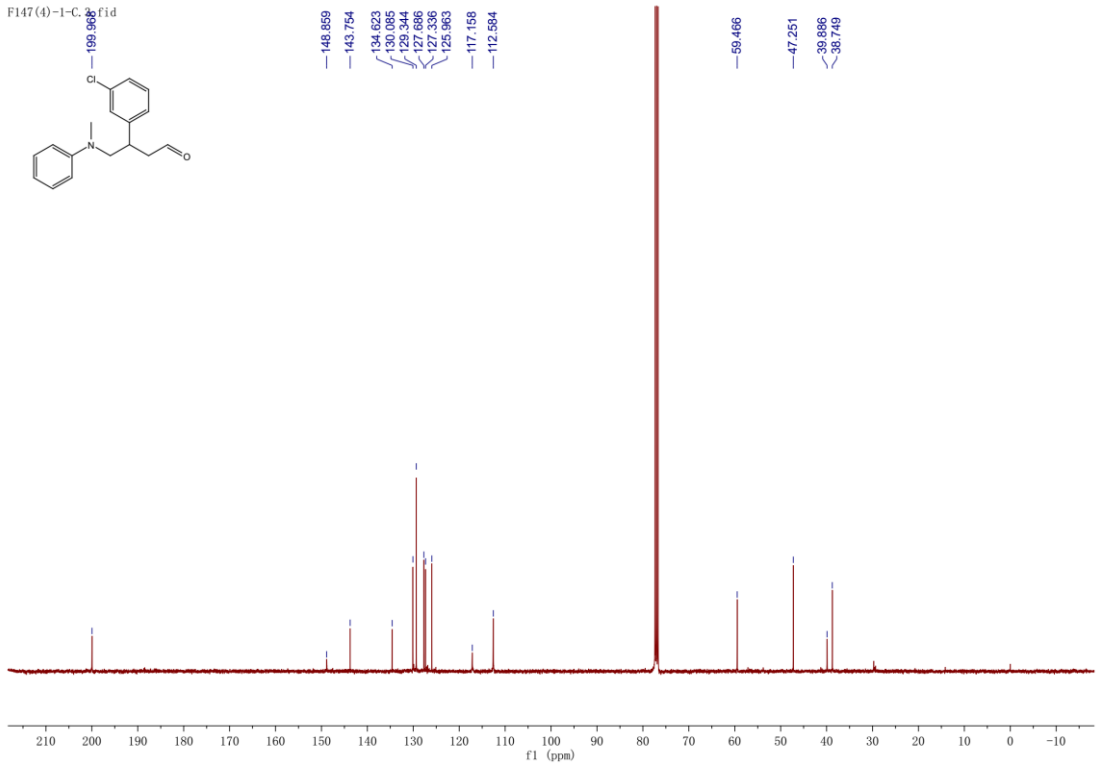
^{13}C NMR (100 MHz, $CDCl_3$) of compound **4k**



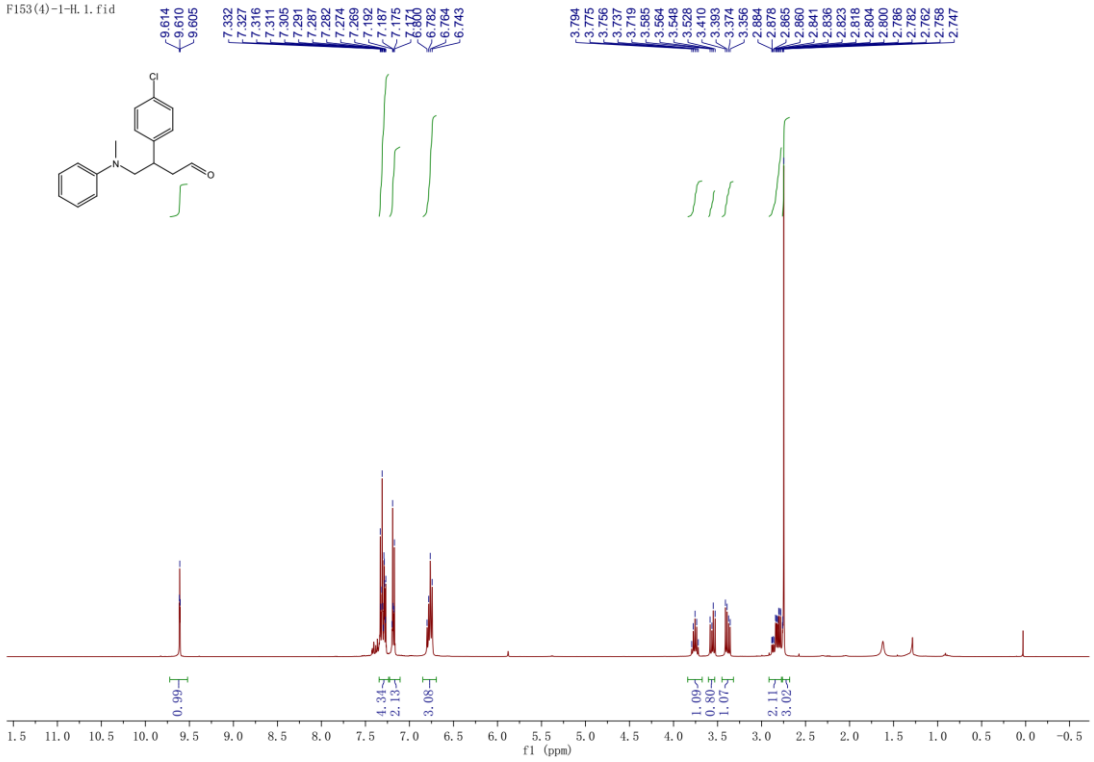
^{1}H NMR (400 MHz, $CDCl_3$) of compound **4l**



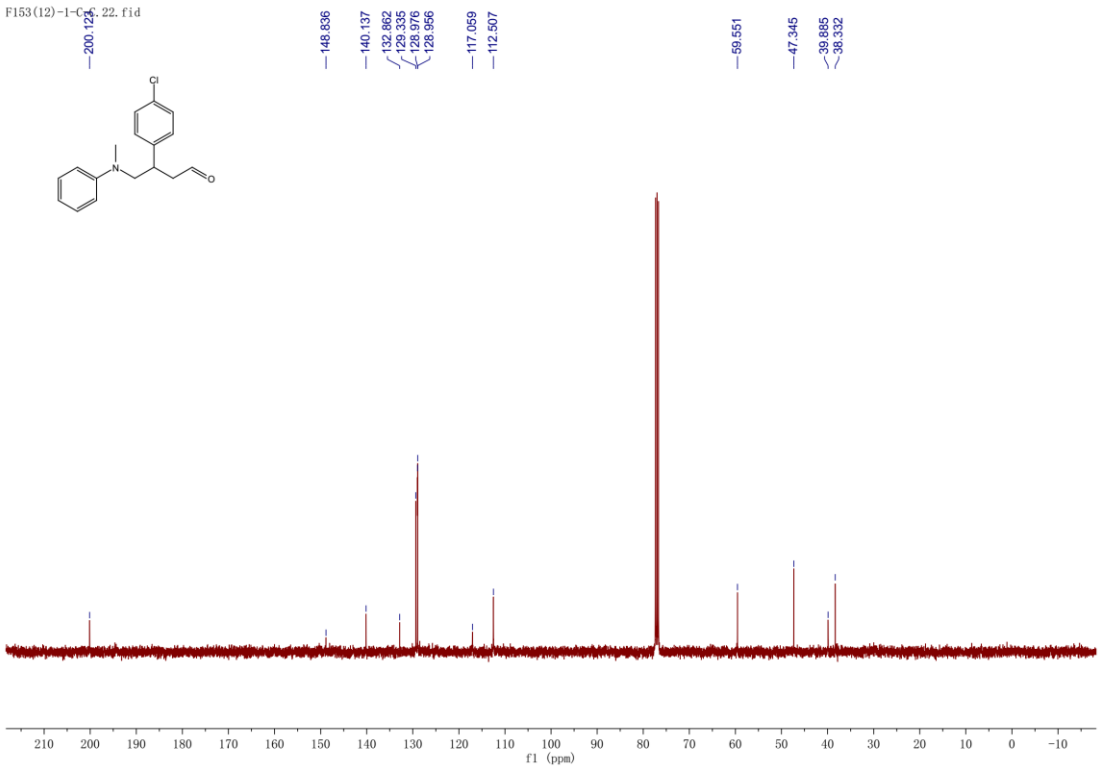
^{13}C NMR (100 MHz, $CDCl_3$) of compound **4l**



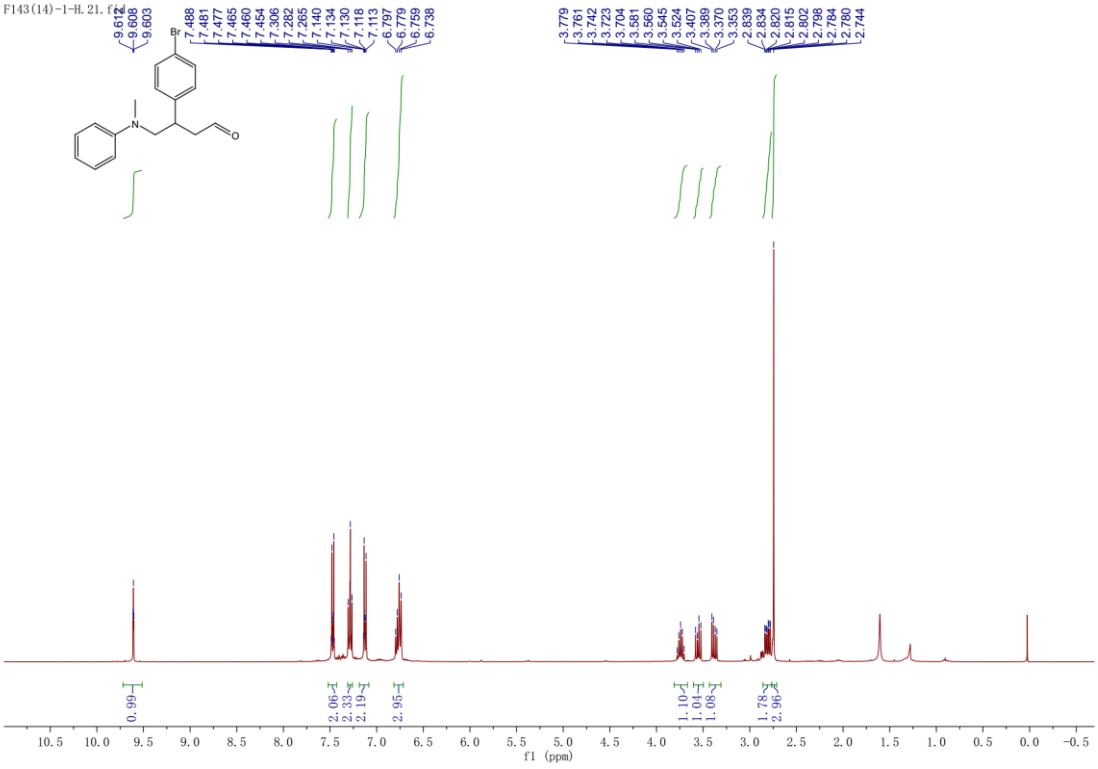
^{1}H NMR (400 MHz, $CDCl_3$) of compound **4m**



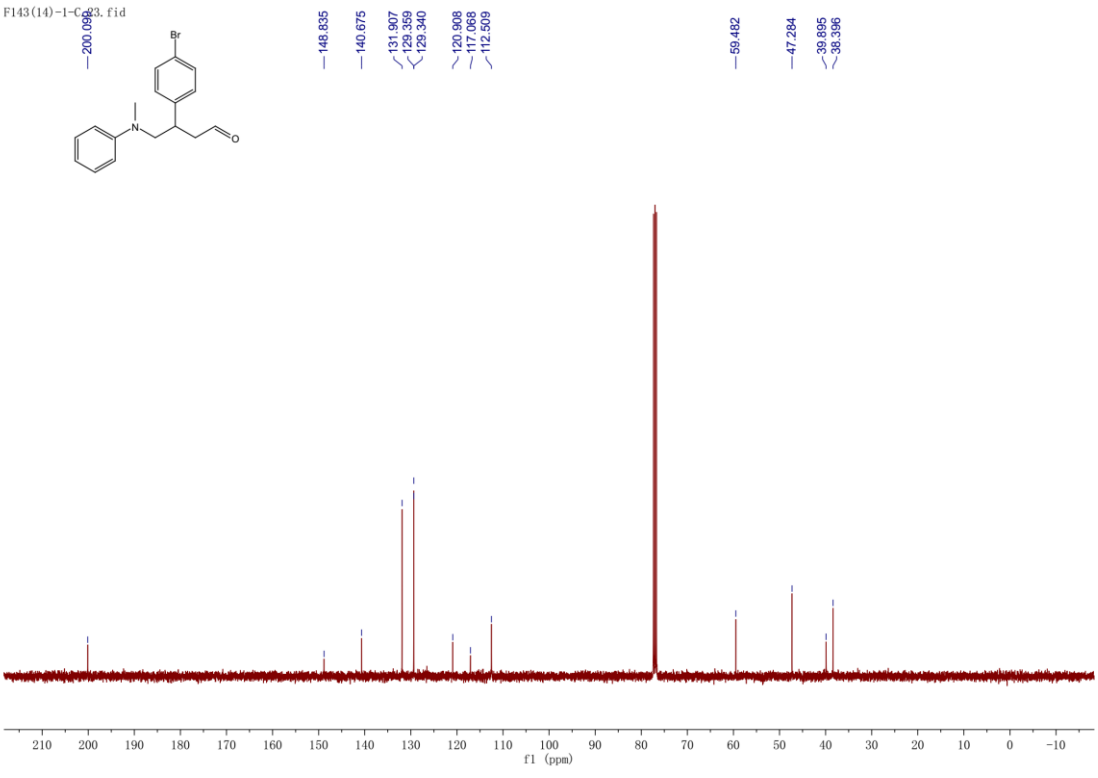
^{13}C NMR (100 MHz, $CDCl_3$) of compound **4m**



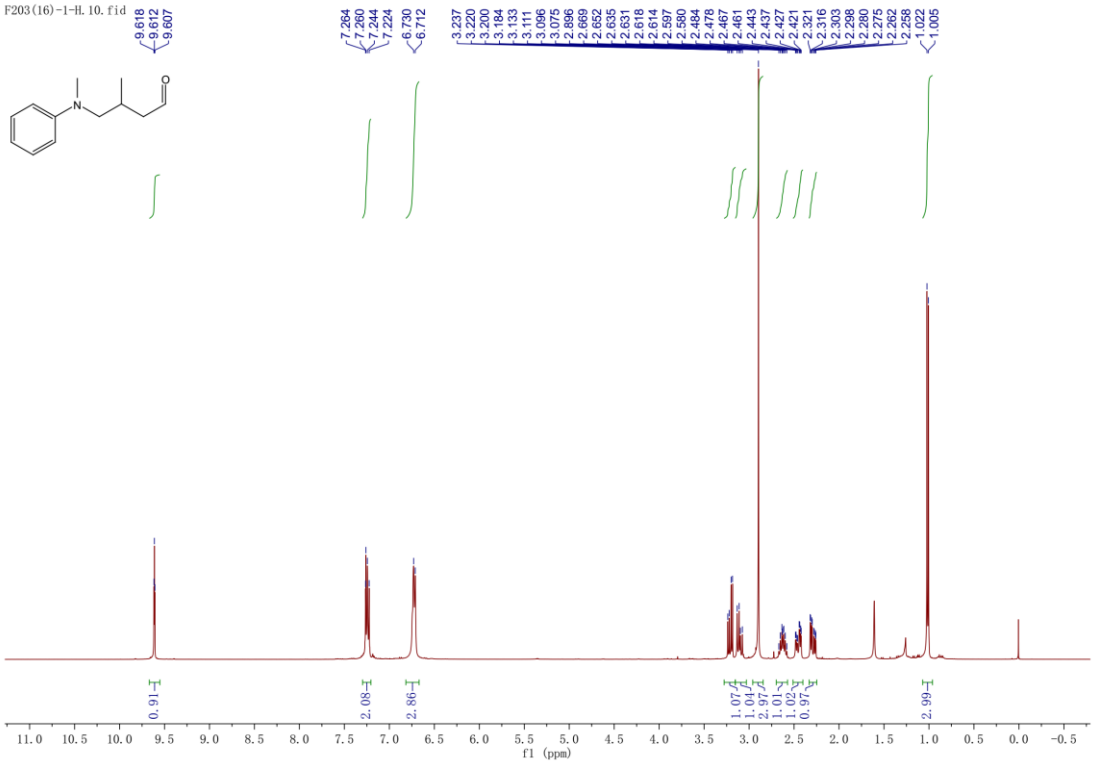
^{1}H NMR (400 MHz, $CDCl_3$) of compound **4n**



