Electronic Supplementary Material (ESI) for ChemComm.

Electronic Supplementary Information

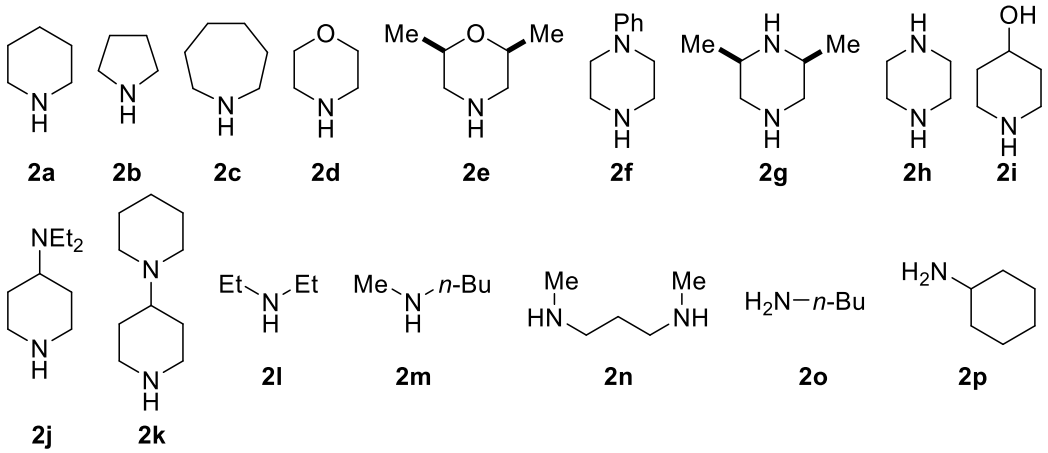
Table of Contents

1. General

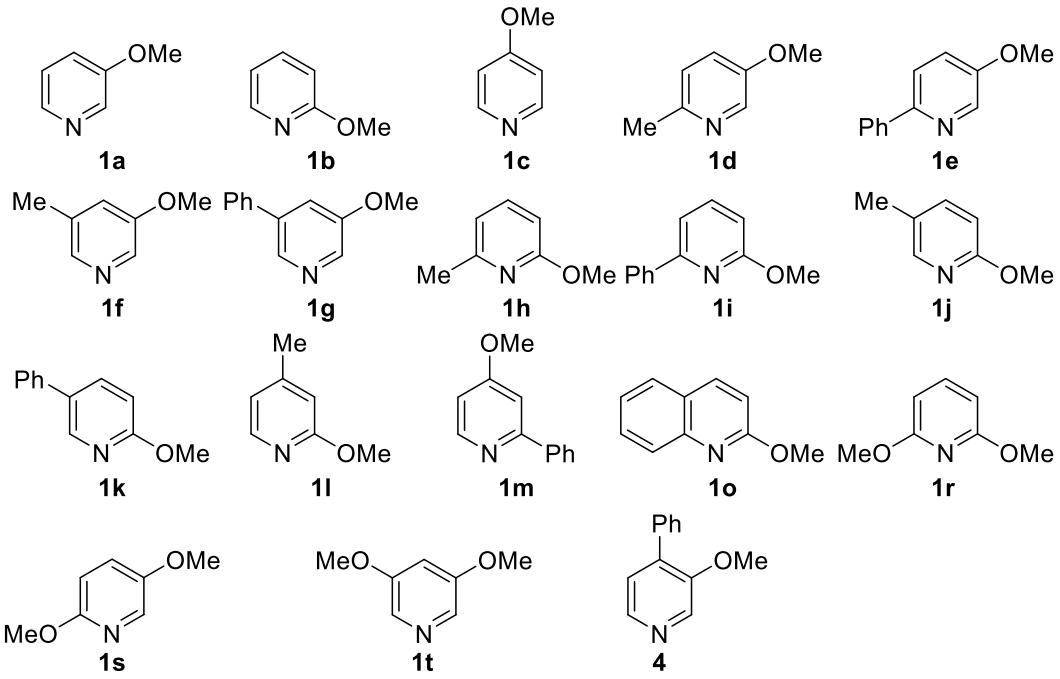
^{1}H NMR spectra (300, 400 or 500 MHz) were recorded on a Bruker Avance 300, 400 or 500 spectrometer in $CDCl_3$ [using TMS (for ^{1}H, $\delta = 0.00$) as internal standard]. ^{13}C NMR spectra (75, 100 or 125 MHz) were recorded on a Bruker Avance 300, 400 or 500 spectrometer in $CDCl_3$ [using $CDCl_3$ (for ^{13}C, $\delta = 77.00$) as internal standard]. The following abbreviations were used to explain the multiplicities: s = singlet, d = doublet, t = triplet, q = quartet, br = broad. High-resolution mass spectra were obtained with a Waters Q-Tof Premier mass spectrometer. Flash chromatography was performed using Merck silica gel 60 with distilled solvents. Tetrahydrofuran (THF) was taken from a solvent purification system (PS-400-5, innovative technology Inc.). NaH (60% dispersion in mineral oil), NaI and LiI were purchased from Sigma-Aldrich, Inc. Due to moisture sensitivity of NaH, it was consistently handled under an Ar atmosphere in a glovebox or with Schlenk techniques under an inert (N_2 or Ar) atmosphere. NaI and LiI were dried over P_2O_5 under reduced pressure at 60 °C and 120 °C, respectively. Other solvents and reagents, otherwise noted, were commercially available and used as received.

2. Synthesis of starting materials

Amines **2a** [CAS: 110-89-4], **2b** [CAS: 123-75-1], **2c** [CAS: 111-49-9], **2d** [CAS: 110-91-8], **2e** [CAS: 6485-55-8], **2f** [CAS: 92-54-6], **2g** [CAS: 21655-48-1], **2h** [CAS: 110-85-0], **2i** [CAS: 5382-16-1], **2j** [CAS: 143300-64-5], **2k** [CAS: 4897-50-1], **2l** [CAS: 109-89-7], **2m** [CAS: 110-68-9], **2n** [CAS: 111-33-1], **2o** [CAS: 109-73-9], and **2p** [CAS: 108-91-8] were commercially available and used as received.

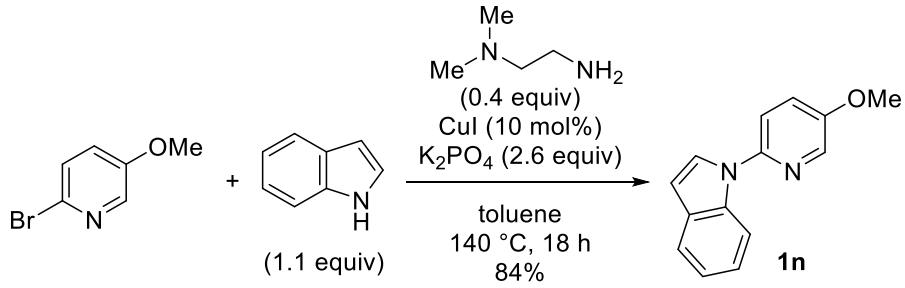


Methoxypyridines **1a** [CAS: 7295-76-3], **1b** [CAS: 1628-89-3], **1c** [CAS: 620-08-6], **1d** [CAS: 55270-47-8], **1f** [CAS: 78210-42-1], **1g** [CAS: 53698-52-5], **1h** [CAS: 63071-03-4], **1i** [CAS: 35070-08-7], **1j** [CAS: 13472-56-5], **1l** [CAS: 100848-70-2], **1m** [CAS: 53698-56-9], **1r** [CAS: 6231-18-1], **1s** [CAS: 867267-24-1], and **1t** [CAS: 18677-48-0] as well as methoxyquinoline **1o** [CAS: 6931-16-4] were commercially available and used as received. Methoxypyridines **1e**,[1] **1k**,[2] and **4**[3] were synthesized based on the corresponding literature procedures. Their spectra data are identical to those reported.



[1] X. Rao, C. Liu, Y. Xing, Y. Fu, J. Qiu and Z. Jin, *Asian J. Org. Chem.,* 2013, **2**, 514.
[2] S. Hibi, K. Ueno, S. Nagato, K. Kawano, K. Ito, Y. Norimine, O. Takenaka, T. Hanada and M. Yonaga, *J. Med. Chem.,* 2012, **55**, 10584.
[3] T. Truong and O. Daugulis, *J. Am. Chem. Soc.*, 2011, **133**, 4243.

2.1. Synthesis of 1-(5-methoxypyridin-2-yl)-1*H*-indole (1n)



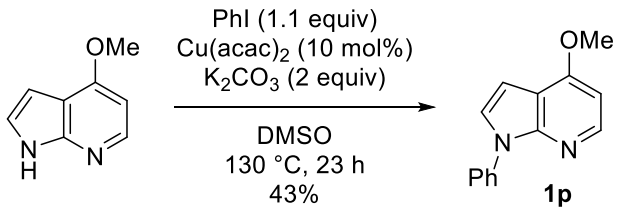
To a 100 mL sealed tube containing 2-bromo-5-methoxypyridine (CAS: 105170-27-2) (545 mg, 2.90 mmol), indole (391 mg, 3.34 mmol), CuI (67.8 mg, 0.356 mmol) and K_3PO_4 (1.72 g, 8.08 mmol) in toluene (30 mL) was added *N*,*N*-dimethylethylenediamine (131 μL, 1.20 mmol) at 23 °C under a N_2 atmosphere. The tube was sealed and the solution was then stirred at 140 °C for 18 h. The reaction mixture was filtered through a Celite pad with washing with EtOAc. The collected filtrate was washed with brine, dried over $MgSO_4$, filtered and concentrated *in vacuo*. The resulting crude material was purified by flash column chromatography (hexane : EtOAc =20:1) to yield **1n** (544 mg, 2.43 mmol) in 84% yield as an orange oil.

^{1}H NMR (400 MHz, $CDCl_3$): δ 8.23 (d, *J* = 2.8 Hz, 1H), 8.01 (dd, *J* = 8.4, 0.8 Hz, 1H), 7.65 (d, *J* = 8.0 Hz, 1H), 7.60 (d, *J* = 3.4 Hz, 1H), 7.38 (d, *J* = 8.8 Hz, 1H), 7.31 (dd, *J* = 8.8, 2.8 Hz, 1H), 7.28-7.24 (m, 1H), 7.19-7.15 (m, 1H), 6.674-6.665 (m, 1H), 3.87 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$): δ 153.4, 146.0, 135.4, 135.2, 130.0, 126.4, 123.8, 122.8, 121.1, 120.9, 115.7, 112.2, 104.6, 56.0.

ESIHRMS: Found m/z 225.1028; Calcd for $C_{14}H_{13}N_2O$ $[M+H]^+$ 225.1028.

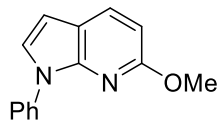
2.2. Synthesis of 4-methoxy-1-phenyl-1*H*-pyrrolo[2,3-*b*]pyridine (1p)



To a 10 mL sealed tube containing 4-methoxy-1*H*-pyrrolo[2,3-*b*]pyridine (CAS: 122379-63-9) (369 mg, 2.49 mmol), $Cu(acac)_2$ (66.4 mg, 0.254 mmol) and K_2CO_3 (695 mg, 5.03 mmol) in DMSO (5 mL) was added iodobenzene (0.31 mL, 2.77 mmol) at 23 °C under a N_2 atmosphere. The tube was sealed and the solution was then stirred at 130 °C for 23 h. The reaction mixture was quenched with saturated aqueous NH_4Cl solution at 0 °C. The reaction mixture was filtered through a Celite pad with washing with CH_2Cl_2. The collected filtrate was extracted thrice with CH_2Cl_2 and the combined organic extracts were washed with brine, dried over $MgSO_4$, filtered and concentrated *in vacuo*. The resulting crude material was purified by flash column chromatography (hexane : EtOAc =20:1) to yield **1p** (238 mg, 1.06 mmol) in 43% yield as a yellow solid.

^{1}H NMR (400 MHz, $CDCl_3$): δ 8.26 (d, *J* = 5.6 Hz, 1H), 7.73 (d, *J* = 7.2 Hz, 2H), 7.52 (d, *J* = 2.0 Hz, 1H), 7.49 (d, *J* = 8.4 Hz, 1H), 7.35 (d, *J* = 3.6 Hz, 1H), 7.32 (t, *J* = 7.2 Hz, 1H), 6.70 (d, *J* = 3.6 Hz, 1H), 6.58 (d, *J* = 5.6 Hz, 1H), 4.01 (s, 3H).
^{13}C NMR (100 MHz, $CDCl_3$): δ 159.9, 149.2, 145.6, 138.7, 129.3, 126.3, 125.7, 124.1, 111.7, 98.9, 98.6, 55.5.
ESIHRMS: Found m/z 225.1024; Calcd for $C_{14}H_{13}N_2O$ $[M+H]^+$ 225.1028.

2.3. Synthesis of 6-methoxy-1-phenyl-1*H*-pyrrolo[2,3-*b*]pyridine (1q)



Prepared using 6-methoxy-1*H*-pyrrolo[2,3-*b*]pyridine (CAS: 896722-53-5) (296 mg, 2.00 mmol) for 13 h by the procedure described in section 2.2.
Purification: Hexane:EtOAc = 40:1
Yield: 398 mg (1.78 mmol, 89% yield) as a pale yellow oil.

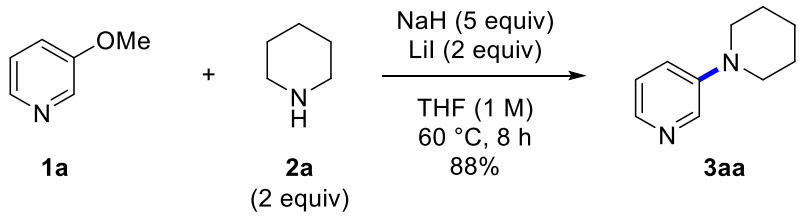
^{1}H NMR (400 MHz, $CDCl_3$): δ 7.83-7.82 (m, 2H), 7.79 (d, *J* = 8.4 Hz, 1H), 7.48–7.44 (m, 2H), 7.31 (d, *J* = 3.6 Hz, 1H), 7.28-7.24 (m, 1H), 6.62 (d, *J* = 8.4 Hz, 1H), 6.51 (d, *J* = 3.6 Hz, 1H), 3.94 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$): δ 161.0, 144.9, 138.9, 131.9, 129.1, 125.6, 124.3, 123.1, 115.4, 104.8, 102.2, 53.4.

ESIHRMS: Found m/z 225.1033; Calcd for $C_{14}H_{13}N_2O$ $[M+H]^+$ 225.1028.

3. Nucleophilic amination of methoxypyridines

3.1. Synthesis of 3-(piperidin-1-yl)pyridine (3aa)[4] (a typical procedure)



To a 10 mL sealed tube containing 3-methoxypyridine (**1a**) (55.0 mg, 0.504 mmol), NaH (101 mg, 2.53 mmol), and LiI (134 mg, 1.00 mmol) in THF (500 μL) was added piperidine (**2a**) (98.8 μL, 1.00 mmol) at 0 °C under a N_2 atmosphere. The tube was sealed and the solution was then stirred at 60 °C for 8 h. The reaction mixture was quenched with cold water at 0 °C and the organic materials were extracted thrice with CH_2Cl_2. The combined organic extracts were washed with brine, dried over $MgSO_4$, filtered and concentrated *in vacuo*. The resulting crude material was purified by flash column chromatography (hexane : EtOAc =3:1) to yield **3aa** (72.1 mg, 0.444 mmol) in 88% yield as a yellow oil.

^{1}H NMR (400 MHz, $CDCl_3$): δ 8.31 (d, *J* = 2.8 Hz, 1H), 8.05 (dd, *J* = 4.4, 1.6 Hz, 1H), 7.18 (dd, *J* = 8.4, 4.4 Hz, 1H), 7.13 (ddd, *J* = 8.4, 2.8, 1.6 Hz, 1H), 3.19 (t, *J* = 5.2 Hz, 4H), 1.74-1.69 (m, 4H), 1.62-1.57 (m, 2H).

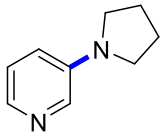
^{13}C NMR (100 MHz, $CDCl_3$): δ 147.7, 140.0, 138.9, 123.3, 122.6, 49.8, 25.5, 24.0.

A larger scale reaction was performed using 3-methoxypyridine (**1a**) (5.49 g, 50.3 mmol) and piperidine (**2a**) (10 mL, 101 mmol) in the presence of NaH (10.0 g, 250

[4] N. Marion, E. C. Ecarnot, O. Navarro, D. Amoroso, A. Bell and S. P. Nolan, *J. Org. Chem.*, 2006, **71**, 3816.

mmol) and LiI (13.4 g, 100 mmol) in THF (50 mL) under a 250 mL sealed tube, that was completed within 6 h to provide **3aa** (7.49 g, 46.2 mmol) in 92% yield.

3.2. Synthesis of 3-(pyrrolidin-1-yl)pyridine (3ab)[5]



Prepared using methoxypyridine **1a** (51.4 mg, 0.471 mmol) and amine **2b** (83.5 μL, 1.00 mmol) for 4 h.

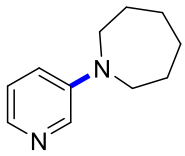
Purification: Hexane:EtOAc = 2:1

Yield: 63.2 mg (0.426 mmol, 90% yield) as a yellow oil.

^{1}H NMR (400 MHz, $CDCl_3$): δ 7.99 (d, *J* = 2.8 Hz, 1H), 7.92 (d, *J* = 4.4 Hz, 1H), 7.10 (dd, *J* = 8.4, 4.4 Hz, 1H), 6.80 (dd, *J* = 8.4, 2.8 Hz, 1H), 3.29 (t, *J* = 6.4 Hz, 4H), 2.04-2.01 (m, 4H).

^{13}C NMR (100 MHz, $CDCl_3$): δ 143.7, 136.9, 134.4, 123.5, 117.7, 47.3, 25.4.

3.3. Synthesis of 1-(pyridin-3-yl)azepane (3ac)[6]



Prepared using methoxypyridine **1a** (54.9 mg, 0.503 mmol) and amine **2c** (114 μL, 1.01 mmol) for 9 h.

Purification: Hexane:Et_2O = 1:2

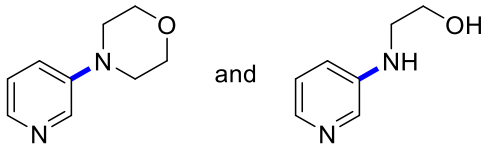
Yield: 76.3 mg (0.433 mmol, 82% yield) as a yellow oil.

^{1}H NMR (400 MHz, $CDCl_3$): δ 8.12 (d, *J* = 2.4 Hz, 1H), 7.89 (d, *J* = 4.4 Hz, 1H), 7.08 (dd, *J* = 8.4, 4.4 Hz, 1H), 6.93 (dd, *J* = 8.4, 2.4 Hz, 1H), 3.46 (t, *J* = 6.0 Hz, 4H), 1.81-1.79 (m, 4H), 1.57-1.54 (m, 4H).

^{13}C NMR (100 MHz, $CDCl_3$): δ 144.6, 136.6, 134.1, 123.6, 117.3, 48.9, 27.4, 27.0.

[5] G. Manolikakes, A. Gavryushin and P. Knochel, *J. Org. Chem.*, 2008, **73**, 1429.
[6] Q. Deng, Y. Zhang, H. Zhu and T. Tu, *Chem. Asian J.*, 2017, **12**, 2364.

3.4. Synthesis of 4-(pyridin-3-yl)morpholine (3ad)[6] and 2-(pyridin-3-ylamino)ethan-1-ol (3ad')



Prepared using methoxypyridine **1a** (54.1 mg, 0.496 mmol) and amine **2d** (87.1 μL, 0.996 mmol) for 5 h.

Purification: MeOH:CH_2Cl_2 = 1:20

Yield of **3ad**: 26.1 mg (0.159 mmol, 32% yield) as a yellow oil.

^{1}H NMR (400 MHz, $CDCl_3$): δ 8.31 (m, 1H), 8.13 (m, 1H), 7.18-7.17 (m, 2H), 3.88 (t, *J* = 4.8 Hz, 4H), 3.19 (t, *J* = 4.8 Hz, 4H).

^{13}C NMR (100 MHz, $CDCl_3$): δ 146.9, 141.1, 138.3, 123.5, 122.1, 66.7, 48.6.

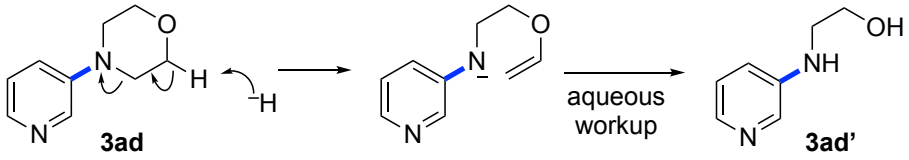
Yield of **3ad'**: 37.8 mg (0.274 mmol, 55% yield) as a yellow oil.

^{1}H NMR (400 MHz, $CDCl_3$): δ 7.93 (m, 1H), 7.89 (d, *J* = 4.2 Hz, 1H), 7.07 (dd, *J* = 7.7, 4.2 Hz, 1H), 6.90 (d, *J* = 7.7 Hz, 1H), 4.12 (brs, 2H), 3.84 (t, *J* = 5.1 Hz, 2H), 3.26 (t, *J* = 5.1 Hz, 2H).

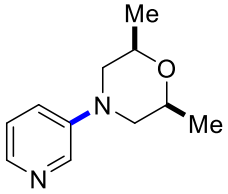
^{13}C NMR (100 MHz, $CDCl_3$): δ 144.6, 138.2, 135.7, 124.0, 119.1, 60.5, 45.7.

ESIHRMS: Found *m/z* 139.0868; Calcd for $C_7H_{11}N_2O$ $[M+H]^+$ 139.0871.

The formation of **3ad'** most likely occurs through deprotonative ring-opening of **3ad** to form acylic enol intermediate followed by its hydrolysis in aqueous workup.



3.5. Synthesis of (2*S**,6*R**)-2,6-dimethyl-4-(pyridin-3-yl)morpholine (3ae)



Prepared using methoxypyridine **1a** (56.7 mg, 0.520 mmol) and amine **2e** (129 μL, 1.04 mmol) for 6 h.

Purification: Hexane:EtOAc = 1:1

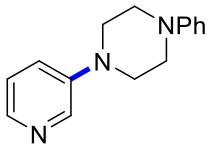
Yield: 72.3 mg (0.376 mmol, 72% yield) as a yellow oil.

^{1}H NMR (400 MHz, $CDCl_3$): δ 8.30 (m, 1H), 8.12-8.10 (m, 1H), 7.16 (m, 2H), 3.84-3.78 (m, 2H), 3.45 (d, *J* =11.3 Hz, 2H), 2.46 (t, *J* = 11.3 Hz, 2H), 1.27 (d, *J* = 6.2 Hz, 6H).

^{13}C NMR (100 MHz, $CDCl_3$): δ 146.6, 140.8, 138.3, 123.5, 122.1, 71.5, 54.0, 19.0.

ESIHRMS: Found *m/z* 193.1341; Calcd for $C_{11}H_{17}N_2O$ $[M+H]^+$ 193.1341.

3.6. Synthesis of 1-phenyl-4-(pyridin-3-yl)piperazine (3af)[6]



Prepared using methoxypyridine **1a** (55.9 mg, 0.512 mmol) and amine **2f** (153 μL, 1.00 mmol) for 5 h.

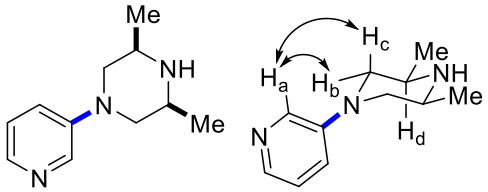
Purification: Hexane:CH_2Cl_2 = 1:8

Yield: 107 mg (0.446 mmol, 87% yield) as a yellow solid.

^{1}H NMR (400 MHz, $CDCl_3$): δ 8.37 (d, *J* = 2.8 Hz, 1H), 8.13 (dd, *J* = 4.4, 1.2 Hz, 1H), 7.30 (dd, *J* = 8.4, 7.4 Hz, 2H), 7.24 (dd, *J* = 8.4, 4.4 Hz, 1H), 7.18 (ddd, *J* = 8.4, 2.8, 1.2 Hz, 1H), 6.99 (d, *J* = 8.4 Hz, 2H), 6.91 (t, *J* = 7.4 Hz, 1H), 3.37-3.36 (m, 8H).

^{13}C NMR (100 MHz, $CDCl_3$): δ 151.1, 146.9, 141.1, 138.9, 129.3, 123.5, 122.6, 120.3, 116.5, 49.3, 48.7.

3.7. Synthesis of (3*S**,5*R**)-3,5-dimethyl-1-(pyridin-3-yl)piperazine (3ag)



NOESY correlation
(between H_a and H_b as well as H_a and H_c)

No NOESY correlation
(between H_a and H_d)

Prepared using methoxypyridine **1a** (56.1 mg, 0.514 mmol) and amine **2g** (114 mg, 0.998 mmol) for 21 h.

Purification: CH_2Cl_2:NEt_3 = 40:1

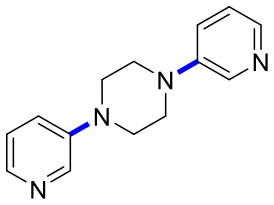
Yield: 71.2 mg (0.372 mmol, 72% yield) as a yellow oil.

^{1}H NMR (400 MHz, $CDCl_3$): δ 8.31 (d, *J* = 2.1 Hz, 1H), 8.10 (d, *J* = 3.9 Hz, 1H), 7.17-7.16 (m, 2H), 3.52 (dd, *J* = 12.0, 1.8 Hz, 2H), 3.15-3.10 (m, 2H), 2.49 (t, *J* = 11.2 Hz, 2H), 1.24 (d, *J* = 6.3 Hz, 6H).

^{13}C NMR (100 MHz, $CDCl_3$): δ 146.9, 140.4, 138.6, 123.4, 122.3, 55.3, 50.5, 19.7.

ESIHRMS: Found m/z 192.1500; Calcd for $C_{11}H_{18}N_3$ $[M+H]^+$ 192.1501.

3.8. Synthesis of 1,4-di(pyridin-3-yl)piperazine (3ah)[6]



Prepared using methoxypyridine **1a** (115 mg, 1.05 mmol) and amine **2h** (41.6 mg, 0.483 mmol) for 7 h.

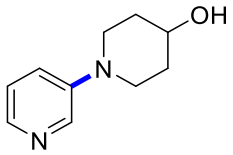
Purification: MeOH:CH_2Cl_2 = 1:4

Yield: 86.5 mg (0.360 mmol, 75% yield) as a white solid.

^{1}H NMR (400 MHz, $CDCl_3$): δ 8.37 (d, *J* = 2.6 Hz, 2H), 8.16 (dd, *J* = 4.4, 1.2 Hz, 2H), 7.26-7.19 (m, 4H), 3.39 (s, 8H).

^{13}C NMR (100 MHz, $CDCl_3$): δ 146.7, 141.4, 139.0, 123.6, 122.8, 48.6.

3.9. Synthesis of 1-(pyridin-3-yl)piperidin-4-ol (3ai)



Prepared using methoxypyridine **1a** (53.4 mg, 0.490 mmol), amine **2i** (105 mg, 1.04 mmol), NaH (142 mg, 3.55 mmol), and LiI (133 mg, 0.997 mmol) at 90 °C for 25 h.

Purification: EtOAc:MeOH = 10:1

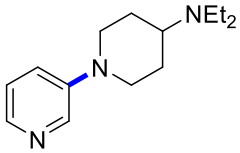
Yield: 47.0 mg (0.264 mmol, 56% yield) as a yellow oil.

^{1}H NMR (400 MHz, $CDCl_3$): δ 8.33 (m, 1H), 8.08 (m, 1H), 7.23-7.18 (m, 2H), 3.89 (quintet, *J* = 4.2 Hz, 1H), 3.60-3.55 (m, 2H), 3.02-2.96 (m, 2H), 2.05-2.00 (m, 2H), 1.75-1.69 (m, 3H).

^{13}C NMR (100 MHz, $CDCl_3$): δ 147.1, 139.9, 138.5, 123.7, 122.9, 67.2, 46.4, 33.8.

ESIHRMS: Found m/z 179.1178; Calcd for $C_{10}H_{15}N_2O$ $[M+H]^+$ 179.1184.

3.10. Synthesis of *N*,*N*-diethyl-1-(pyridin-3-yl)piperidin-4-amine (3aj)



Prepared using methoxypyridine **1a** (55.6 mg, 0.509 mmol) and amine **2j** (157 mg, 1.00 mmol) for 7 h.

Purification: CH_2Cl_2:NEt_3 = 40:1

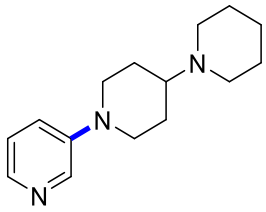
Yield: 95.6 mg (0.410 mmol, 80% yield) as a white solid.

^{1}H NMR (400 MHz, $CDCl_3$): δ 8.31 (d, *J* = 2.7 Hz, 1H), 8.06 (dd, *J* = 4.4, 1.4 Hz, 1H), 7.19 (ddd, *J* = 8.0, 2.7, 1.4 Hz, 1H), 7.13 (dd, *J* = 8.0, 4.4 Hz, 1H), 3.77-3.74 (m, 2H), 2.79-2.73 (m, 2H), 2.69-2.63 (m, 1H), 2.60 (q, *J* = 7.2 Hz, 4H), 1.90-1.87 (m, 2H), 1.71-1.65 (m, 2H), 1.06 (t, *J* = 7.2 Hz, 6H).

^{13}C NMR (100 MHz, $CDCl_3$): δ 147.0, 140.2, 138.9, 123.4, 122.6, 57.7, 49.0, 43.5, 28.3, 13.7.

ESIHRMS: Found m/z 234.1973; Calcd for $C_{14}H_{24}N_3$ $[M+H]^+$ 234.1970.

3.11. Synthesis of 1'-(pyridin-3-yl)-1,4'-bipiperidine (3ak)



Prepared using methoxypyridine **1a** (51.9 mg, 0.476 mmol) and amine **2k** (168 mg, 0.998 mmol) for 24 h.

Purification: CH_2Cl_2:MeOH = 10:1

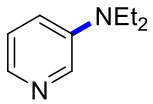
Yield: 115 mg (0.469 mmol, 98% yield) as an orange solid.

^{1}H NMR (400 MHz, $CDCl_3$): δ 8.31 (d, *J* = 2.4 Hz, 1H), 8.06 (dd, *J* = 4.4, 0.8 Hz, 1H), 7.18 (ddd, *J* = 8.4, 2.4, 0.8 Hz, 1H), 7.13 (dd, *J* = 8.4, 4.4 Hz, 1H), 3.78-3.75 (m, 2H), 2.76 (dt, *J* = 12.4, 2.4 Hz, 2H), 2.56 (t, *J* = 5.1 Hz, 4H), 2.47-2.43 (m, 1H), 1.97-1.94 (m, 2H), 1.70 (dt, *J* = 12.4, 4.0 Hz, 2H), 1.66-1.60 (m, 4H), 1.49-1.43 (m, 2H).

^{13}C NMR (100 MHz, $CDCl_3$): δ 147.0, 140.3, 138.9, 123.4, 122.6, 62.4, 50.2, 48.8, 27.6, 26.2, 24.7.

ESIHRMS: Found m/z 246.1971; Calcd for $C_{15}H_{24}N_3$ $[M+H]^+$ 246.1970.

3.12. Synthesis of *N*,*N*-diethylpyridin-3-amine (3al)[6]



Prepared using methoxypyridine **1a** (54.3 mg, 0.498 mmol) and amine **2l** (103 μL, 0.996 mmol) for 27 h.

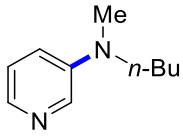
Purification: Hexane:CH_2Cl_2 = 1:8

Yield: 58.2 mg (0.387 mmol, 78% yield) as a pale yellow oil.

^{1}H NMR (400 MHz, $CDCl_3$): δ 8.10 (d, *J* = 3.2 Hz, 1H), 7.89 (d, *J* = 4.5 Hz, 1H), 7.09 (dd, *J* = 8.4, 4.5 Hz, 1H), 6.93 (ddd, *J* = 8.4, 3.2, 1.2 Hz, 1H), 3.36 (q, *J* = 7.2 Hz, 4H), 1.17 (t, *J* = 7.2 Hz, 6H).

^{13}C NMR (100 MHz, $CDCl_3$): δ 143.6, 136.8, 134.7, 123.6, 117.9, 44.1, 12.4.

3.13. Synthesis of *N*-butyl-*N*-methylpyridin-3-amine (3am)[5]



Prepared using methoxypyridine **1a** (55.9 mg, 0.512 mmol) and amine **2m** (119 μL, 1.00 mmol) for 24 h.

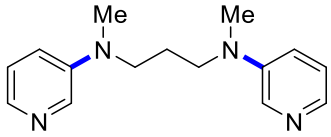
Purification: Hexane:Et_2O = 1:1

Yield: 56.9 mg (0.346 mmol, 68% yield) as a pale yellow oil.

^{1}H NMR (400 MHz, $CDCl_3$): δ 8.12 (d, *J* = 3.0 Hz, 1H), 7.94 (dd, *J* = 4.4, 0.8 Hz, 1H). 7.11 (dd, *J* = 8.4, 4.4 Hz, 1H), 6.94 (ddd, *J* = 8.4, 3.0, 0.8 Hz, 1H), 3.33 (t, *J* = 7.4 Hz, 2H), 2.95 (s, 3H), 1.61-1.53 (m, 2H), 1.36 (sextet, *J* = 7.4 Hz, 2H), 0.96 (t, *J* = 7.4 Hz, 3H).

^{13}C NMR (100 MHz, $CDCl_3$): δ 145.1, 137.2, 134.8, 123.4, 118.1, 52.1, 37.9, 28.6, 20.3, 13.9.

3.14. N^1,N^3-dimethyl-N^1,N^3-di(pyridin-3-yl)propane-1,3-diamine (3an)



Prepared using methoxypyridine **1a** (106 μL, 1.05 mmol) and amine **2n** (51.8 mg, 0.507 mmol) for 13 h.

Purification: CH_2Cl_2:MeOH = 20:1

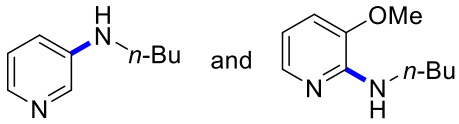
Yield: 79.9 mg (0.312 mmol, 62% yield) as an orange oil.

^{1}H NMR (400 MHz, $CDCl_3$): δ 8.13 (d, *J* = 2.2 Hz, 2H), 7.96 (d, *J* = 4.3 Hz, 2H), 7.10 (dd, *J* = 8.4, 4.3 Hz, 2H), 6.94 (dd, *J* = 8.4, 2.2 Hz, 2H), 3.39 (t, *J* = 7.3 Hz, 4H), 2.95 (s, 6H), 1.89 (quintet, *J* = 7.3 Hz, 2H).

^{13}C NMR (100 MHz, $CDCl_3$): δ 145.0, 137.9, 135.1, 123.5, 118.6, 49.9, 38.1, 23.9.

ESIHRMS: Found m/z 257.1764; Calcd for $C_{15}H_{21}N_4$ $[M+H]^+$ 257.1766.

3.15. Synthesis of *N*-butylpyridin-3-amine (3ao)[7] and *N*-butyl-3-methoxypyridin-2-amine (3ao')



Prepared using methoxypyridine **1a** (56.4 mg, 0.517 mmol) and amine **2o** (100 μL, 1.01 mmol) for 10 h.

Purification: Hexane:EtOAc = from 10:1 (for **3ao'**) to 1:1 (for **3ao**)

Yield of **3ao**: 47.6 mg (0.317 mmol, 61% yield) as a yellow solid along with 8% recovery of methoxypyridine **1a**.

^{1}H NMR (400 MHz, $CDCl_3$): δ 8.05 (m, 1H), 7.96 (d, *J* = 4.8 Hz, 1H), 7.08 (dd, *J* = 8.4, 4.8 Hz, 1H), 6.87 (dd, *J* = 8.4, 1.6 Hz, 1H), 3.64 (brs, 1H), 3.12 (t, *J* = 7.2 Hz, 2H), 1.62 (tt, *J* = 7.2, 7.2 Hz, 2H), 1.44 (tq, *J* = 7.2, 7.2 Hz, 2H), 0.97 (t, *J* = 7.2 Hz, 3H).

^{13}C NMR (100 MHz, $CDCl_3$): δ 145.0, 138.3, 135.8, 123.8, 118.4, 43.3, 31.5, 20.2, 13.9.

[7] T. Kubo, C. Katoh, K. Yamada, K. Okano, H. Tokuyama and T. Fukuyama, *Tetrahedron*, 2008, **64**, 11230.

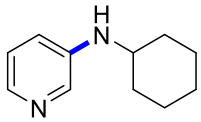
Yield of **3ao'**: 6.9 mg (0.0383 mmol, 7% yield) as a yellow oil.

^{1}H NMR (400 MHz, $CDCl_3$): δ 7.71 (d, *J* = 5.2 Hz, 1H), 6.79 (d, *J* = 7.6 Hz, 1H), 6.48 (dd, *J* = 7.6, 5.2 Hz, 1H), 4.85 (brs, 1H), 3.82 (s, 3H), 3.47-3.42 (2H, m), 1.63 (tt, *J* = 7.6, 7.6 Hz, 2H), 1.44 (tq, *J* = 7.6, 7.6 Hz, 2H), 0.96 (t, *J* = 7.6 Hz, 3H).

^{13}C NMR (100 MHz, $CDCl_3$): δ 150.2, 142.2, 138.7, 113.3, 111.1, 55.1, 40.8, 32.0, 20.3, 13.9.

ESIHRMS: Found m/z 181.1333; Calcd for $C_{10}H_{17}N_2O$ $[M+H]^+$ 181.1341.