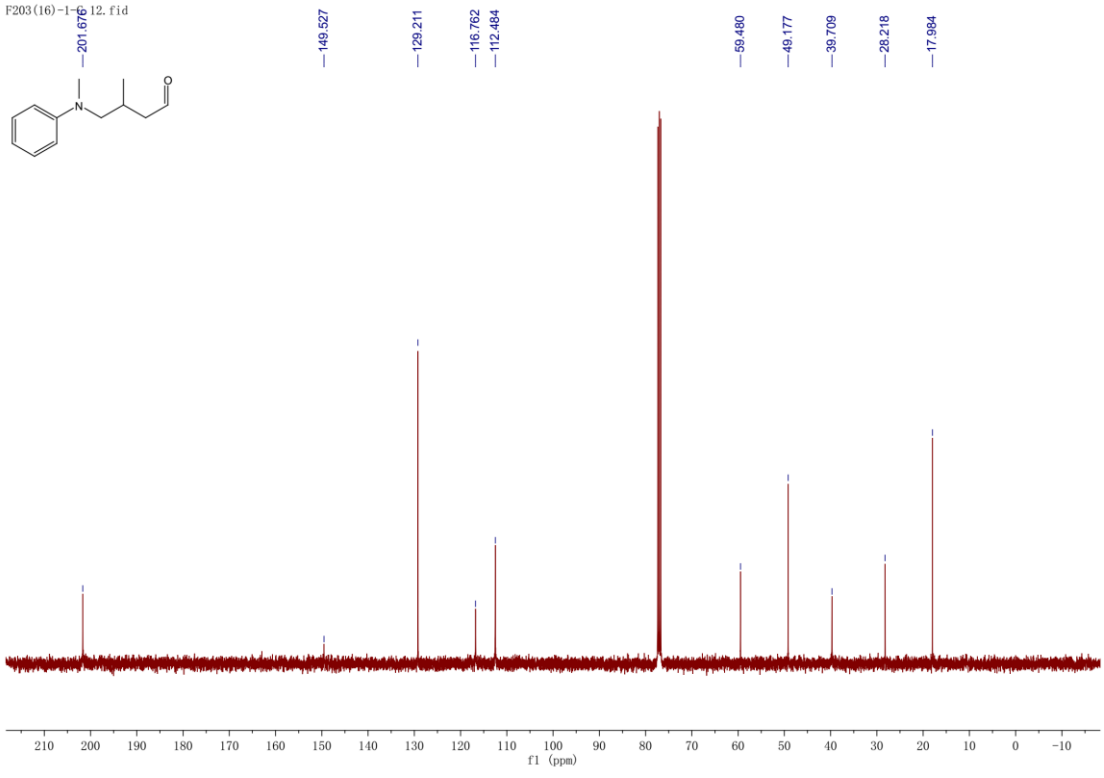
^{13}C NMR (100 MHz, $CDCl_3$) of compound **4n**



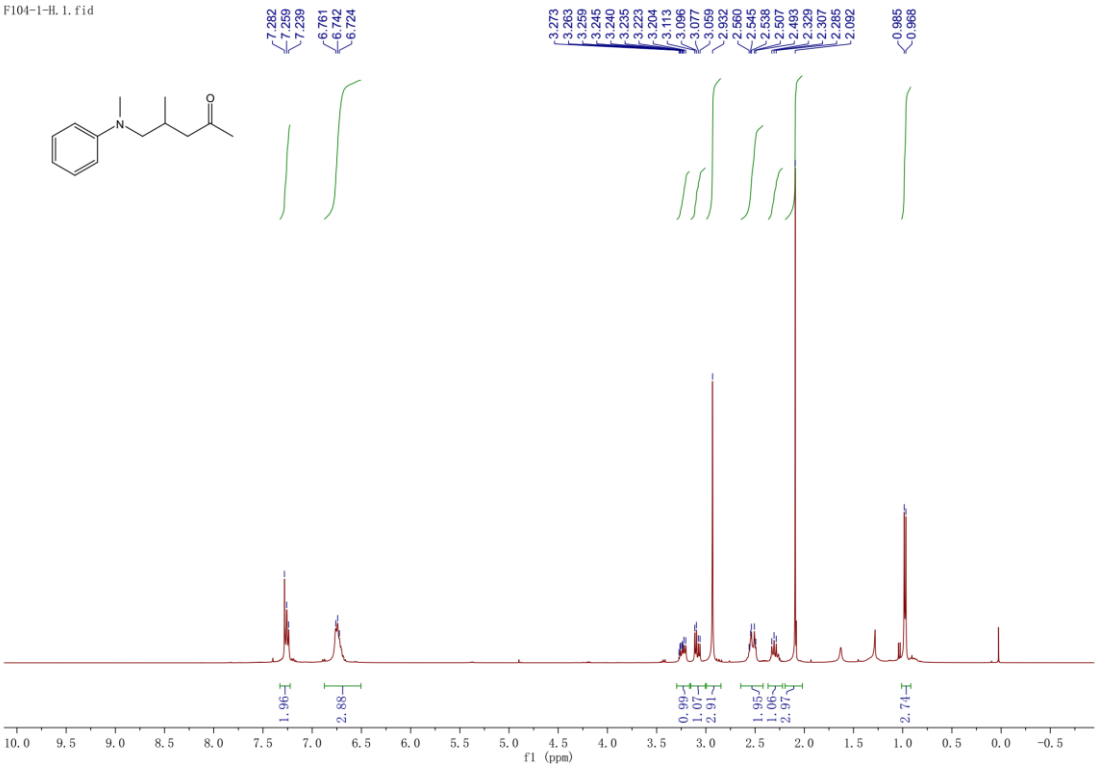
^{1}H NMR (400 MHz, $CDCl_3$) of compound **4o**



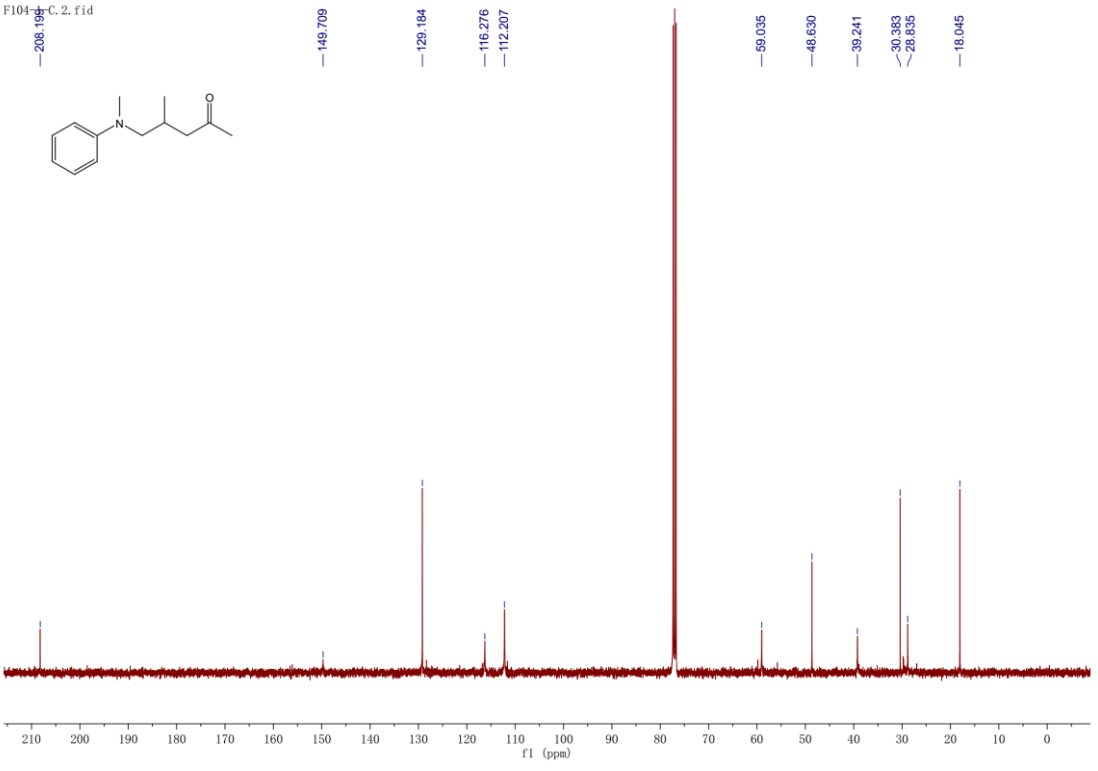
^{13}C NMR (100 MHz, $CDCl_3$) of compound **4o**



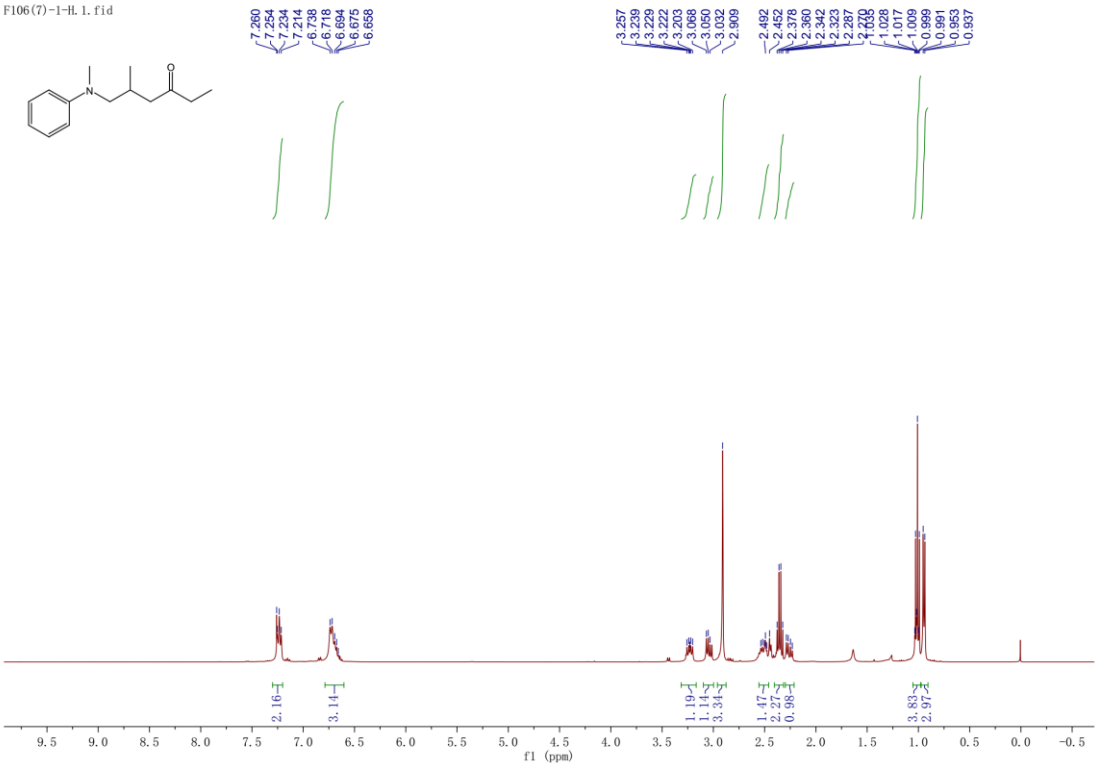
^{1}H NMR (400 MHz, $CDCl_3$) of compound **4p**



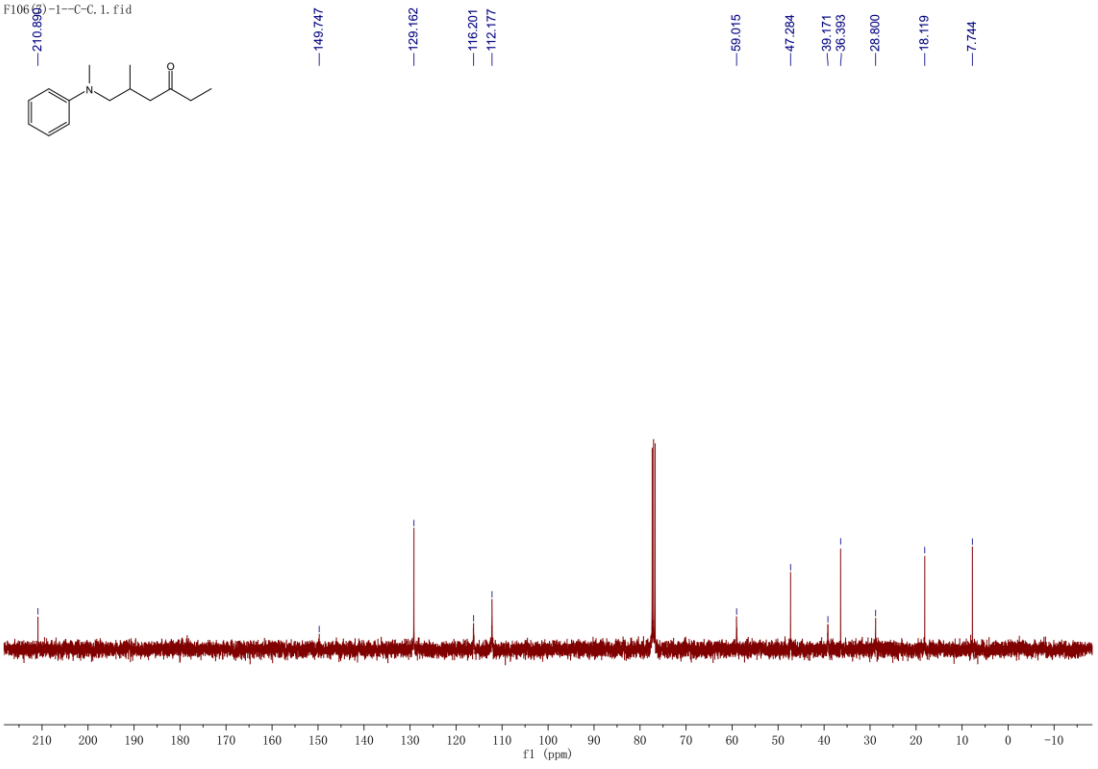
^{13}C NMR (100 MHz, $CDCl_3$) of compound **4p**



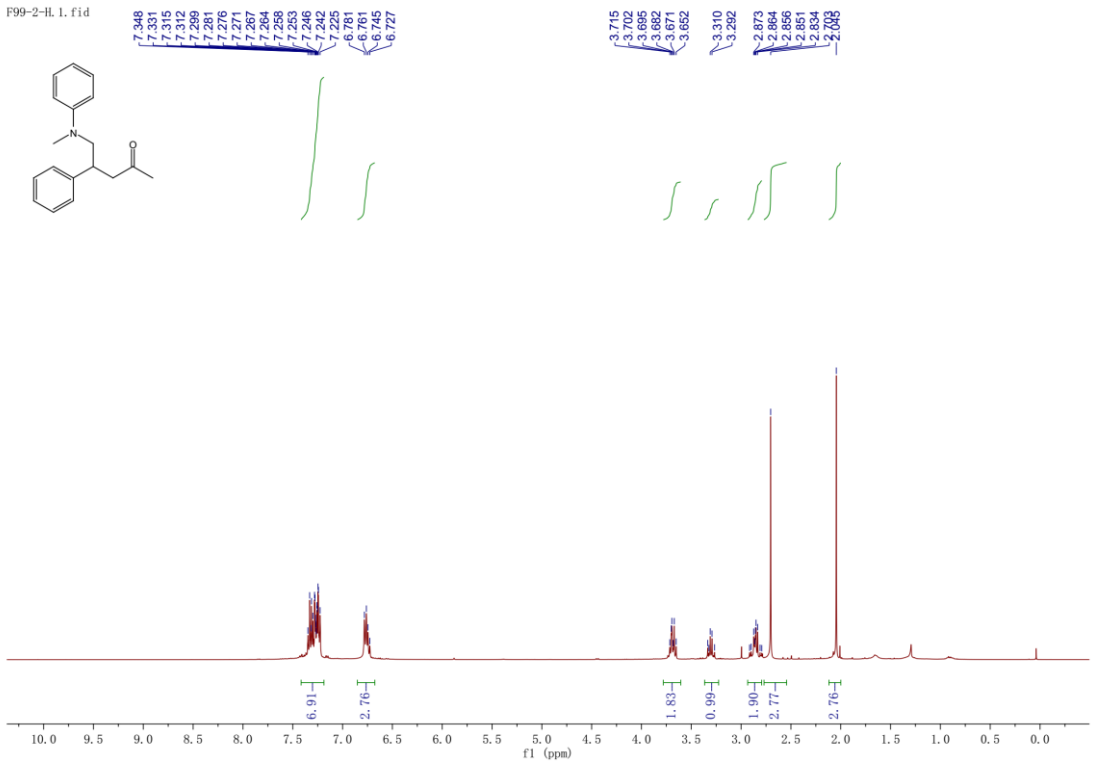
^{1}H NMR (400 MHz, $CDCl_3$) of compound **4q**



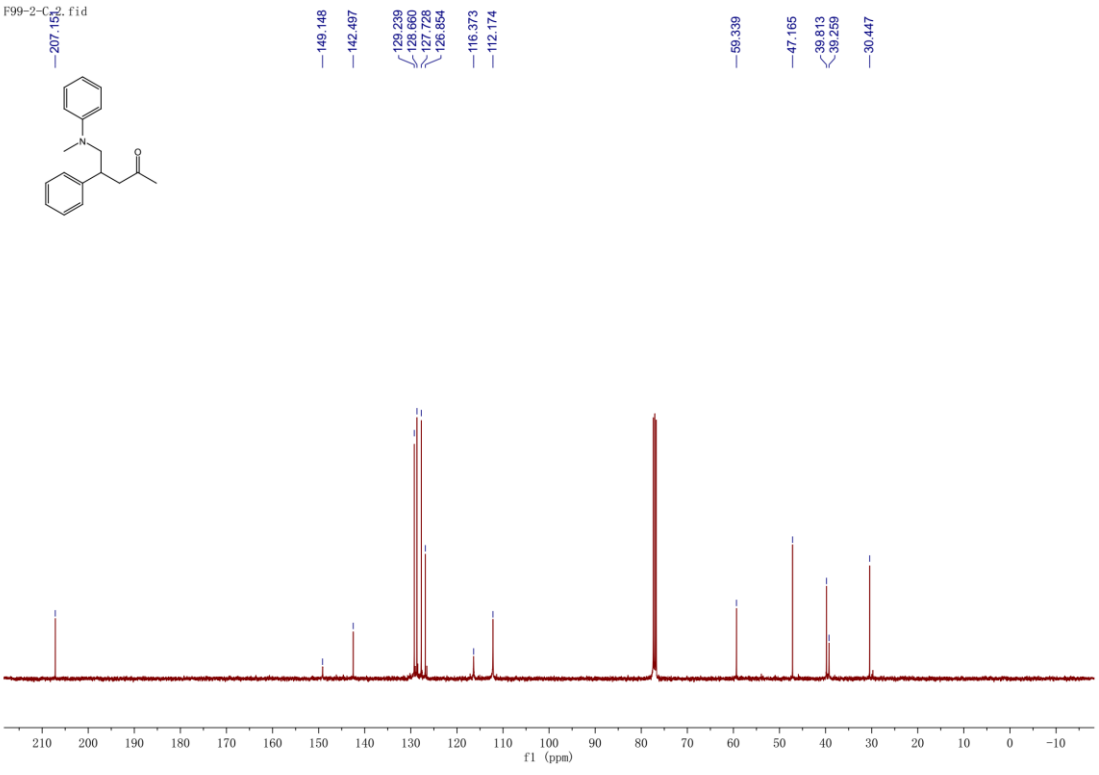
^{13}C NMR (100 MHz, $CDCl_3$) of compound **4q**