3.16. Synthesis of *N*-cyclohexylpyridin-3-amine (3ap)[8]



Prepared using methoxypyridine **1a** (55.8 mg, 0.511 mmol) and amine **2p** (120 μL, 1.05 mmol) for 22 h.

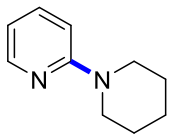
Purification: Hexane:Et_2O = 1:2

Yield: 50.6 mg (0.287 mmol, 56% yield) as a white solid along with 12% recovery of methoxypyridine **1a**.

^{1}H NMR (400 MHz, $CDCl_3$): δ 7.99 (d, *J* = 2.4 Hz, 1H), 7.90 (d, *J* = 4.4 Hz, 1H), 7.05 (dd, *J* = 8.0, 4.4 Hz, 1H), 6.84 (dd, *J* = 8.0, 2.4 Hz, 1H), 3.58 (brs, 1H), 3.25-3.24 (m, 1H), 2.06-2.03 (m, 2H), 1.80-1.75 (m, 2H), 1.68-1.65 (m, 1H), 1.43-1.33 (m, 2H), 1.28-1.12 (m, 3H).

^{13}C NMR (100 MHz, $CDCl_3$): δ 143.3, 138.2, 136.4, 123.7, 118.7, 51.4, 33.2, 25.8, 24.9.

3.17. Synthesis of 2-(piperidin-1-yl)pyridine (3ba)[4]



Prepared using methoxypyridine **1b** (54.6 mg, 0.500 mmol) and amine **2a** (100 μL, 1.01 mmol) for 5 h. Control experiment using NaH alone resulted in no formation of **3ba** at all.

Purification: Hexane:EtOAc = 100:1

Yield: 70.9 mg (0.437 mmol, 87% yield) as a pale yellow oil.

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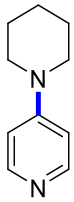
[8] Z. Zhang, J. Mao, D. Zhu, F. Wu, H. Chen and B. Wan, *Tetrahedron*, 2006, **62**, 4435.

^{1}H NMR (300 MHz, $CDCl_3$): δ 8.17 (d, *J* = 4.8 Hz, 1H), 7.43 (dd, *J* = 8.4, 7.2 Hz, 1H), 6.63 (d, *J* = 8.4 Hz, 1H), 6.55 (dd, *J* = 7.2, 4.8 Hz, 1H), 3.52 (4H, m), 1.64 (6H, m).

^{13}C NMR (75 MHz, $CDCl_3$): δ 159.8, 148.0, 137.3, 112.4, 107.1, 46.3, 25.5, 24.7.

3.18. Synthesis of 4-(piperidin-1-yl)pyridine (3ca)[9]



Prepared using methoxypyridine **1c** (56.2 mg, 0.515 mmol) and amine **2a** (100 μL, 1.01 mmol) for 6 h. Control experiment using NaH alone resulted in no formation of **3ca** at all.

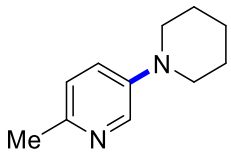
Purification: Hexane:EtOAc = 1:50

Yield: 74.1 mg (0.457 mmol, 89% yield) as an orange oil.

^{1}H NMR (300 MHz, $CDCl_3$): δ 8.22 (2H, d, *J* = 6.3 Hz), 6.64 (2H, d, *J* = 6.3 Hz), 3.33 (4H, m), 1.65 (6H, m).

^{13}C NMR (75 MHz, $CDCl_3$): δ 154.9, 150.1, 108.2, 47.2, 25.1, 24.3.

3.19. Synthesis of 2-methyl-5-(piperidin-1-yl)pyridine (3da)



Prepared using methoxypyridine **1d** (61.4 mg, 0.499 mmol) and amine **2a** (98.8 μL, 1.00 mmol) for 5 h.

Purification: EtOAc

Yield: 51.7 mg (0.293 mmol, 59% yield) as a yellow oil.

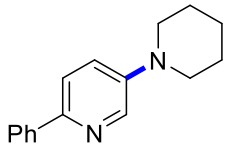
^{1}H NMR (400 MHz, $CDCl_3$): δ 8.19 (d, *J* = 2.8 Hz, 1H), 7.13 (dd, *J* = 8.5, 2.8 Hz, 1H), 7.00 (d, *J* = 8.5 Hz, 1H), 3.12 (t, *J* = 5.6 Hz, 4H), 2.45 (s, 3H), 1.74-1.68 (m, 4H), 1.60-1.55 (m, 2H).

[9] S. Abou-Shehada, M. C. Teasdale, S. D. Bull, C. E. Wade and J. M. J. Williams, *ChemSusChem*, 2015, **8**, 1083.

^{13}C NMR 100 MHz, $CDCl_3$): δ 148.6, 145.8, 138.4, 124.2, 122.9, 50.6, 25.7, 24.1, 23.2.

ESIHRMS: Found m/z 177.1396; Calcd for $C_{11}H_{17}N_2$ $[M+H]^+$ 177.1392.

3.20. Synthesis of 2-phenyl-5-(piperidin-1-yl)pyridine (3ea)



Prepared using methoxypyridine **1e** (92.7 mg, 0.500 mmol) and amine **2a** (98.8 μL, 1.00 mmol) for 7 h.

Purification: CH_2Cl_2

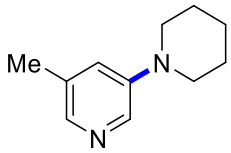
Yield: 106 mg (0.444 mmol, 89% yield) as a pale brown solid.

^{1}H NMR (500 MHz, $CDCl_3$): δ 8.38 (d, *J* = 3.0 Hz, 1H), 7.93 (d, *J* = 7.5 Hz, 2H), 7.60 (d, *J* = 8.5 Hz, 1H), 7.43 (dd, *J* = 7.5, 7.5 Hz, 2H), 7.32 (t, *J* = 7.5 Hz, 1H), 7.25 (dd, *J* = 8.5, 3.0 Hz, 1H), 3.24 (t, *J* = 5.5 Hz, 4H), 1.74-1.71 (m, 4H), 1.64-1.59 (m, 2H).

^{13}C NMR (125 MHz, $CDCl_3$): δ 147.6, 146.5, 139.5, 138.3, 128.6, 127.7, 126.1, 123.2, 120.4, 49.8, 25.5, 24.1.

ESIHRMS: Found m/z 239.1543; Calcd for $C_{16}H_{19}N_2$ $[M+H]^+$ 239.1548.

3.21. Synthesis of 3-methyl-5-(piperidin-1-yl)pyridine (3fa)



Prepared using methoxypyridine **1f** (62.9 mg, 0.511 mmol) and amine **2a** (98.8 μL, 1.00 mmol) for 5 h.

Purification: Hexane:EtOAc = 1:1

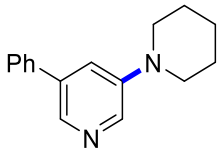
Yield: 60.7 mg (0.344 mmol, 67% yield) as a brown oil.

^{1}H NMR (400 MHz, $CDCl_3$): δ 8.12 (d, *J* = 2.5 Hz, 1H), 7.90 (m, 1H), 6.99 (m, 1H), 3.17 (t, *J* = 5.4 Hz, 4H), 2.27 (s, 3H), 1.73-1.68 (m, 4H), 1.61-1.57 (m, 2H).

^{13}C NMR (100 MHz, $CDCl_3$): δ 147.5, 140.7, 136.3, 132.9, 123.4, 50.0, 25.6, 24.1, 18.5.

ESIHRMS: Found m/z 177.1397; Calcd for $C_{11}H_{17}N_2$ $[M+H]^+$ 177.1392.

3.22. Synthesis of 3-phenyl-5-(piperidin-1-yl)pyridine (3ga)



Prepared using methoxypyridine **1g** (93.2 mg, 0.503 mmol) and amine **2a** (98.8 μL, 1.00 mmol) for 23 h.

Purification: CH_2Cl_2:EtOAc = 20:1

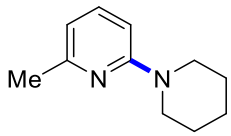
Yield: 88.2 mg (0.370 mmol, 74% yield) as an orange solid.

^{1}H NMR (400 MHz, $CDCl_3$): δ 8.29-8.28 (m, 2H), 7.56 (d, *J* = 7.2 Hz, 2H), 7.45 (dd, *J* = 7.2, 7.2 Hz, 2H), 7.36 (t, *J* = 7.2 Hz, 1H), 7.34 (m, 1H), 3.26 (t, *J* = 5.4 Hz, 4H), 1.76-1.71 (m, 4H), 1.65-1.60 (m, 2H).

^{13}C NMR (100 MHz, $CDCl_3$): δ 147.7, 138.64, 138.62, 137.7, 136.7, 128.9, 127.9, 127.3, 121.2, 49.9, 25.6, 24.1.

ESIHRMS: Found m/z 239.1546; Calcd for $C_{16}H_{19}N_2$ $[M+H]^+$ 239.1548.

3.23. Synthesis of 2-methyl-6-(piperidin-1-yl)pyridine (3ha)[10]



Prepared using methoxypyridine **1h** (61.4 mg, 0.499 mmol) and amine **2a** (98.8 μL, 1.00 mmol) for 5 h.

Purification: Hexane:EtOAc = 20:1

Yield: 68.5 mg (0.389 mmol, 78% yield) as a colorless oil.

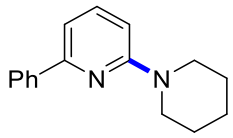
^{1}H NMR (400 MHz, $CDCl_3$): δ 7.33 (dd, *J* = 8.4, 7.3 Hz, 1H), 6.44-6.42 (m, 2H), 3.50-3.49 (m, 4H), 2.38 (s, 3H), 1.65-1.63 (m, 6H).

^{13}C NMR (100 MHz, $CDCl_3$): δ 159.6, 156.7, 137.6, 111.8, 103.7, 46.4, 25.6, 24.8, 24.7.

ESIHRMS: Found m/z 177.1392; Calcd for $C_{11}H_{17}N_2$ $[M+H]^+$ 177.1392.

[10] Y. Lin, M. Li, X. Ji, J. Wu and S. Cao, *Tetrahedron,* 2017, **73**, 1466.

3.24. Synthesis of 2-phenyl-6-(piperidin-1-yl)pyridine (3ia)



Prepared using methoxypyridine **1i** (91.4 mg, 0.493 mmol) and amine **2a** (98.8 μL, 1.00 mmol) for 3 h.

Purification: Hexane:EtOAc = 20:1

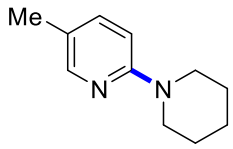
Yield: 97.6 mg (0.410 mmol, 83% yield) as a colorless oil.

^{1}H NMR (400 MHz, $CDCl_3$): δ 8.01 (d, *J* = 7.2 Hz, 2H), 7.49 (dd, *J* = 8.4, 7.6 Hz, 1H), 7.40 (dd, *J* = 7.2, 7.2 Hz, 2H), 7.34 (t, *J* = 7.2 Hz, 1H), 7.04 (d, *J* = 7.6 Hz, 1H), 6.58 (d, *J* = 8.4 Hz, 1H), 3.62-3.61 (m, 4H), 1.66 (m, 6H).

^{13}C NMR (100 MHz, $CDCl_3$): δ 159.4, 155.1, 140.2, 138.0, 128.4 (overlapped), 126.8, 108.9, 105.5, 46.3, 25.6, 24.9.

ESIHRMS: Found m/z 239.1542; Calcd for $C_{16}H_{19}N_2$ $[M+H]^+$ 239.1548.

3.25. Synthesis of 5-methyl-2-(piperidin-1-yl)pyridine (3ja)



Prepared using methoxypyridine **1j** (61.7 mg, 0.501 mmol) and amine **2a** (98.8 μL, 1.00 mmol) for 5 h.

Purification: Hexane:EtOAc = 20:1

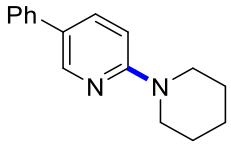
Yield: 75.9 mg (0.431 mmol, 86% yield) as a pale yellow oil.

^{1}H NMR (400 MHz, $CDCl_3$): δ 8.02 (d, *J* = 2.4 Hz, 1H), 7.30 (dd, *J* = 8.4, 2.4 Hz, 1H), 6.61 (d, *J* = 8.4 Hz, 1H), 3.48-3.46 (m, 4H), 2.20 (s, 3H), 1.67-1.65 (m, 6H).

^{13}C NMR (100 MHz, $CDCl_3$): δ 158.5, 147.6, 138.3, 121.4, 107.1, 46.8, 25.5, 24.7, 17.3.

ESIHRMS: Found m/z 177.1399; Calcd for $C_{11}H_{17}N_2$ $[M+H]^+$ 177.1392.

3.26. Synthesis of 5-phenyl-2-(piperidin-1-yl)pyridine (3ka)



Prepared using methoxypyridine **1k** (95.6 mg, 0.516 mmol) and amine **2a** (98.8 μL, 1.00 mmol) for 9 h.

Purification: Hexane:EtOAc = 20:1

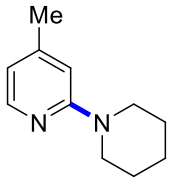
Yield: 83.2 mg (0.349 mmol, 68% yield) as a white solid.

^{1}H NMR (400 MHz, $CDCl_3$): δ 8.44 (d, *J* = 2.5 Hz, 1H), 7.69 (dd, *J* = 8.9, 2.5 Hz, 1H), 7.52 (d, *J* = 7.2 Hz, 2H), 7.41 (dd, *J* = 7.2 ,7.2 Hz, 2H), 7.30 (t, *J* = 7.2 Hz, 1H), 6.71 (d, *J* = 8.9 Hz, 1H), 3.58 (m, 4H), 1.67 (m, 6H).

^{13}C NMR (100 MHz, $CDCl_3$): δ 158.9, 146.2, 138.6, 136.0, 128.9, 126.6, 126.1, 125.3, 106.8, 46.4, 25.6, 24.8.

ESIHRMS: Found m/z 239.1543; Calcd for $C_{16}H_{19}N_2$ $[M+H]^+$ 239.1548.

3.27. Synthesis of 4-methyl-2-(piperidin-1-yl)pyridine (3la)



Prepared using methoxypyridine **1l** (61.0 mg, 0.495 mmol) and amine **2a** (98.8 μL, 1.00 mmol) for 5 h.

Purification: Hexane:EtOAc = 20:1

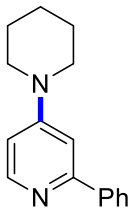
Yield: 61.2 mg (0.347 mmol, 70% yield) as a pale yellow oil.

^{1}H NMR (400 MHz, $CDCl_3$): δ 8.04 (d, *J* = 5.0 Hz, 1H), 6.46 (m, 1H), 6.41 (dd, *J* = 5.0, 0.5 Hz, 1H), 3.51 (m, 4H), 2.24 (s, 3H), 1.63 (m, 6H).

^{13}C NMR (100 MHz, $CDCl_3$): δ 160.1, 148.1, 147.6, 114.1, 107.5, 46.4, 25.6, 24.8, 21.4.

ESIHRMS: Found m/z 177.1398; Calcd for $C_{11}H_{17}N_2$ $[M+H]^+$ 177.1392.

3.28. Synthesis of 2-phenyl-4-(piperidin-1-yl)pyridine (3ma)



Prepared using methoxypyridine **1m** (90.4 mg, 0.488 mmol) and amine **2a** (98.8 μL, 1.00 mmol) for 5 h.

Purification: Hexane:EtOAc = 5:1

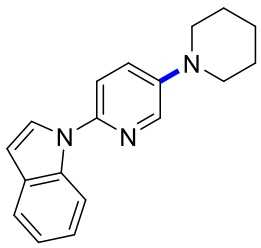
Yield: 100 mg (0.421 mmol, 86% yield) as a pale yellow oil.

^{1}H NMR (400 MHz, $CDCl_3$): δ 8.33 (d, *J* = 6.0 Hz, 1H), 7.91 (d, *J* = 7.2 Hz, 2H), 7.44 (dd, *J* = 7.2, 7.2 Hz, 2H), 7.38 (t, *J* = 7.2 Hz, 1H), 7.07 (d, *J* = 2.5 Hz, 1H), 6.62 (dd, *J* = 6.0, 2.5 Hz, 1H), 3.38 (m, 4H), 1.66 (m, 6H).

^{13}C NMR (100 MHz, $CDCl_3$): δ 158.4, 155.8, 150.1, 140.7, 128.51, 128.48, 127.0, 107.2, 105.5, 47.5, 25.2, 24.4.

ESIHRMS: Found m/z 239.1543; Calcd for $C_{16}H_{19}N_2$ $[M+H]^+$ 239.1548.

3.29. Synthesis of 1-(5-(piperidin-1-yl)pyridin-2-yl)-1*H*-indole (3na)



Prepared using methoxypyridine **1n** (116 mg, 0.516 mmol) and amine **2a** (98.8 μL, 1.00 mmol) for 7 h.

Purification: Hexane:Et_2O = 4:1

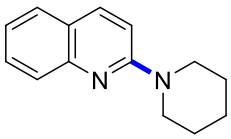
Yield: 88.5 mg (0.319 mmol, 62% yield) as a brown solid.

^{1}H NMR (400 MHz, $CDCl_3$): δ 8.22 (d, *J* = 3.2 Hz, 1H), 7.98 (d, *J* = 8.4 Hz, 1H), 7.65 (d, *J* = 7.8 Hz, 1H), 7.61 (d, *J* = 3.4 Hz, 1H), 7.35 (d, *J* = 2.0 Hz, 2H), 7.27-7.23 (m, 1H), 7.18-7.14 (m, 1H), 6.66 (d, *J* = 3.4 Hz, 1H), 3.20 (t, *J* = 5.5 Hz, 4H), 1.77-1.72 (m, 4H), 1.64-1.59 (m, 2H).

^{13}C NMR (100 MHz, $CDCl_3$): δ 145.7, 144.4, 137.2, 135.2, 129.9, 126.4, 125.9, 122.6, 121.0, 120.6, 115.6, 112.1, 104.2, 50.4, 25.6, 24.0.

ESIHRMS: Found m/z 278.1653; Calcd for $C_{18}H_{20}N_3$ $[M+H]^+$ 278.1657.

3.30. Synthesis of 2-(piperidin-1-yl)quinoline (3oa)[11]



Prepared using 2-methoxyquinoline **1o** (82.0 mg, 0.515 mmol) and amine **2a** (98.8 μL, 1.00 mmol) for 4 h.

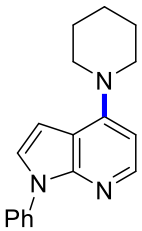
Purification: Hexane:EtOAc = 20:1

Yield: 94.3 mg (0.444 mmol, 86% yield) as a yellow oil.

^{1}H NMR (400 MHz, $CDCl_3$): δ 7.83 (d, *J* = 8.8 Hz, 1H), 7.68 (d, *J* = 8.4 Hz, 1H), 7.56 (dd, *J* = 7.6, 1.2 Hz, 1H), 7.50 (ddd, *J* = 8.4, 7.2, 1.5 Hz, 1H), 7.20-7.16 (m, 1H), 6.97 (d, *J* = 9.2 Hz, 1H), 3.72-3.71 (m, 4H), 1.67 (m, 6H).

^{13}C NMR (100 MHz, $CDCl_3$): δ 157.7, 148.1, 137.2, 129.4, 127.1, 126.5, 122.8, 122.0, 109.9, 46.3, 25.8, 24.9.

3.31. Synthesis of 1-phenyl-4-(piperidin-1-yl)-1*H*-pyrrolo[2,3-*b*]pyridine (3pa)



Prepared using methoxypyridine **1p** (109 mg, 0.488 mmol) and amine **2a** (98.8 μL, 1.00 mmol) for 23 h.

Purification: Hexane:EtOAc = 5:1

Yield: 84.0 mg (0.303 mmol, 62% yield) as a yellow solid.

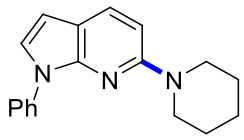
^{1}H NMR (400 MHz, $CDCl_3$): δ 8.14 (d, *J* = 5.5 Hz, 1H), 7.71 (d, *J* = 7.6 Hz, 2H), 7.49 (dd, *J* = 7.6, 7.6 Hz, 2H), 7.32-7.28 (d, *J* = 6.0 Hz, 1H + t, *J* = 7.6 Hz, 1H), 6.62 (d, *J* = 3.7 Hz, 1H), 6.47 (d, *J* = 5.5 Hz, 1H), 3.46 (t, *J* = 5.3 Hz, 4H), 1.80-1.75 (m, 4H), 1.72-1.69 (m, 2H).

^{13}C NMR (100 MHz, $CDCl_3$): δ 152.4, 149.1, 145.0, 138.9, 129.3, 126.2, 124.39, 124.35, 112.0, 103.0, 101.2, 50.8, 25.9, 24.7.

ESIHRMS: Found m/z 278.1663; Calcd for $C_{18}H_{20}N_3$ $[M+H]^+$ 278.1657.

[11] R. Saari, J. C. Torma and T. Nevalainen, *Bioorg. Med. Chem.,* 2011, **19**, 939.

3.32. Synthesis of 1-phenyl-6-(piperidin-1-yl)-1*H*-pyrrolo[2,3-*b*]pyridine (3qa)



Prepared using methoxypyridine **1q** (111 mg, 0.496 mmol) and amine **2a** (98.8 μL, 1.00 mmol) for 21 h.

Purification: Hexane:EtOAc = 100:1

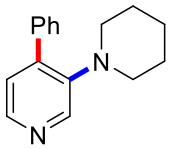
Yield: 128 mg (0.461 mmol, 93% yield) as a yellow oil.

^{1}H NMR (400 MHz, $CDCl_3$): δ 7.86 (d, *J* = 7.6 Hz, 2H), 7.72 (d, *J* = 8.7 Hz, 1H), 7.46 (dd, *J* = 7.6, 7.6 Hz, 2H), 7.26-7.22 (m, 1H + t, *J* = 7.6 Hz, 1H), 6.62 (d, *J* = 8.7 Hz, 1H), 6.44 (d, *J* = 3.6 Hz, 1H), 3.55 (t, *J* = 5.6 Hz, 4H), 1.66-1.64 (m, 6H).

^{13}C NMR (100 MHz, $CDCl_3$): δ 156.8, 146.6, 139.4, 130.7, 128.9, 125.1, 123.3, 123.0, 113.0, 102.8, 102.0, 47.4, 25.7, 24.9.

ESIHRMS: Found m/z 278.1651; Calcd for $C_{18}H_{20}N_3$ $[M+H]^+$ 278.1657.

3.33. Synthesis of 4-phenyl-3-(piperidin-1-yl)pyridine (5)



Prepared using methoxypyridine **4** (92.6 mg, 0.500 mmol) and amine **2a** (98.8 μL, 1.00 mmol) for 5 h.

Purification: Hexane:Et_2O = 1:1

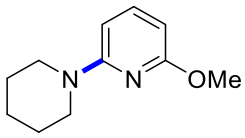
Yield: 82.8 mg (0.347 mmol, 69% yield) as a pale yellow oil.

^{1}H NMR (400 MHz, $CDCl_3$): δ 8.33 (m, 1H), 8.29 (d, *J* = 4.6 Hz, 1H), 7.70 (d, *J* = 7.2 Hz, 2H), 7.45 (dd, *J* = 7.2, 7.2 Hz, 2H), 7.37 (t, *J* = 7.2 Hz, 1H), 7.13 (d, *J* = 4.6 Hz, 1H), 2.86-2.85 (m, 4H), 1.49 (m, 6H).

^{13}C NMR (100 MHz, $CDCl_3$): δ 146.7, 143.8, 141.4, 141.0, 138.9, 128.4, 128.1, 127.9, 125.1, 52.2, 25.9, 24.0.

ESIHRMS: Found m/z 239.1552; Calcd for $C_{16}H_{19}N_2$ $[M+H]^+$ 239.1548.

3.34. Synthesis of 2-methoxy-6-(piperidin-1-yl)pyridine (3ra)



Prepared using methoxypyridine **1r** (141 mg, 1.01 mmol) and amine **2a** (42.8 mg, 0.503 mmol) for 20 h.

Purification: Hexane:EtOAc = 20:1

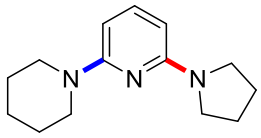
Yield: 73.5 mg (0.382 mmol, 76% yield) as a pale orange oil.

^{1}H NMR (400 MHz, $CDCl_3$): δ 7.36 (dd, *J* = 8.4, 7.6 Hz, 1H), 6.15 (d, *J* = 8.4 Hz, 1H), 6.01 (d, *J* = 7.6 Hz, 1H), 3.86 (s, 3H), 3.50 (m, 4H), 1.63 (m, 6H).

^{13}C NMR (100 MHz, $CDCl_3$): δ 163.1, 158.6, 140.0, 98.1, 97.0, 52.9, 46.3, 25.5, 24.8.

ESIHRMS: Found m/z 193.1341; Calcd for $C_{11}H_{17}N_2O$ $[M+H]^+$ 193.1341.

3.35. Synthesis of 2-(piperidin-1-yl)-6-(pyrrolidin-1-yl)pyridine (6)



Prepared using methoxypyridine **3ra** (98.6 mg, 0.513 mmol) and amine **2b** (83.3 μL, 1.00 mmol) for 5 h.

Purification: Hexane:EtOAc = 100:1

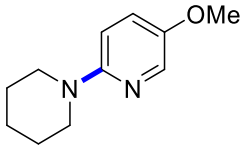
Yield: 93.3 mg (0.403 mmol, 79% yield) as a colorless oil.

^{1}H NMR (400 MHz, $CDCl_3$): 7.26 (dd, *J* = 8.0, 8.0 Hz, 1H), 5.89 (d, *J* = 8.0 Hz, 1H), 5.68 (d, *J* = 8.0 Hz, 1H), 3.48-3.47 (m, 4H), 3.42 (t, *J* = 6.6 Hz, 4H), 1.96-1.92 (m, 4H), 1.61 (m, 6H).

^{13}C NMR (100 MHz, $CDCl_3$): δ 159.0, 156.6, 138.4, 94.7, 93.5, 46.4, 46.3, 25.6, 25.5, 25.0.

ESIHRMS: Found m/z 232.1812; Calcd for $C_{14}H_{22}N_3$ $[M+H]^+$ 232.1814.

3.36. Synthesis of 5-methoxy-2-(piperidin-1-yl)pyridine (3sa)



Prepared using methoxypyridine **1s** (140 mg, 1.01 mmol) and amine **2a** (42.0 mg, 0.493 mmol) for 20 h.

Purification: Hexane:EtOAc = 20:1

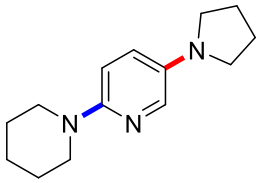
Yield: 74.3 mg (0.386 mmol, 81% yield) as a pale yellow oil.

^{1}H NMR (400 MHz, $CDCl_3$): δ 7.93 (d, *J* = 3.0 Hz, 1H), 7.12 (dd, *J* = 9.1, 3.0 Hz, 1H), 6.64 (d, *J* = 9.1 Hz, 1H), 3.78 (s, 3H), 3.40 (t, *J* = 5.6 Hz, 4H), 1.67-1.60 (m, 6H).

^{13}C NMR (100 MHz, $CDCl_3$): δ 155.7, 148.6, 133.5, 124.9, 108.4, 56.3, 47.6, 25.6, 24.6.

ESIHRMS: Found m/z 193.1349; Calcd for $C_{11}H_{17}N_2O$ $[M+H]^+$ 193.1341.

3.37. Synthesis of 2-(piperidin-1-yl)-5-(pyrrolidin-1-yl)pyridine (7)



Prepared using methoxypyridine **3sa** (96.1 mg, 0.500 mmol) and amine **2b** (83.3 μL, 1.00 mmol) for 49 h.

Purification: Hexane:Et_2O = 1:10

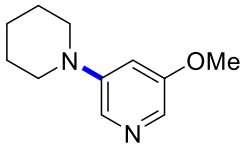
Yield: 37.6 mg (0.163 mmol, 33% yield, 76% yield brsm.) as a green solid along with recovery of starting methoxypyridine **3sa** (54.9 mg, 0.286 mmol).

^{1}H NMR (400 MHz, $CDCl_3$): δ 7.69 (d, *J* = 2.8 Hz, 1H), 6.89 (dd, *J* = 9.0, 2.8 Hz, 1H), 6.67 (d, *J* = 9.0 Hz, 1H), 3.32 (t, *J* = 5.3 Hz, 4H), 3.22 (t, *J* = 6.2 Hz, 4H), 2.00-1.97 (m, 4H), 1.71-1.65 (m, 4H), 1.61-1.58 (m, 2H).

^{13}C NMR (100 MHz, $CDCl_3$): δ 153.3, 138.2, 131.6, 122.3, 109.4, 48.5, 48.1, 25.7, 25.2, 24.6.

ESIHRMS: Found m/z 232.1814; Calcd for $C_{14}H_{22}N_3$ $[M+H]^+$ 232.1814.

3.38. Synthesis of 3-methoxy-5-(piperidin-1-yl)pyridine (3ta)



Prepared using methoxypyridine **1t** (144 mg, 1.03 mmol) and amine **2a** (43.0 mg, 0.505 mmol) for 24 h.

Purification: Hexane:Et_2O = 2:1

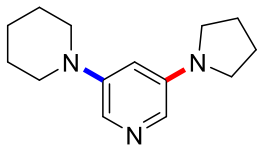
Yield: 67.5 mg (0.351 mmol, 70% yield) as a yellow oil.

^{1}H NMR (400 MHz, $CDCl_3$): δ 7.96 (d, *J* = 1.8 Hz, 1H), 7.77 (d, *J* = 1.8 Hz, 1H), 6.70 (dd, *J* = 1.8, 1.8 Hz, 1H), 3.84 (s, 3H), 3.19 (t, *J* = 5.5 Hz, 4H), 1.73-1.68 (m, 4H), 1.63-1.59 (m, 2H).

^{13}C NMR (100 MHz, $CDCl_3$): δ 156.2, 148.6, 131.9, 126.7, 108.3, 55.5, 49.9, 25.5, 24.1.

ESIHRMS: Found m/z 193.1343; Calcd for $C_{11}H_{17}N_2O$ $[M+H]^+$ 193.1341.

3.39. Synthesis of 3-(piperidin-1-yl)-5-(pyrrolidin-1-yl)pyridine (8)



Prepared using methoxypyridine **3ta** (96.2 mg, 0.500 mmol) and amine **2b** (83.3 μL, 1.00 mmol) for 5 h.

Purification: Hexane:Et_2O = 2:1

Yield: 97.6 mg (0.422 mmol, 84% yield) as a brown solid.

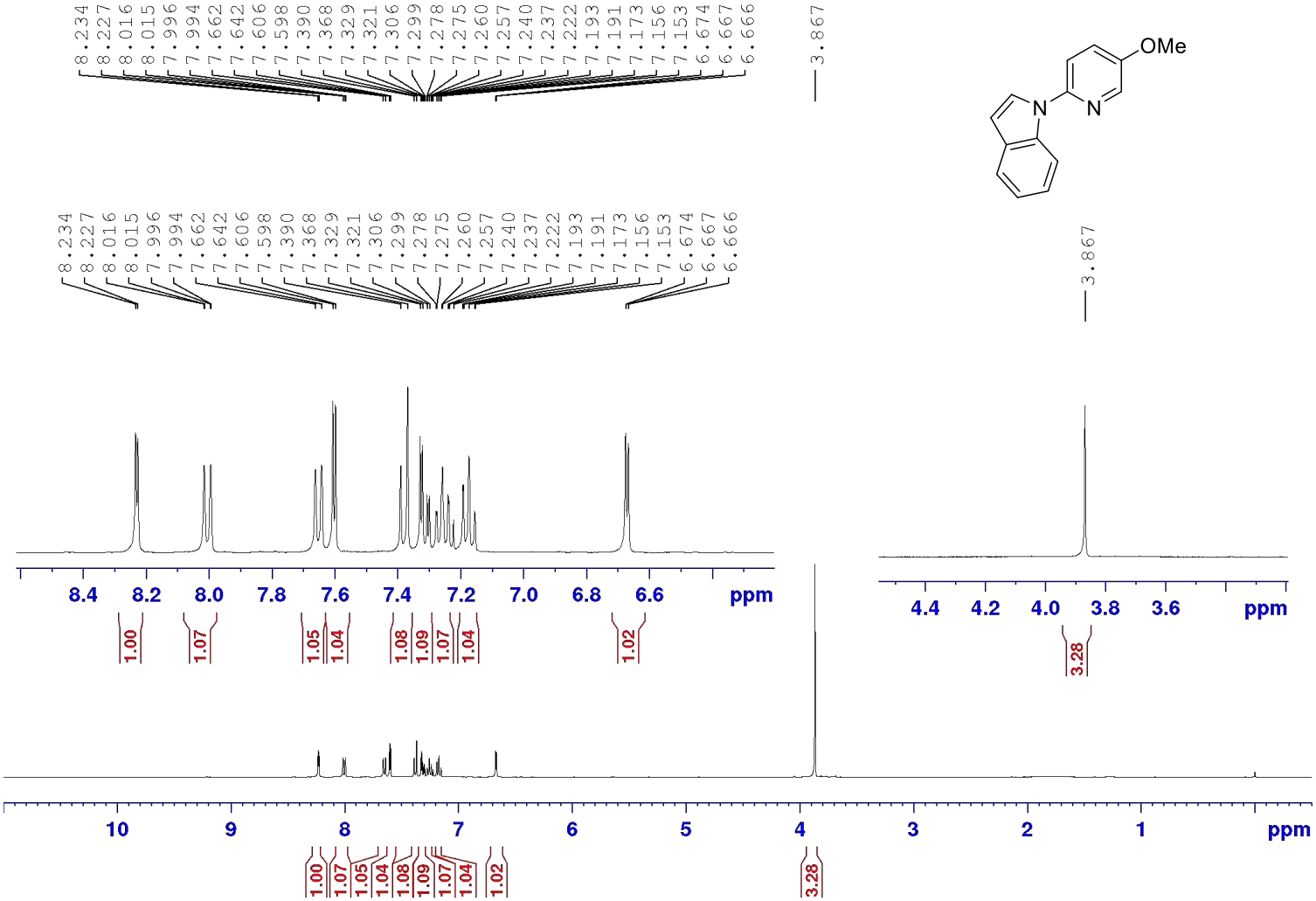
^{1}H NMR (400 MHz, $CDCl_3$): δ 7.69 (d, *J* = 2.3 Hz, 1H), 7.52 (d, *J* = 2.3 Hz, 1H), 6.32 (dd, *J* = 2.3, 2.3 Hz, 1H), 3.28 (t, *J* = 6.6 Hz, 4H), 3.17 (t, *J* = 5.4 Hz, 4H), 2.02-1.98 (m, 4H), 1.74-1.68 (m, 4H), 1.61-1.57 (m, 2H).

^{13}C NMR (100 MHz, $CDCl_3$): δ 148.4, 144.2, 127.4, 126.1, 105.5, 50.4, 47.4, 25.7, 25.4, 24.3.

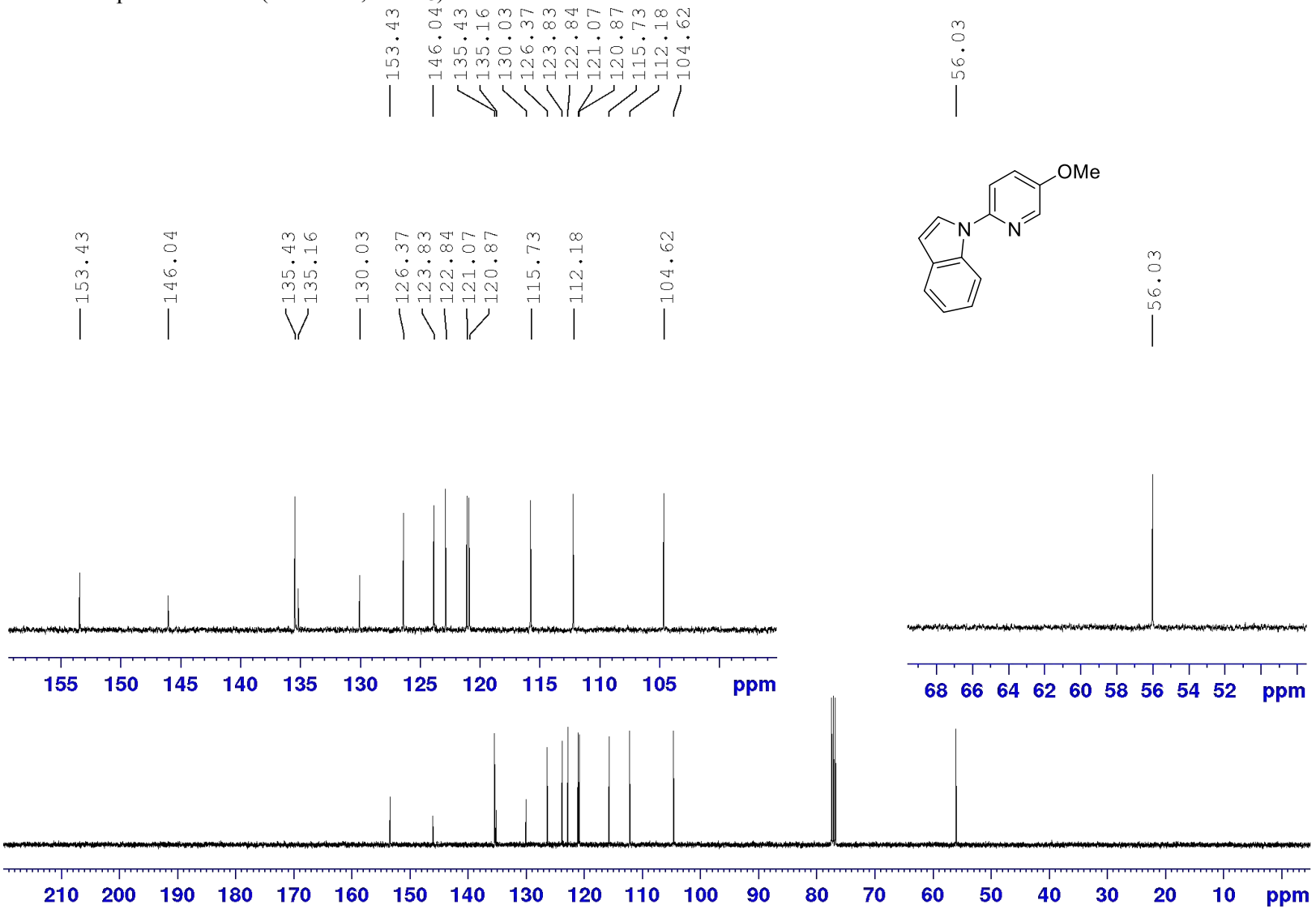
ESIHRMS: Found m/z 232.1808; Calcd for $C_{14}H_{22}N_3$ $[M+H]^+$ 232.1814.

4. ^{1}H and ^{13}C NMR spectra for new compounds

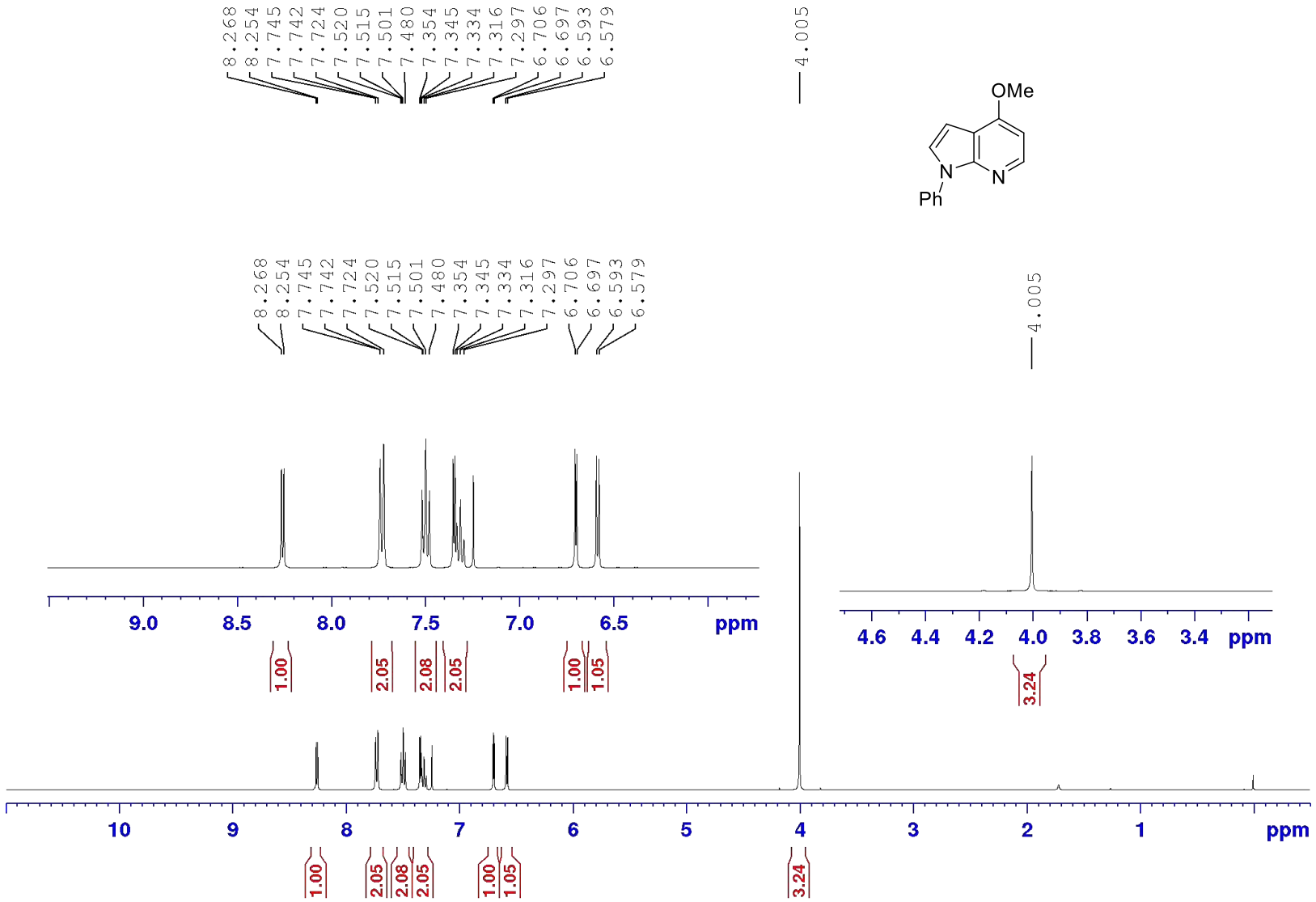
^{1}H NMR Spectrum of **1n** (400 MHz, $CDCl_3$)



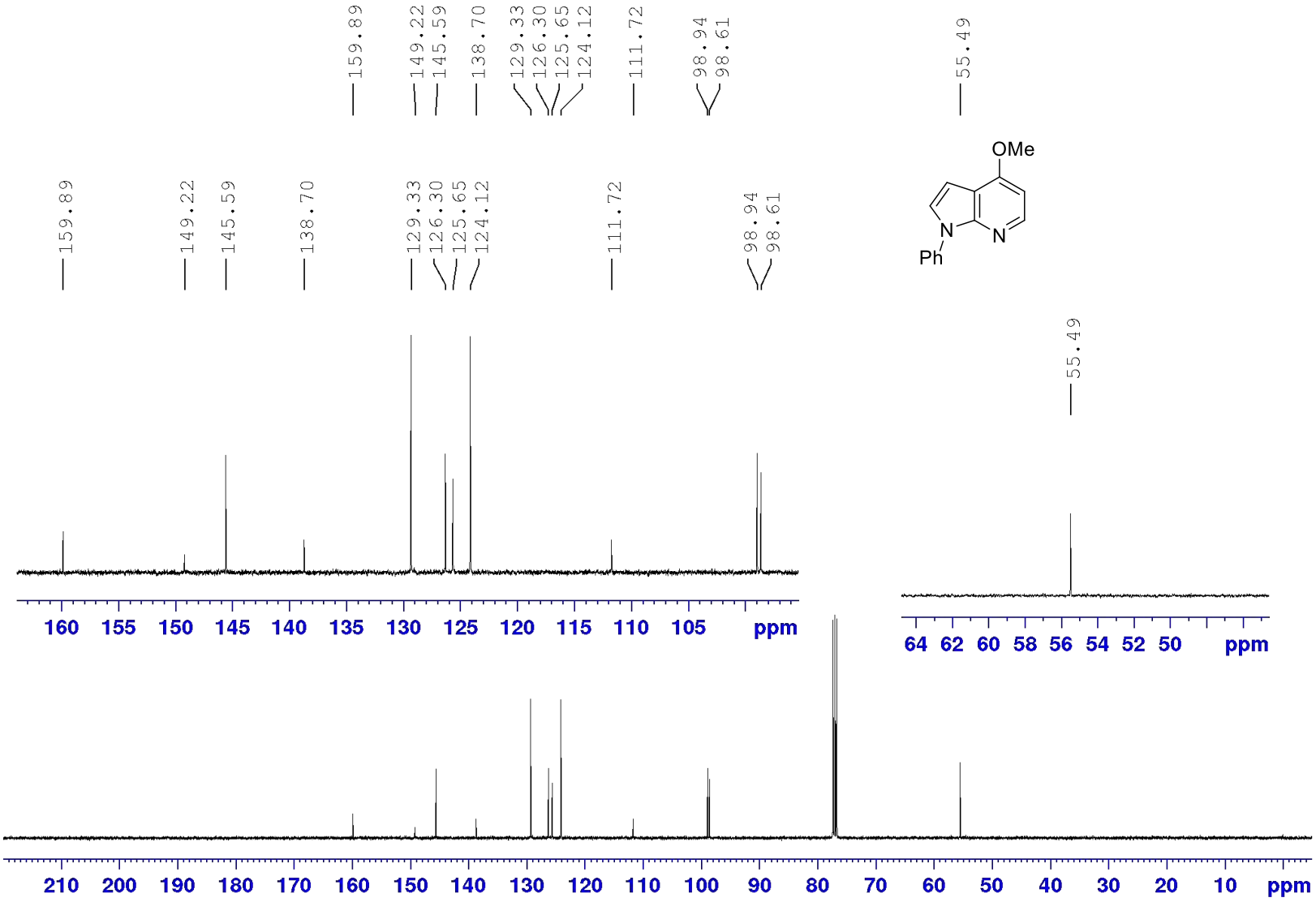
^{13}C NMR Spectrum of **1n** (100 MHz, $CDCl_3$)



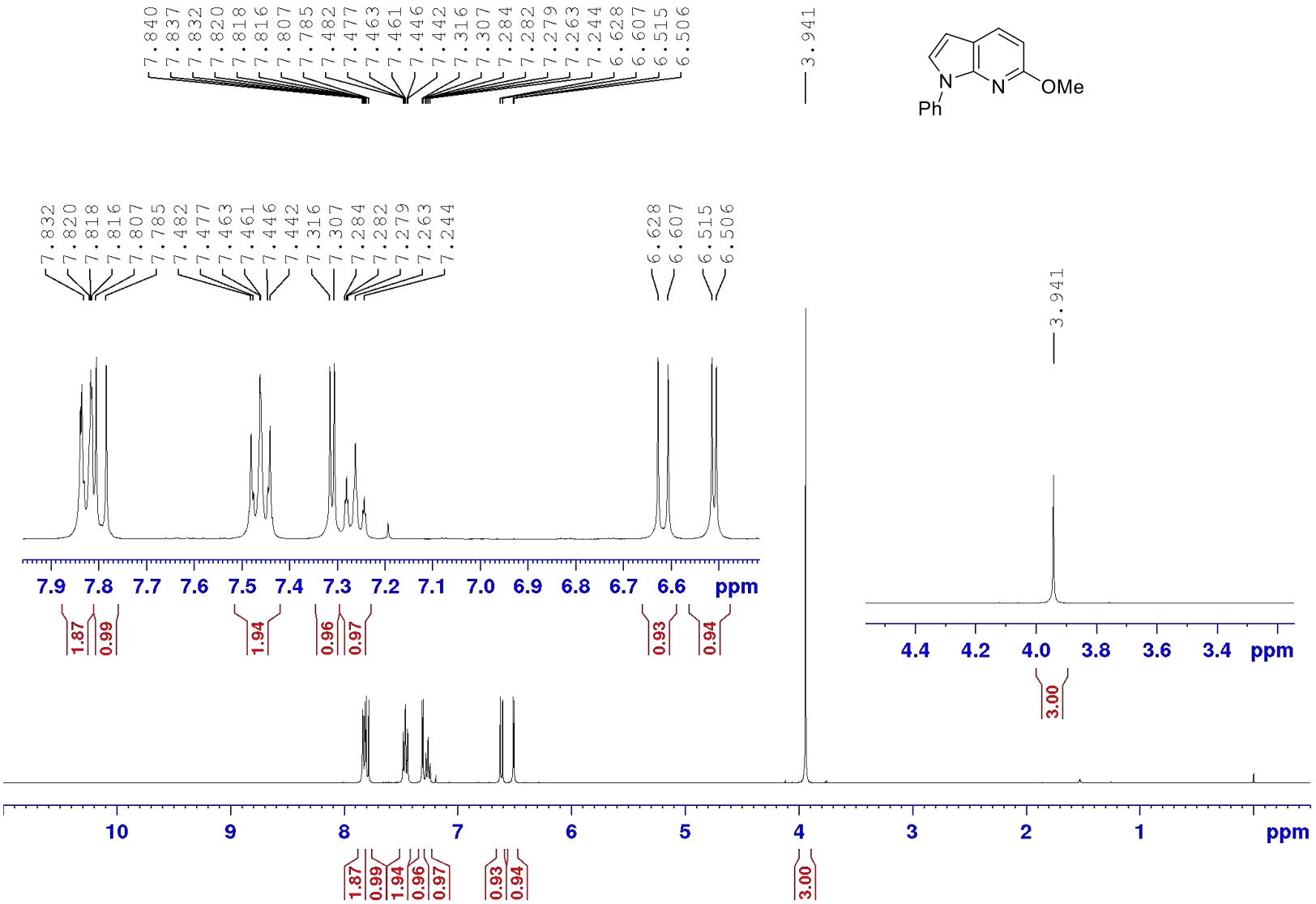
^{1}H NMR Spectrum of **1p** (400 MHz, $CDCl_3$)



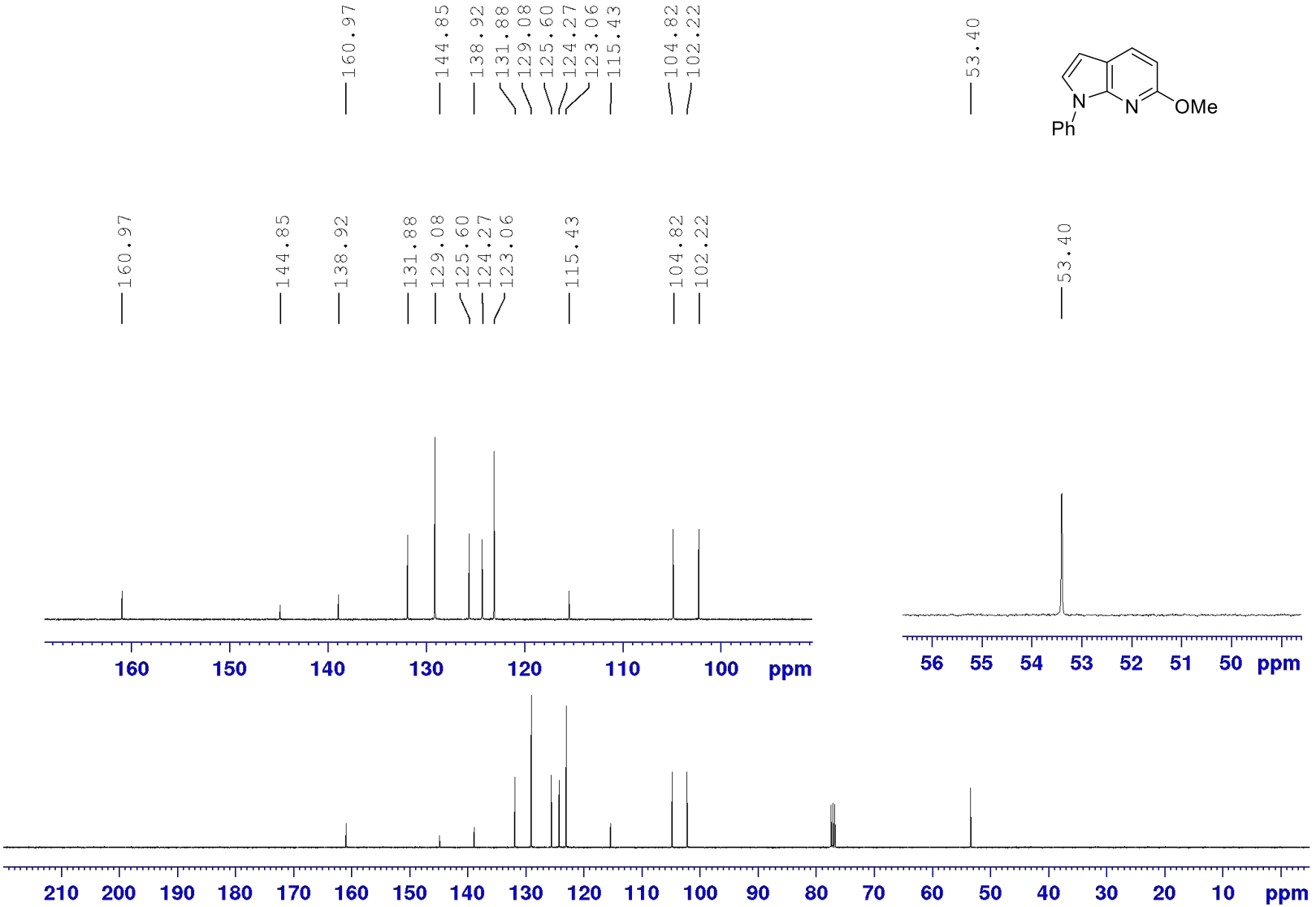
^{13}C NMR Spectrum of **1p** (100 MHz, $CDCl_3$)



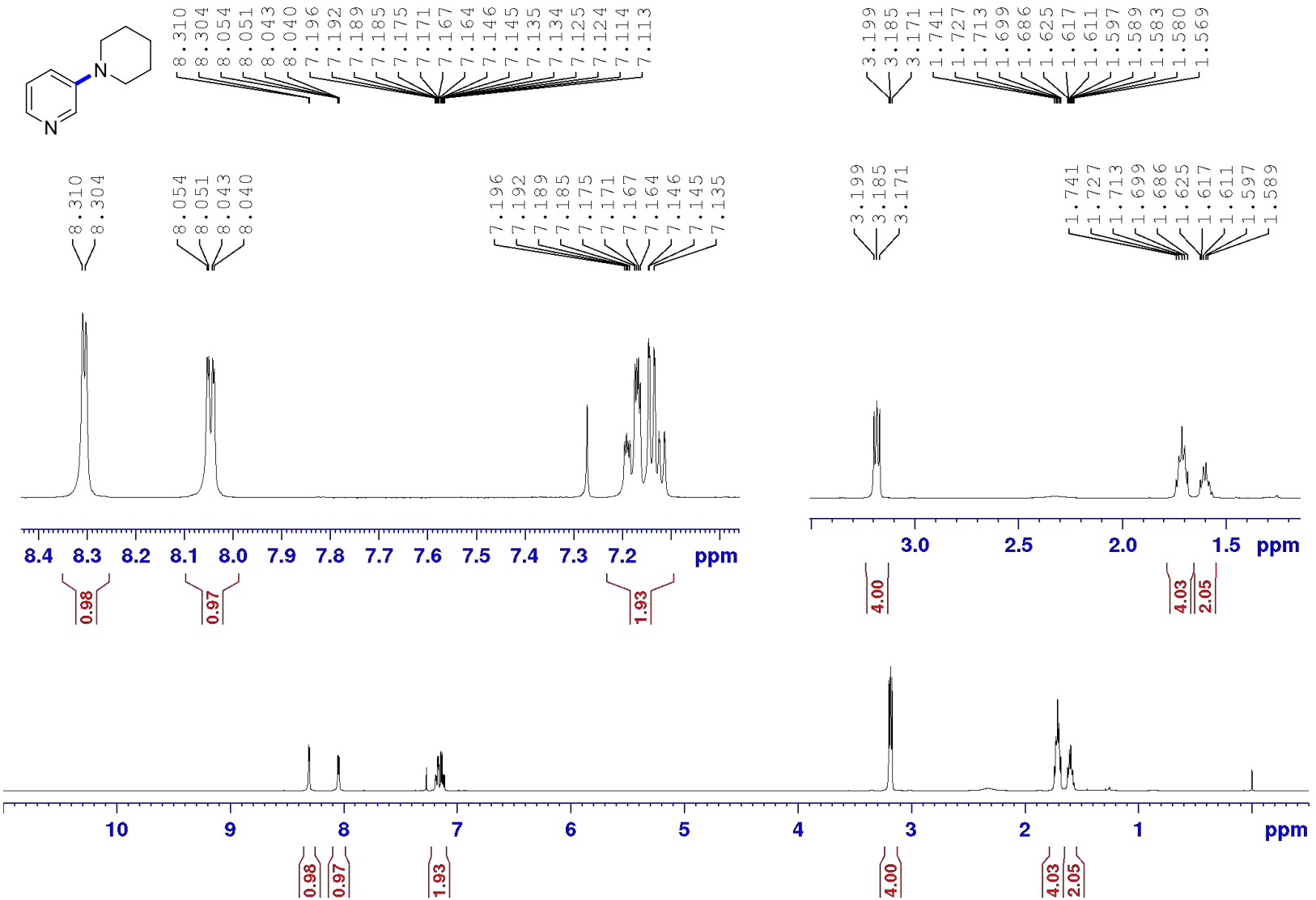
^{1}H NMR Spectrum of **1q** (400 MHz, $CDCl_3$)



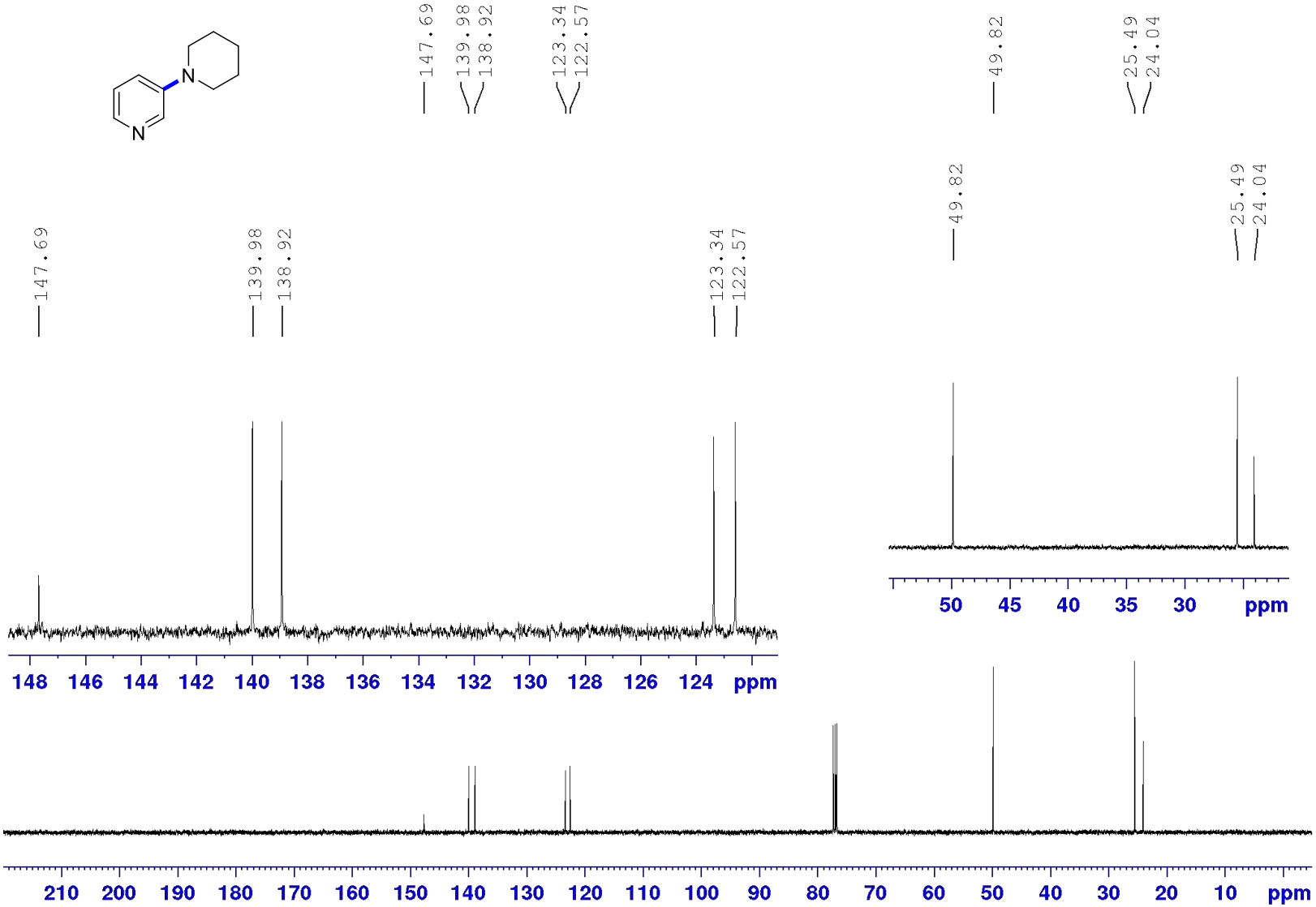
^{13}C NMR Spectrum of **1q** (100 MHz, $CDCl_3$)



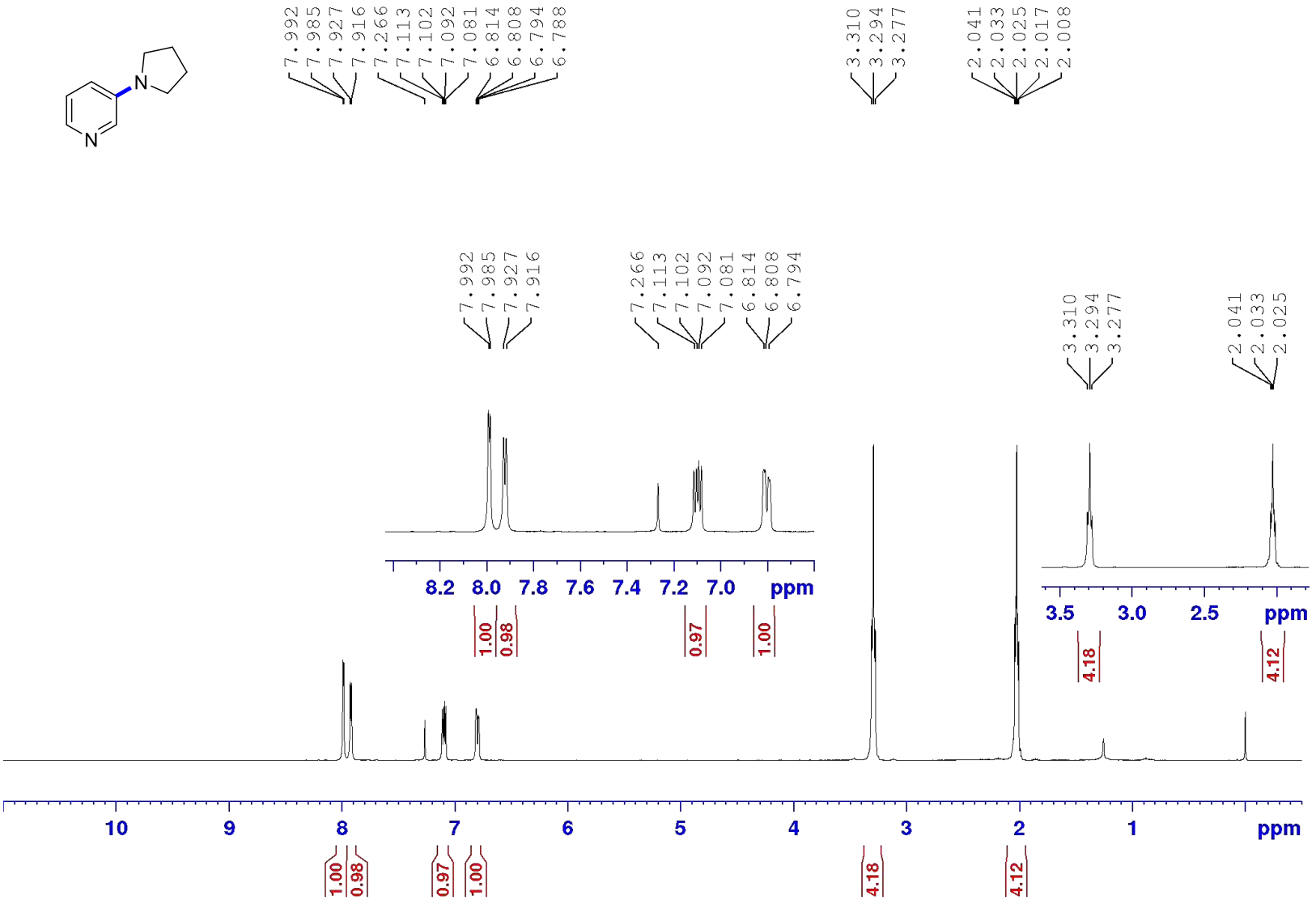
^{1}H NMR Spectrum of **3aa** (400 MHz, $CDCl_3$)



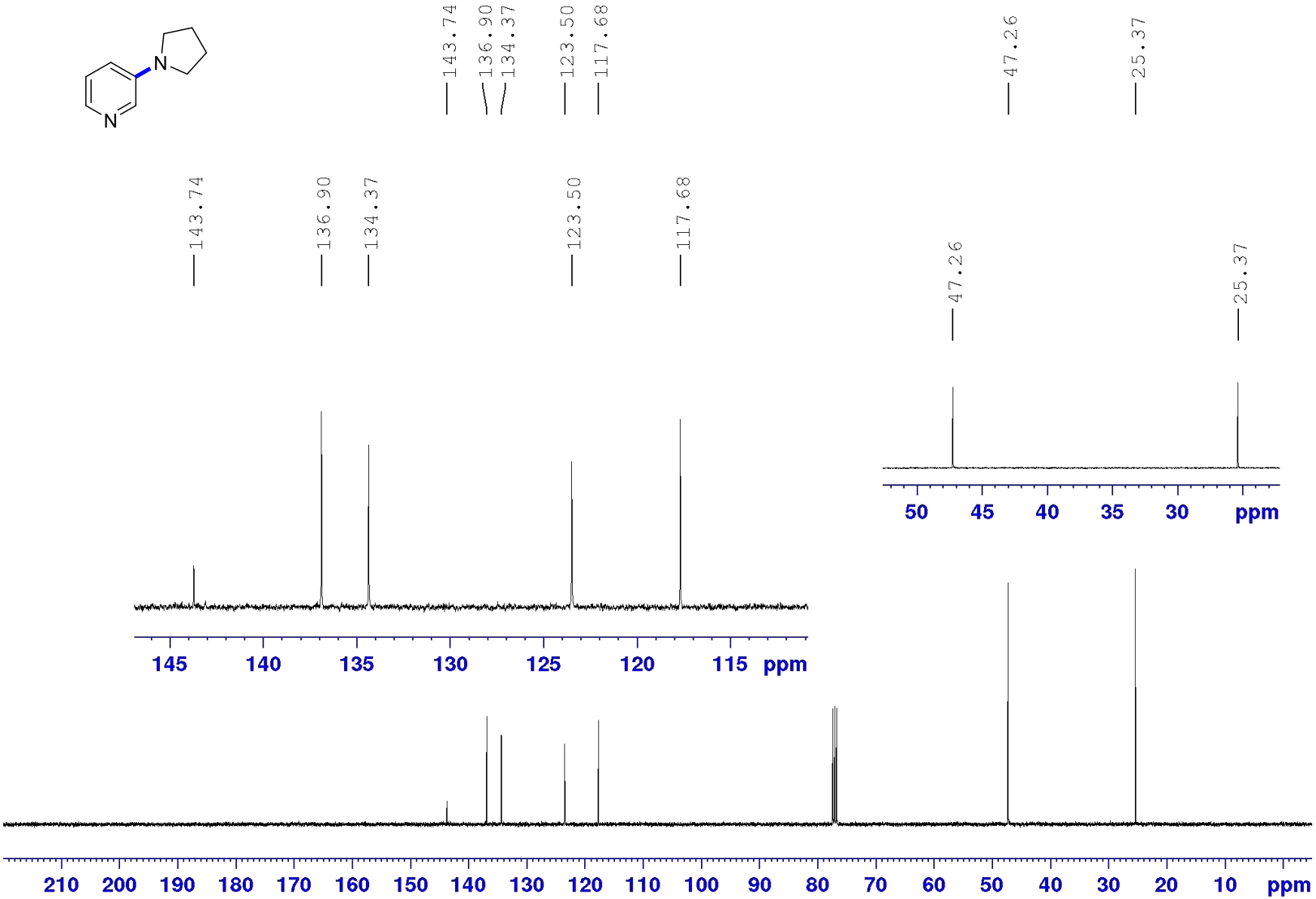
^{13}C NMR Spectrum of **3aa** (100 MHz, $CDCl_3$)



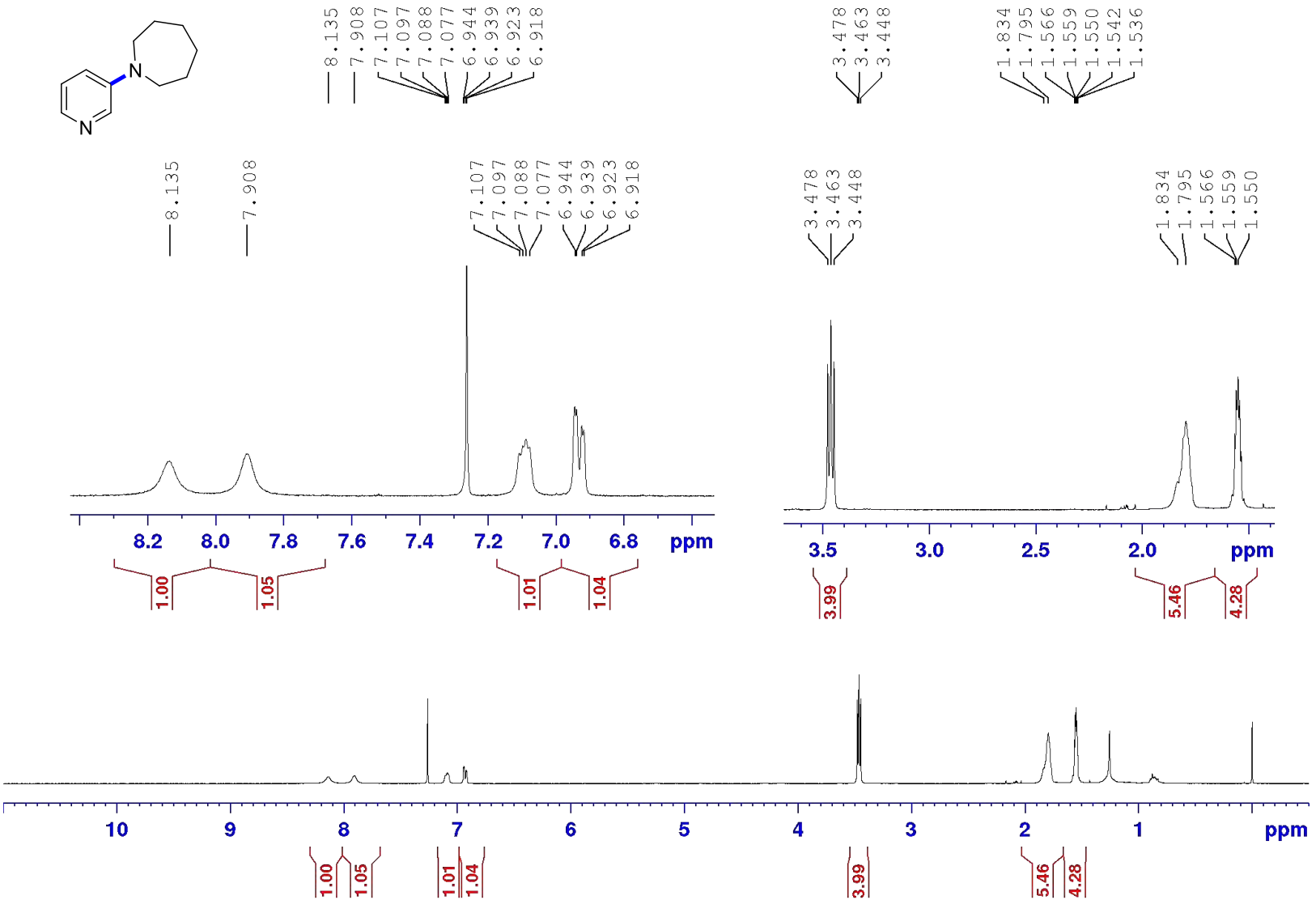
^{1}H NMR Spectrum of **3ab** (400 MHz, $CDCl_3$)



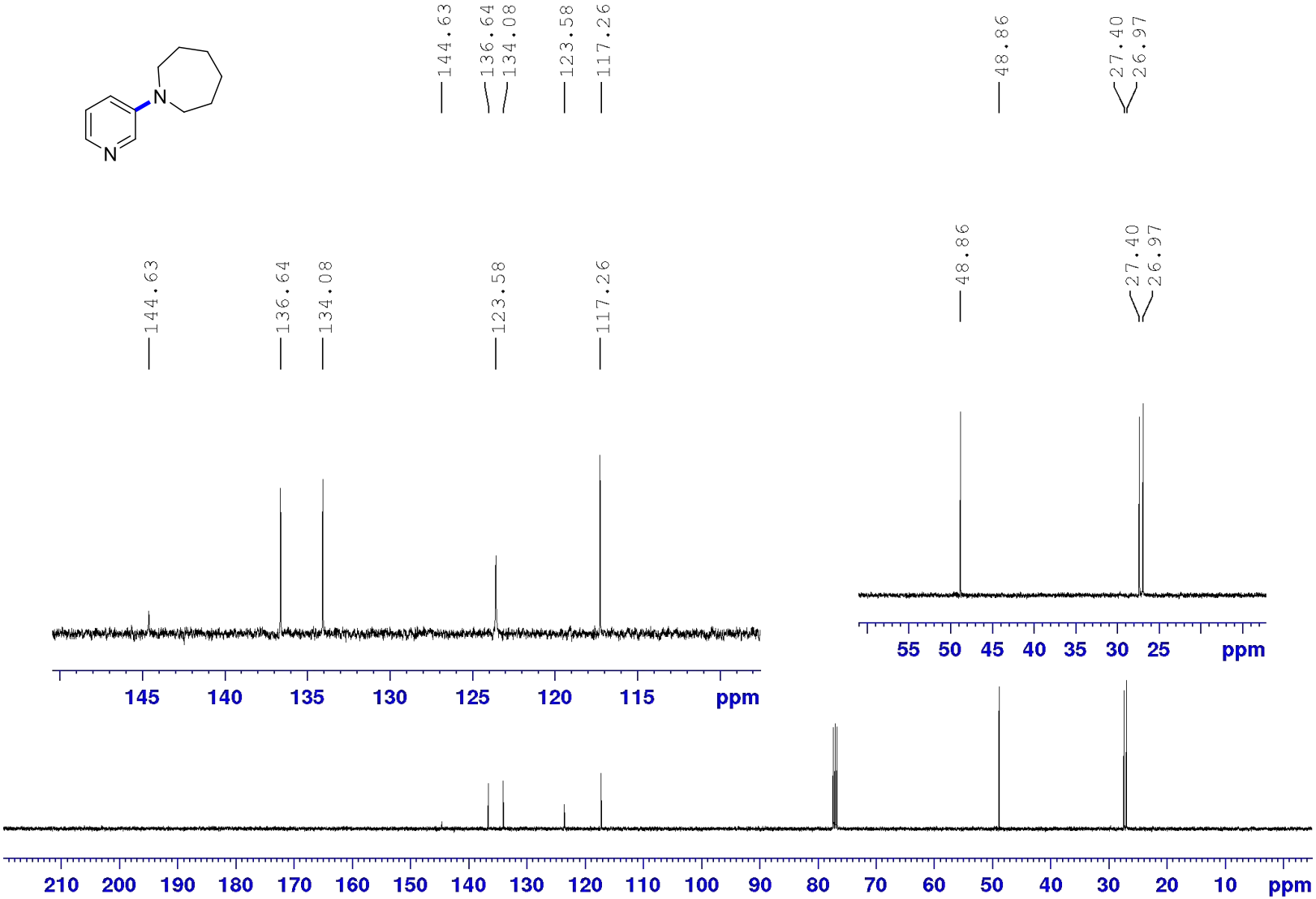
^{13}C NMR Spectrum of **3ab** (100 MHz, $CDCl_3$)