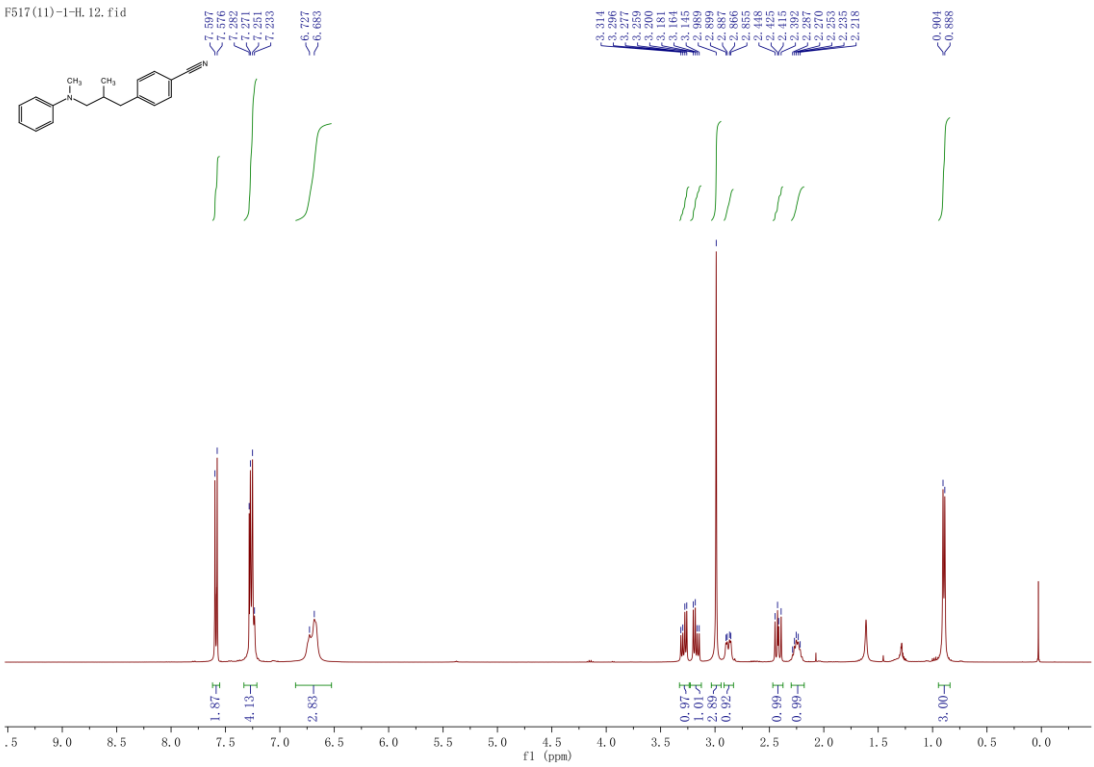
^{1}H NMR (400 MHz, $CDCl_3$) of compound **4r**



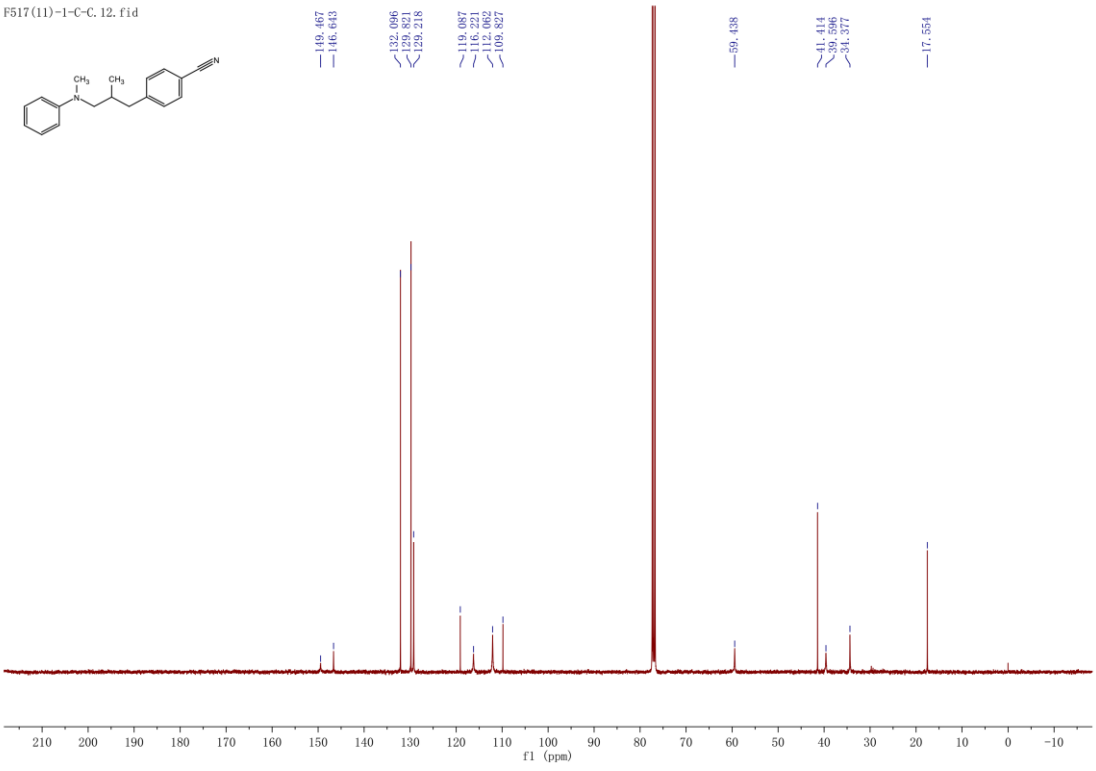
^{13}C NMR (100 MHz, $CDCl_3$) of compound **4r**



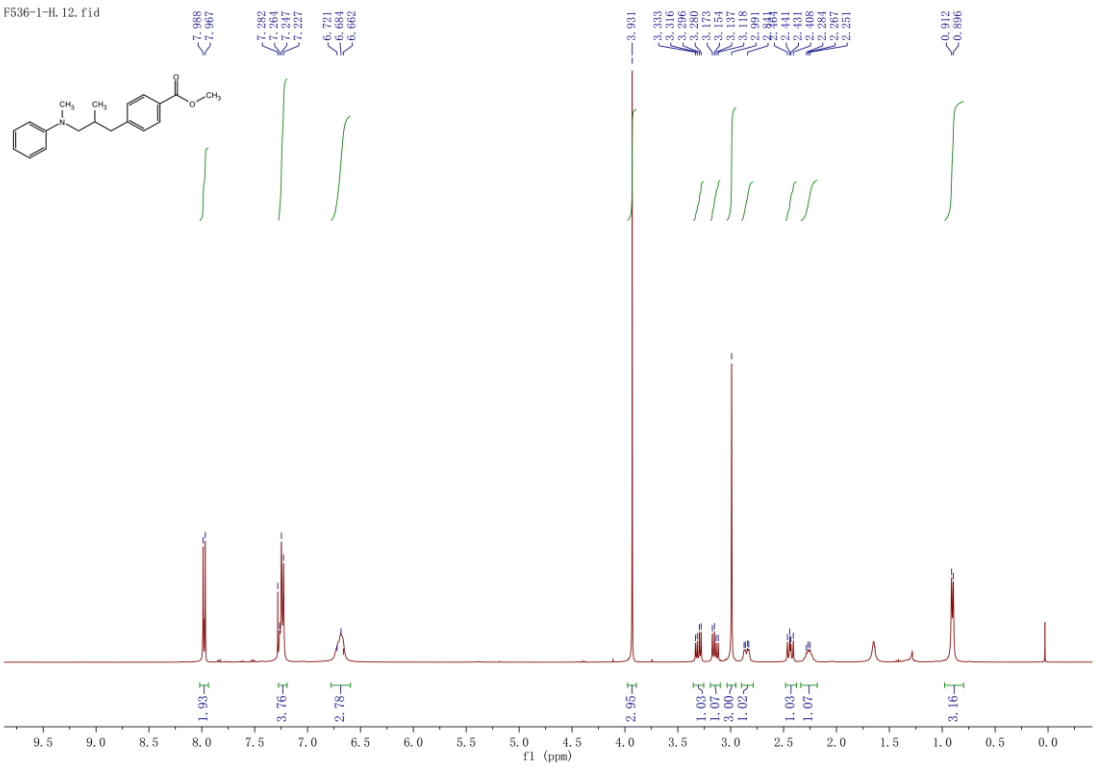
^{1}H NMR (400 MHz, $CDCl_3$) of compound **4u**



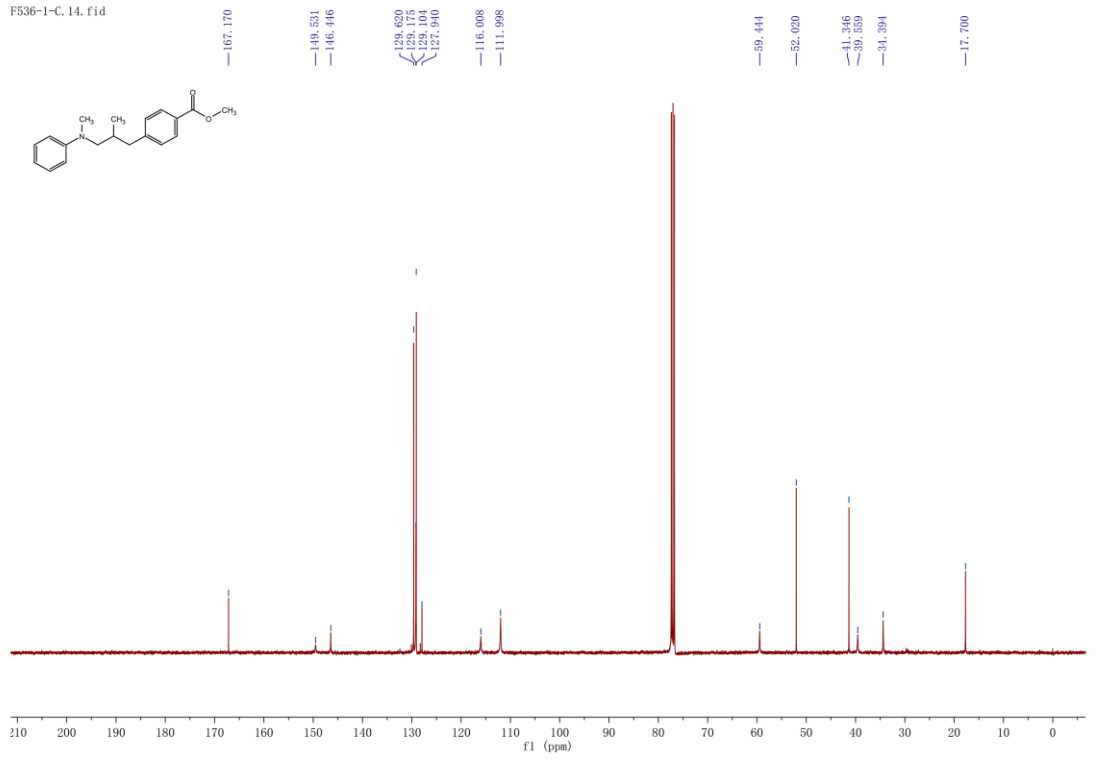
^{13}C NMR (100 MHz, $CDCl_3$) of compound **4u**



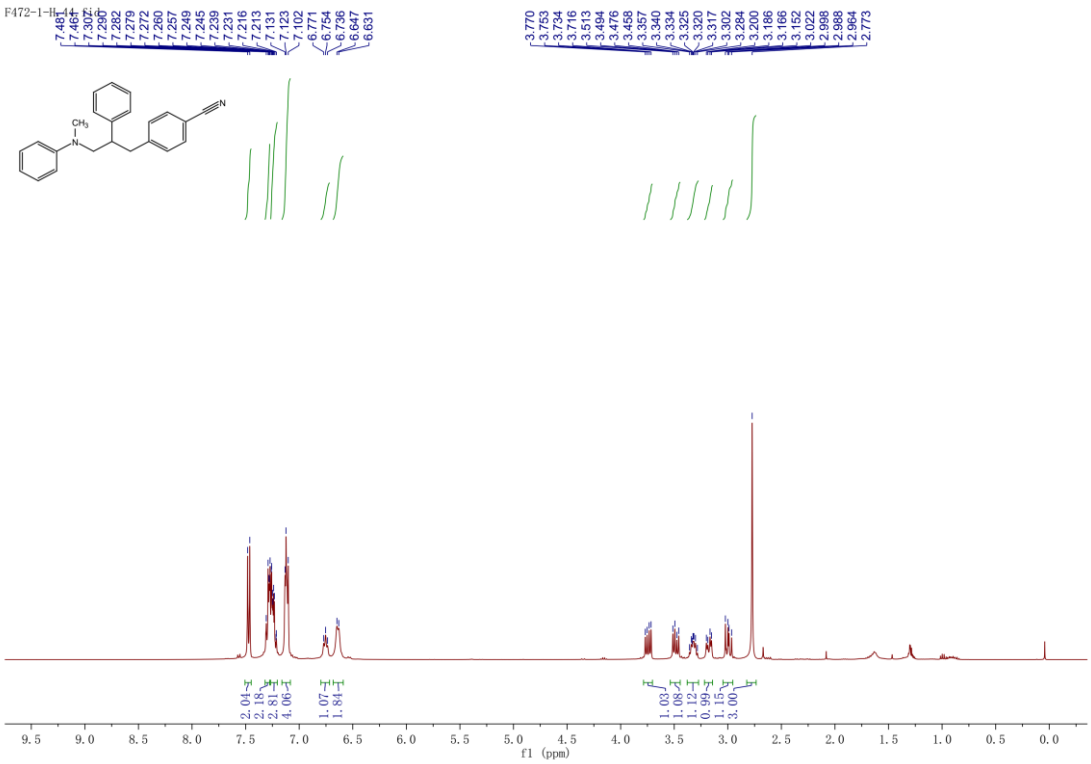
^{1}H NMR (400 MHz, $CDCl_3$) of compound **4v**



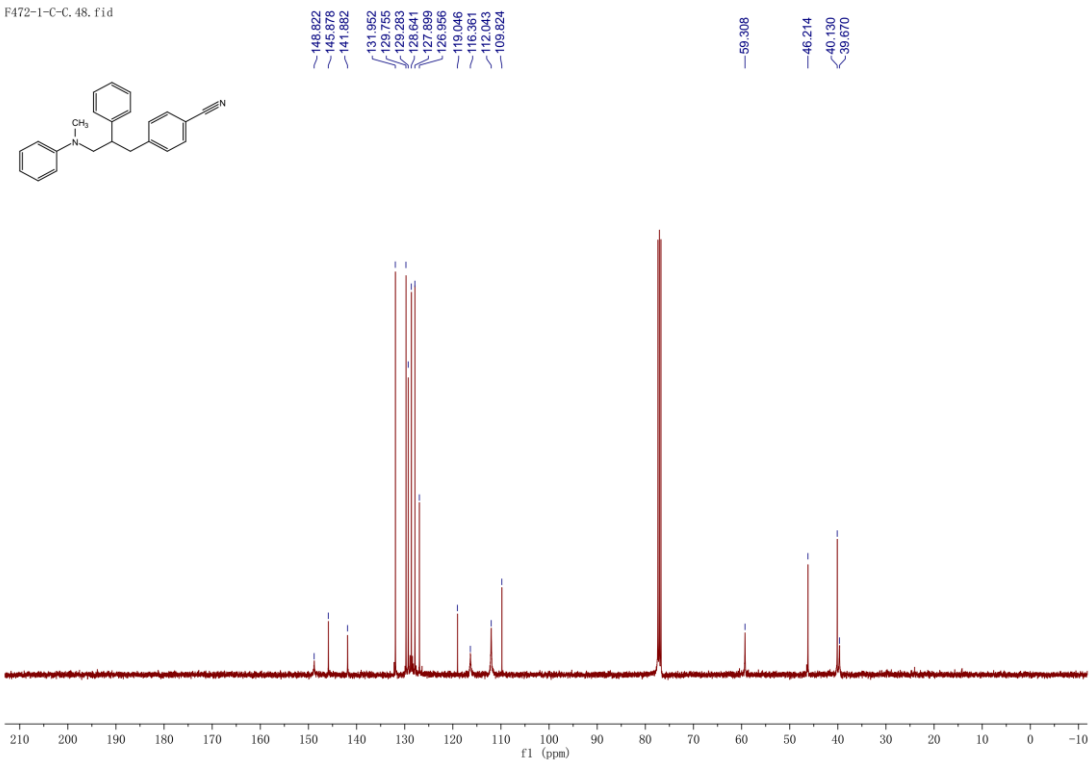
^{13}C NMR (100 MHz, $CDCl_3$) of compound **4v**