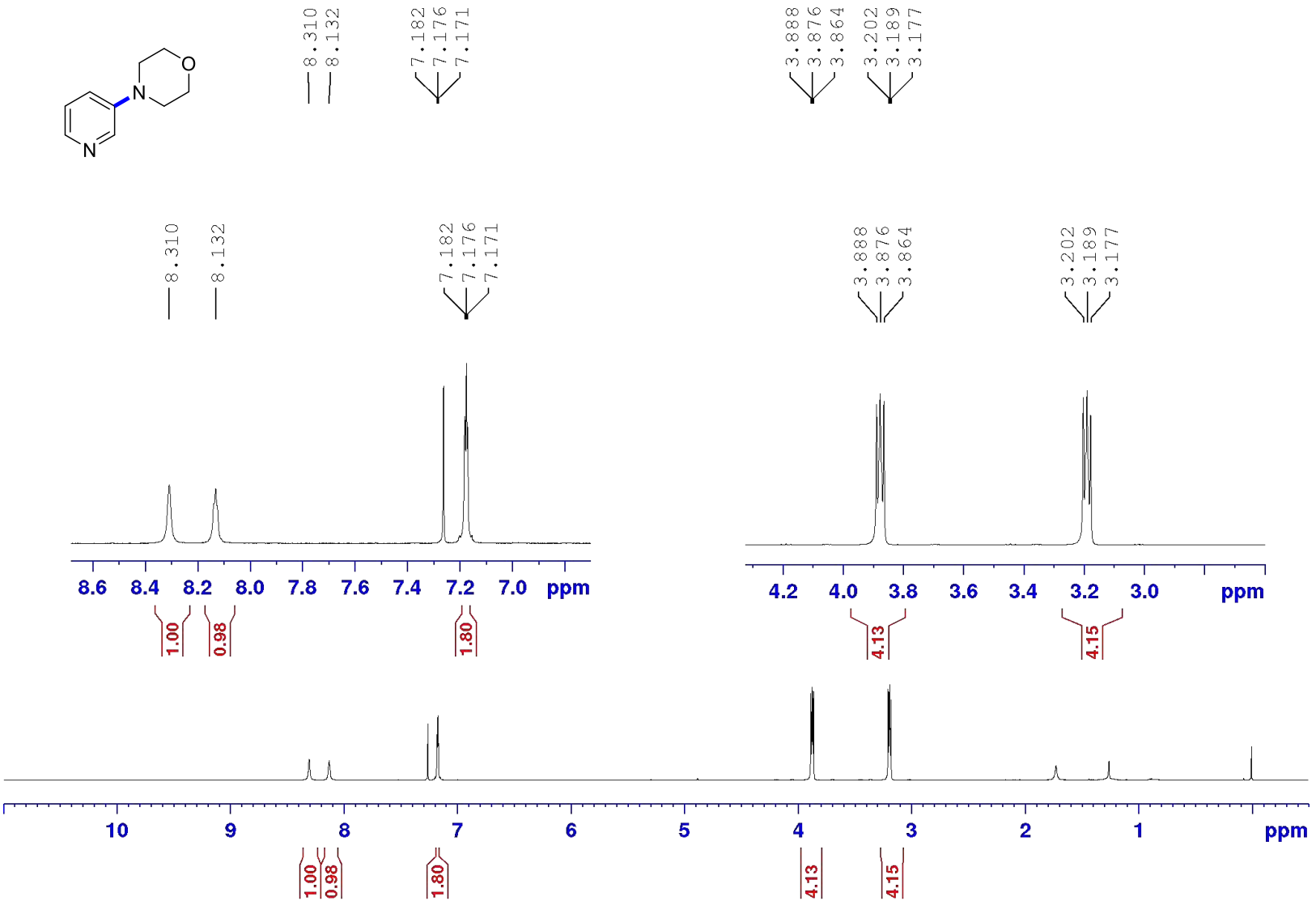
^{1}H NMR Spectrum of **3ac** (400 MHz, $CDCl_3$)



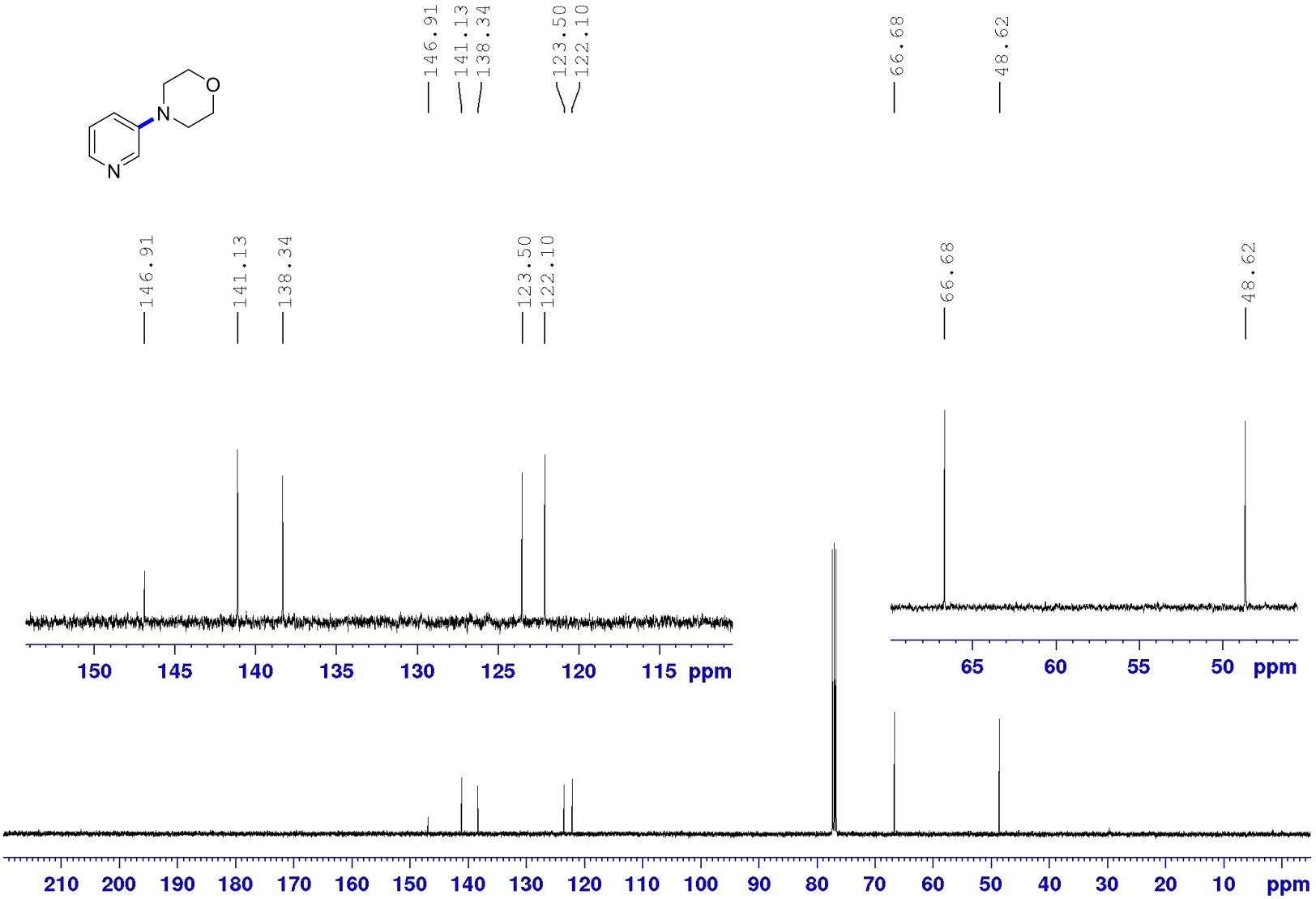
^{13}C NMR Spectrum of **3ac** (100 MHz, $CDCl_3$)



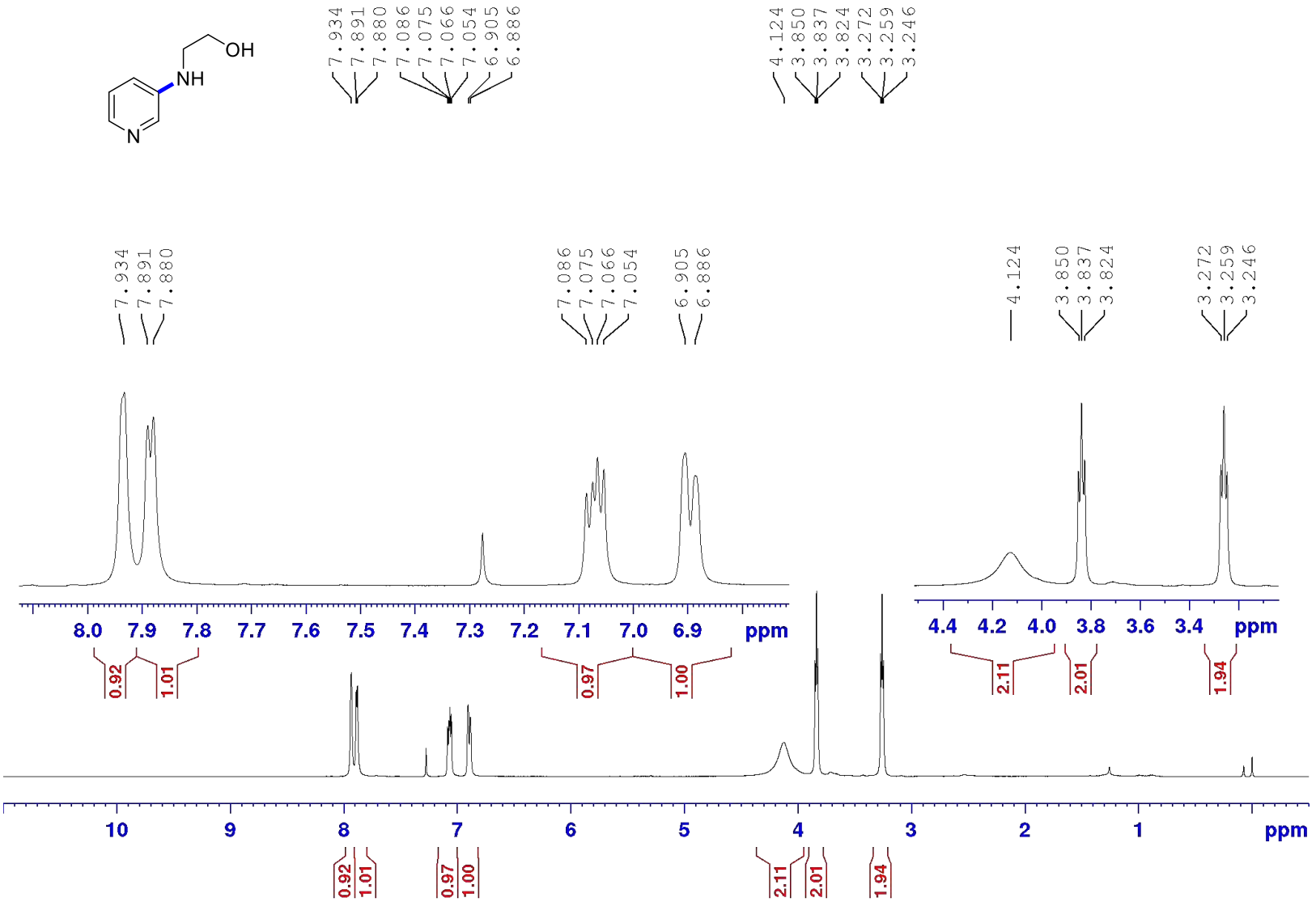
^{1}H NMR Spectrum of **3ad** (400 MHz, $CDCl_3$)



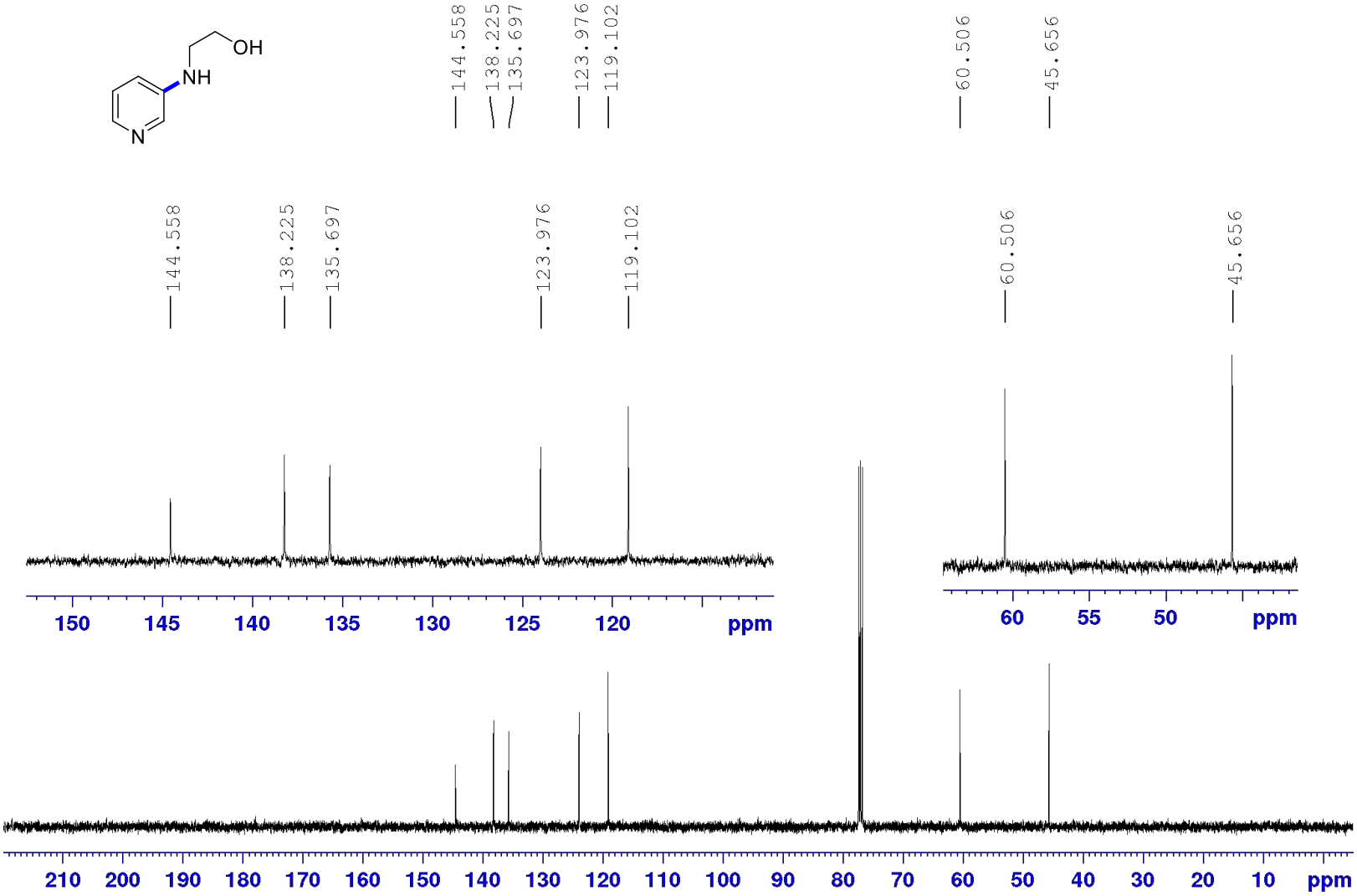
^{13}C NMR Spectrum of **3ad** (100 MHz, $CDCl_3$)



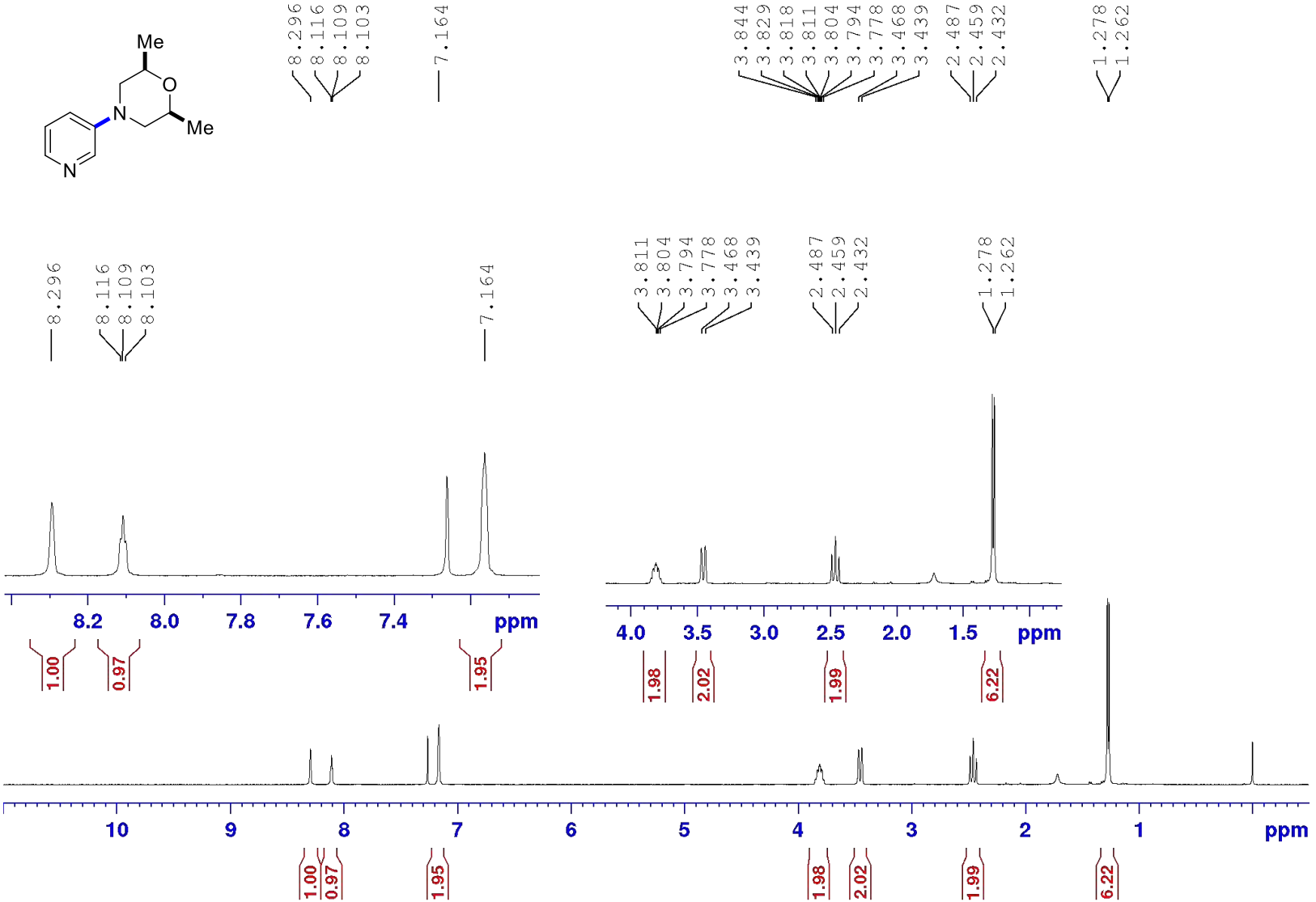
^{1}H NMR Spectrum of **3ad'** (400 MHz, $CDCl_3$)



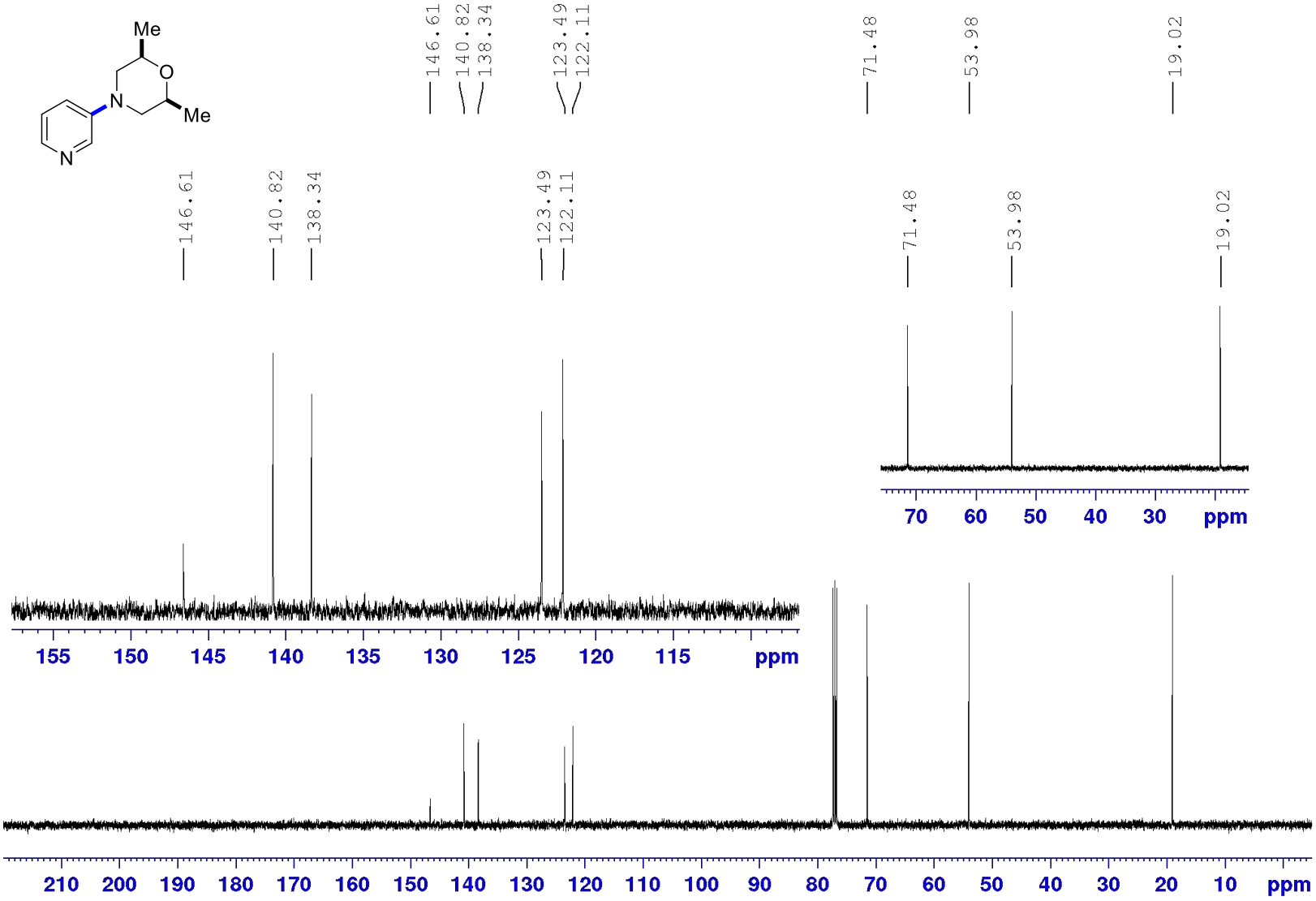
^{13}C NMR Spectrum of **3ad'** (100 MHz, $CDCl_3$)



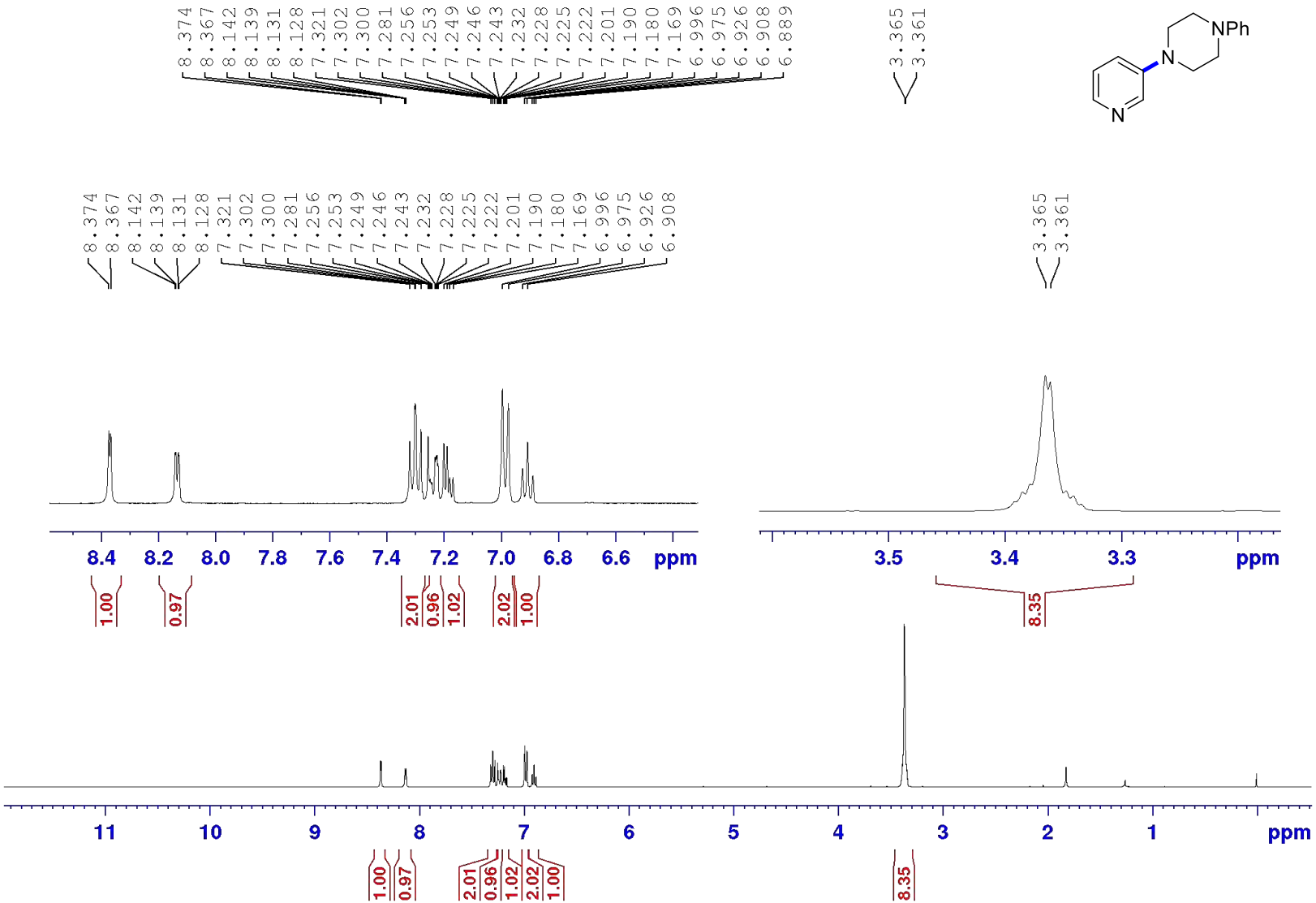
^{1}H NMR Spectrum of **3ae** (400 MHz, $CDCl_3$)



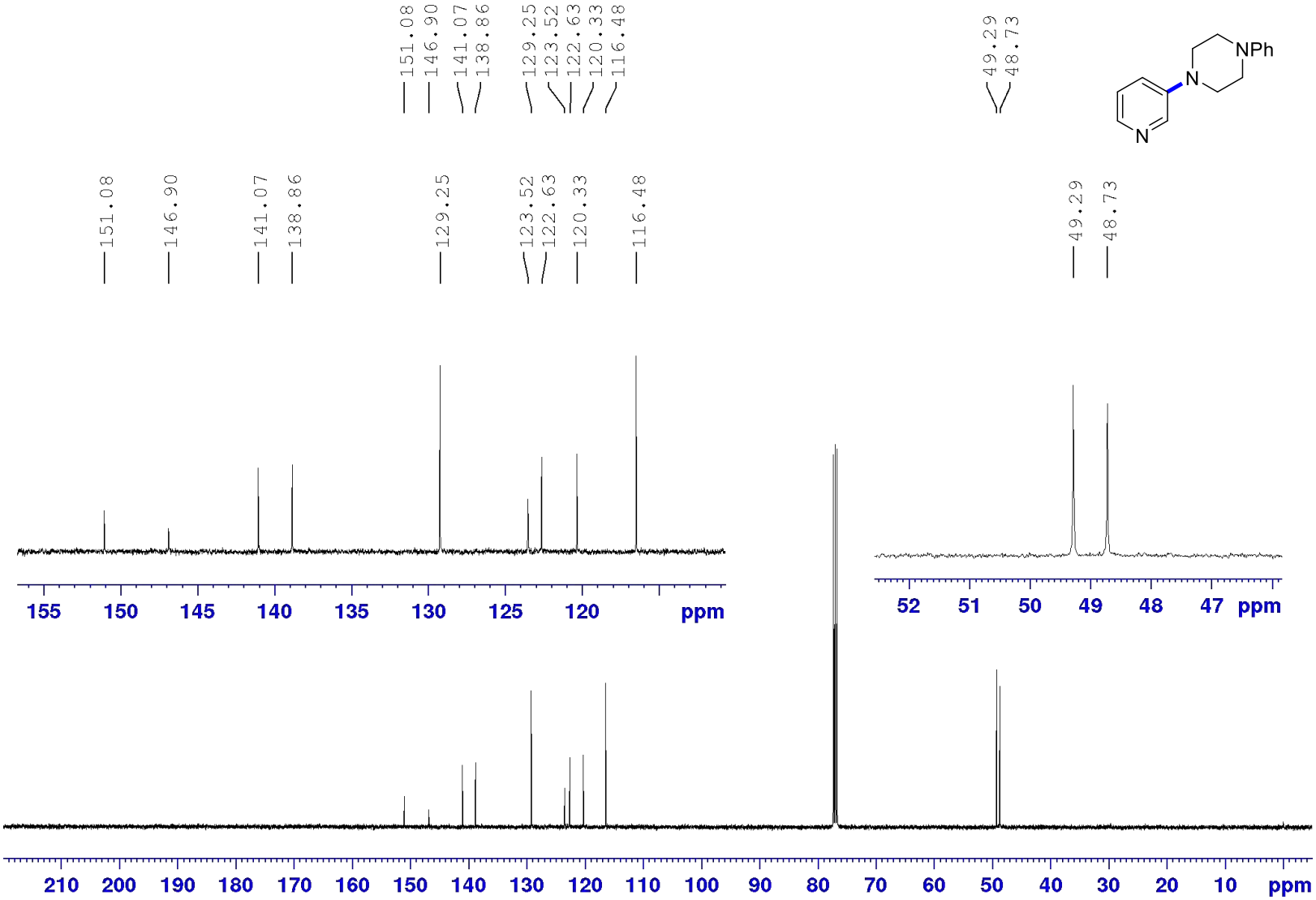
^{13}C NMR Spectrum of **3ae** (100 MHz, $CDCl_3$)



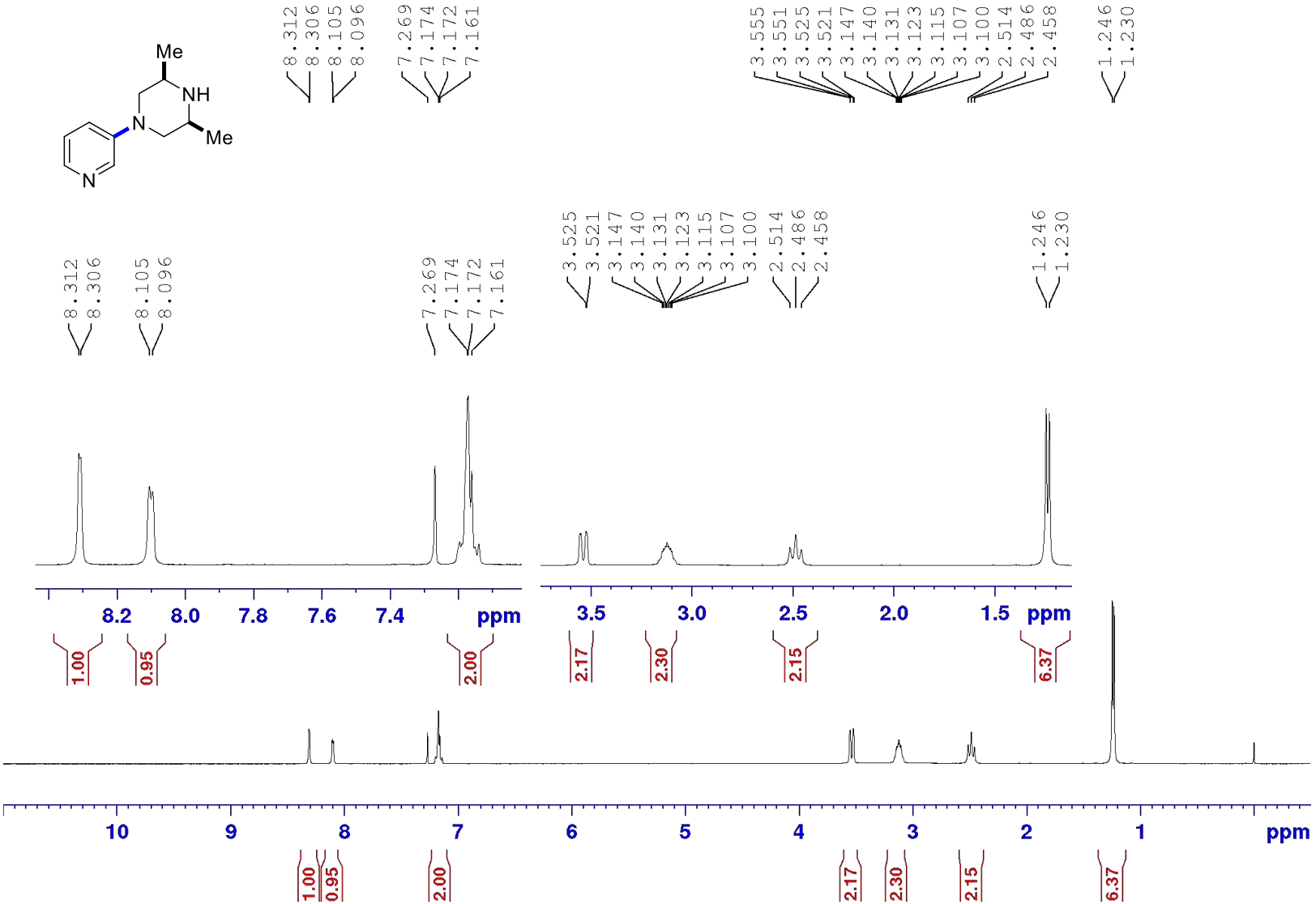
^{1}H NMR Spectrum of **3af** (400 MHz, $CDCl_3$)