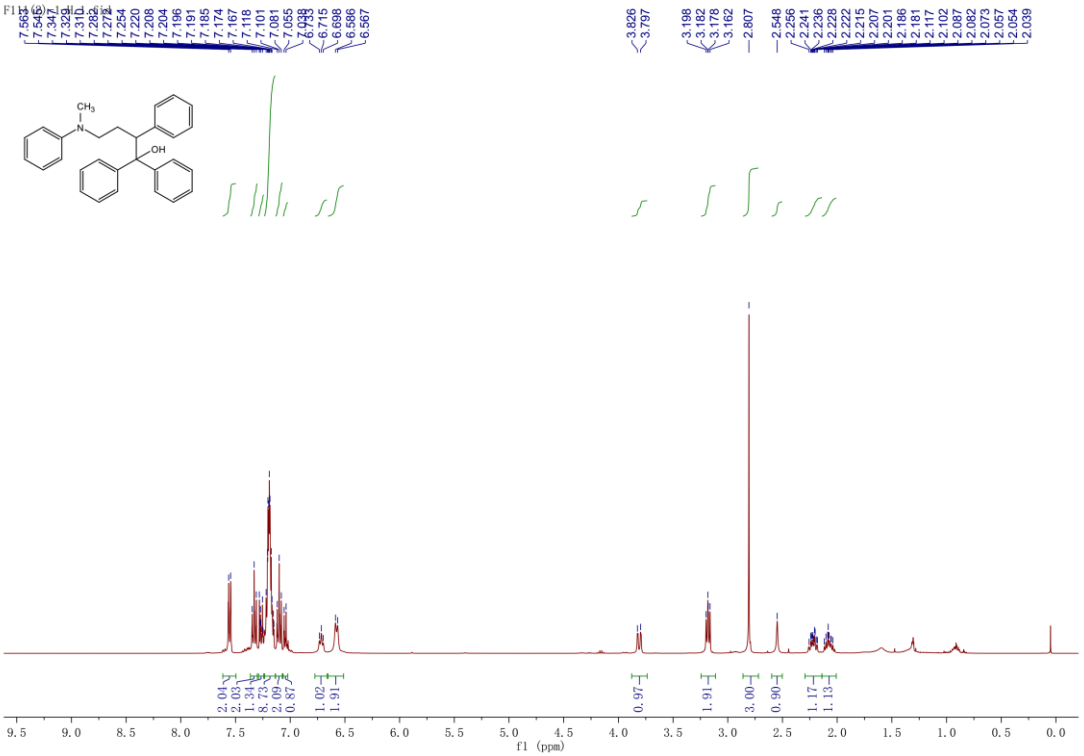
^{1}H NMR (400 MHz, $CDCl_3$) of compound **4y**



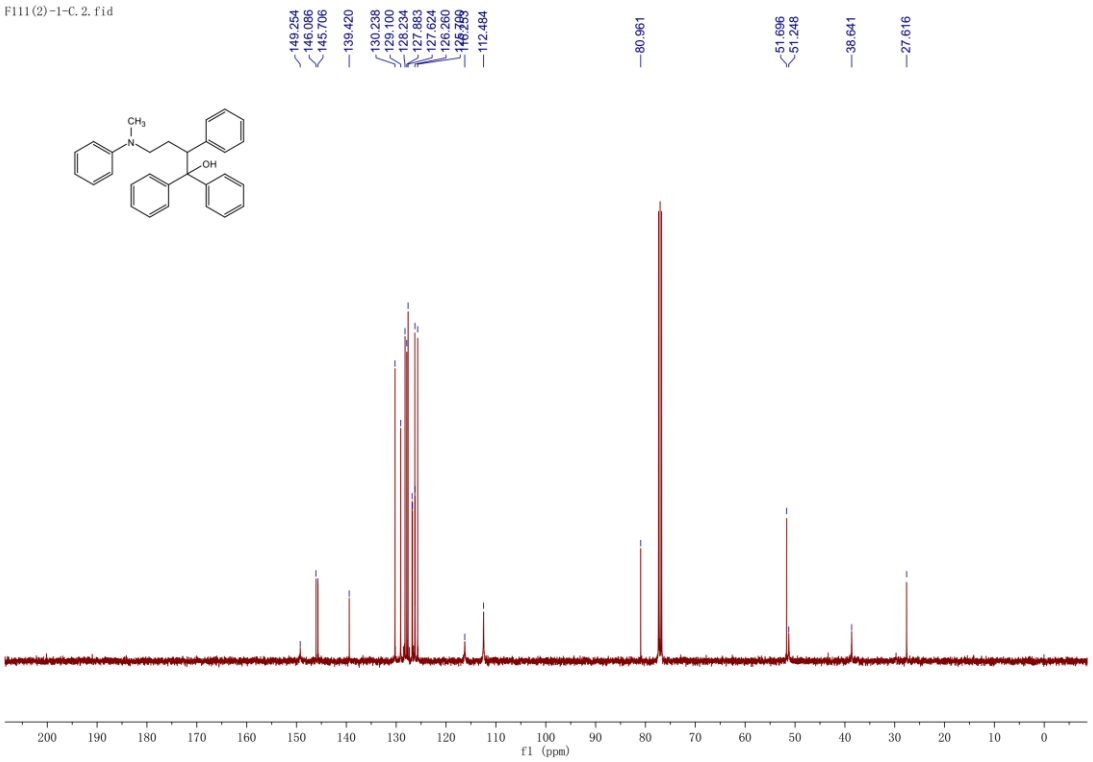
^{13}C NMR (100 MHz, $CDCl_3$) of compound **4y**



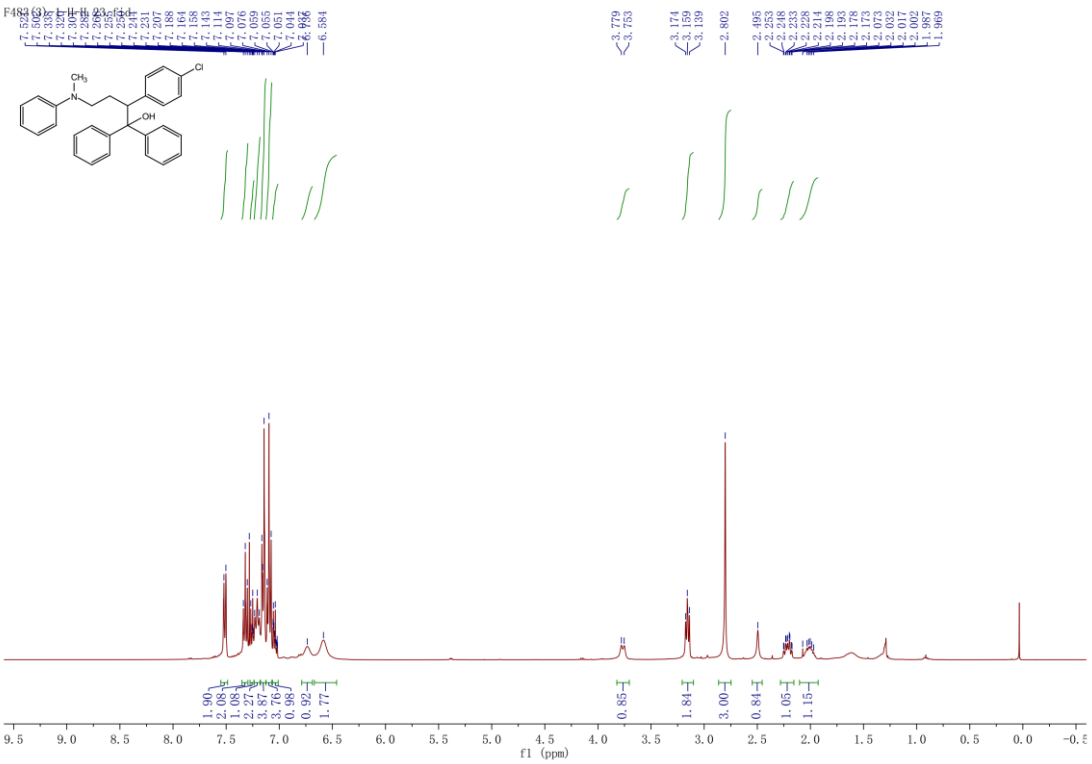
^{1}H NMR (400 MHz, $CDCl_3$) of compound **4aa**



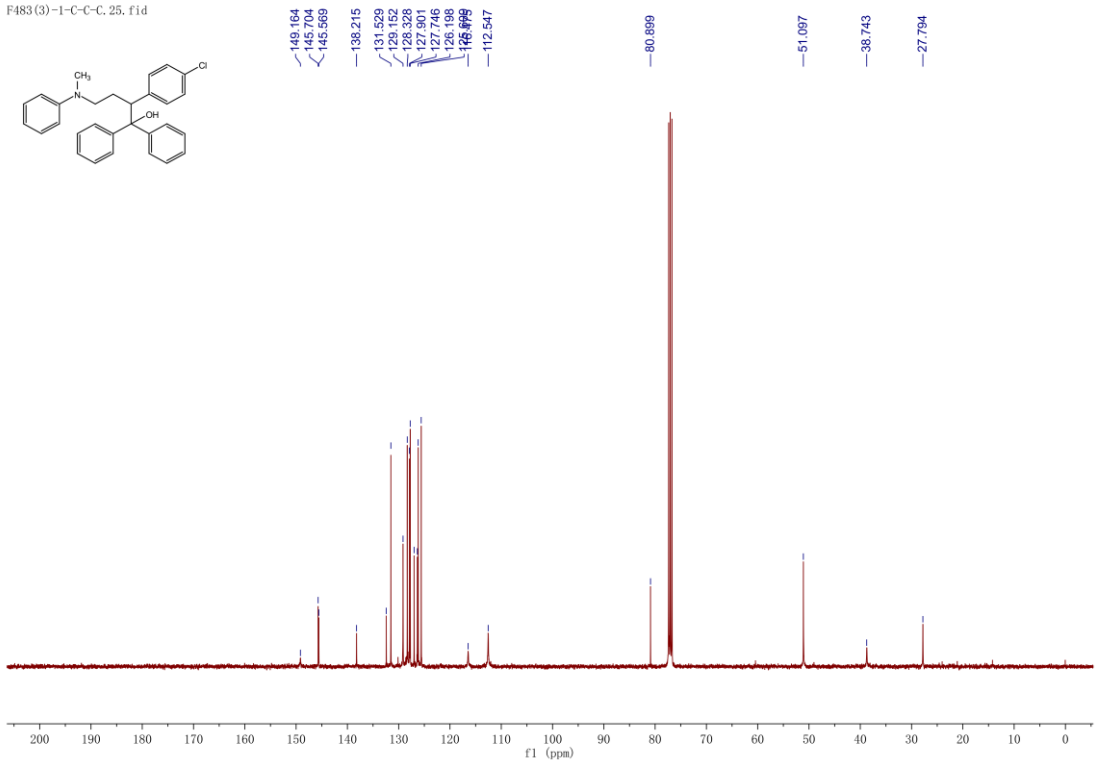
^{13}C NMR (100 MHz, $CDCl_3$) of compound **4aa**



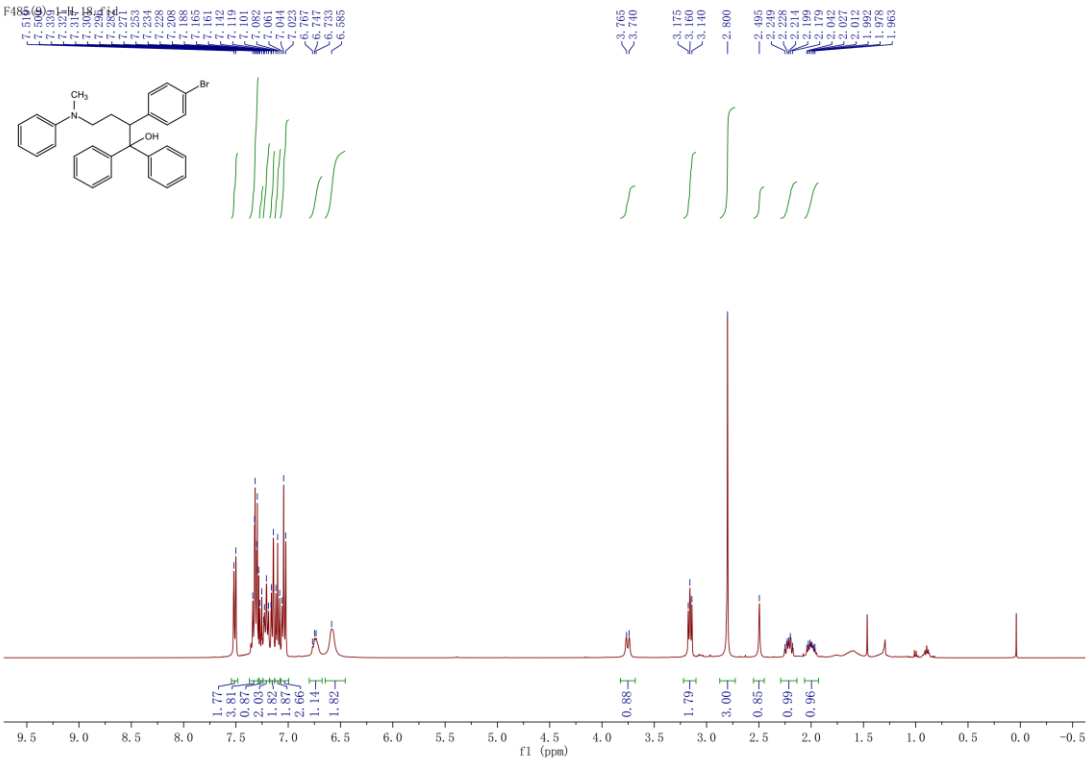
^{1}H NMR (400 MHz, $CDCl_3$) of compound **4ab**



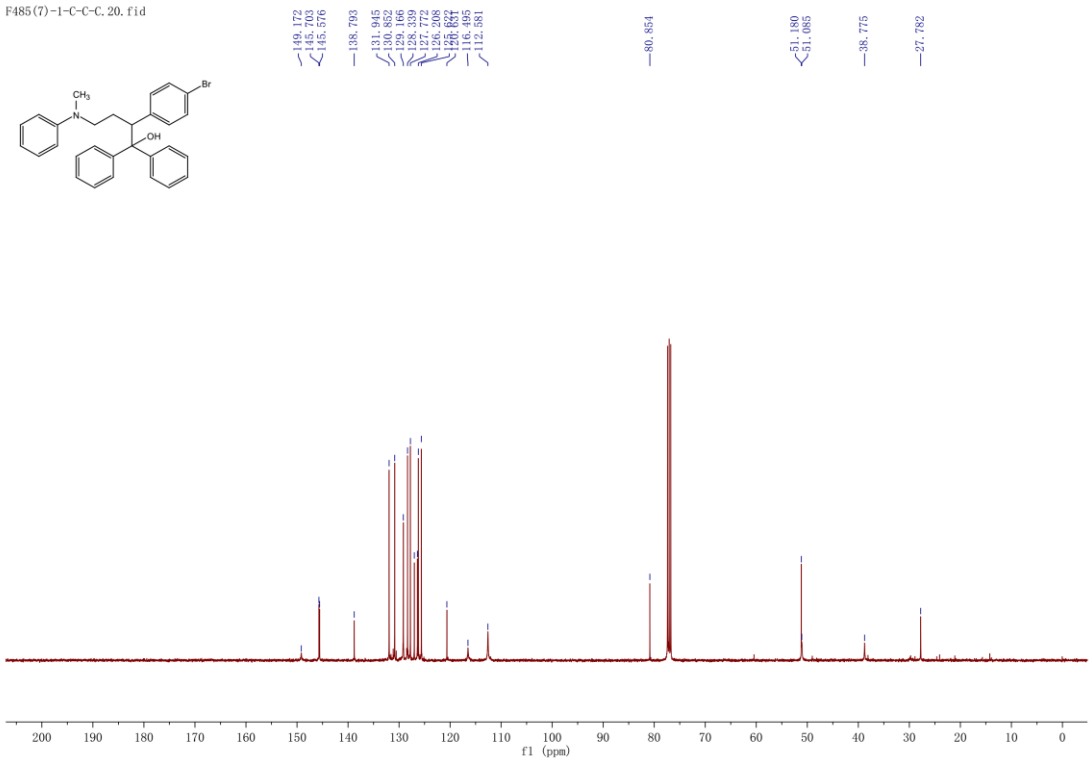
^{13}C NMR (100 MHz, $CDCl_3$) of compound **4ab**



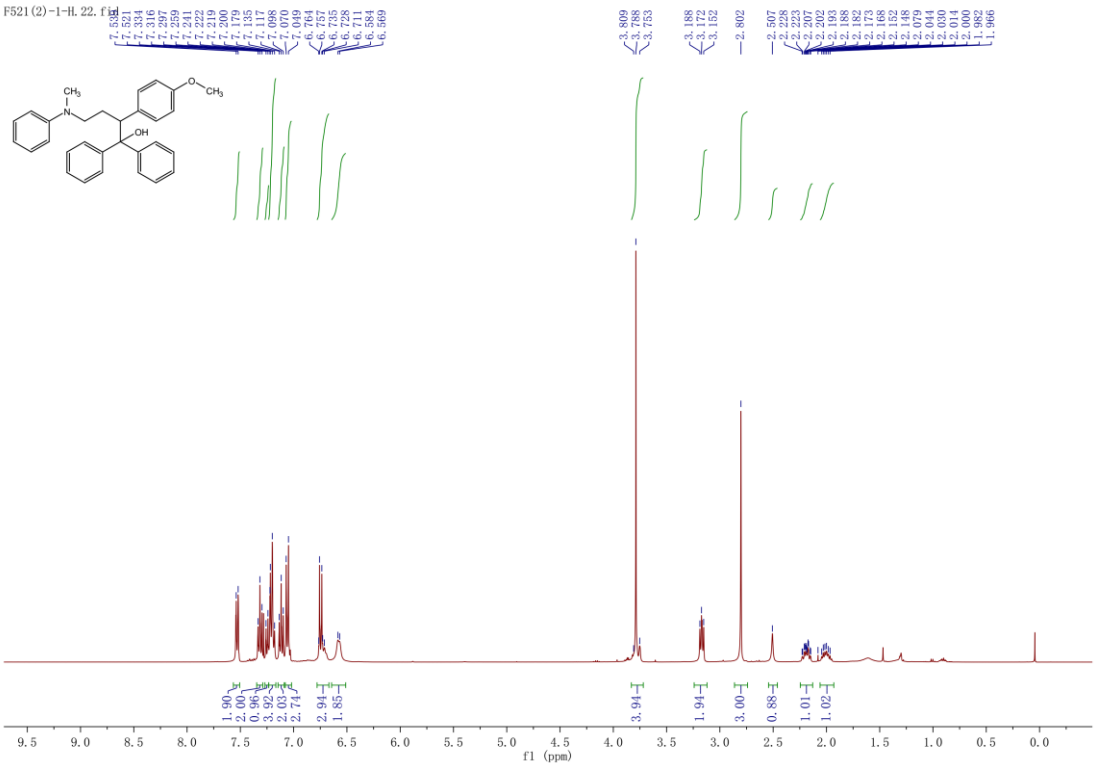
^{1}H NMR (400 MHz, $CDCl_3$) of compound **4ac**