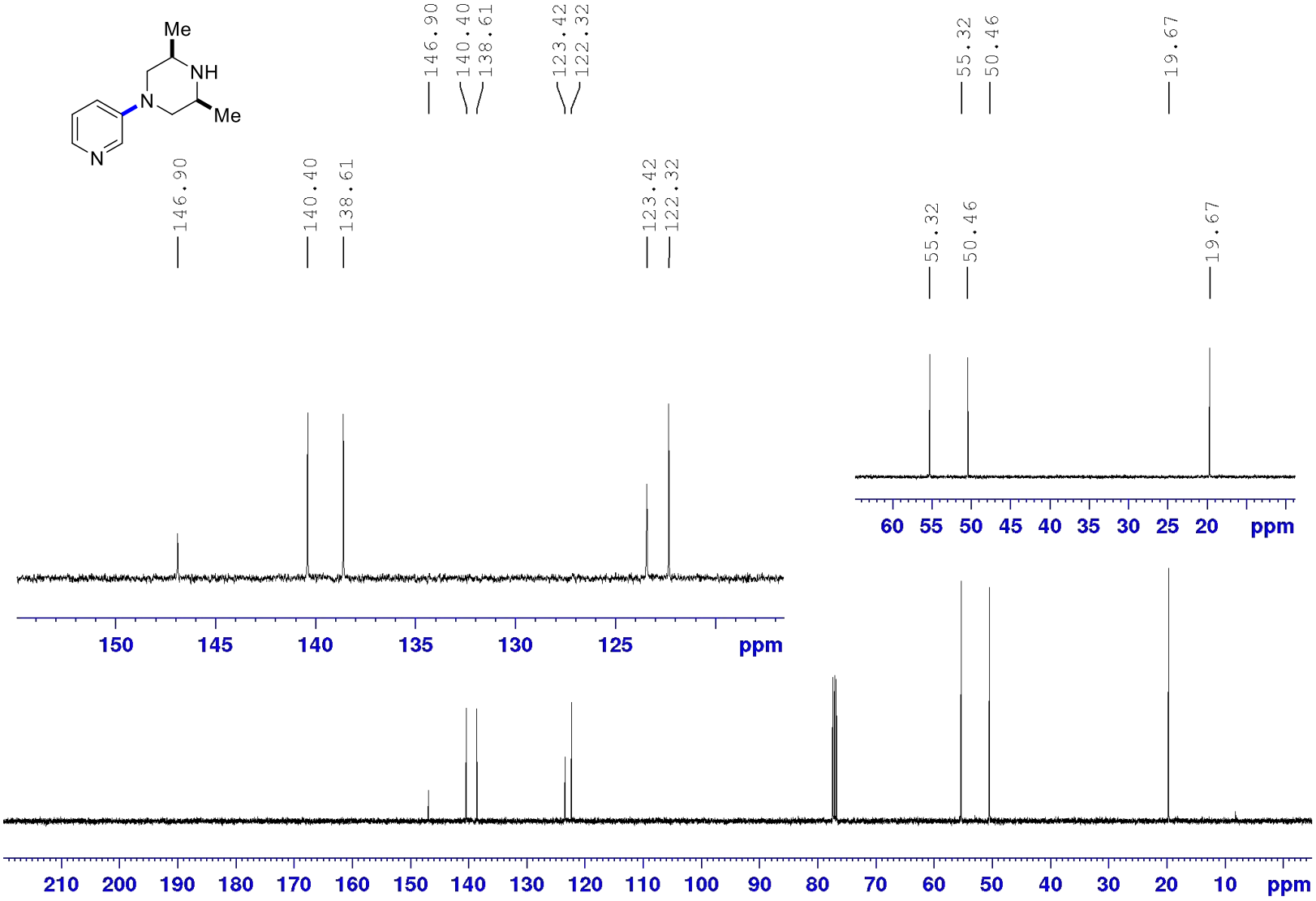
^{13}C NMR Spectrum of **3af** (100 MHz, $CDCl_3$)



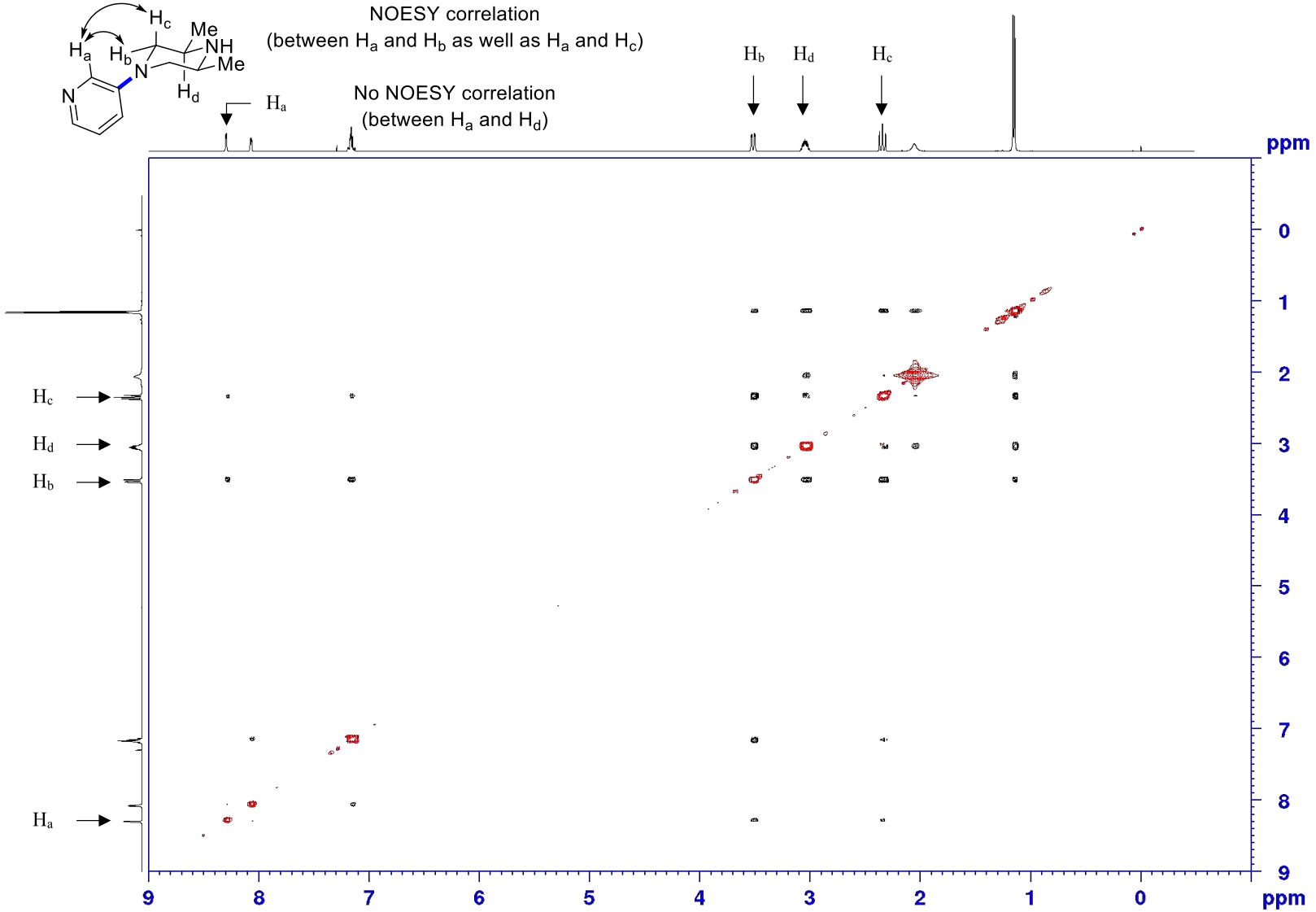
^{1}H NMR Spectrum of **3ag** (400 MHz, $CDCl_3$)



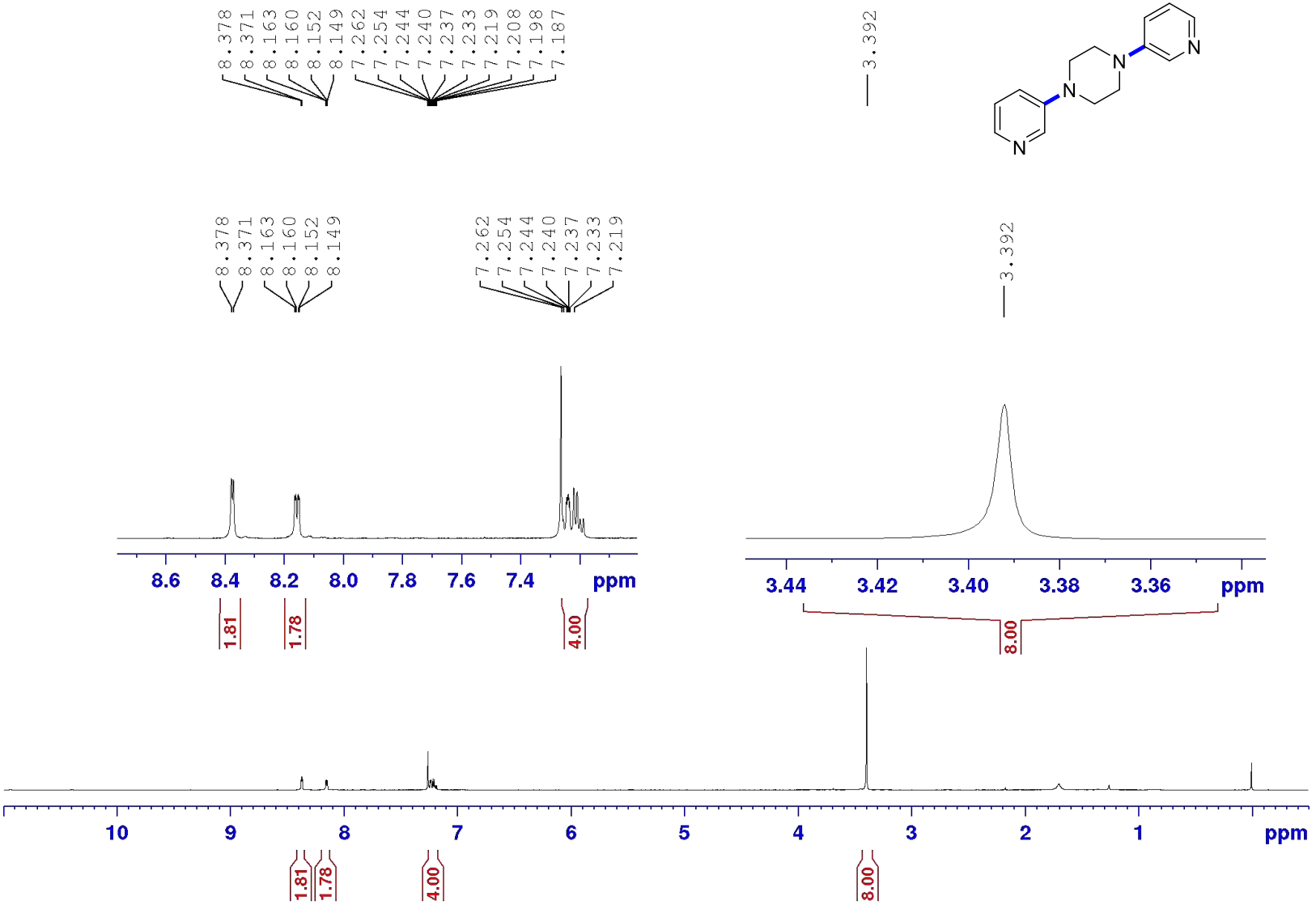
^{13}C NMR Spectrum of **3ag** (100 MHz, $CDCl_3$)



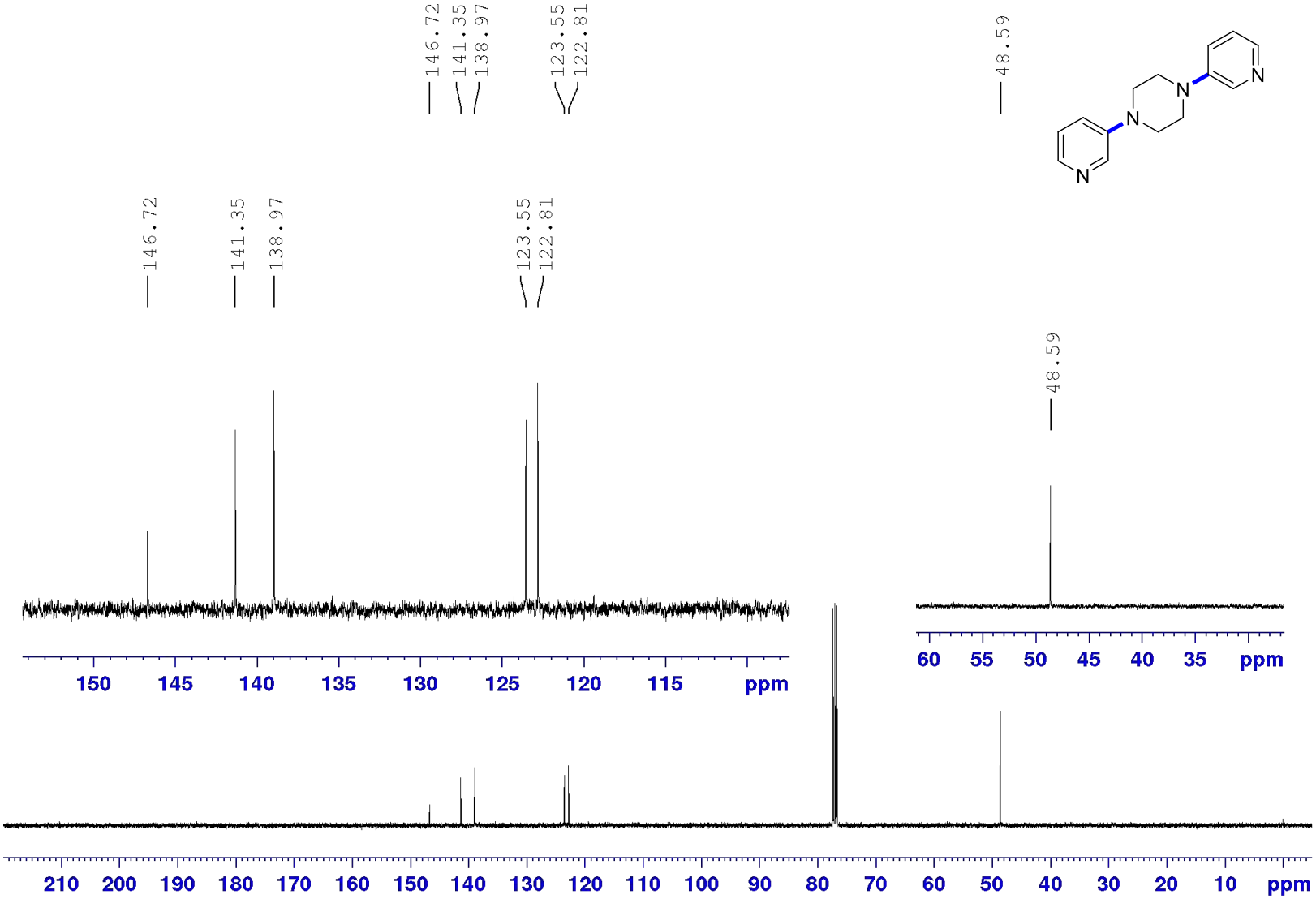
NOESY Spectrum of **3ag** (400 MHz, $CDCl_3$)



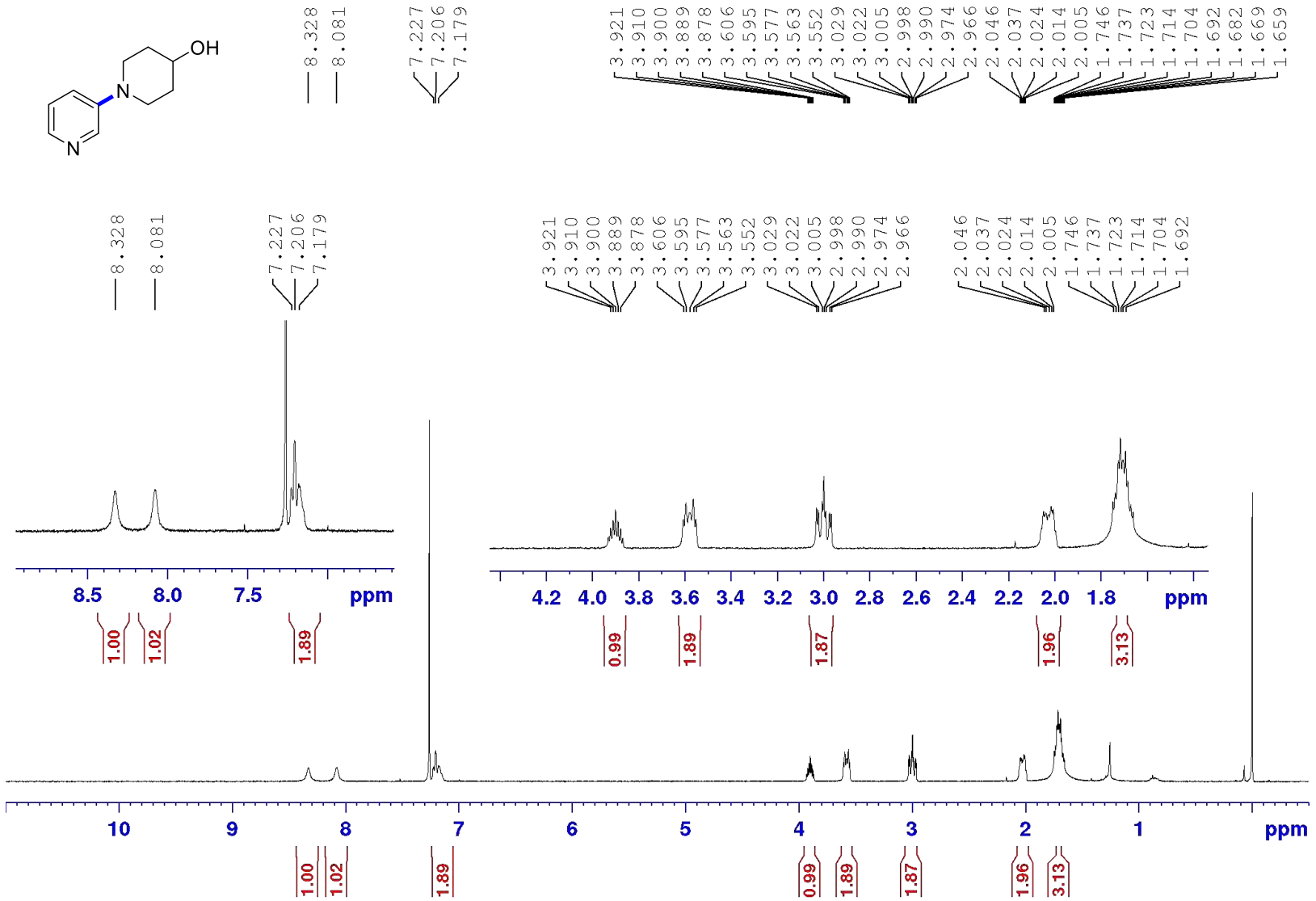
^{1}H NMR Spectrum of **3ah** (400 MHz, $CDCl_3$)



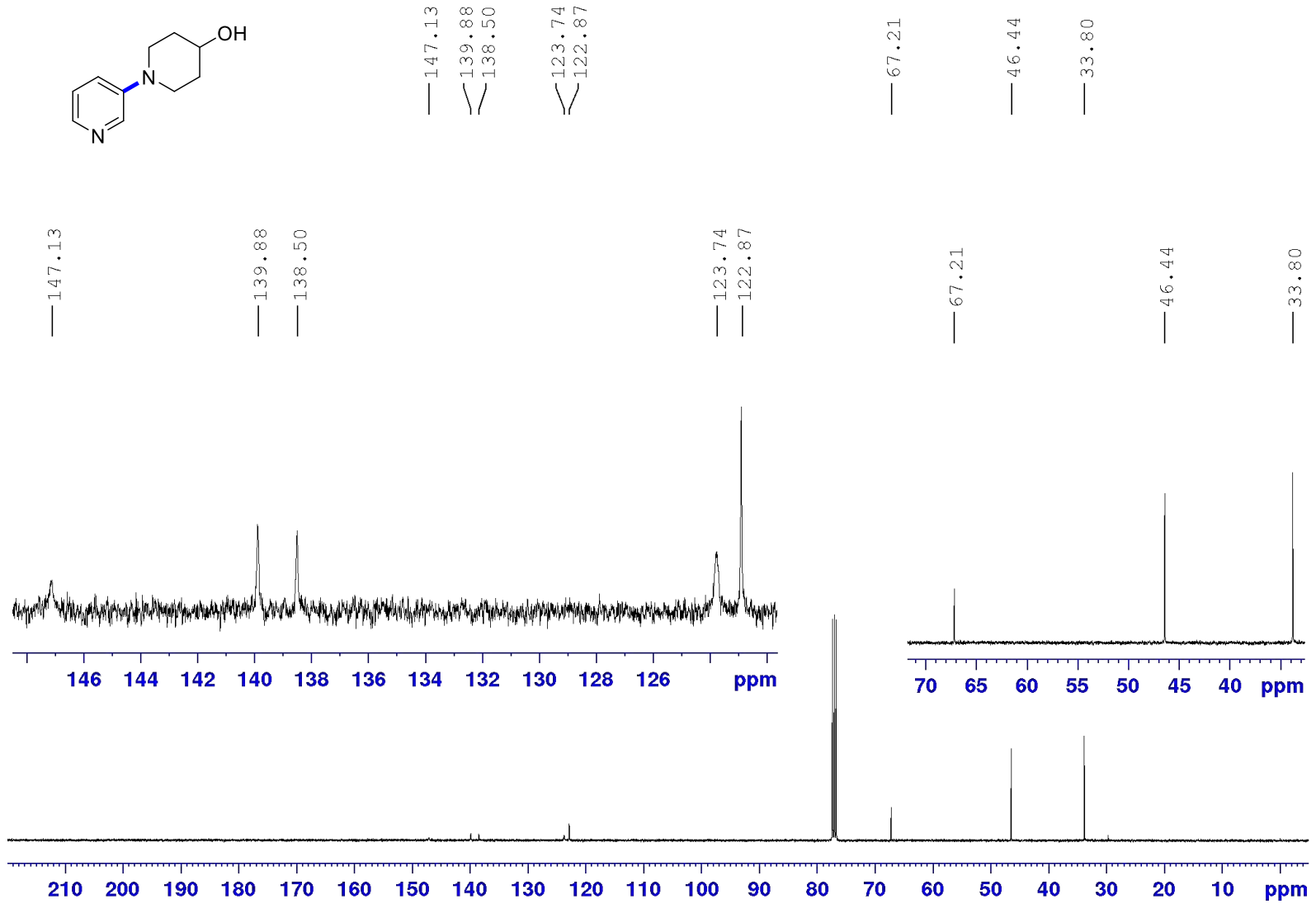
^{13}C NMR Spectrum of **3ah** (100 MHz, $CDCl_3$)



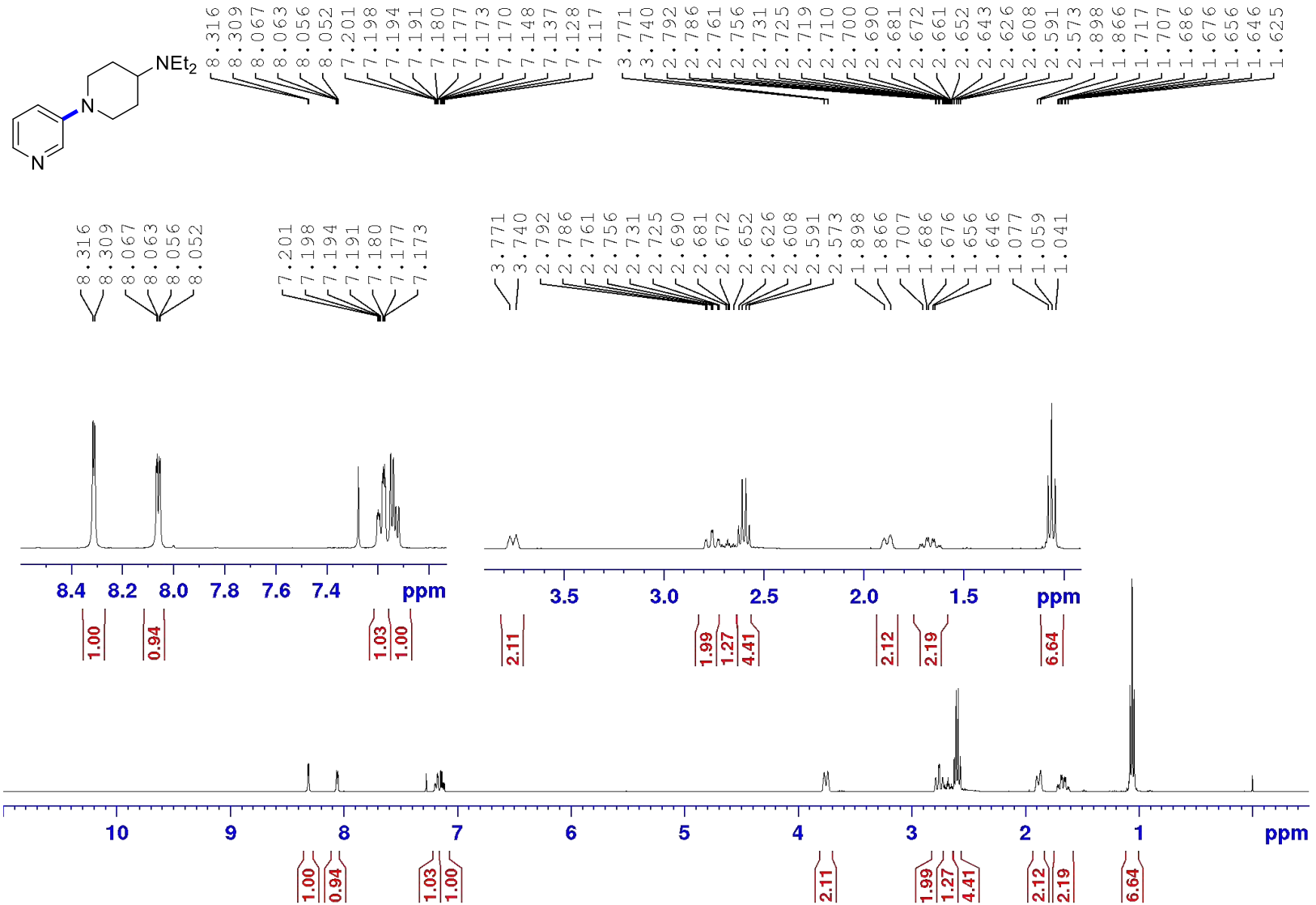
^{1}H NMR Spectrum of **3ai** (400 MHz, $CDCl_3$)



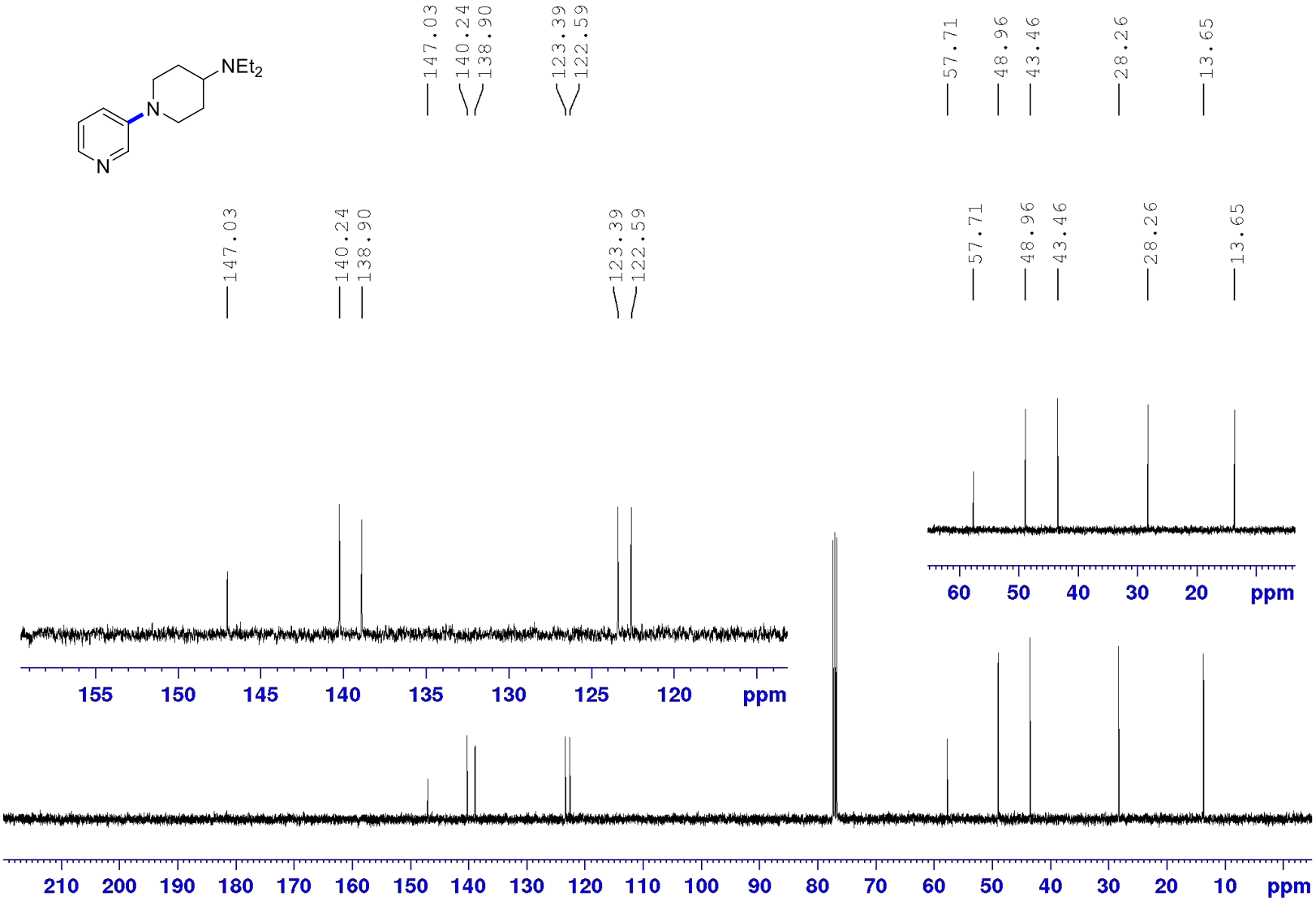
^{13}C NMR Spectrum of **3ai** (100 MHz, $CDCl_3$)



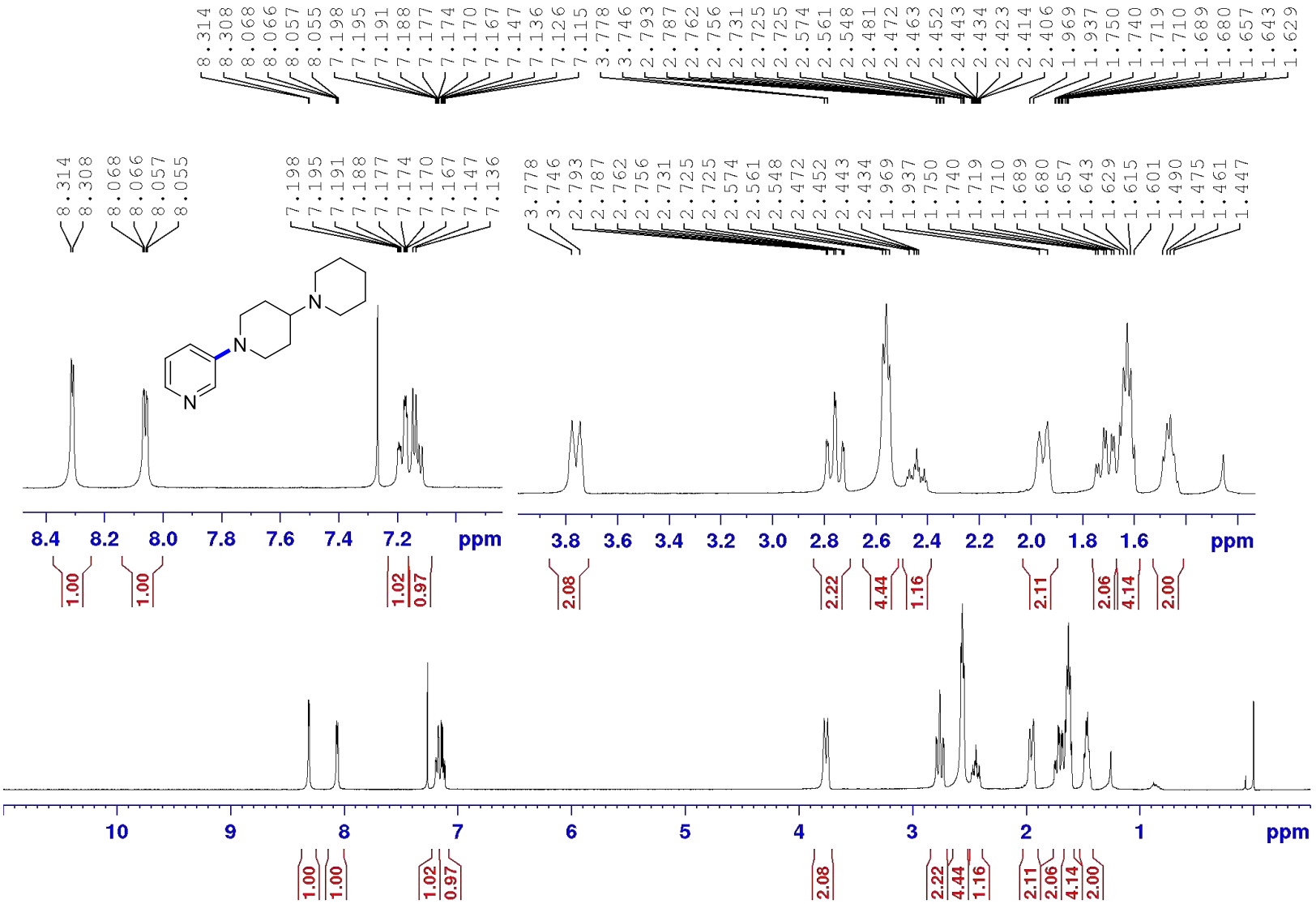
^{1}H NMR Spectrum of **3aj** (400 MHz, $CDCl_3$)



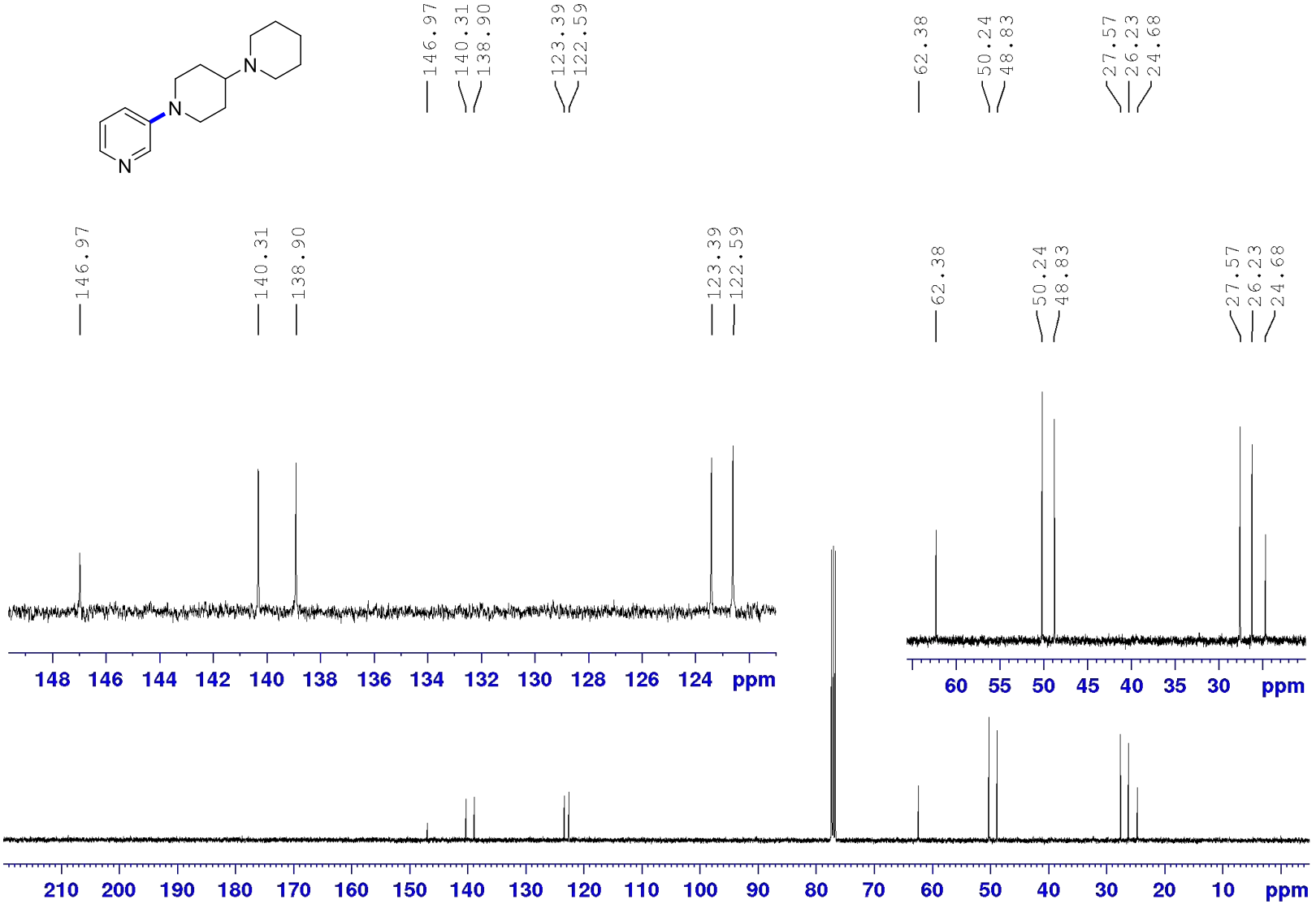
^{13}C NMR Spectrum of **3aj** (100 MHz, $CDCl_3$)



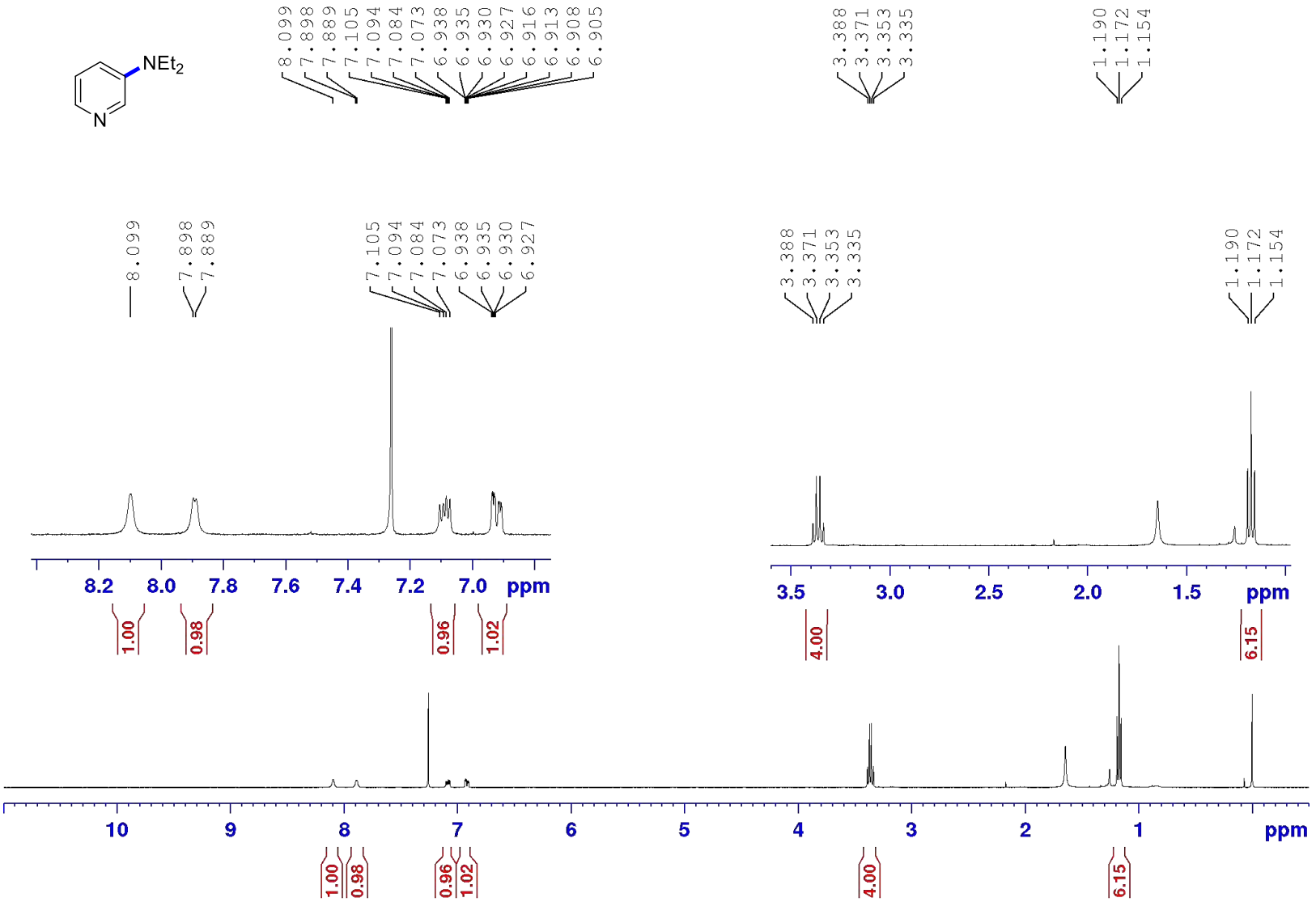
^{1}H NMR Spectrum of **3ak** (400 MHz, $CDCl_3$)



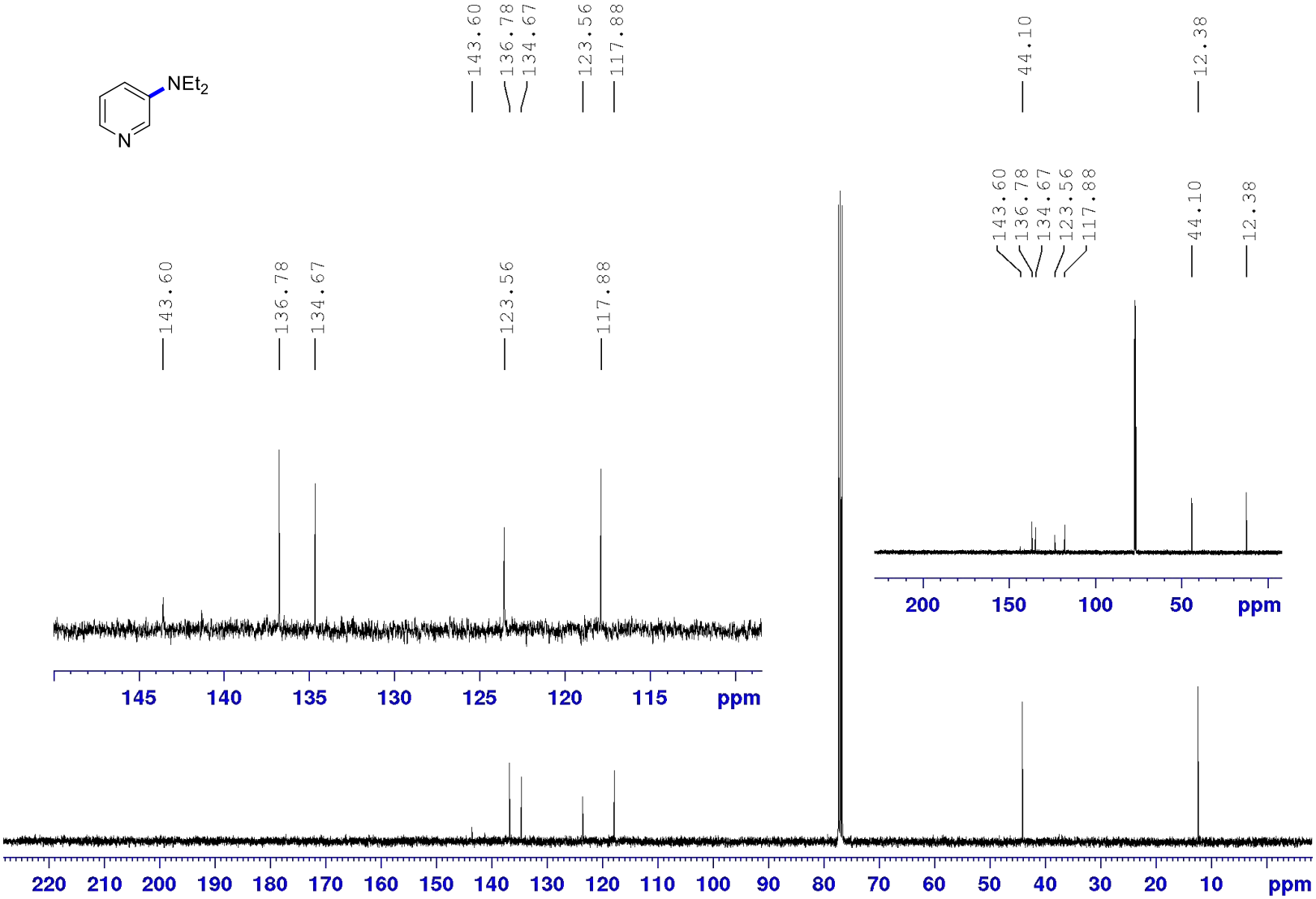
^{13}C NMR Spectrum of **3ak** (100 MHz, $CDCl_3$)



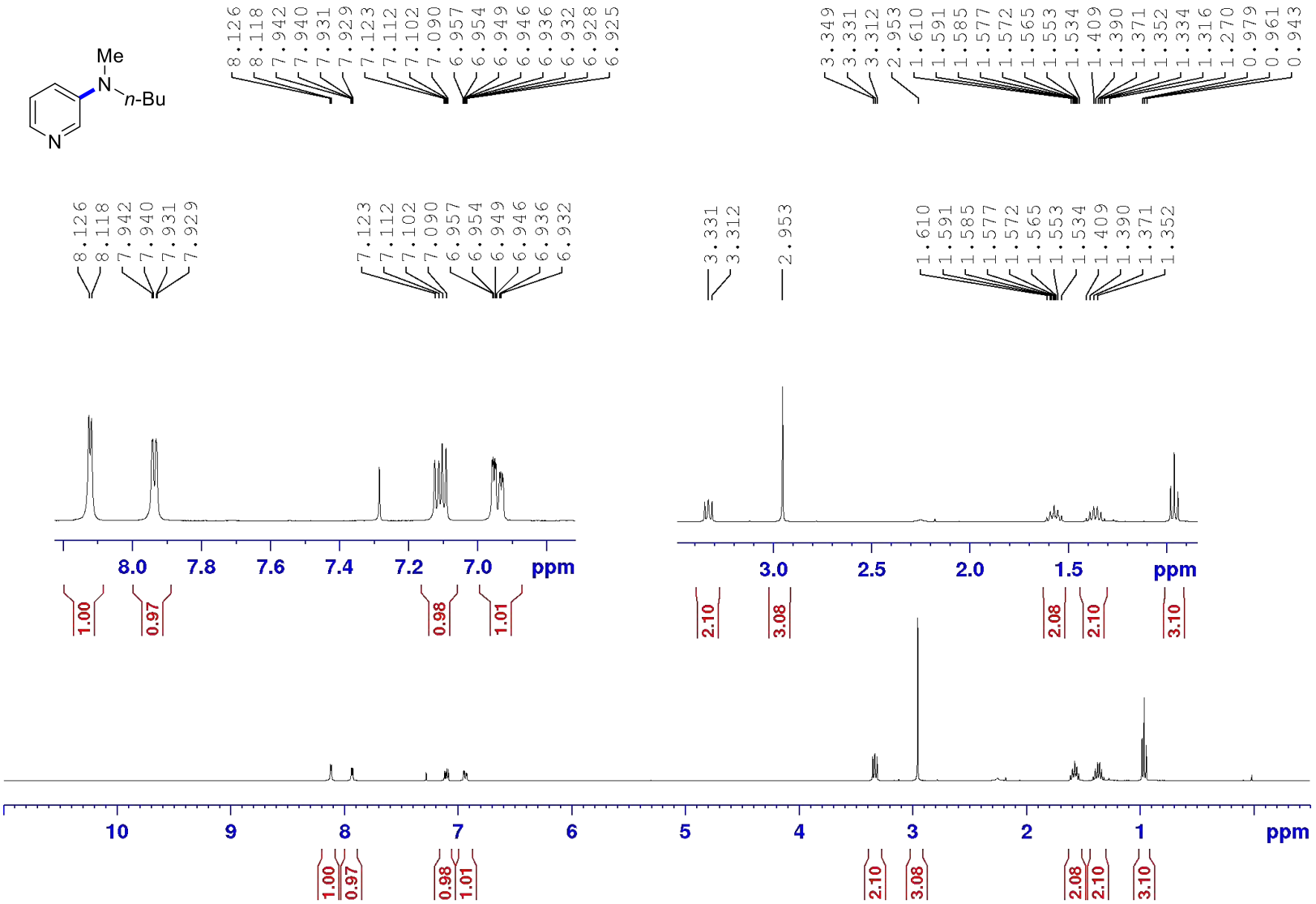
^{1}H NMR Spectrum of **3al** (400 MHz, $CDCl_3$)



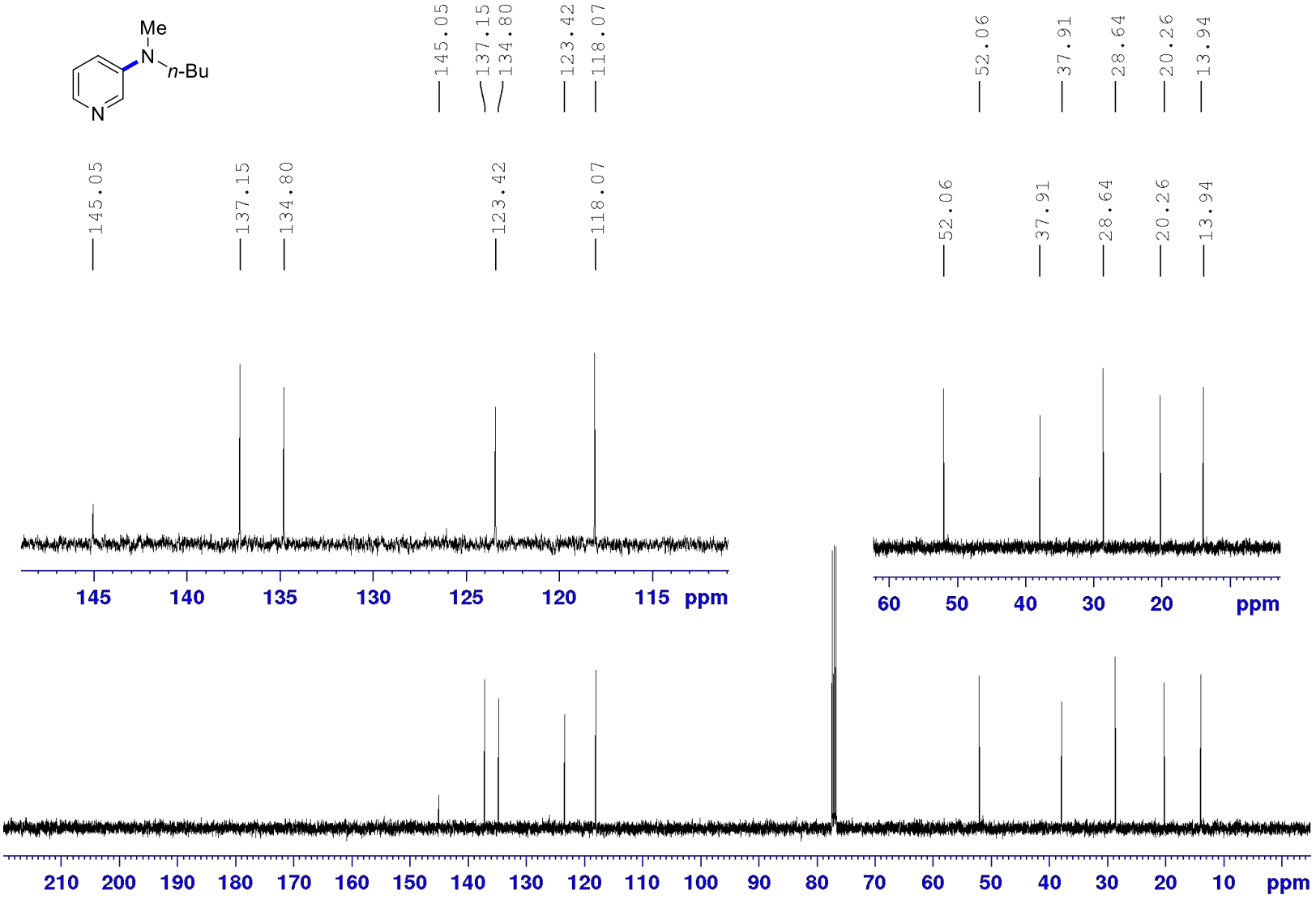
^{13}C NMR Spectrum of **3al** (100 MHz, $CDCl_3$)



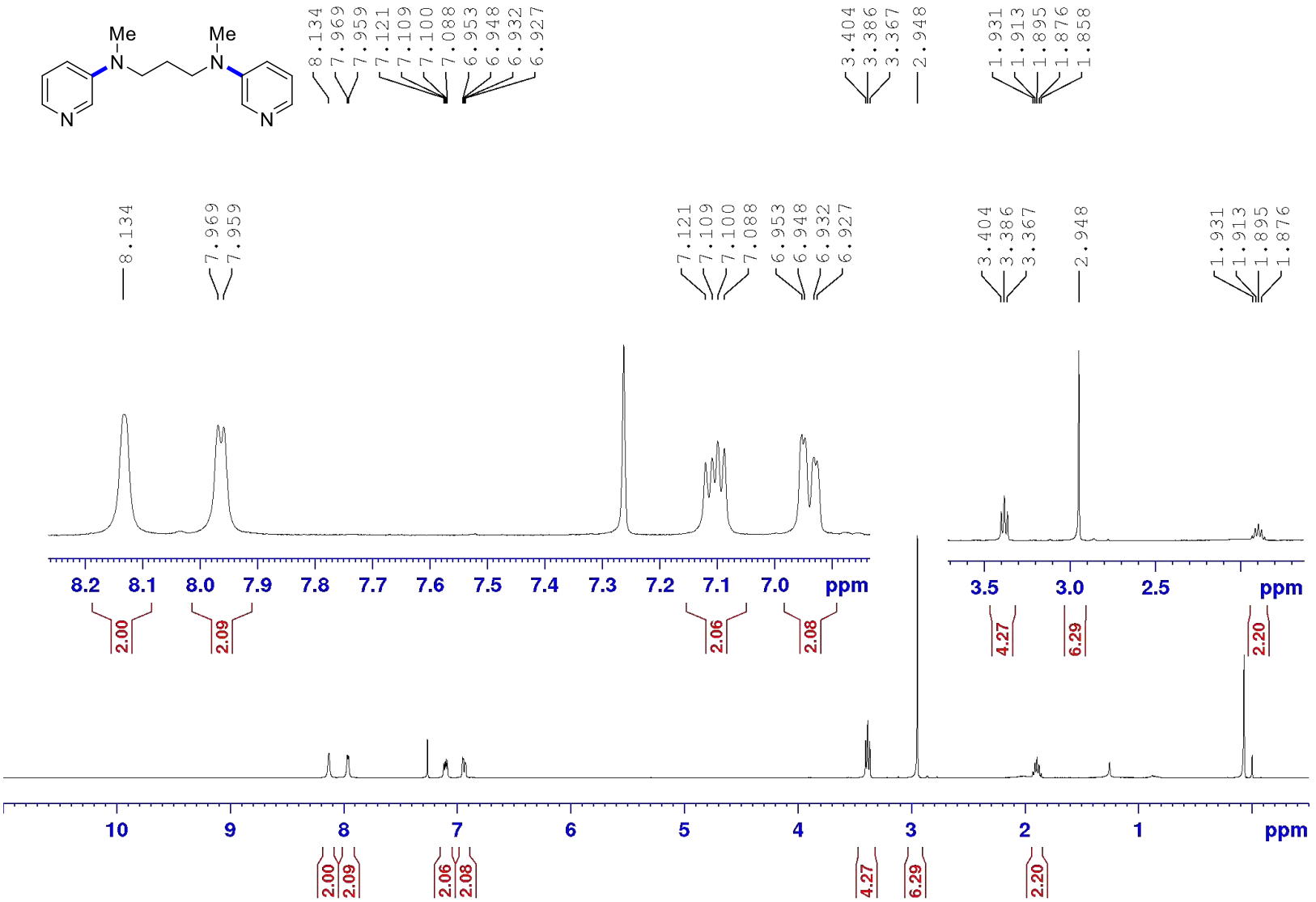
^{1}H NMR Spectrum of **3am** (400 MHz, $CDCl_3$)



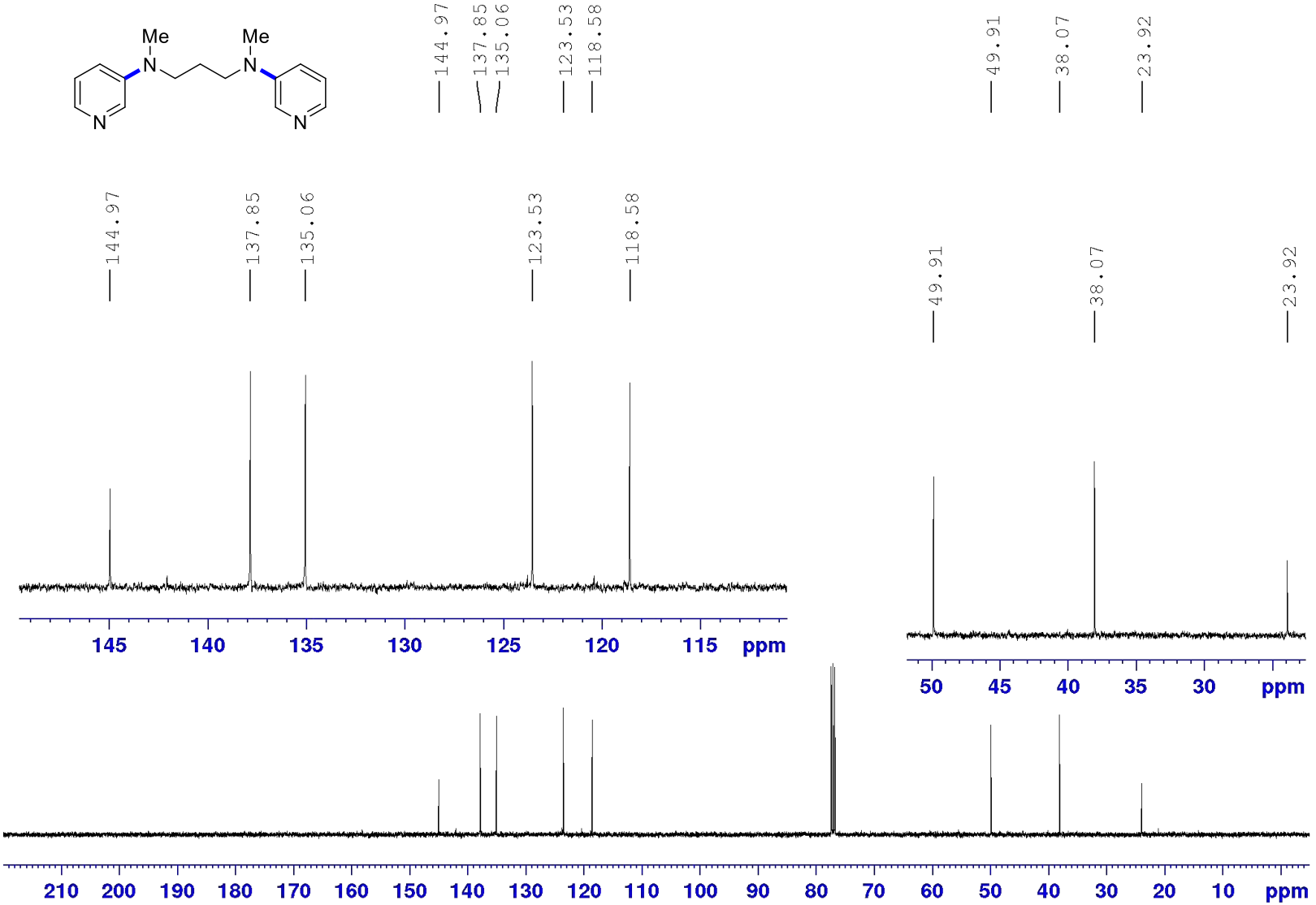
^{13}C NMR Spectrum of **3am** (100 MHz, $CDCl_3$)



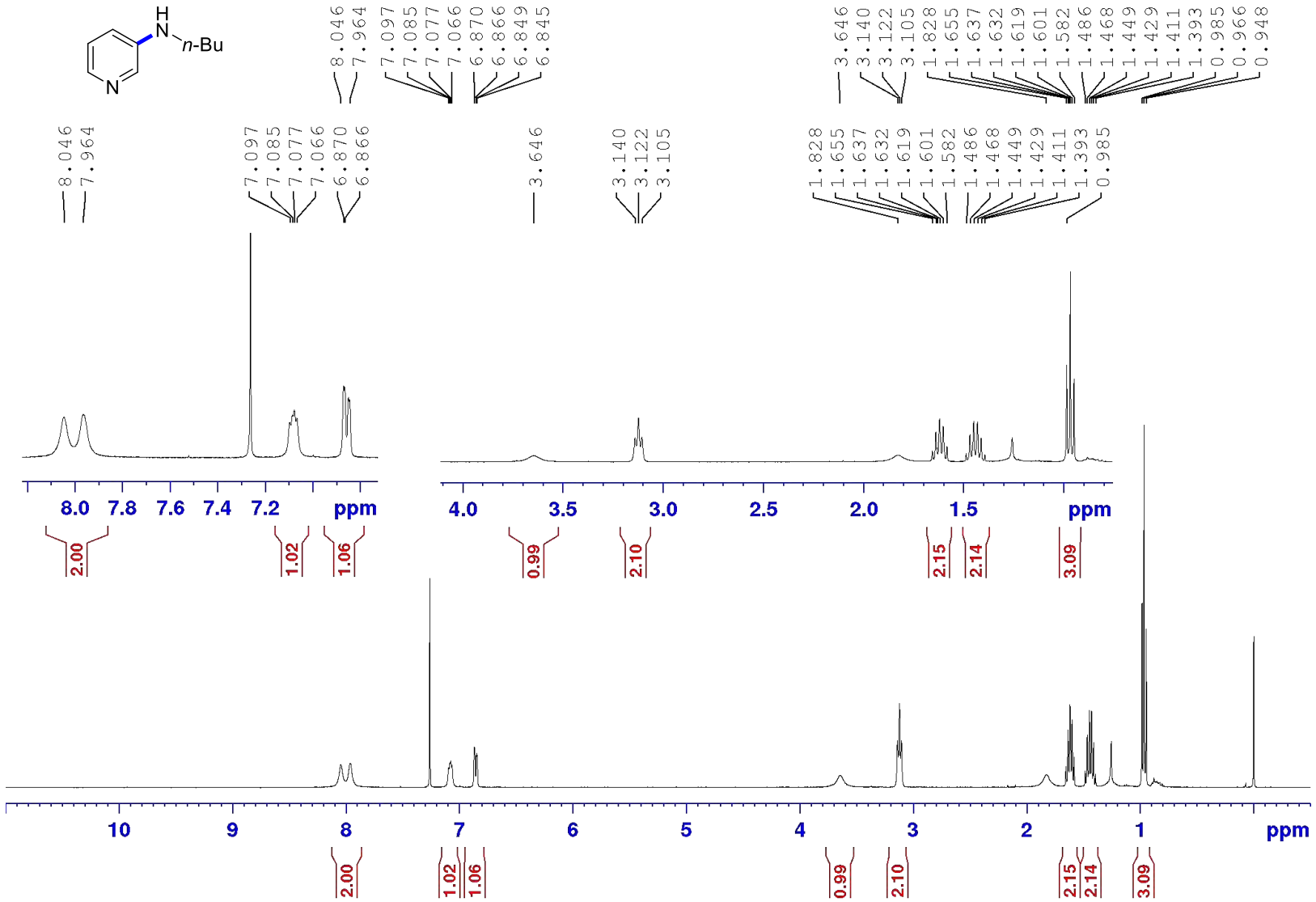
^{1}H NMR Spectrum of **3an** (400 MHz, $CDCl_3$)



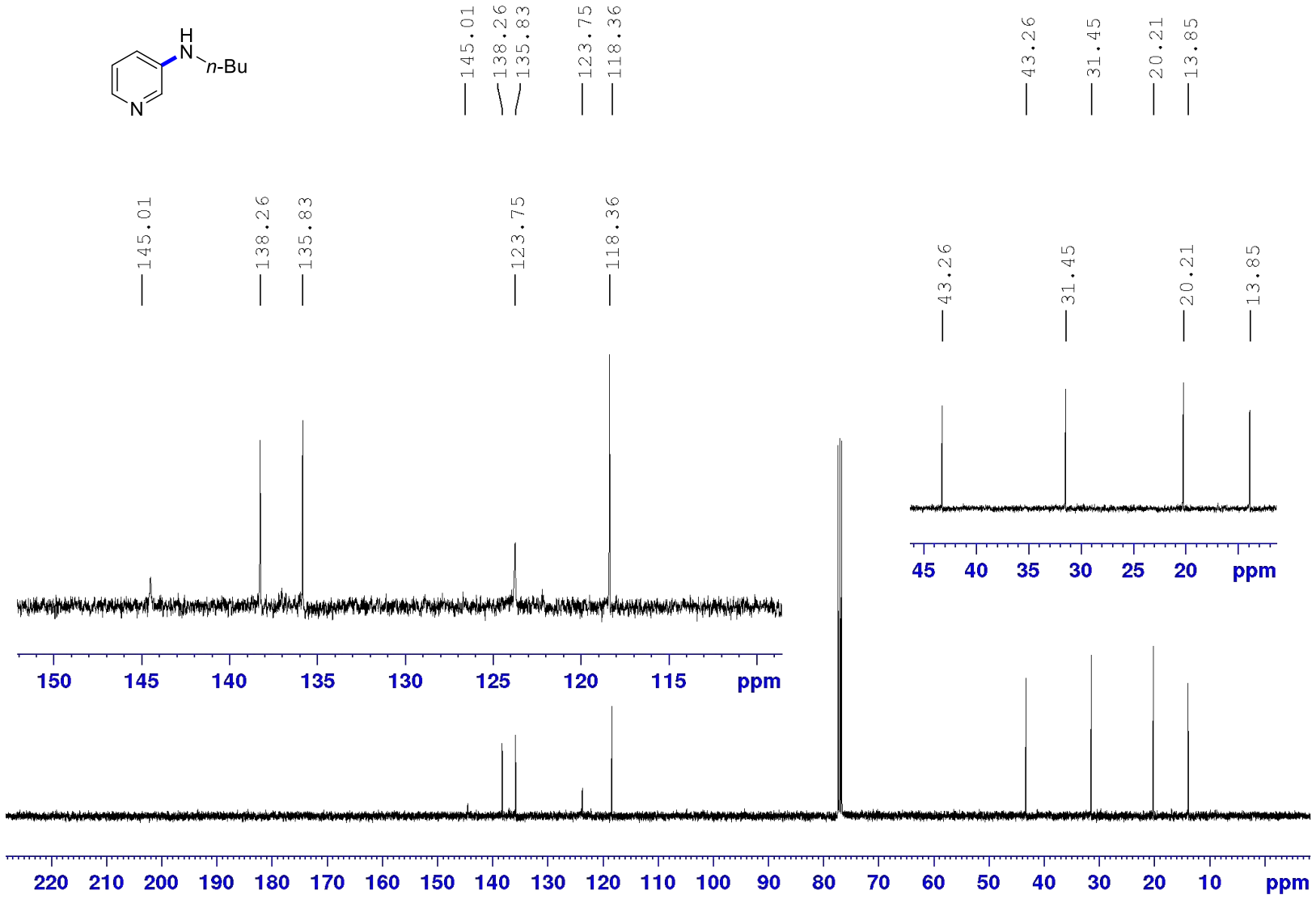
^{13}C NMR Spectrum of **3an** (100 MHz, $CDCl_3$)



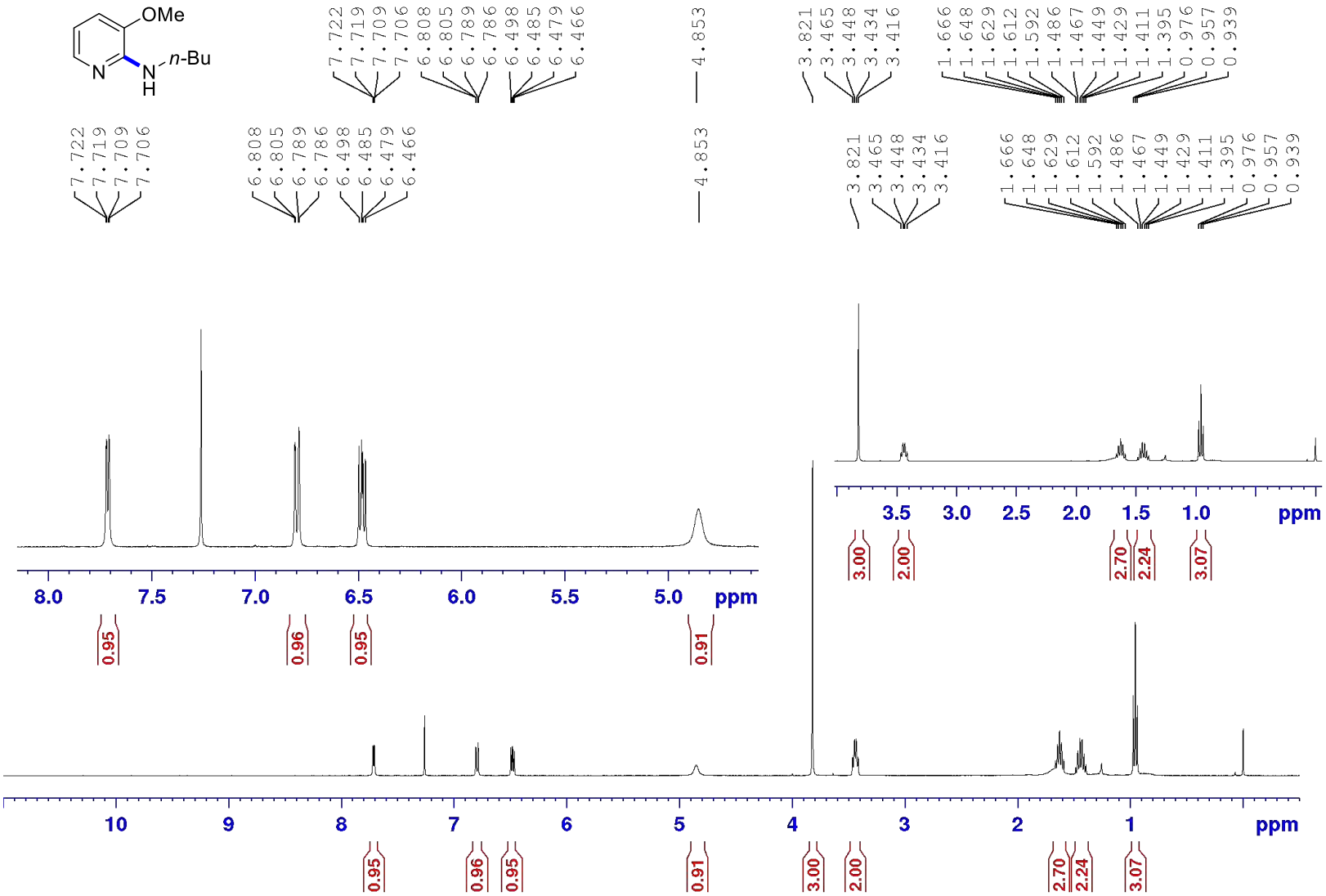
^{1}H NMR Spectrum of **3ao** (400 MHz, $CDCl_3$)



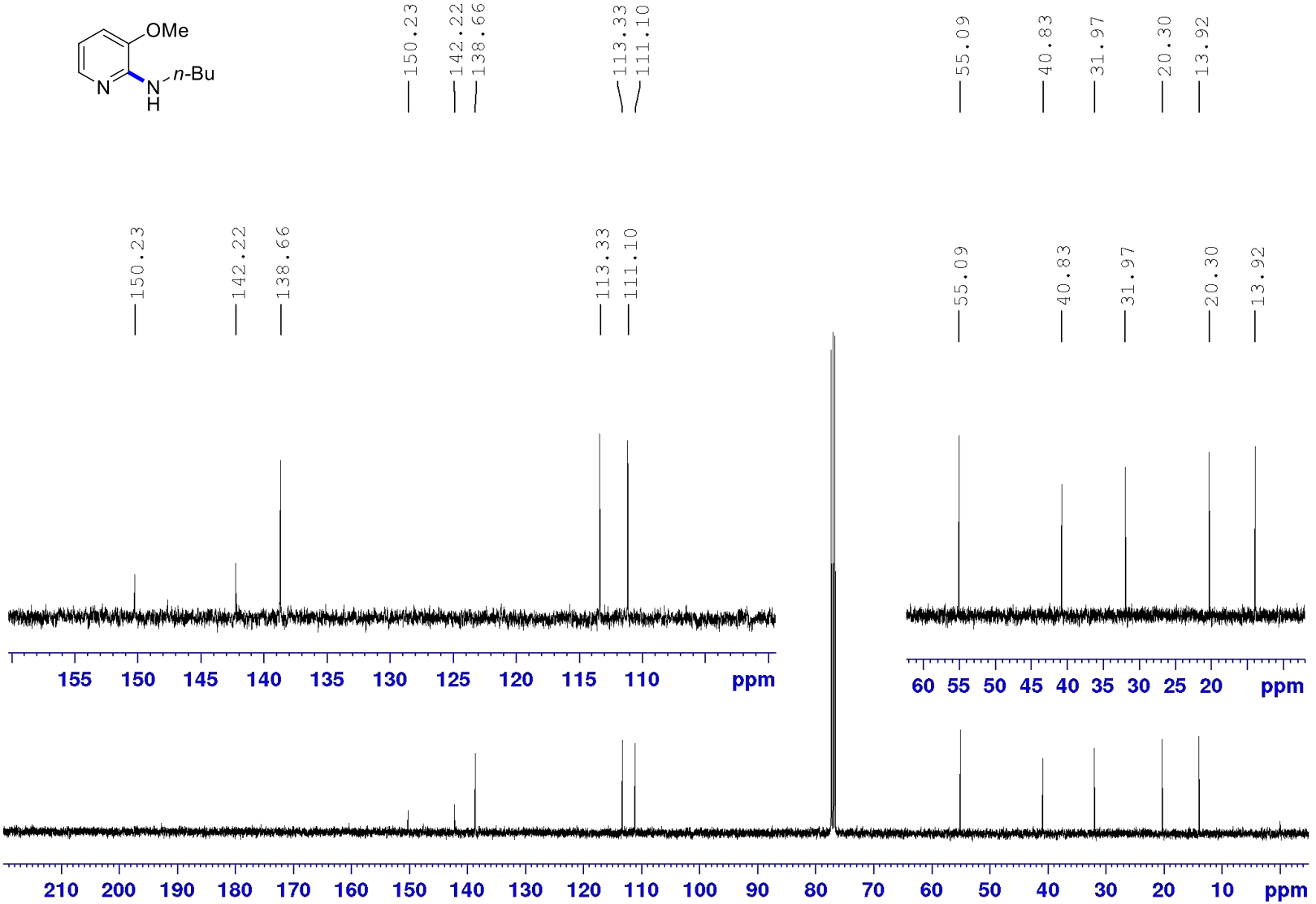
^{13}C NMR Spectrum of **3ao** (100 MHz, $CDCl_3$)