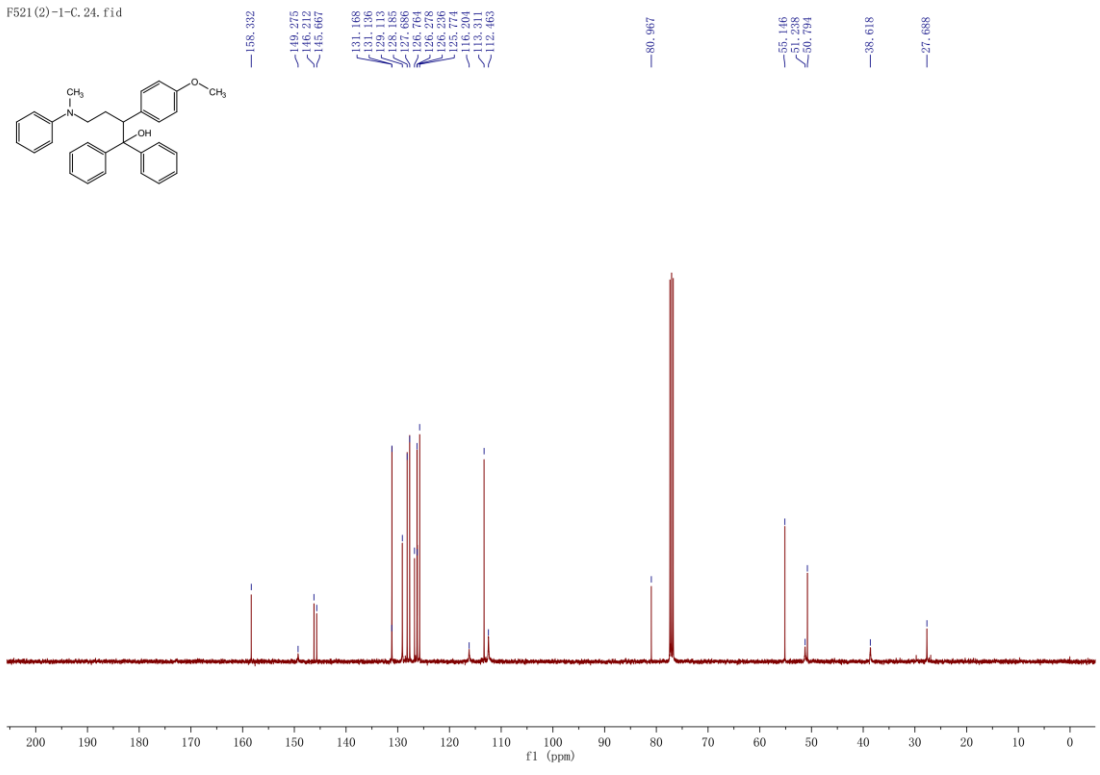
^{13}C NMR (100 MHz, $CDCl_3$) of compound **4ac**



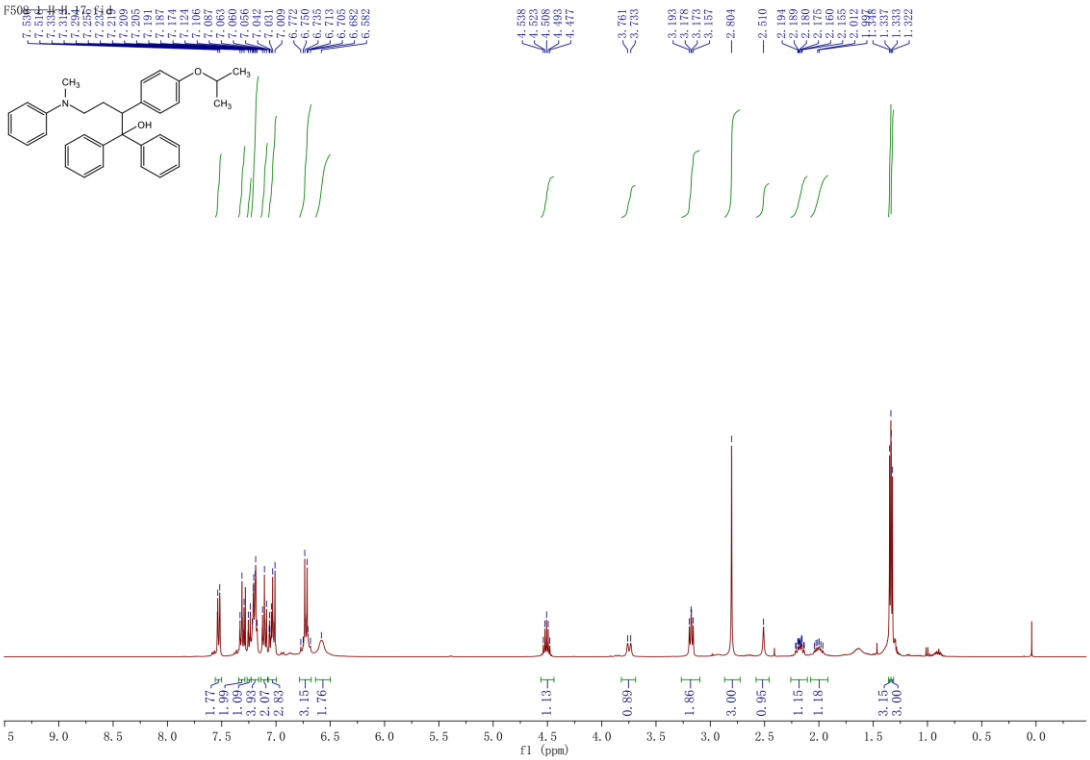
^{1}H NMR (400 MHz, $CDCl_3$) of compound **4ad**



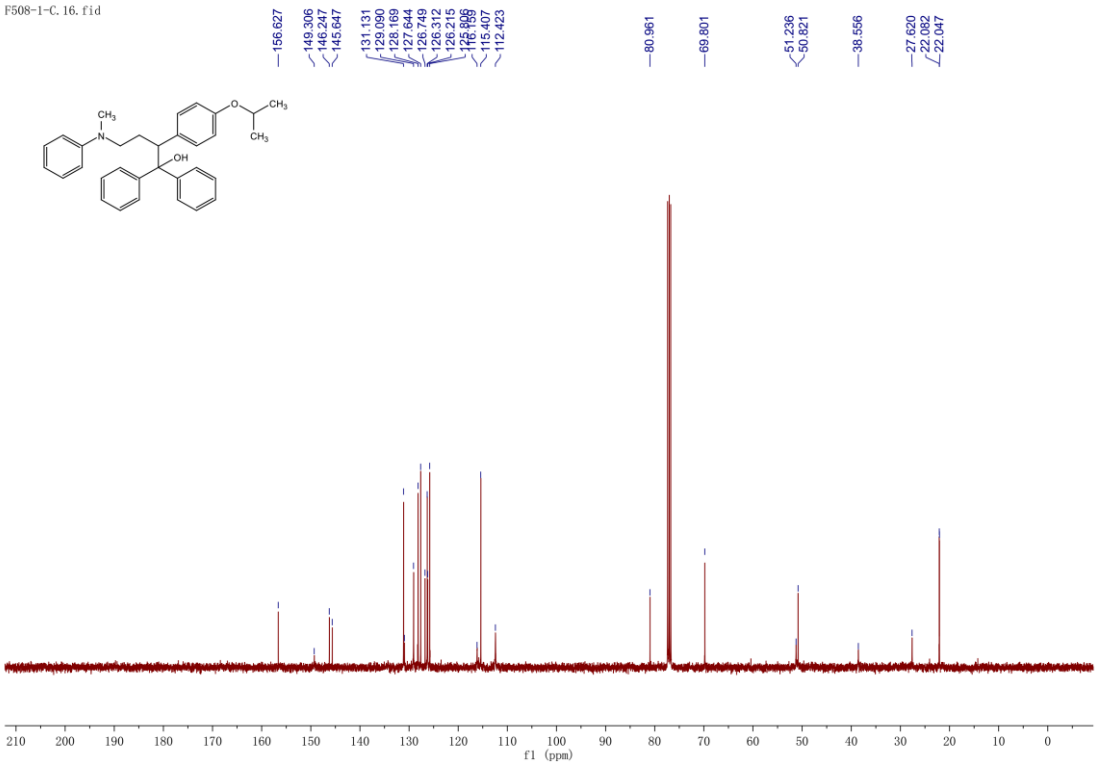
^{13}C NMR (100 MHz, $CDCl_3$) of compound **4ad**



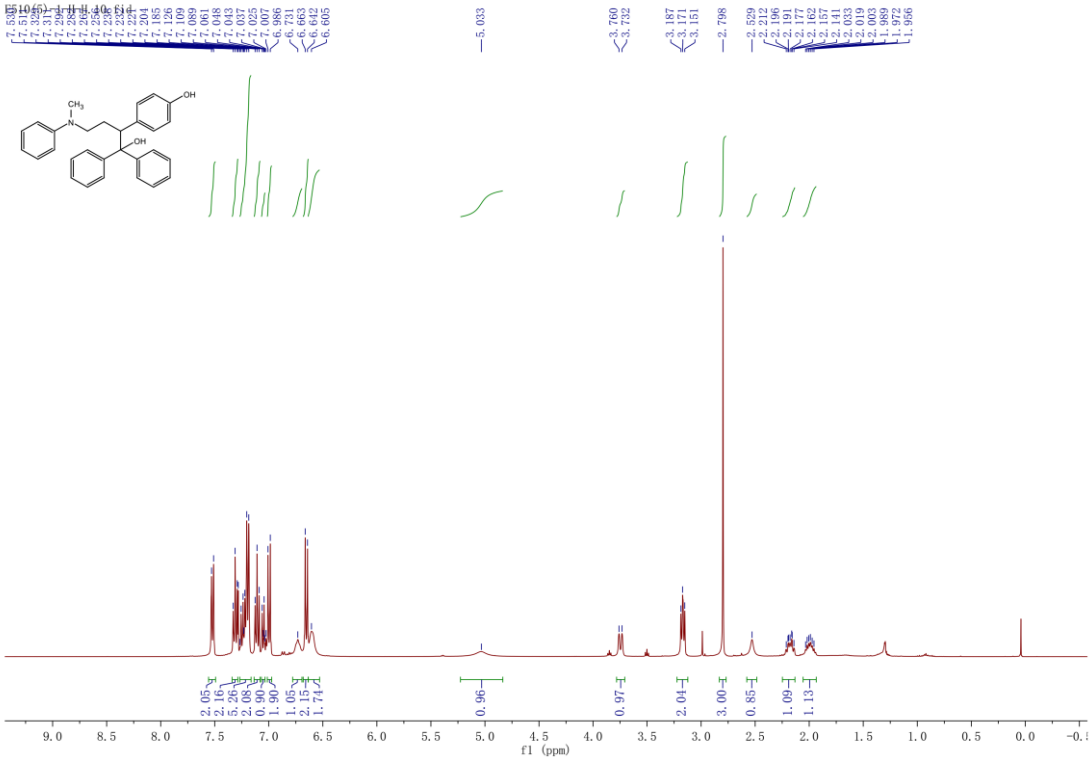
^{1}H NMR (400 MHz, $CDCl_3$) of compound **4ae**



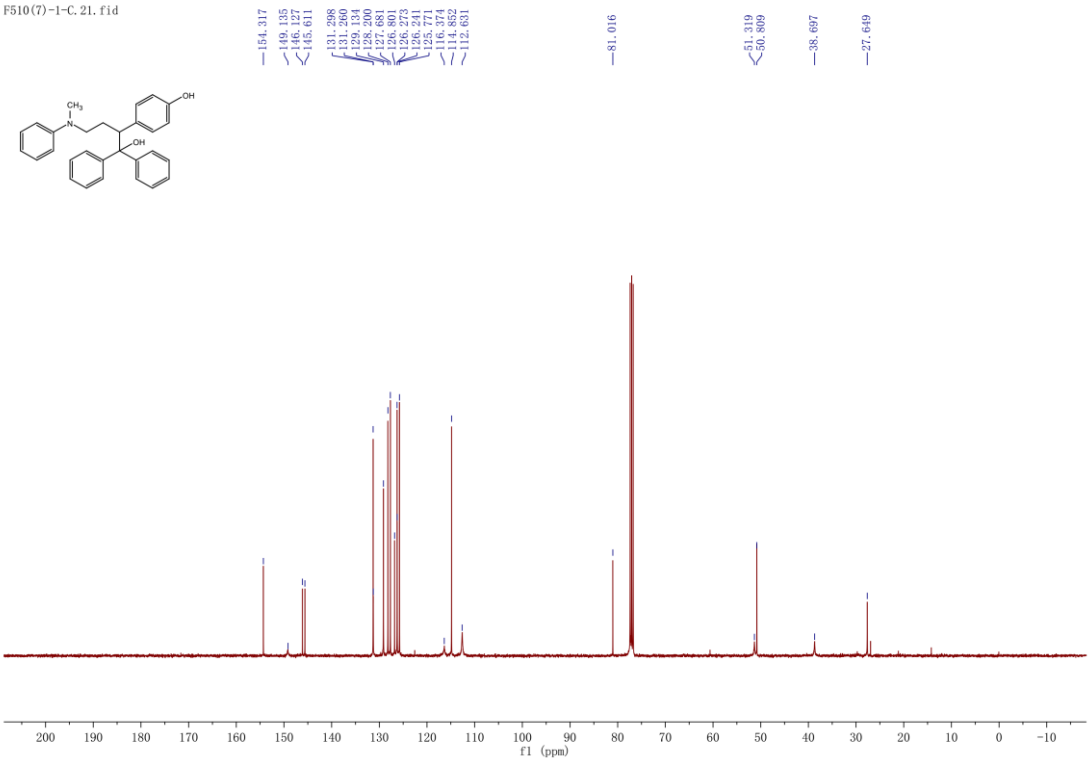
^{13}C NMR (100 MHz, $CDCl_3$) of compound **4ae**



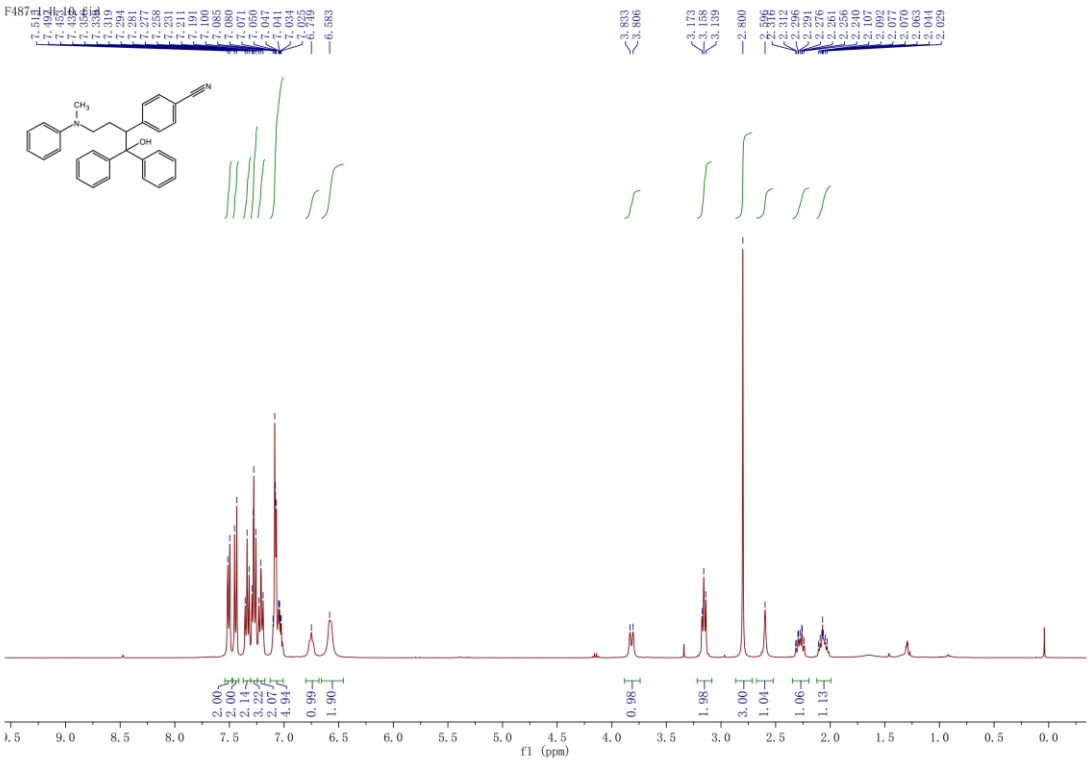
^{1}H NMR (400 MHz, $CDCl_3$) of compound **4af**



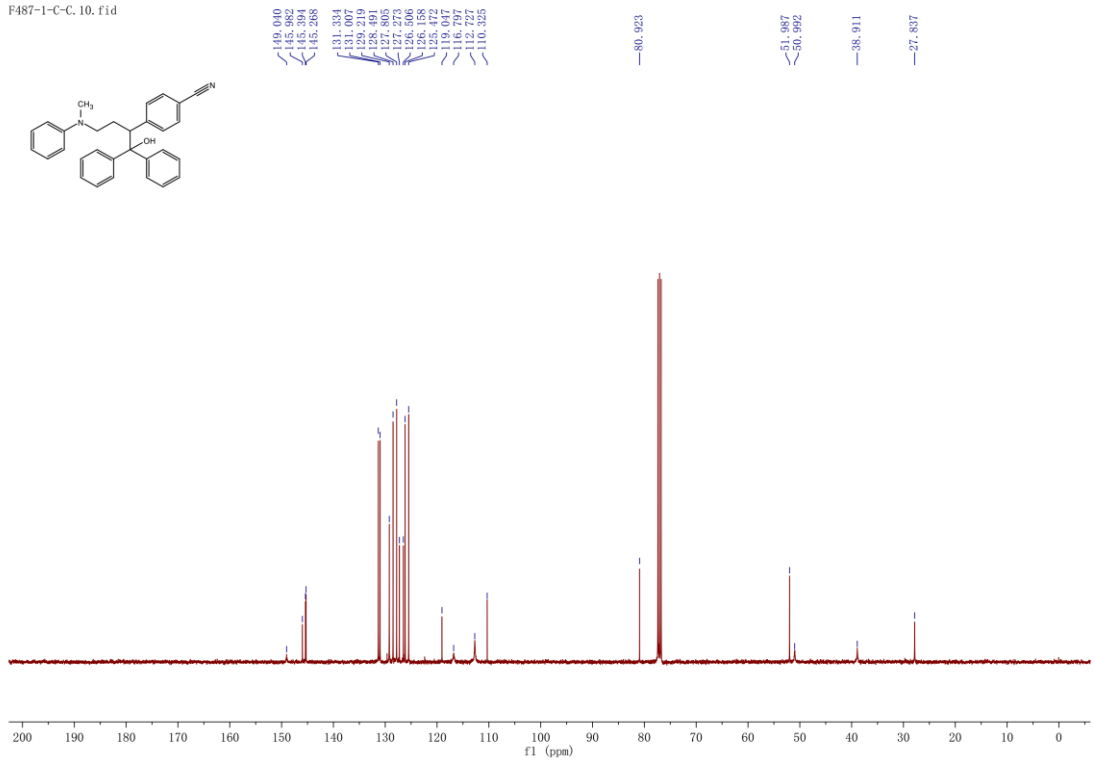
^{13}C NMR (100 MHz, $CDCl_3$) of compound **4af**



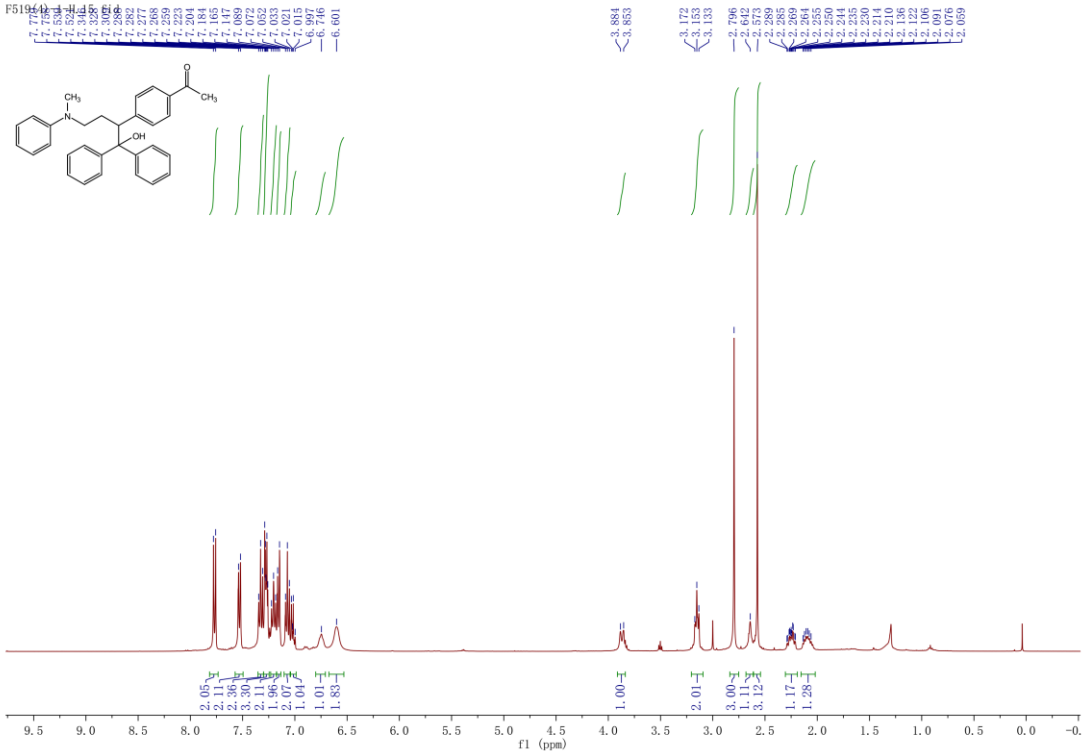
^{1}H NMR (400 MHz, $CDCl_3$) of compound **4ag**



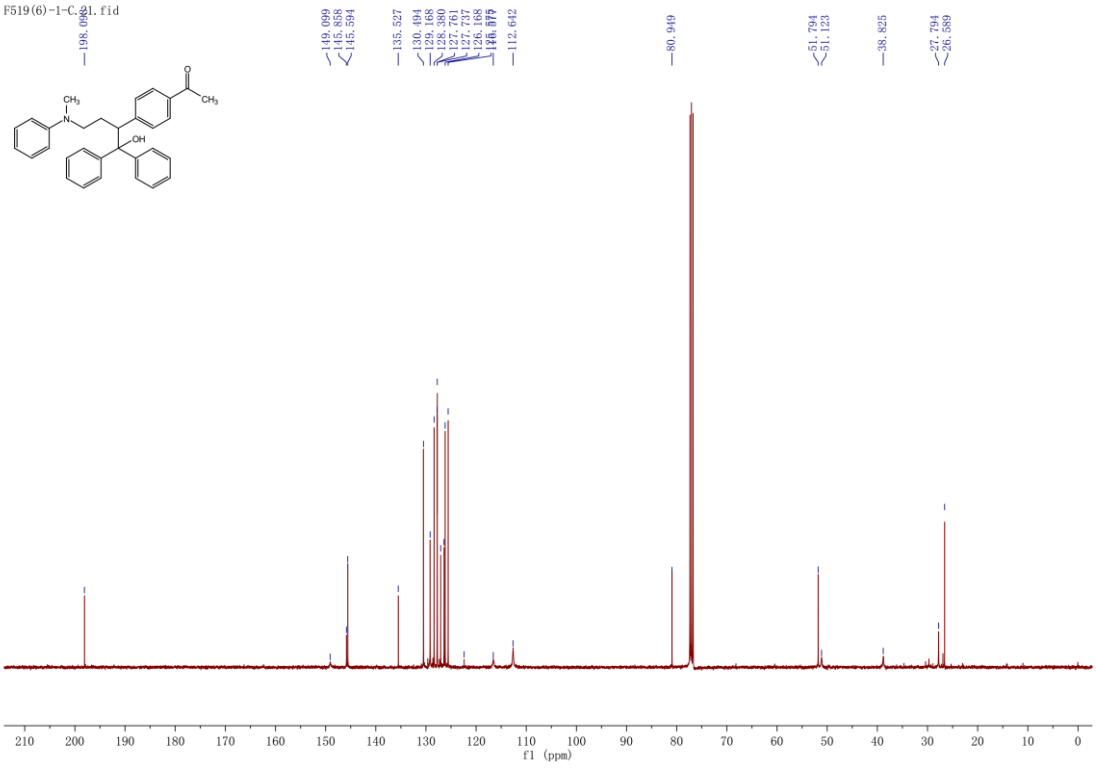
^{13}C NMR (100 MHz, $CDCl_3$) of compound **4ag**



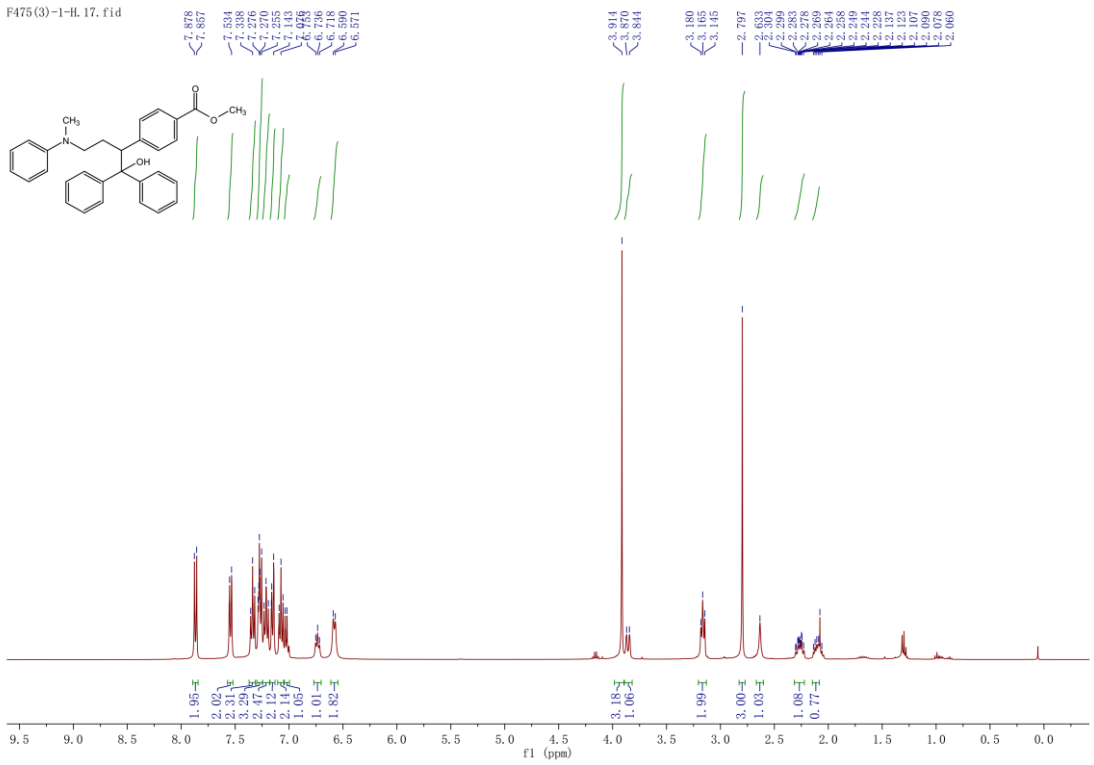
^{1}H NMR (400 MHz, $CDCl_3$) of compound **4ah**



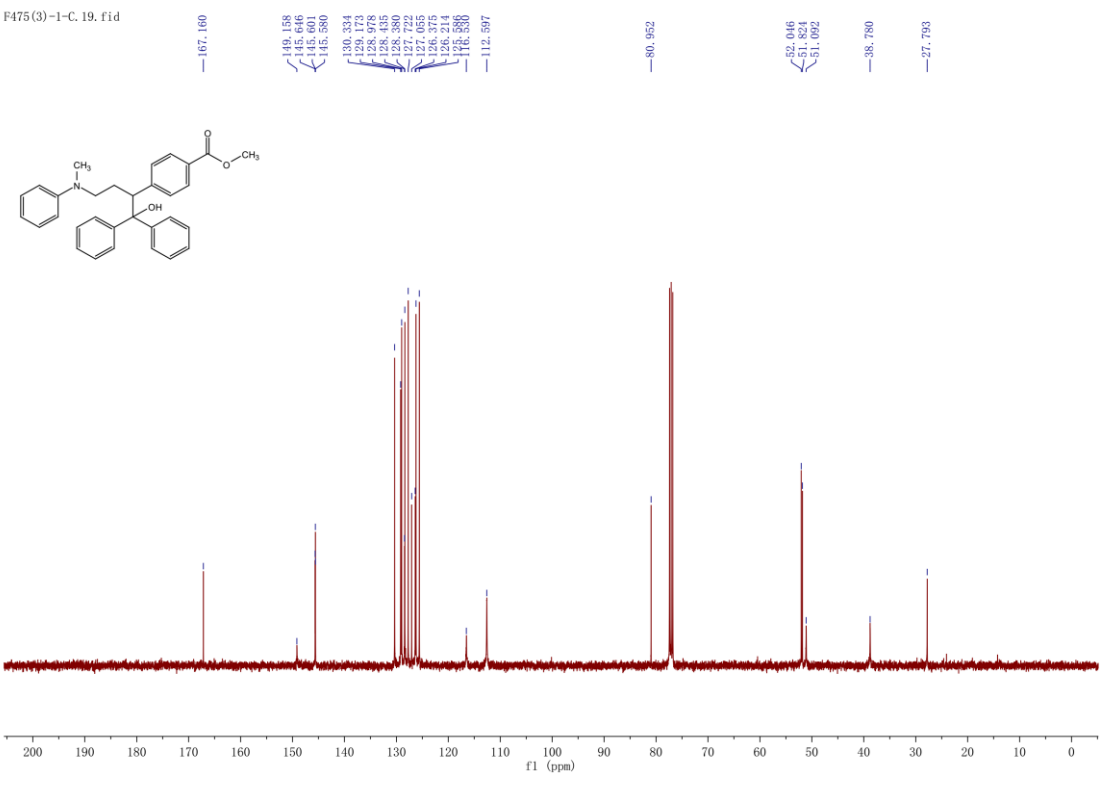
^{13}C NMR (100 MHz, $CDCl_3$) of compound **4ah**



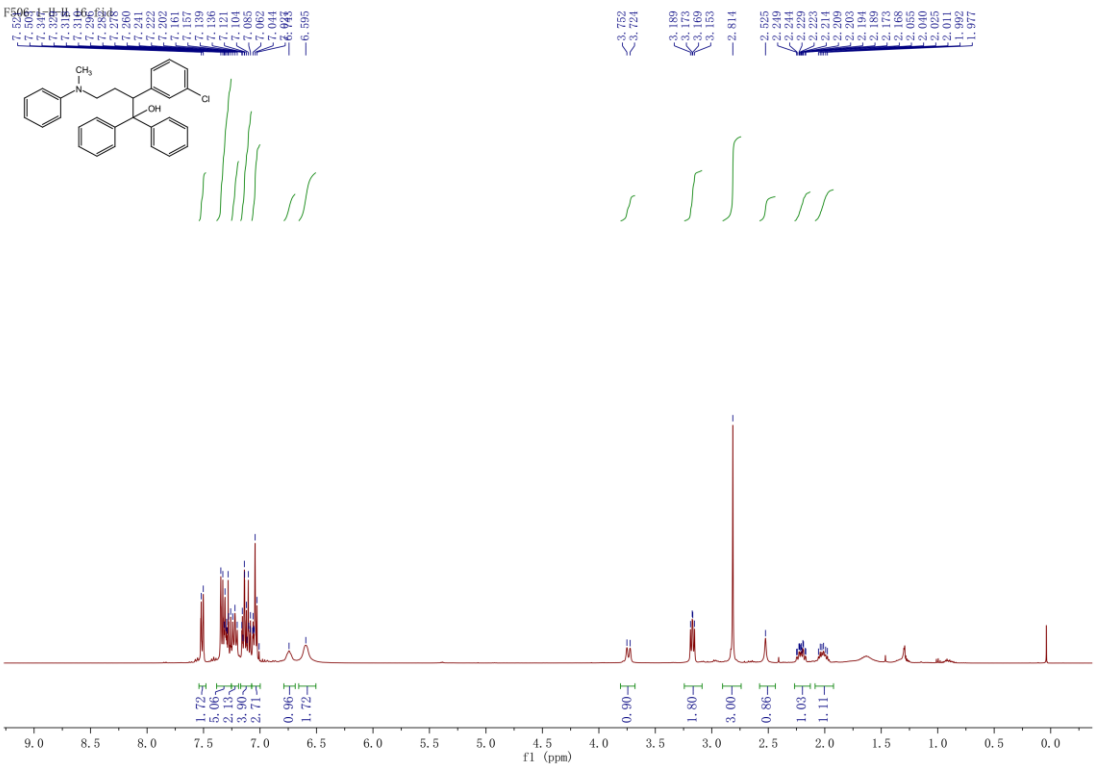
^{1}H NMR (400 MHz, $CDCl_3$) of compound **4ai**



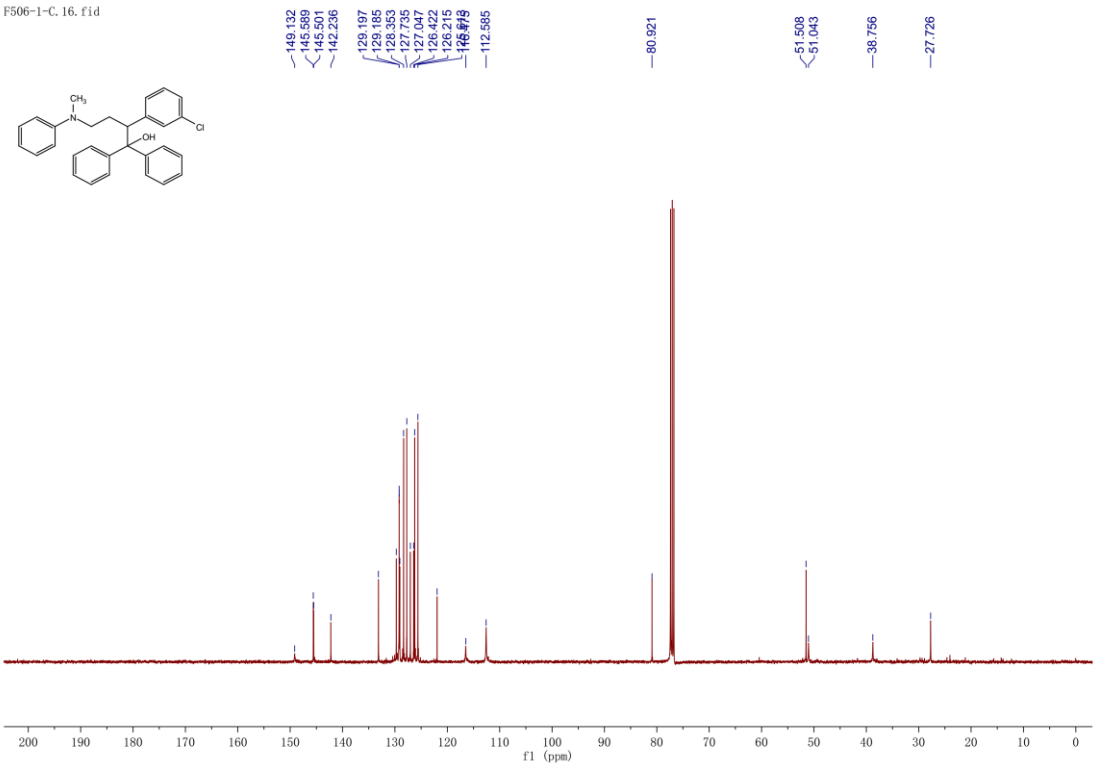
^{13}C NMR (100 MHz, $CDCl_3$) of compound **4ai**