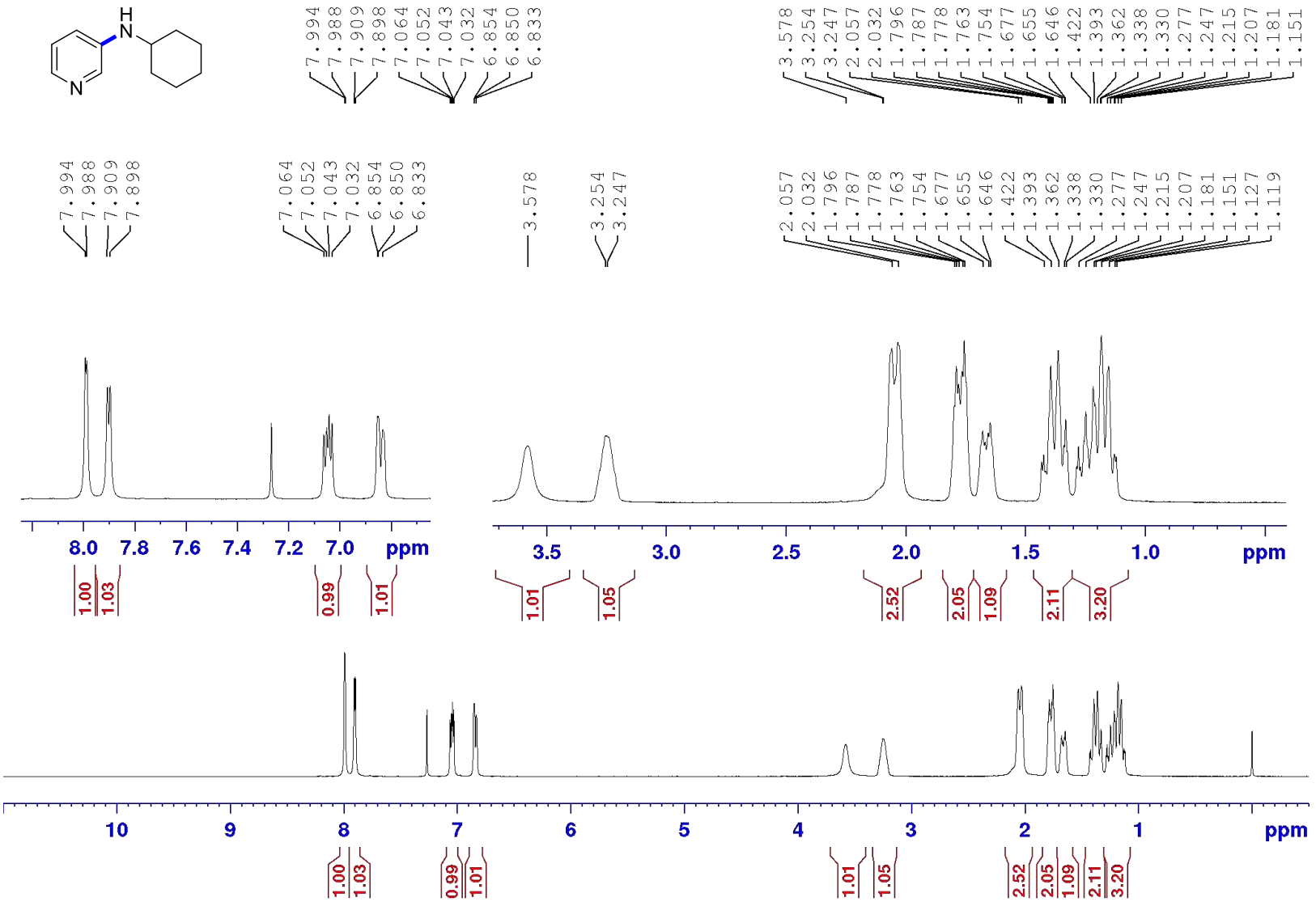
^{1}H NMR Spectrum of **3ao'** (400 MHz, $CDCl_3$)



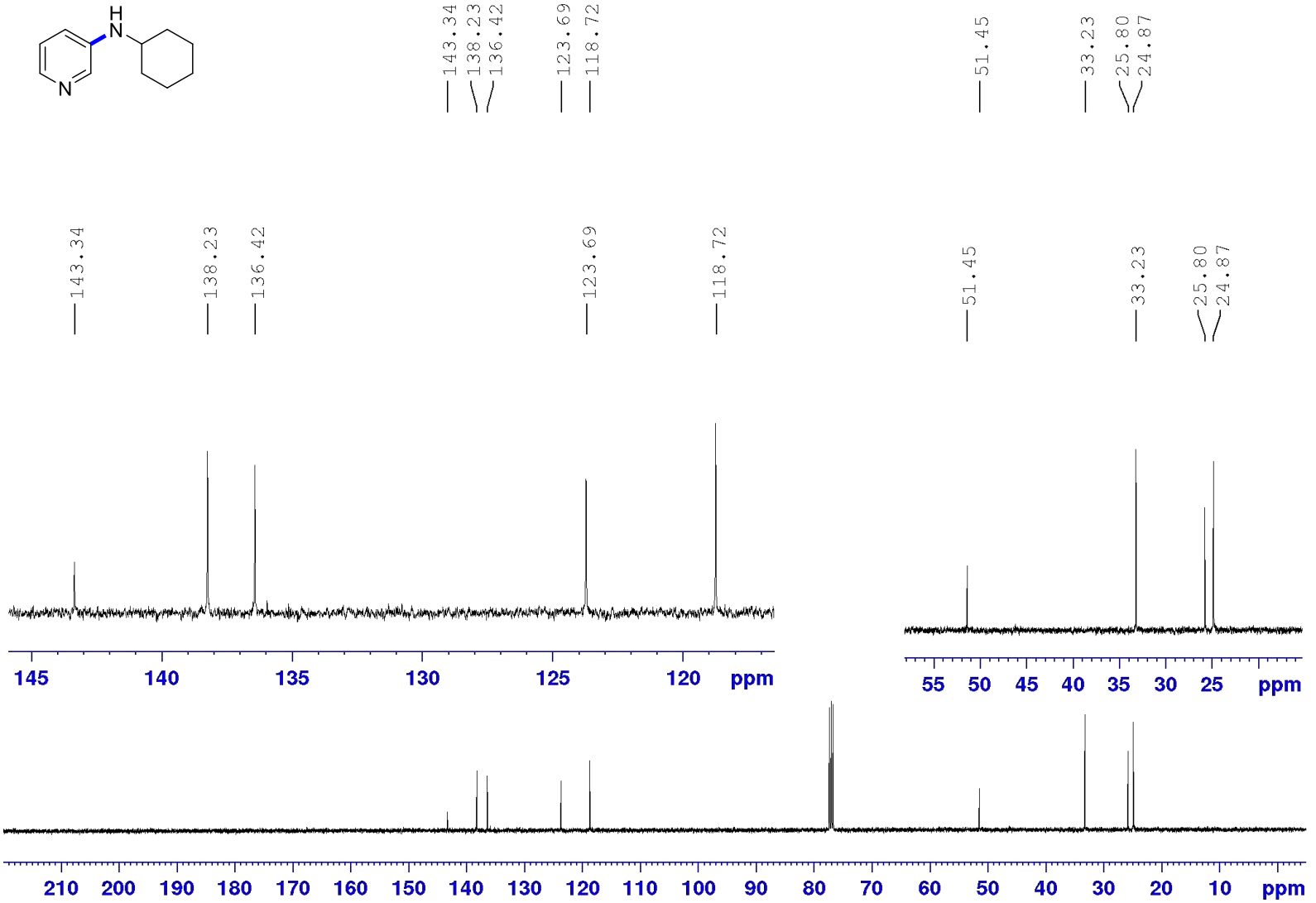
^{13}C NMR Spectrum of **3ao'** (100 MHz, $CDCl_3$)



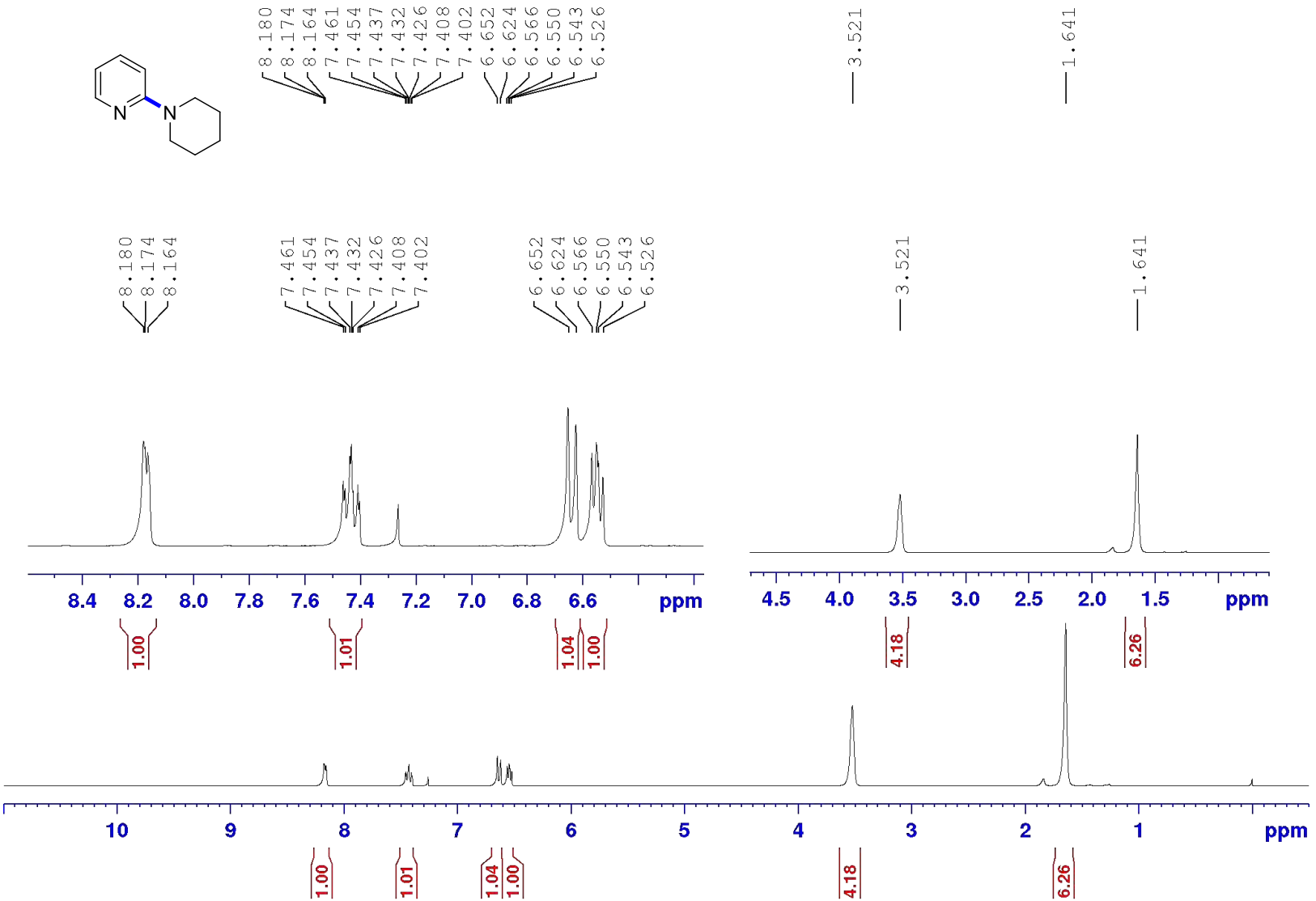
^{1}H NMR Spectrum of **3ap** (400 MHz, $CDCl_3$)



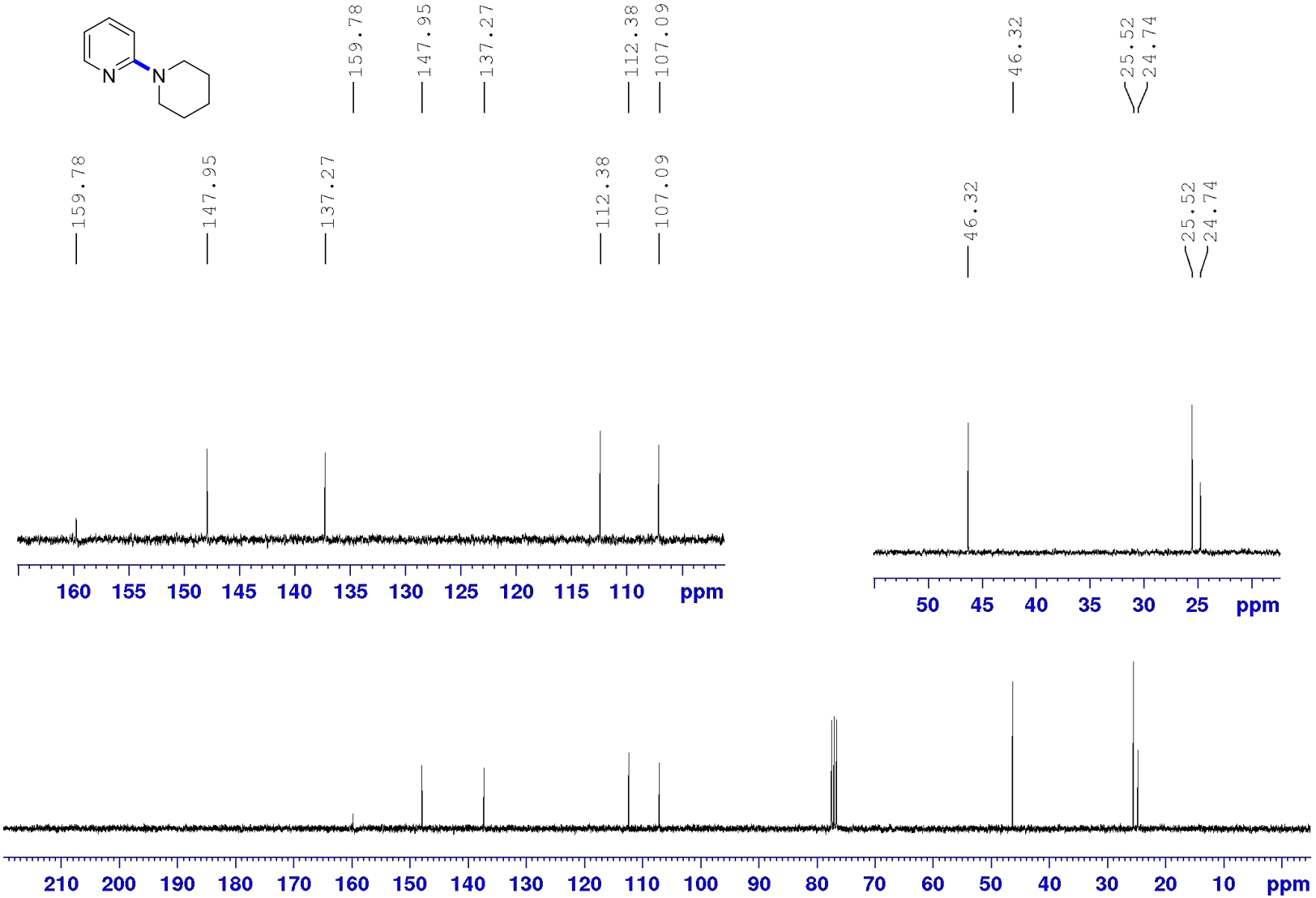
^{13}C NMR Spectrum of **3ap** (100 MHz, $CDCl_3$)



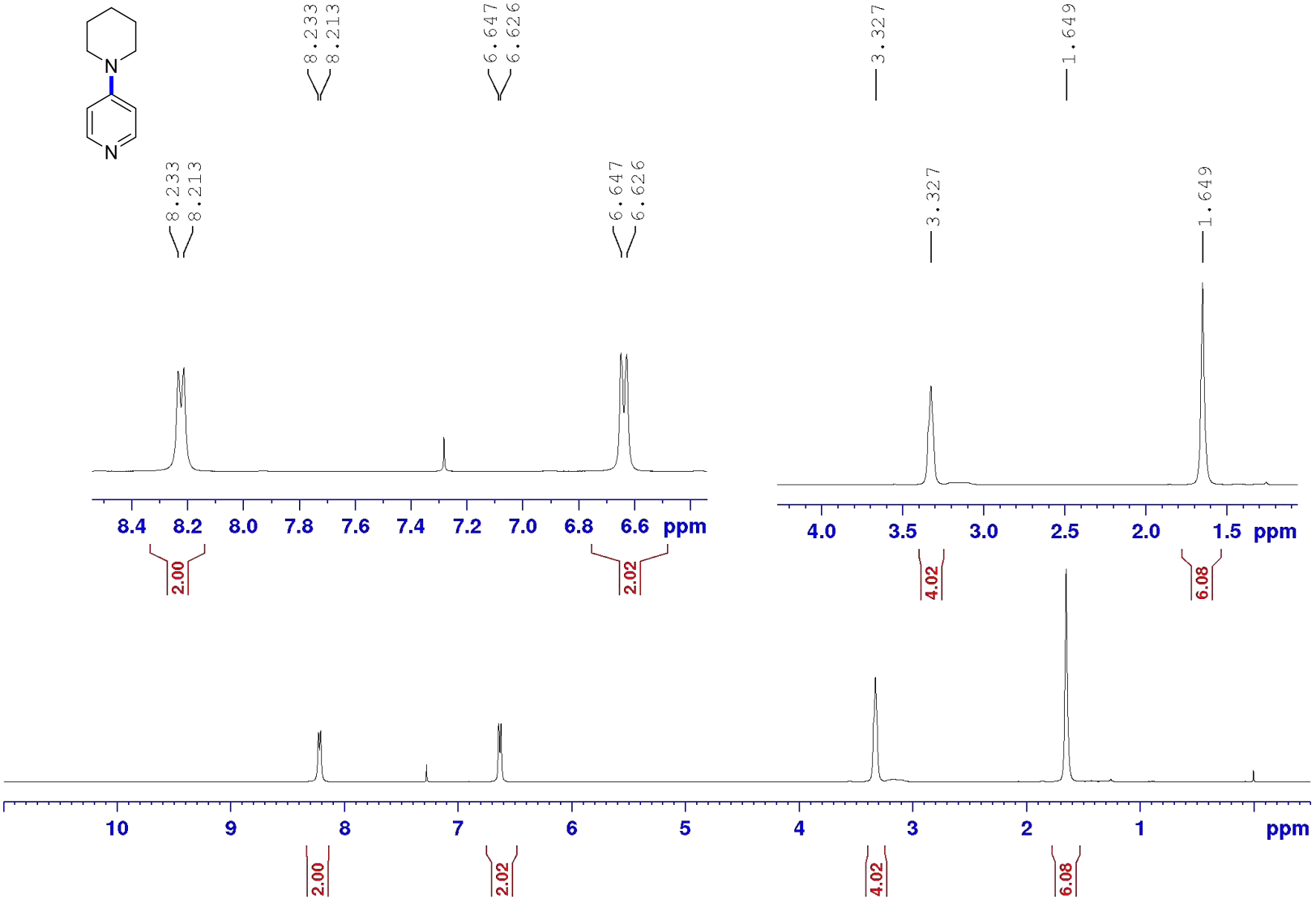
^{1}H NMR Spectrum of **3ba** (300 MHz, $CDCl_3$)



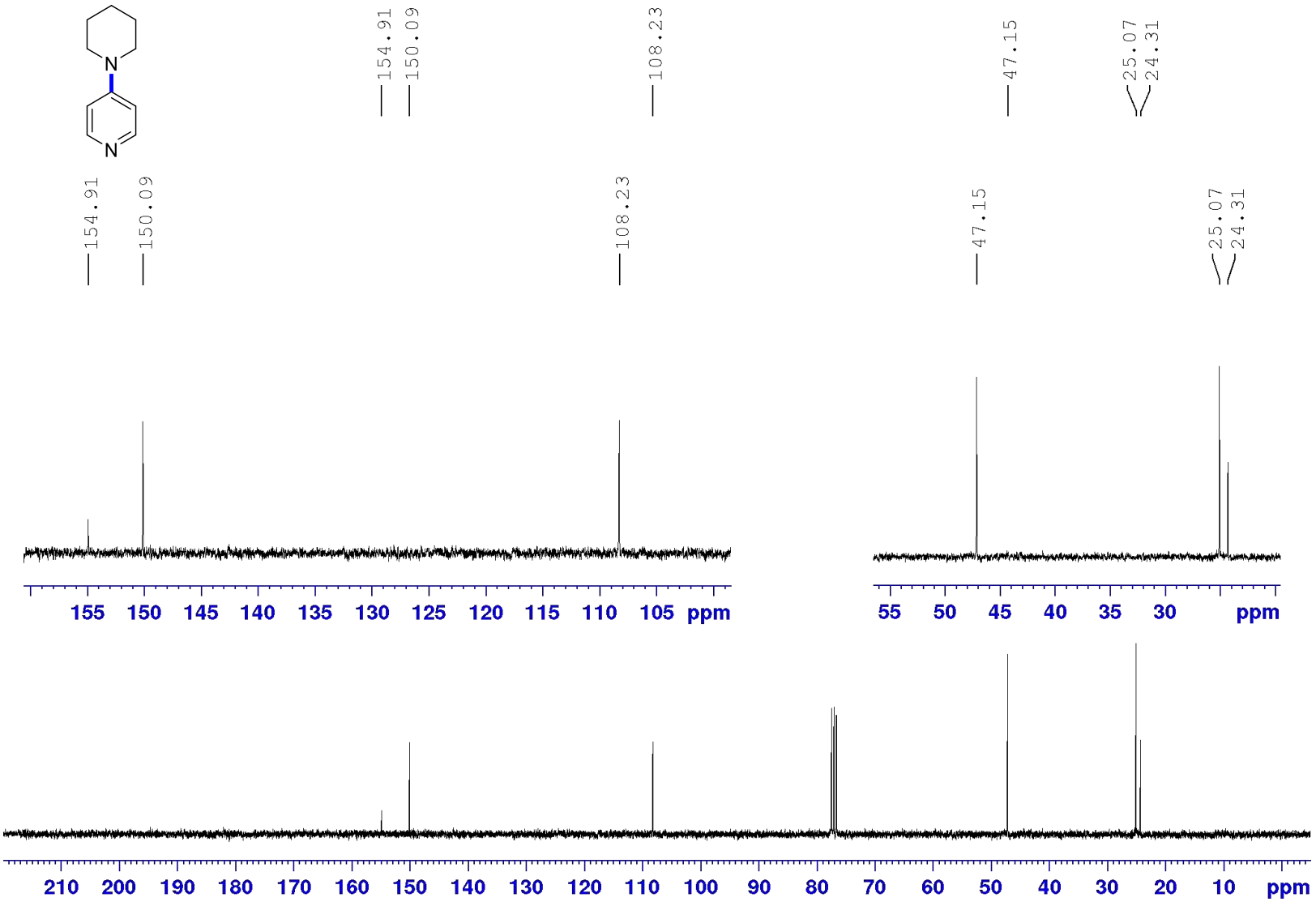
^{13}C NMR Spectrum of **3ba** (75 MHz, $CDCl_3$)



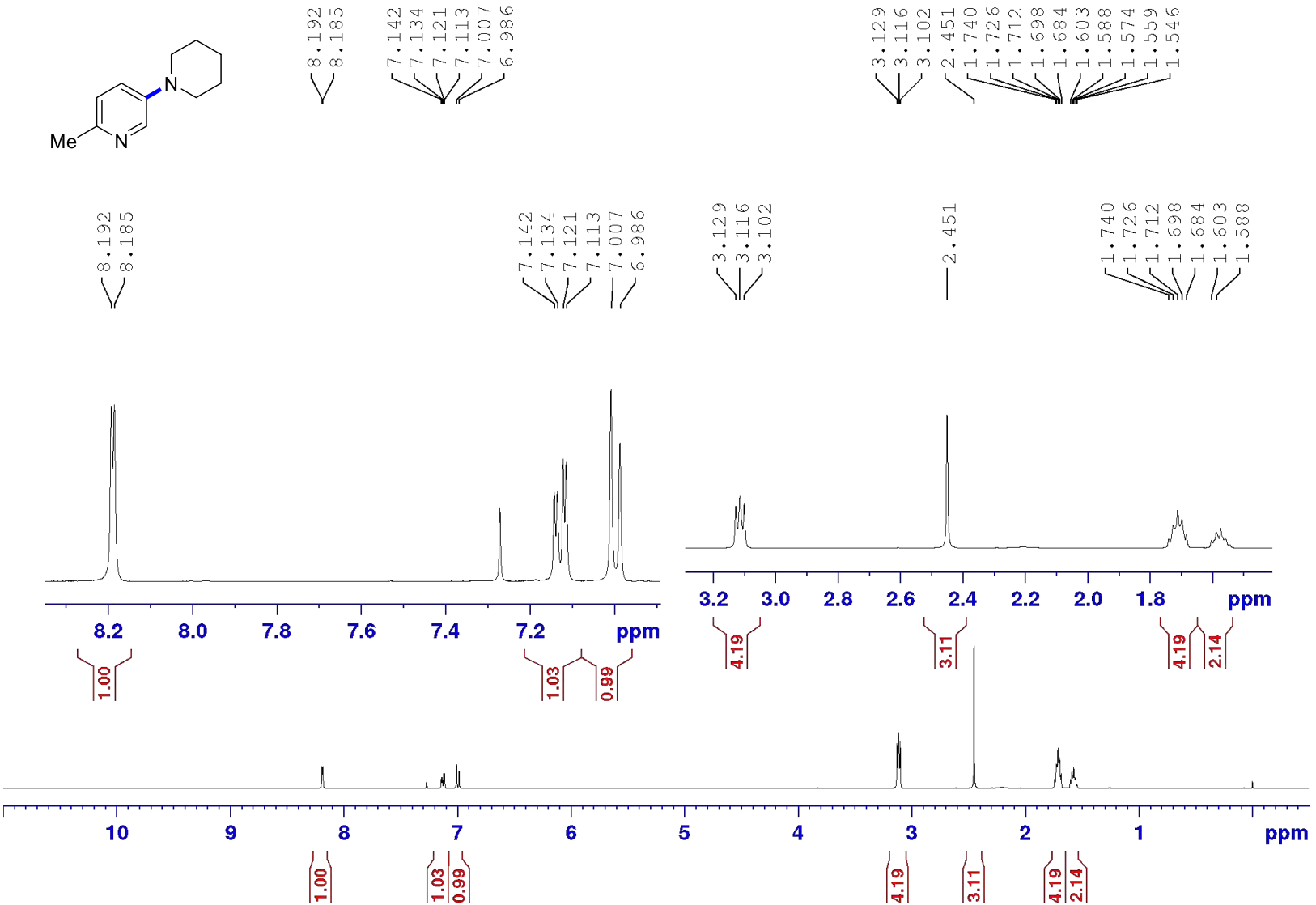
^{1}H NMR Spectrum of **3ca** (300 MHz, $CDCl_3$)



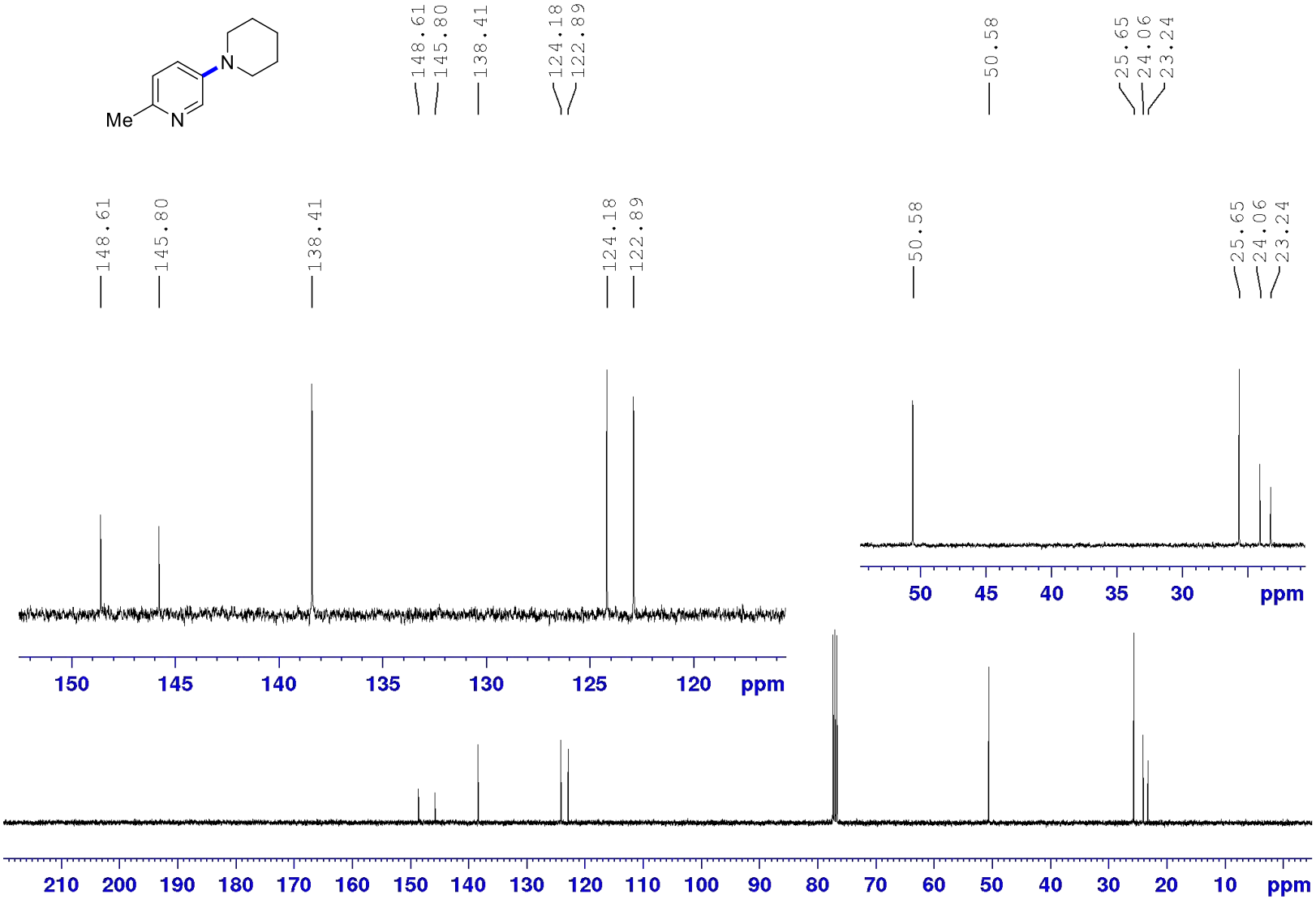
^{13}C NMR Spectrum of **3ca** (75 MHz, $CDCl_3$)



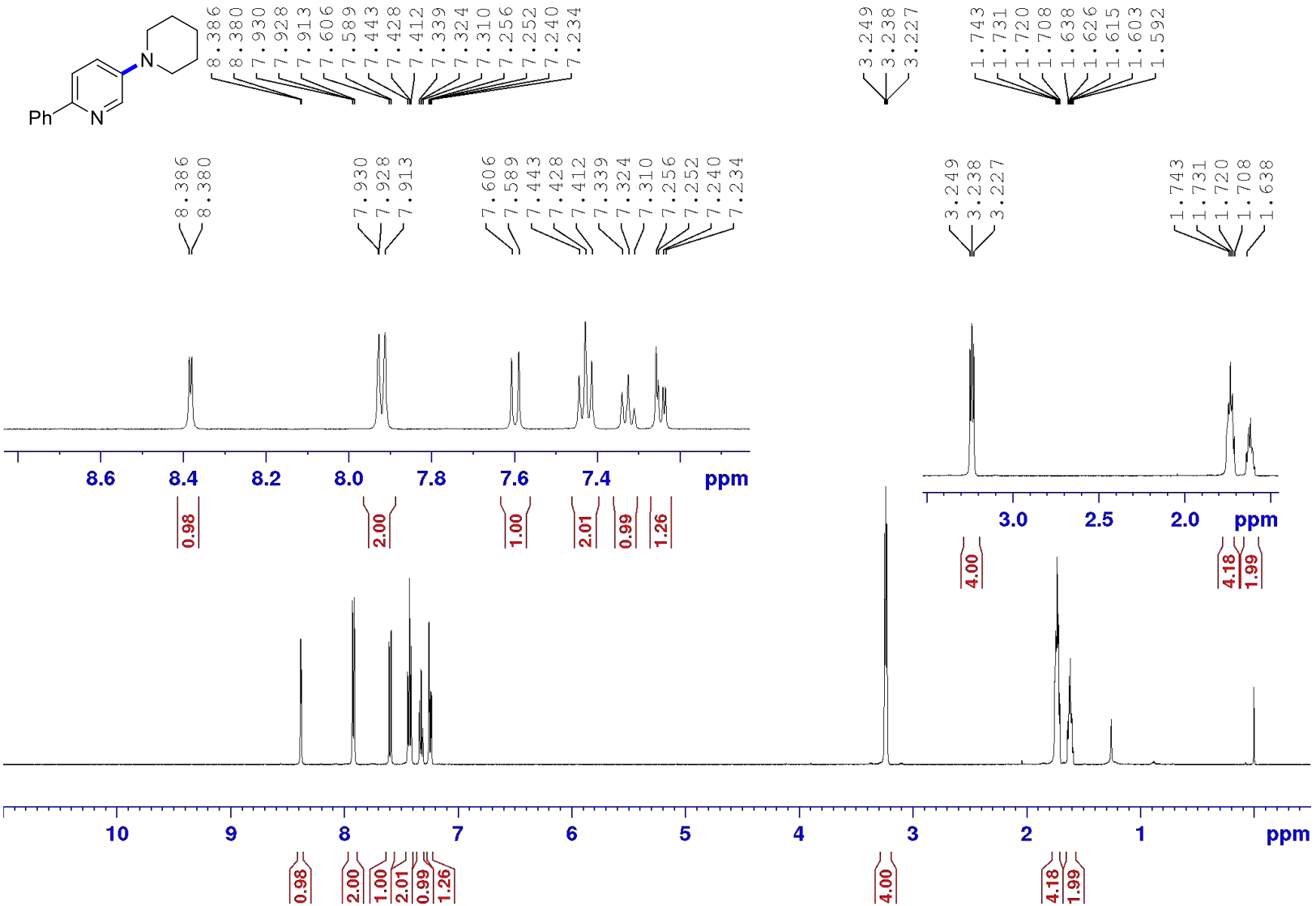
^{1}H NMR Spectrum of **3da** (400 MHz, $CDCl_3$)



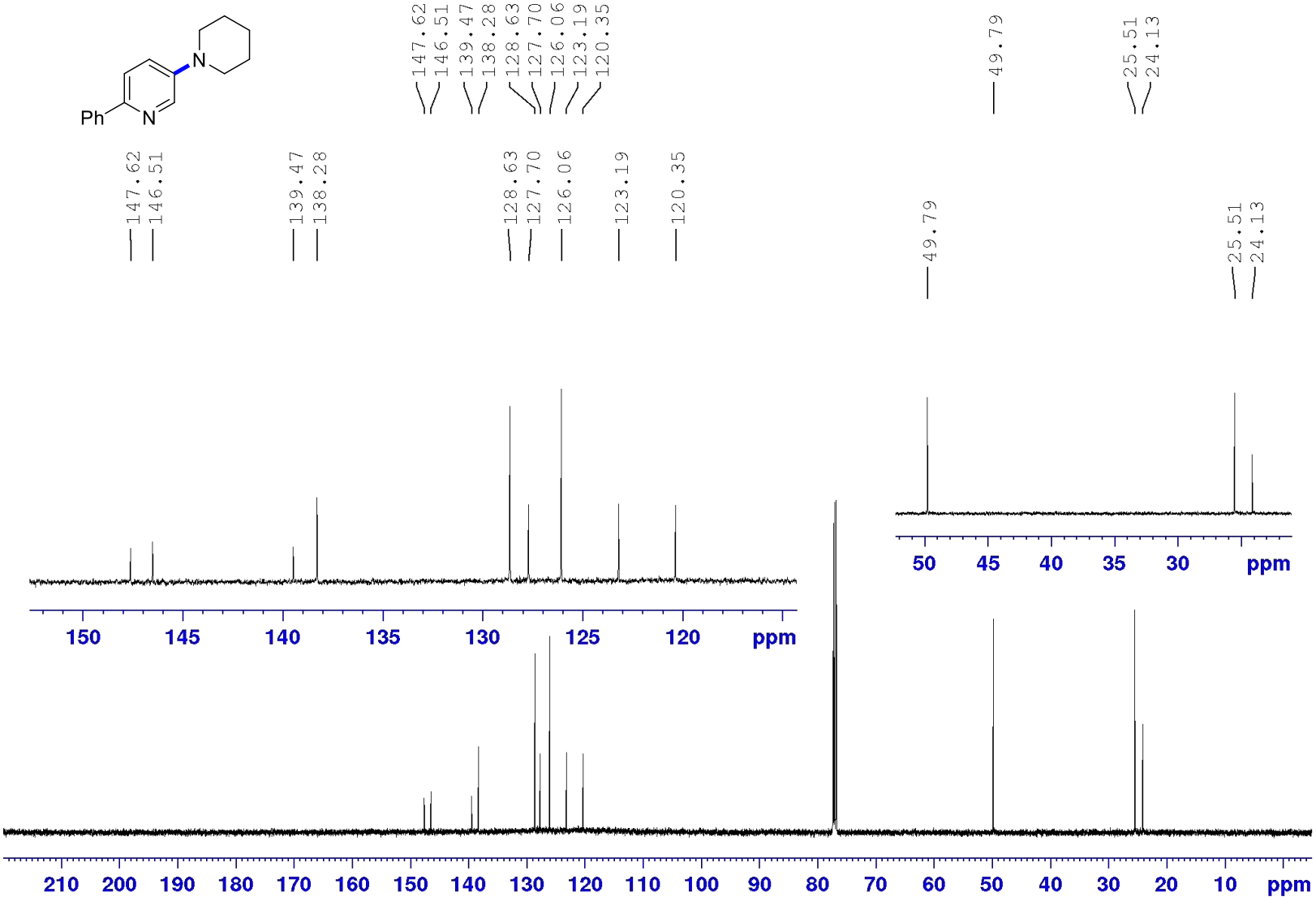
^{13}C NMR Spectrum of **3da** (100 MHz, $CDCl_3$)