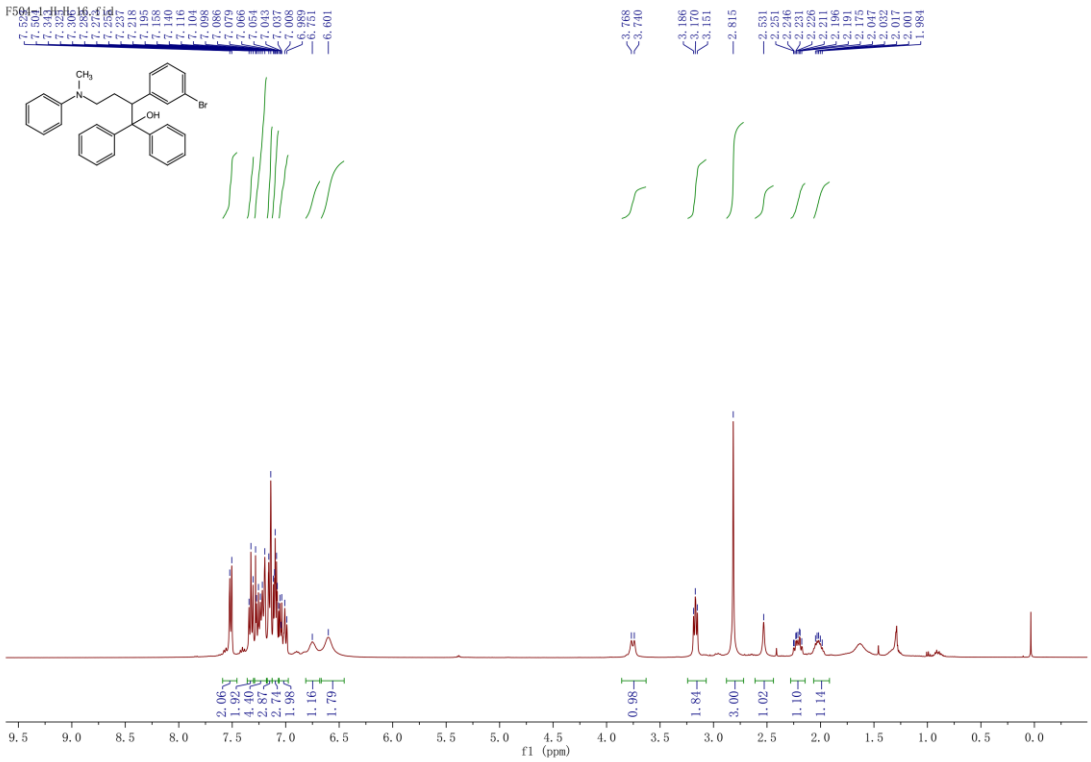
^{1}H NMR (400 MHz, $CDCl_3$) of compound **4aj**



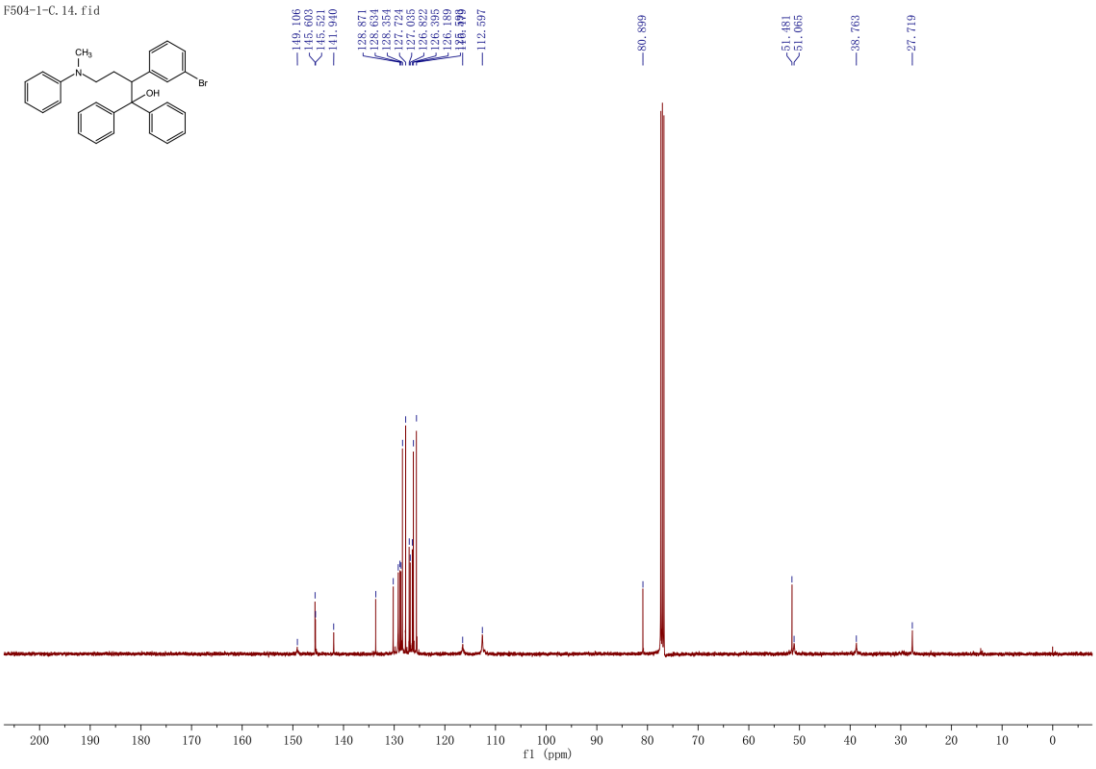
^{13}C NMR (100 MHz, $CDCl_3$) of compound **4aj**



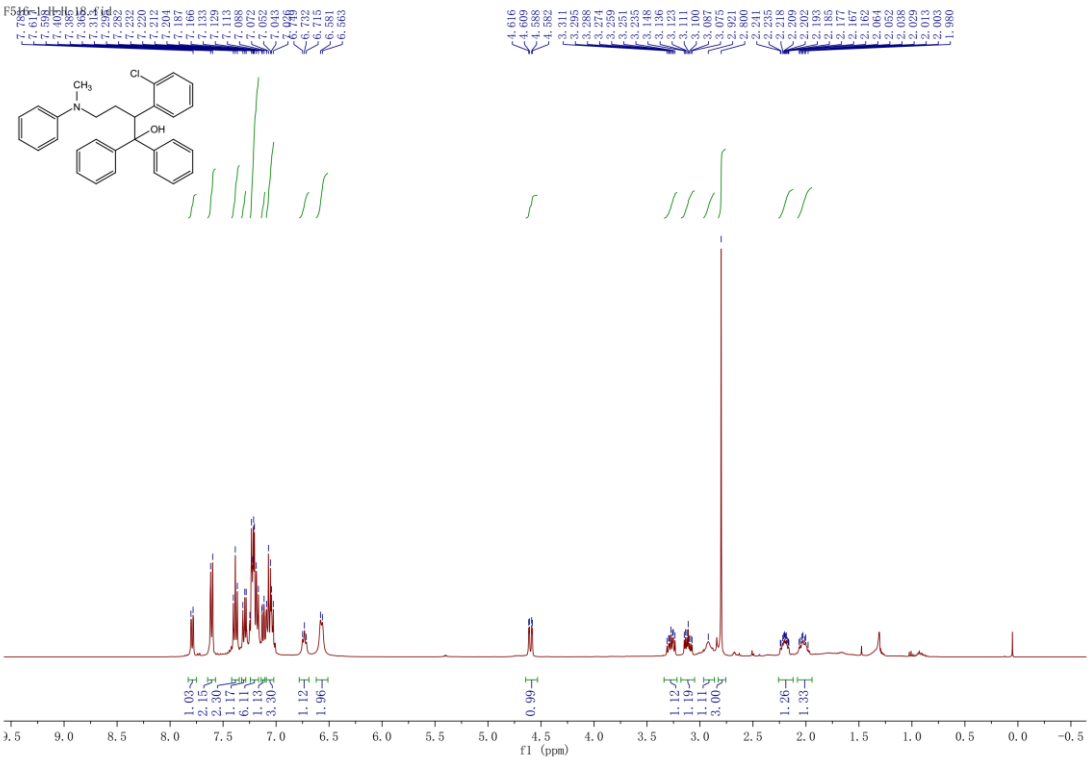
^{1}H NMR (400 MHz, $CDCl_3$) of compound **4ak**



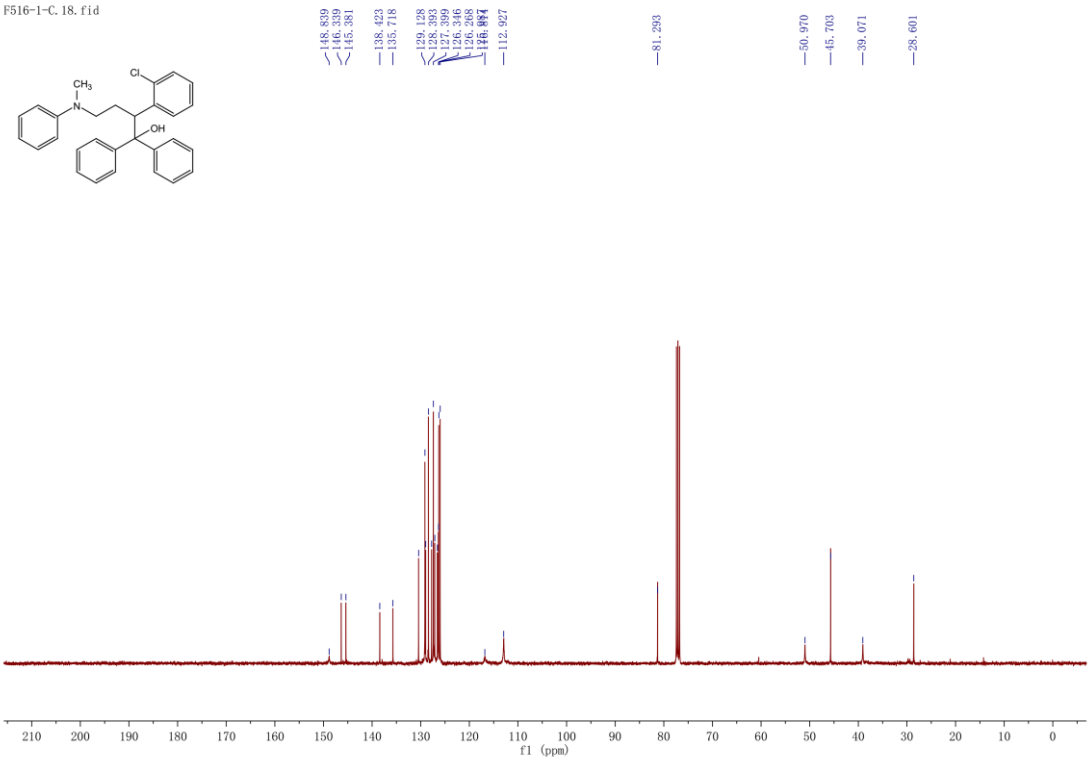
^{13}C NMR (100 MHz, $CDCl_3$) of compound **4ak**



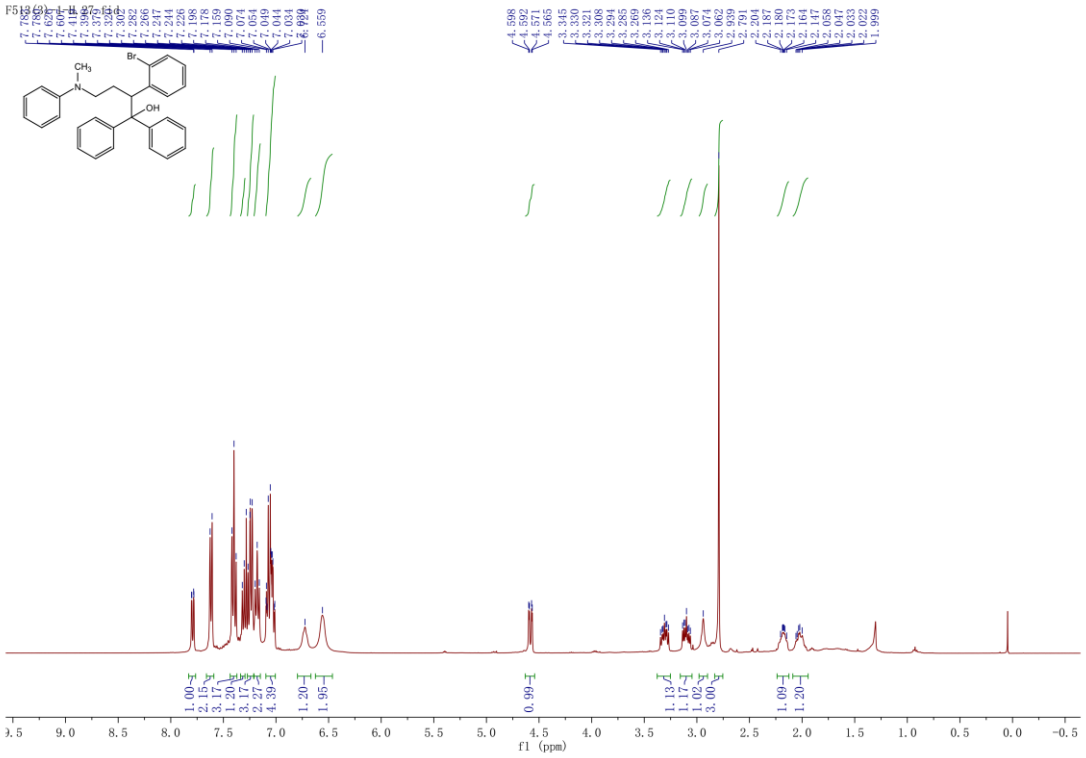
^{1}H NMR (400 MHz, $CDCl_3$) of compound **4al**



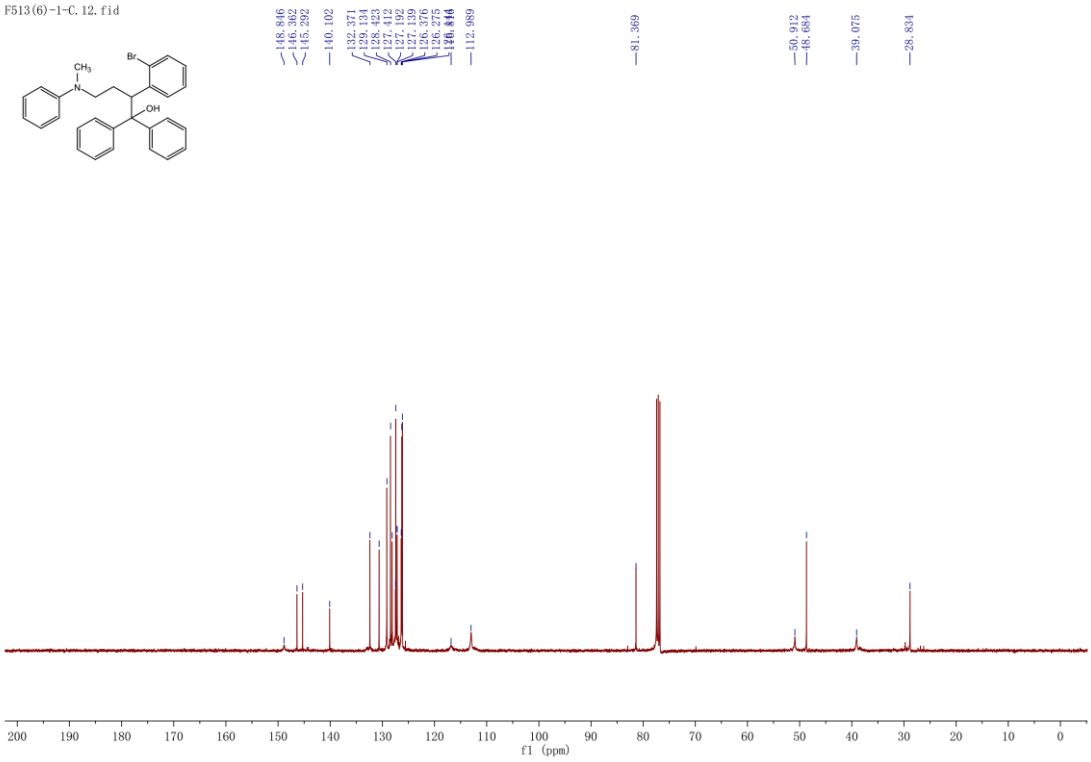
^{13}C NMR (100 MHz, $CDCl_3$) of compound **4al**



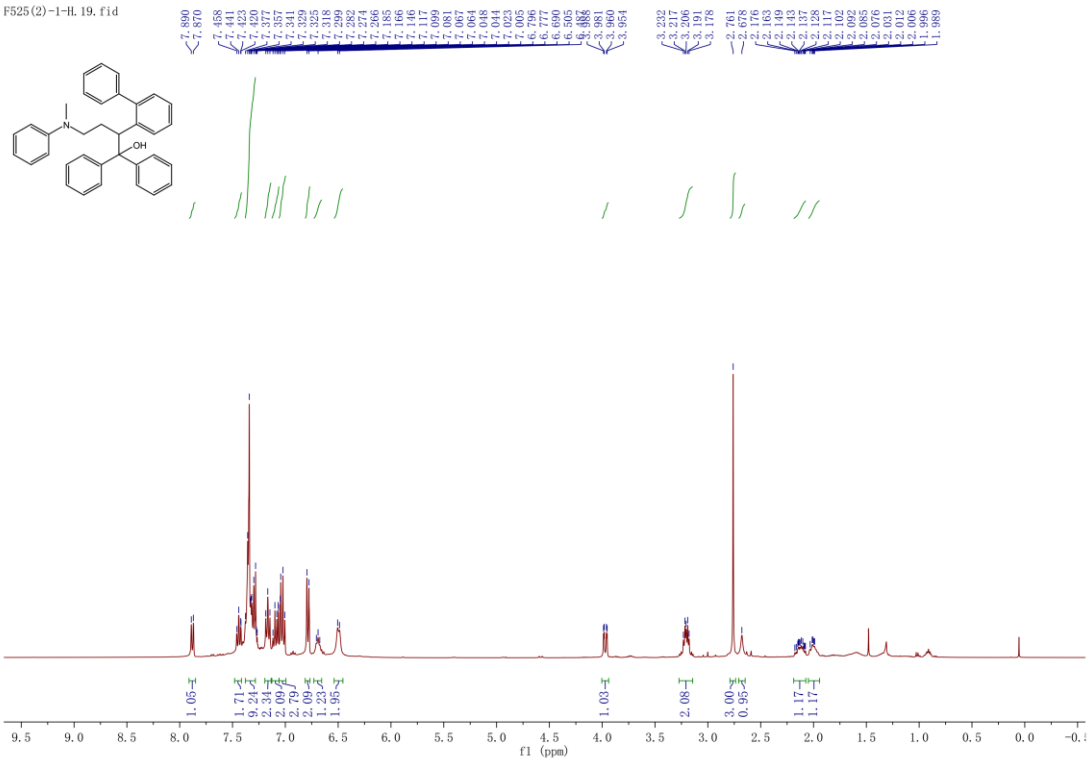
^{1}H NMR (400 MHz, $CDCl_3$) of compound **4am**



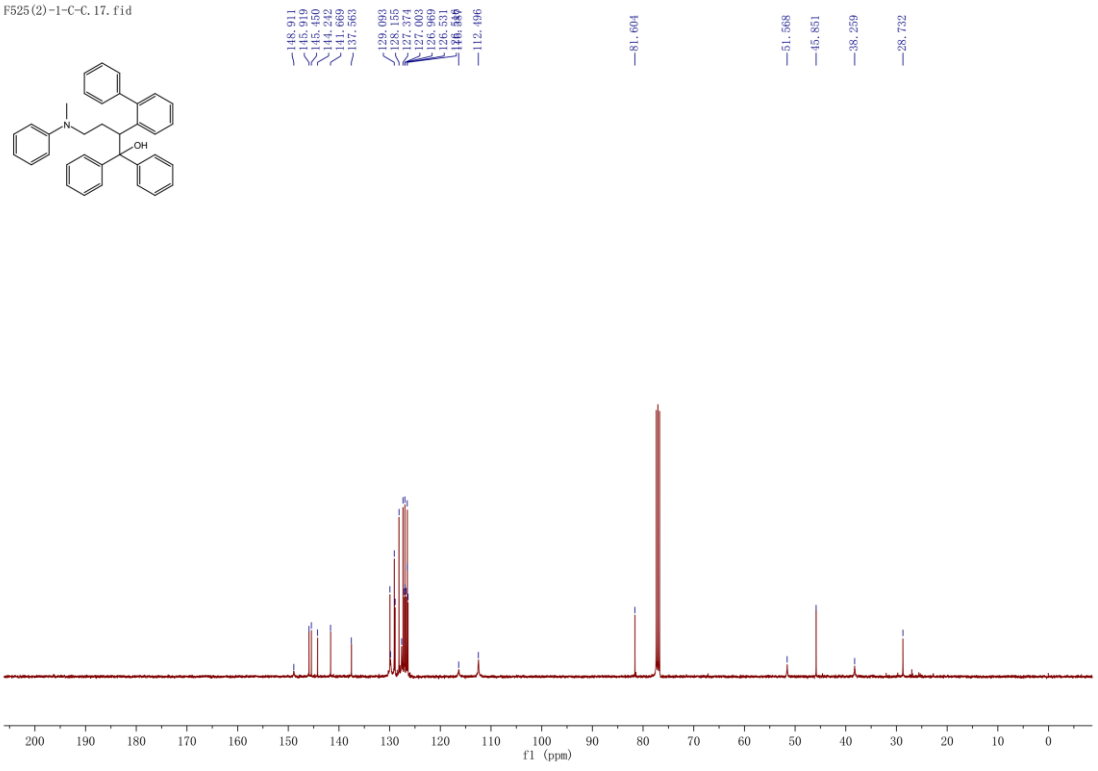
^{13}C NMR (100 MHz, $CDCl_3$) of compound **4am**



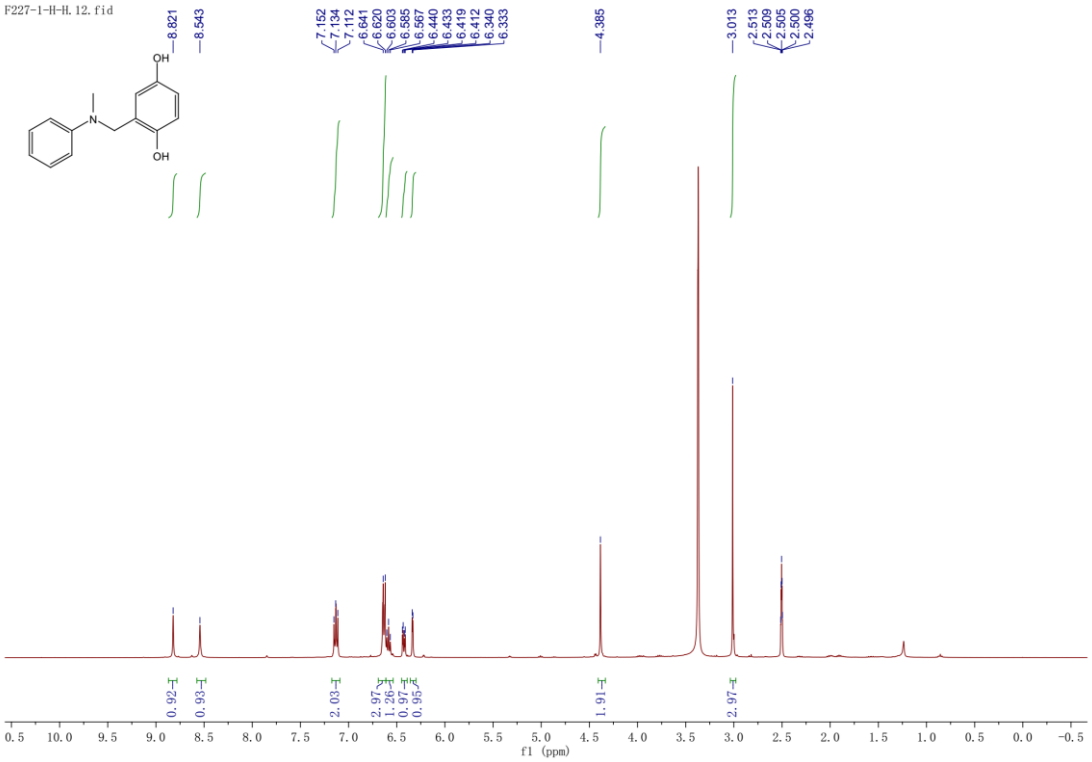
^{1}H NMR (400 MHz, $CDCl_3$) of compound **4an**



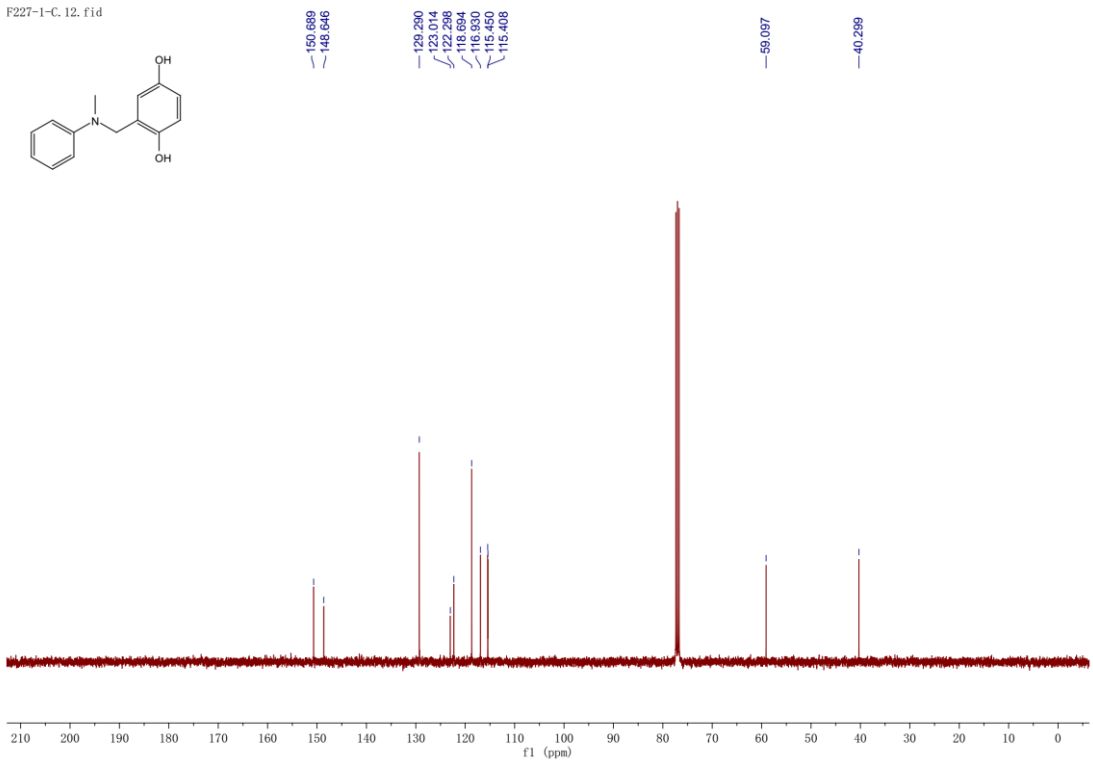
^{13}C NMR (100 MHz, $CDCl_3$) of compound **4an**



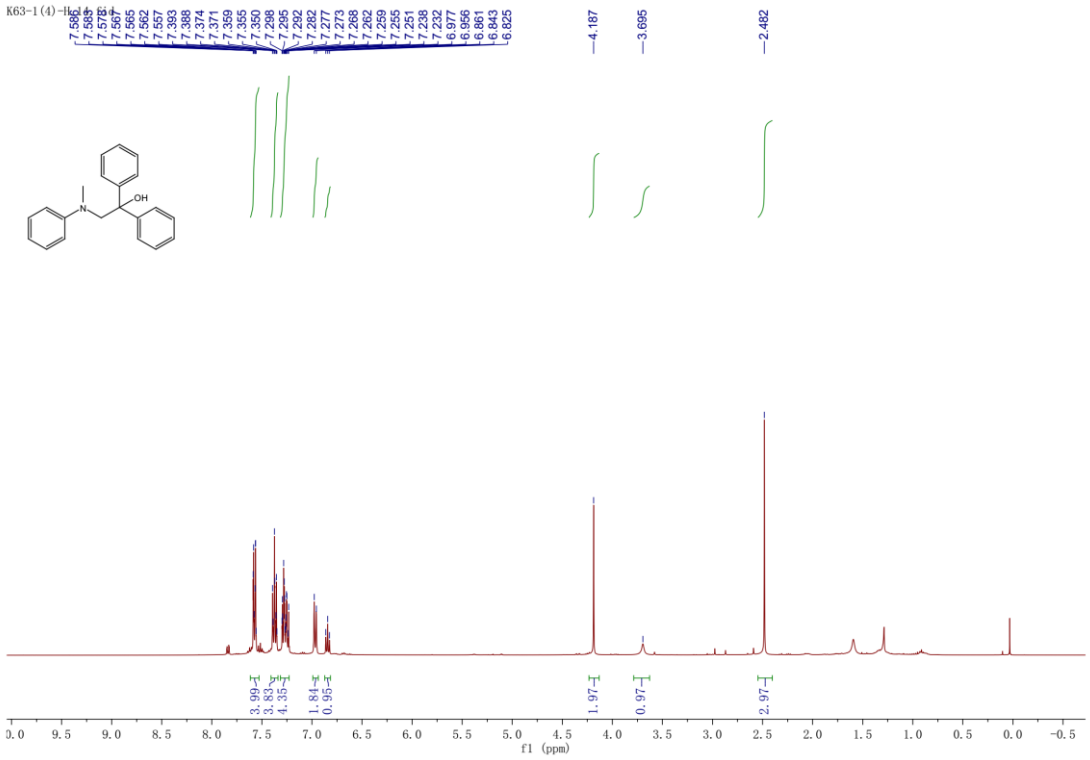
^{1}H NMR (400 MHz, DMSO-d_6) of compound **5a**



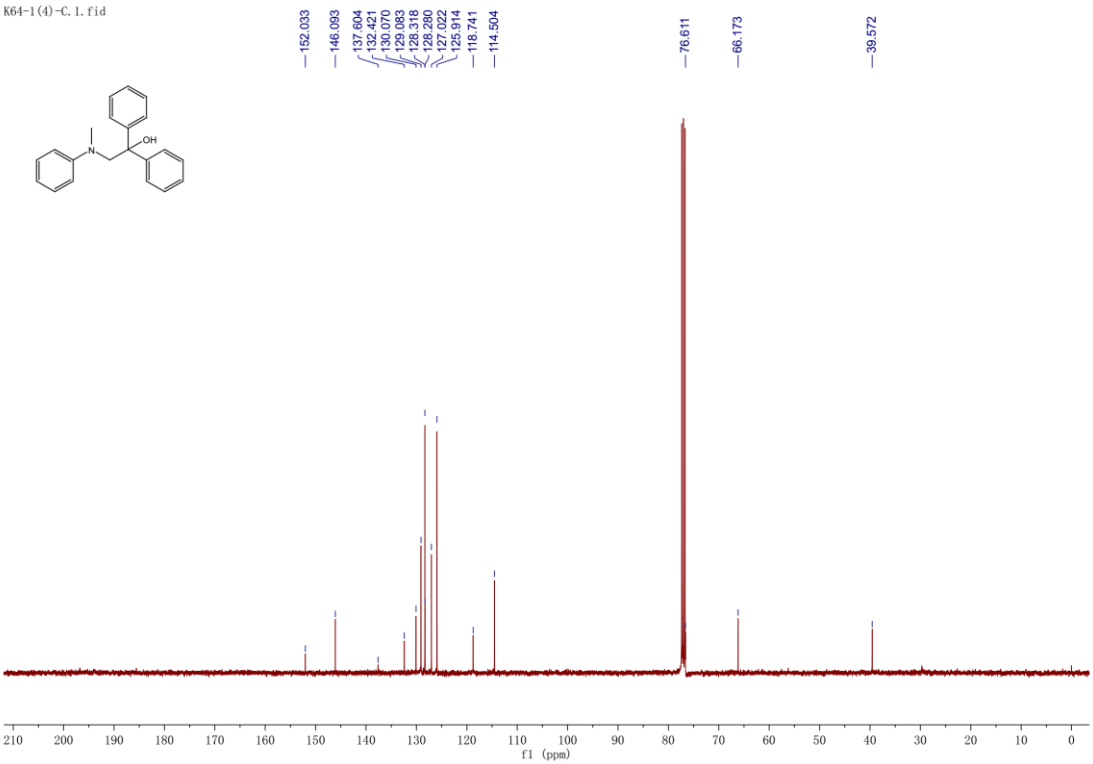
^{13}C NMR (100 MHz, $CDCl_3$) of compound **5a**



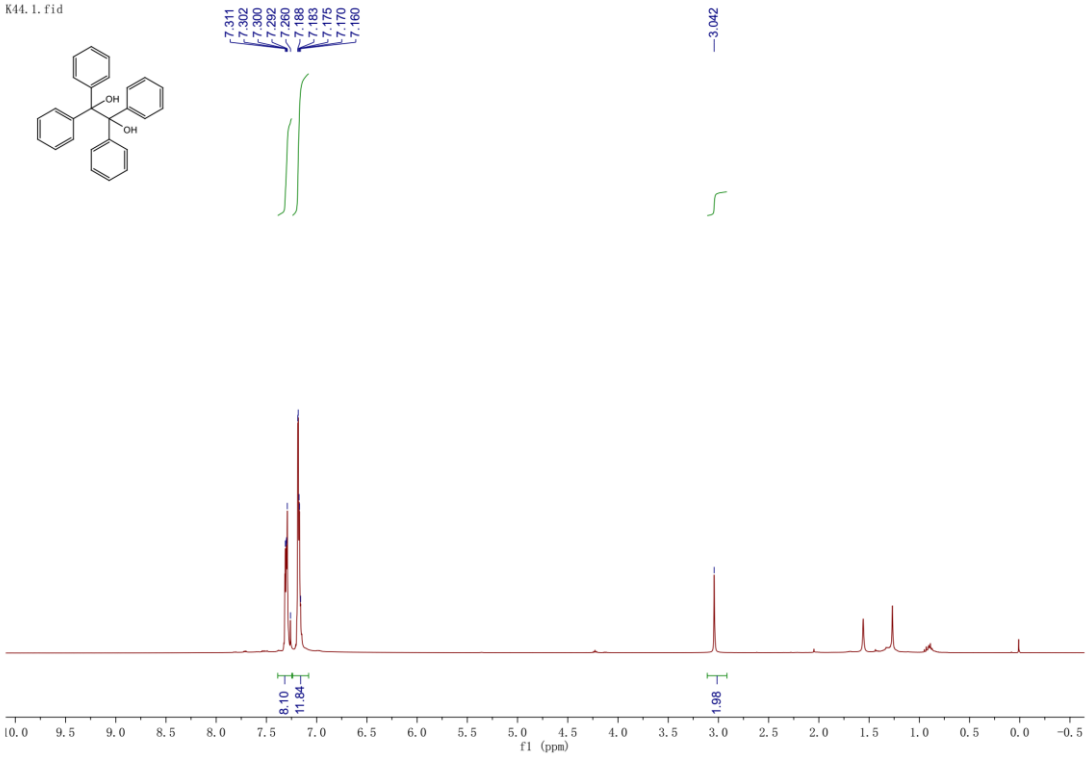
^{1}H NMR (400 MHz, $CDCl_3$) of compound **6a**



^{13}C NMR (100 MHz, $CDCl_3$) of compound **6a**



^{1}H NMR (400 MHz, $CDCl_3$) of compound **7a**



^{13}C NMR (100 MHz, $CDCl_3$) of compound **7a**