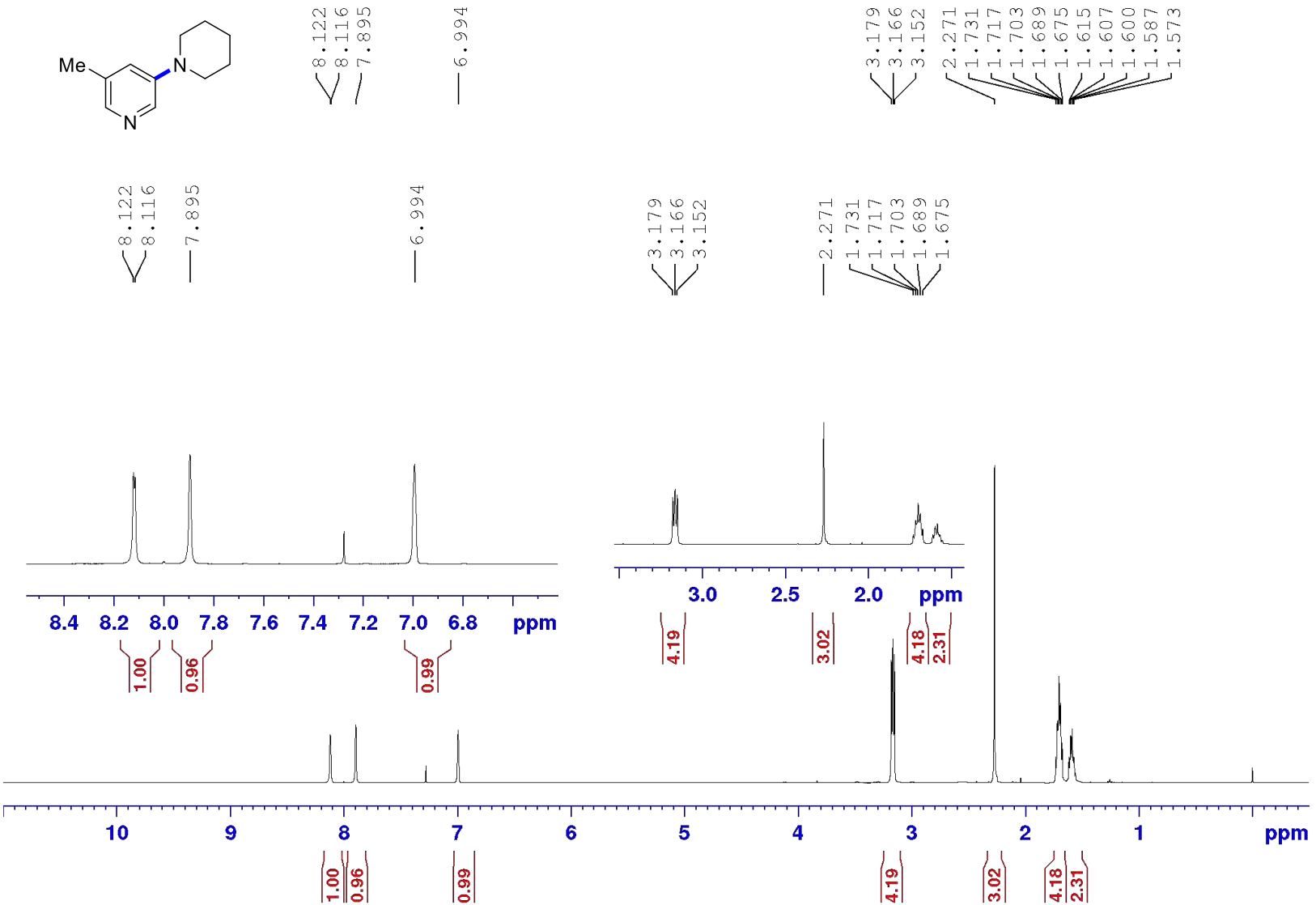
^{1}H NMR Spectrum of **3ea** (500 MHz, $CDCl_3$)



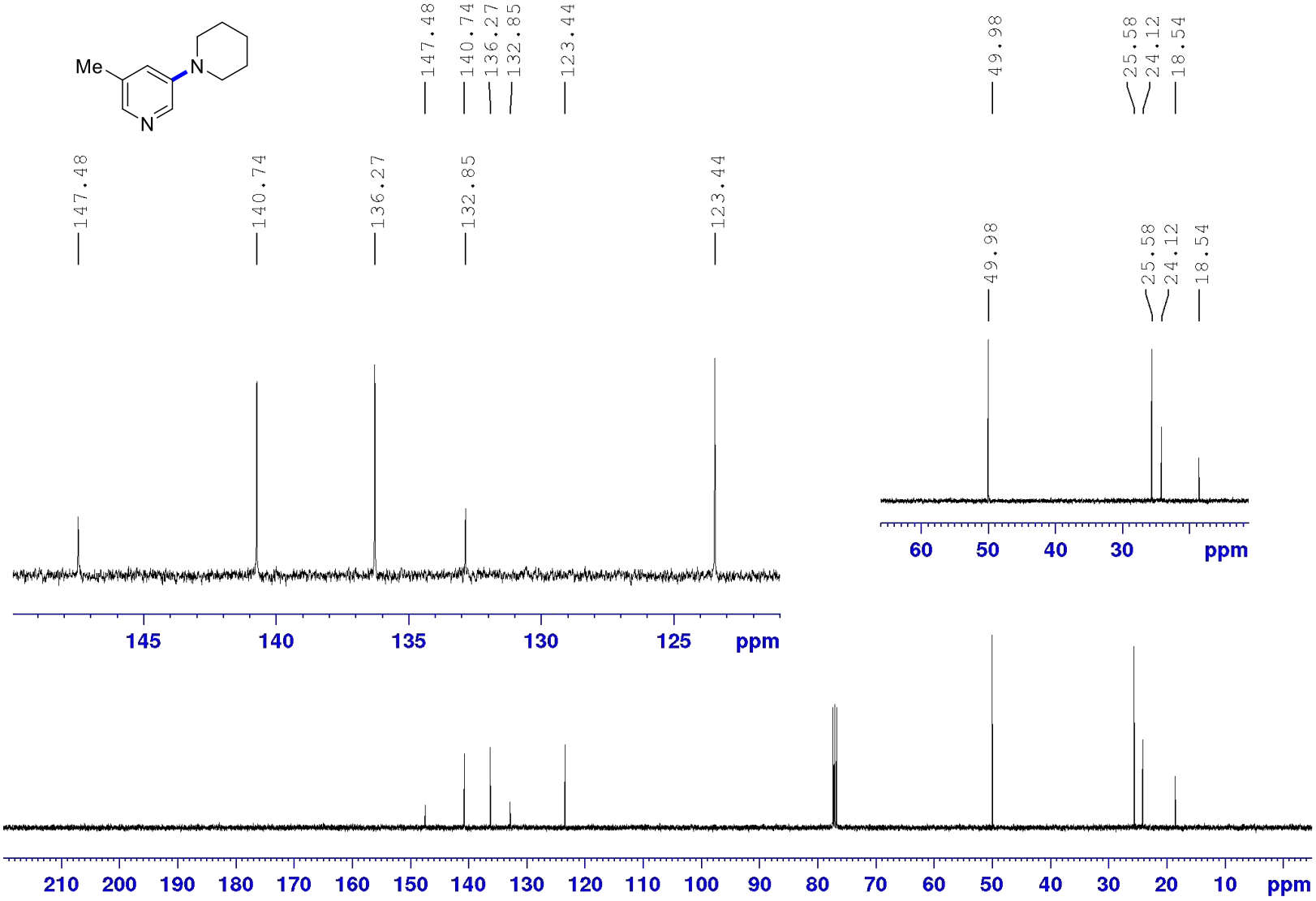
^{13}C NMR Spectrum of **3ea** (125 MHz, $CDCl_3$)



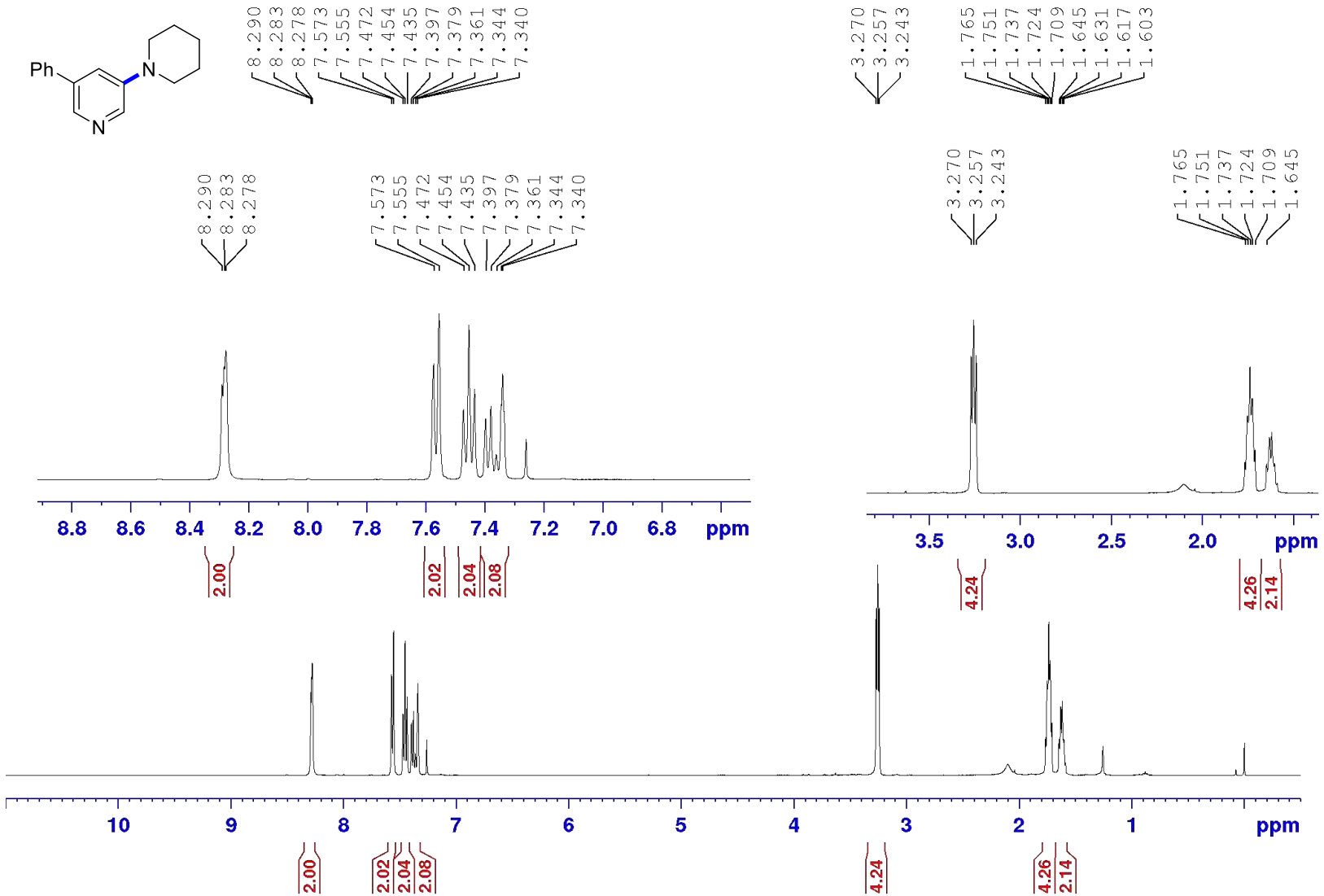
^{1}H NMR Spectrum of **3fa** (400 MHz, $CDCl_3$)



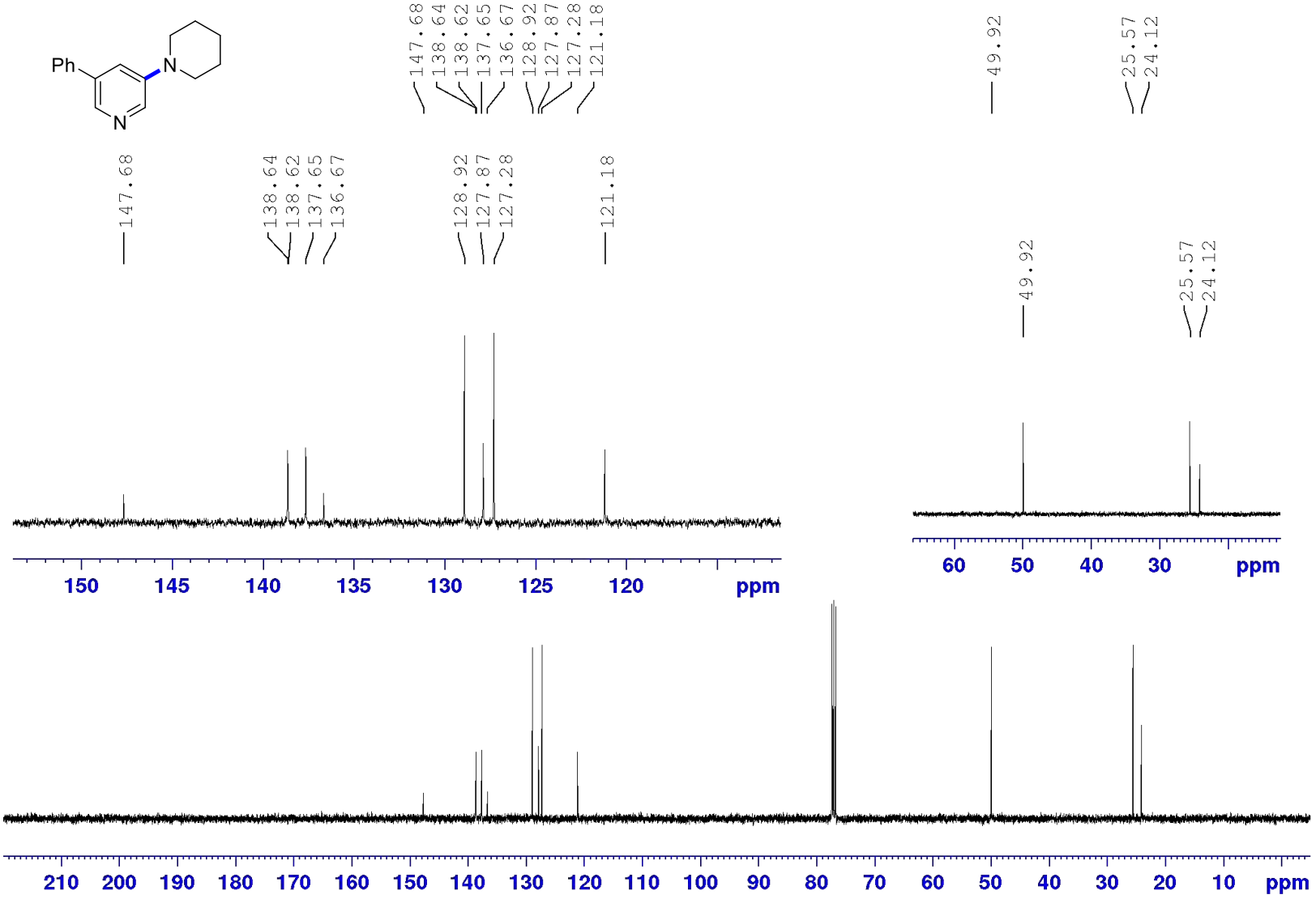
^{13}C NMR Spectrum of **3fa** (100 MHz, $CDCl_3$)



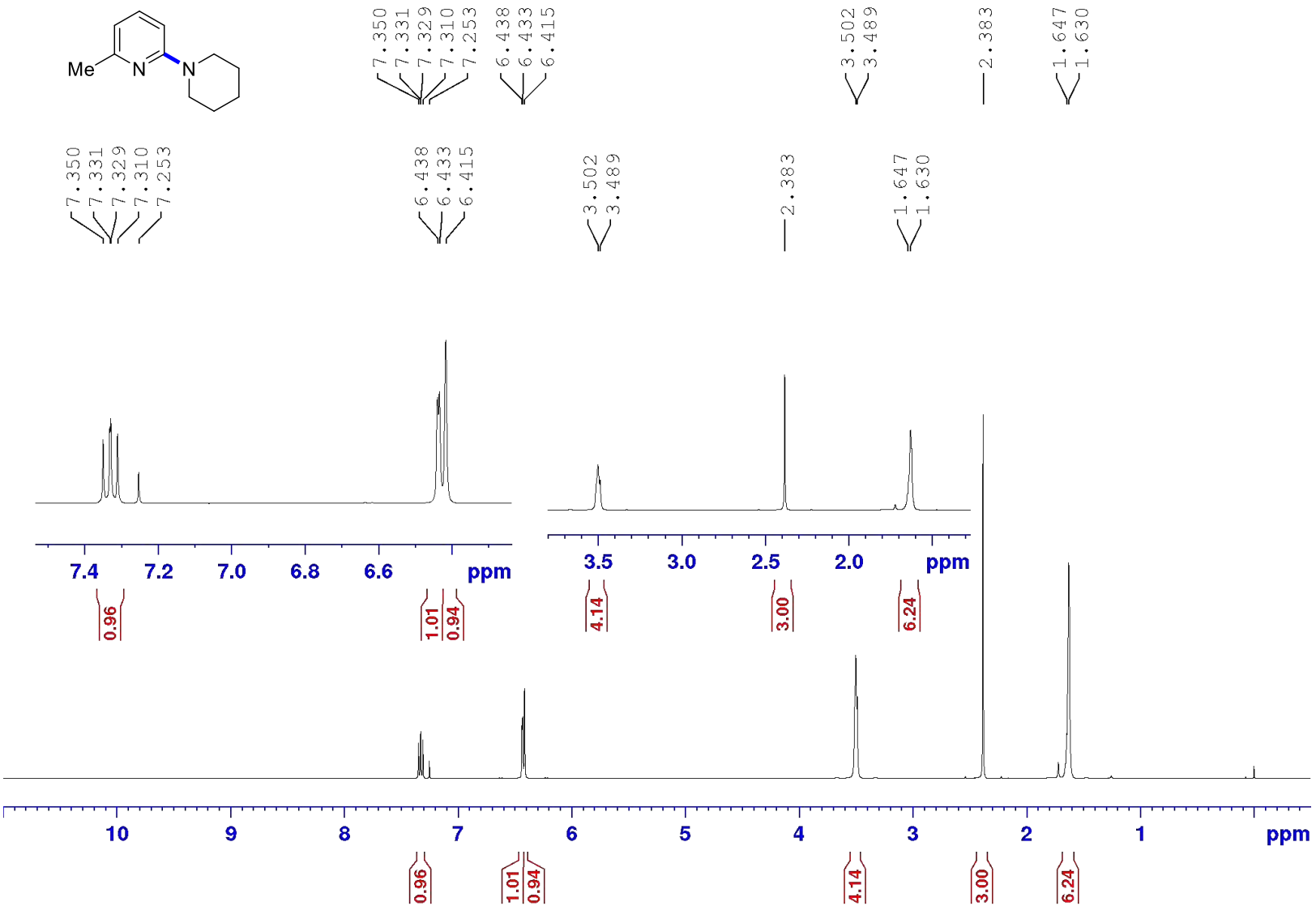
^{1}H NMR Spectrum of **3ga** (400 MHz, $CDCl_3$)



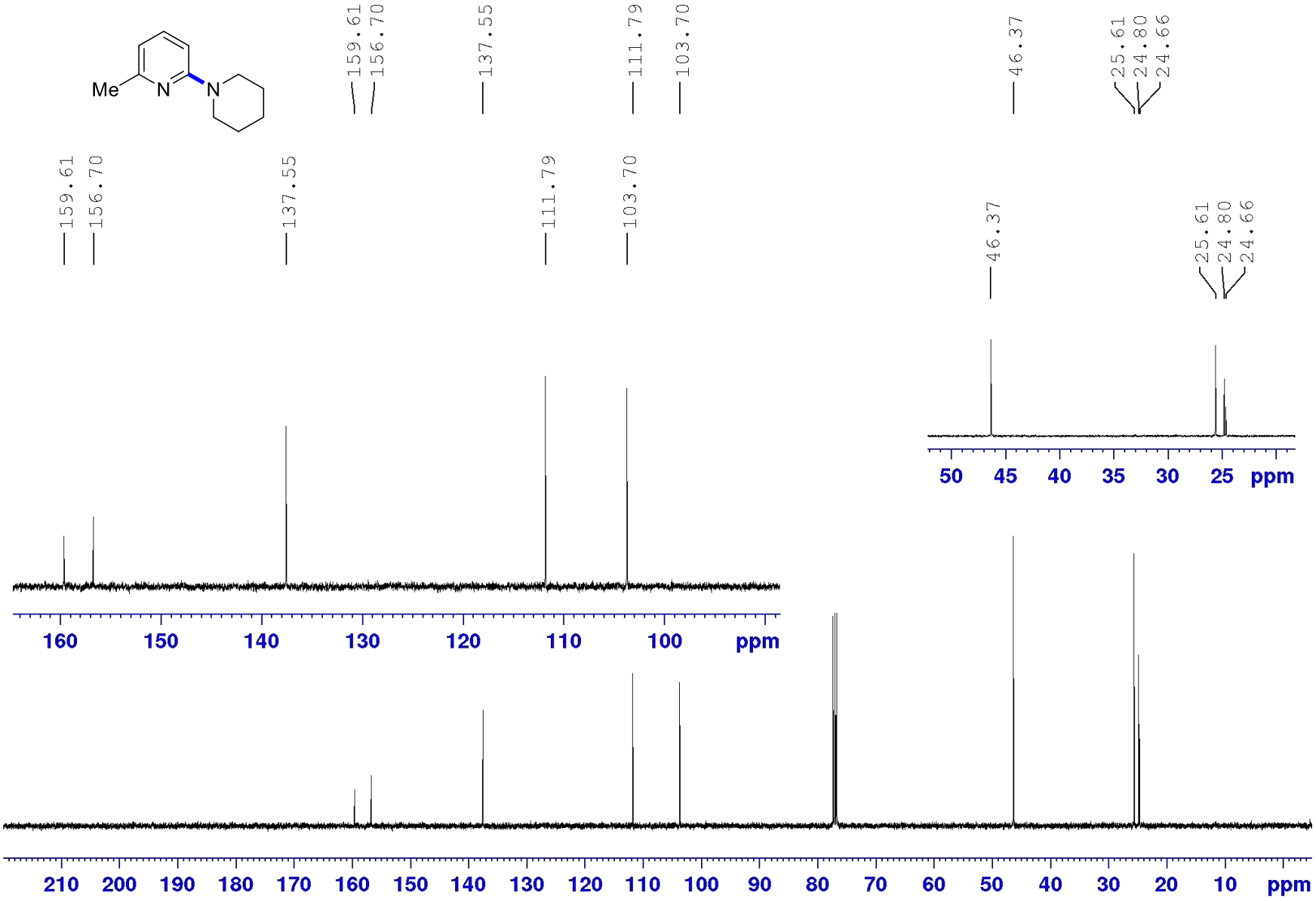
^{13}C NMR Spectrum of **3ga** (100 MHz, $CDCl_3$)



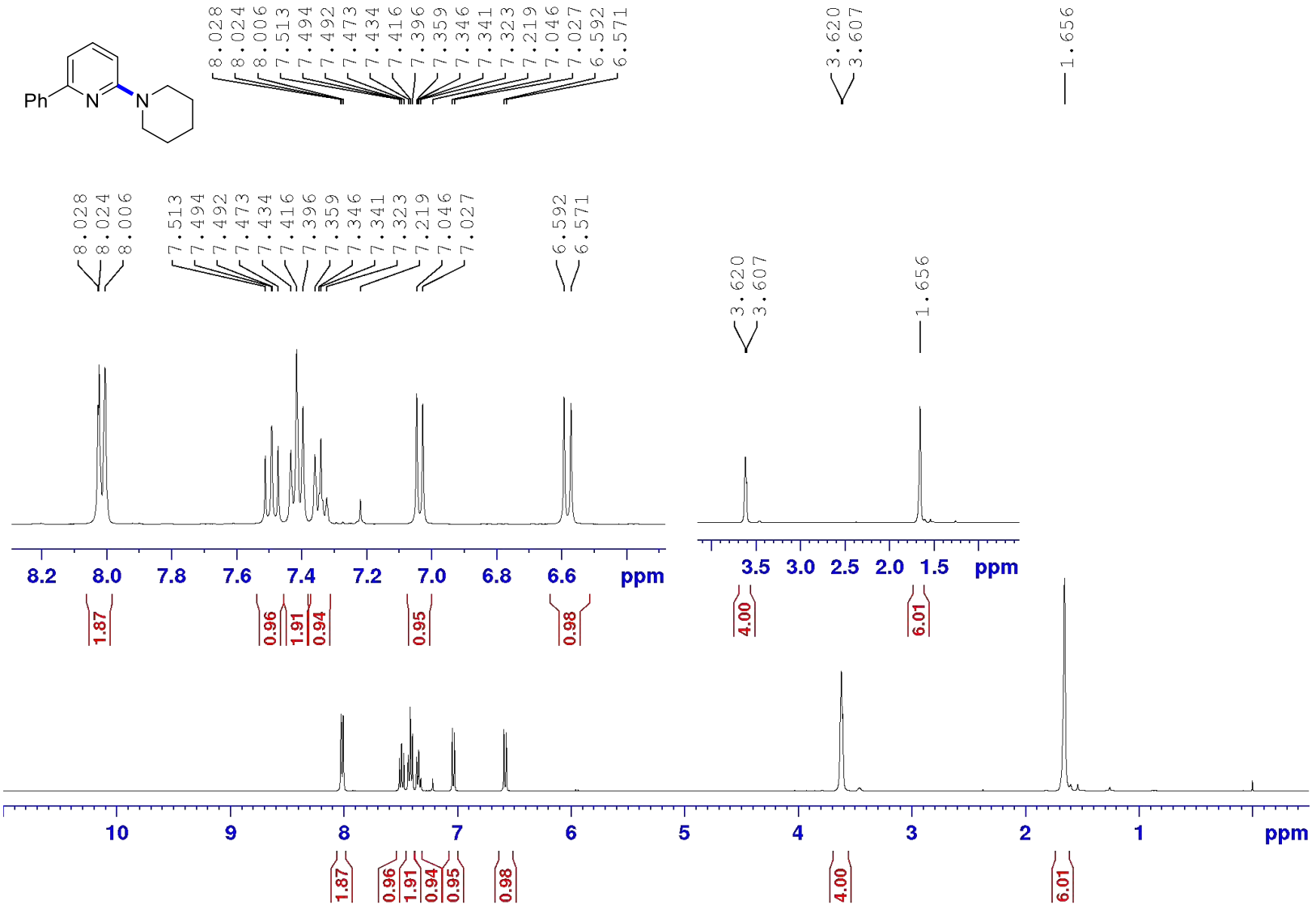
^{1}H NMR Spectrum of **3ha** (400 MHz, $CDCl_3$)



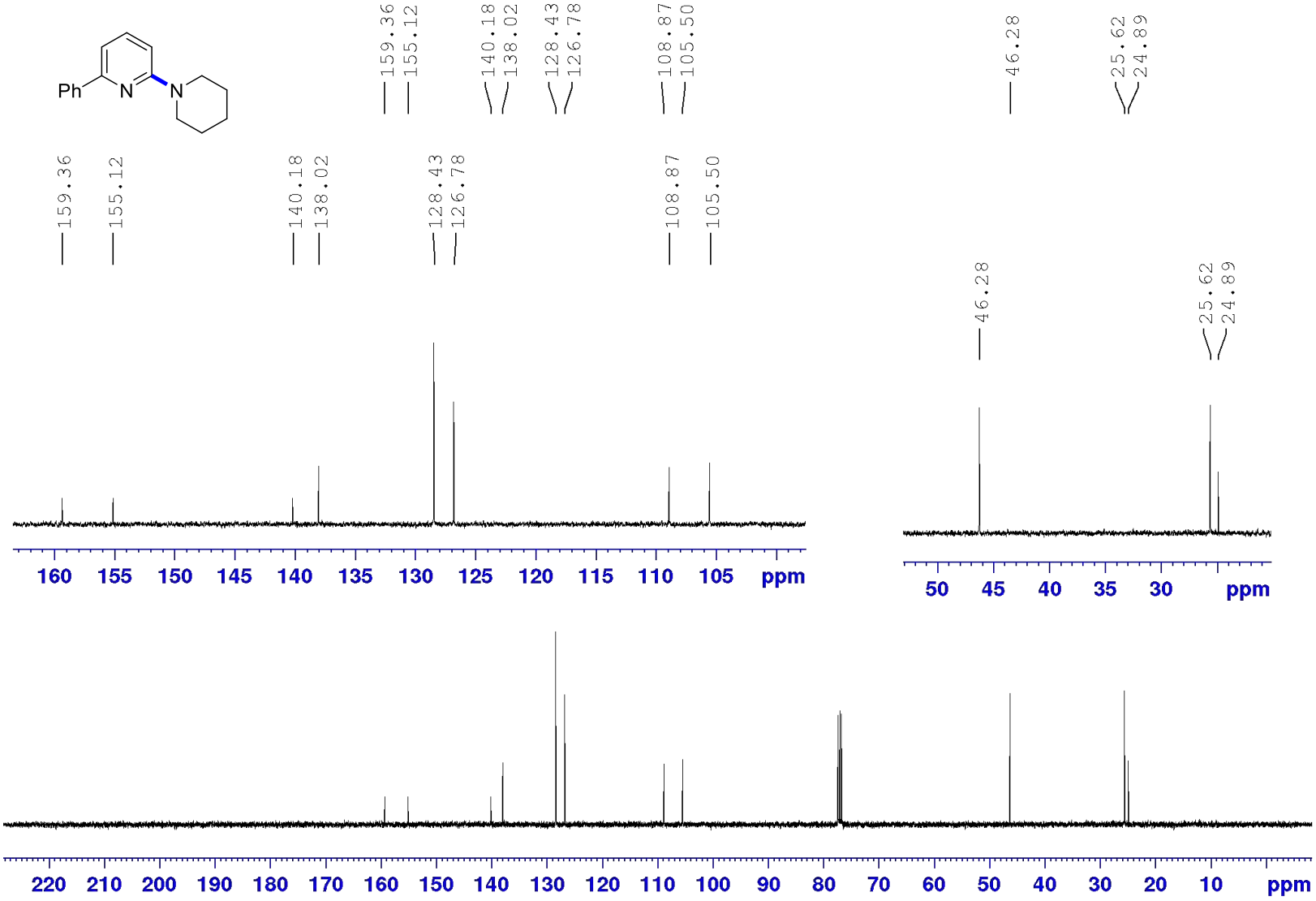
^{13}C NMR Spectrum of **3ha** (100 MHz, $CDCl_3$)



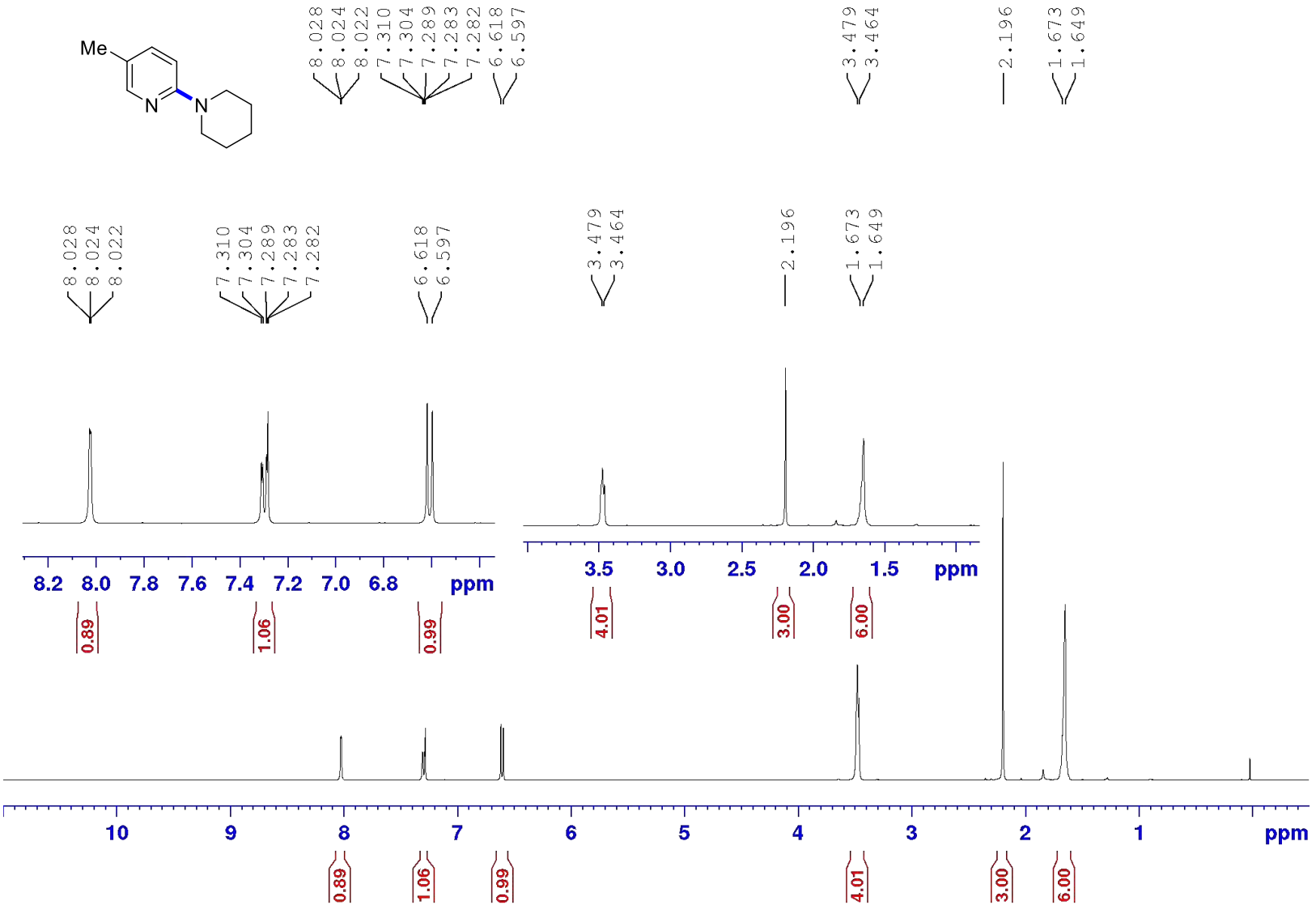
^{1}H NMR Spectrum of **3ia** (400 MHz, $CDCl_3$)



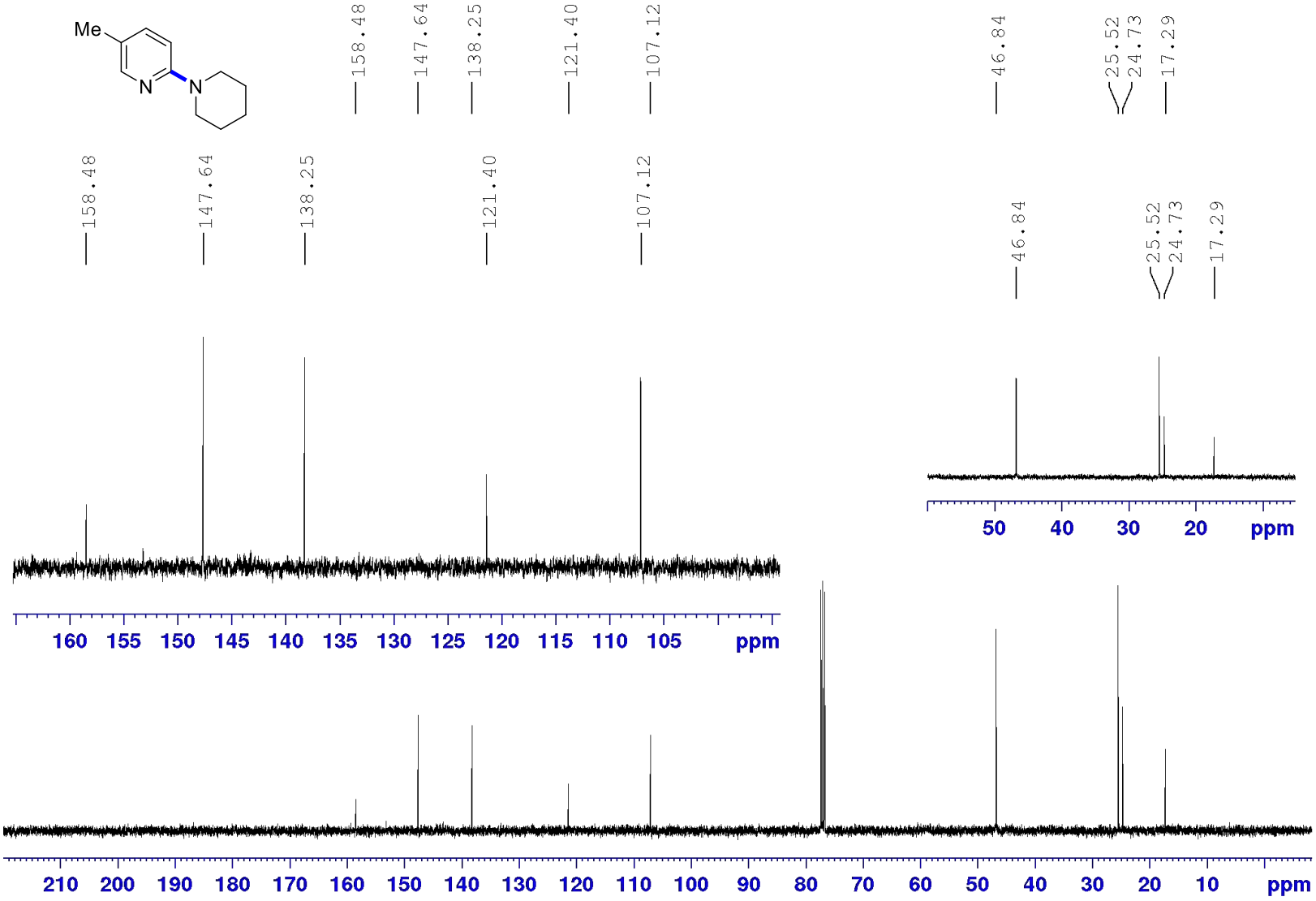
^{13}C NMR Spectrum of **3ia** (100 MHz, $CDCl_3$)



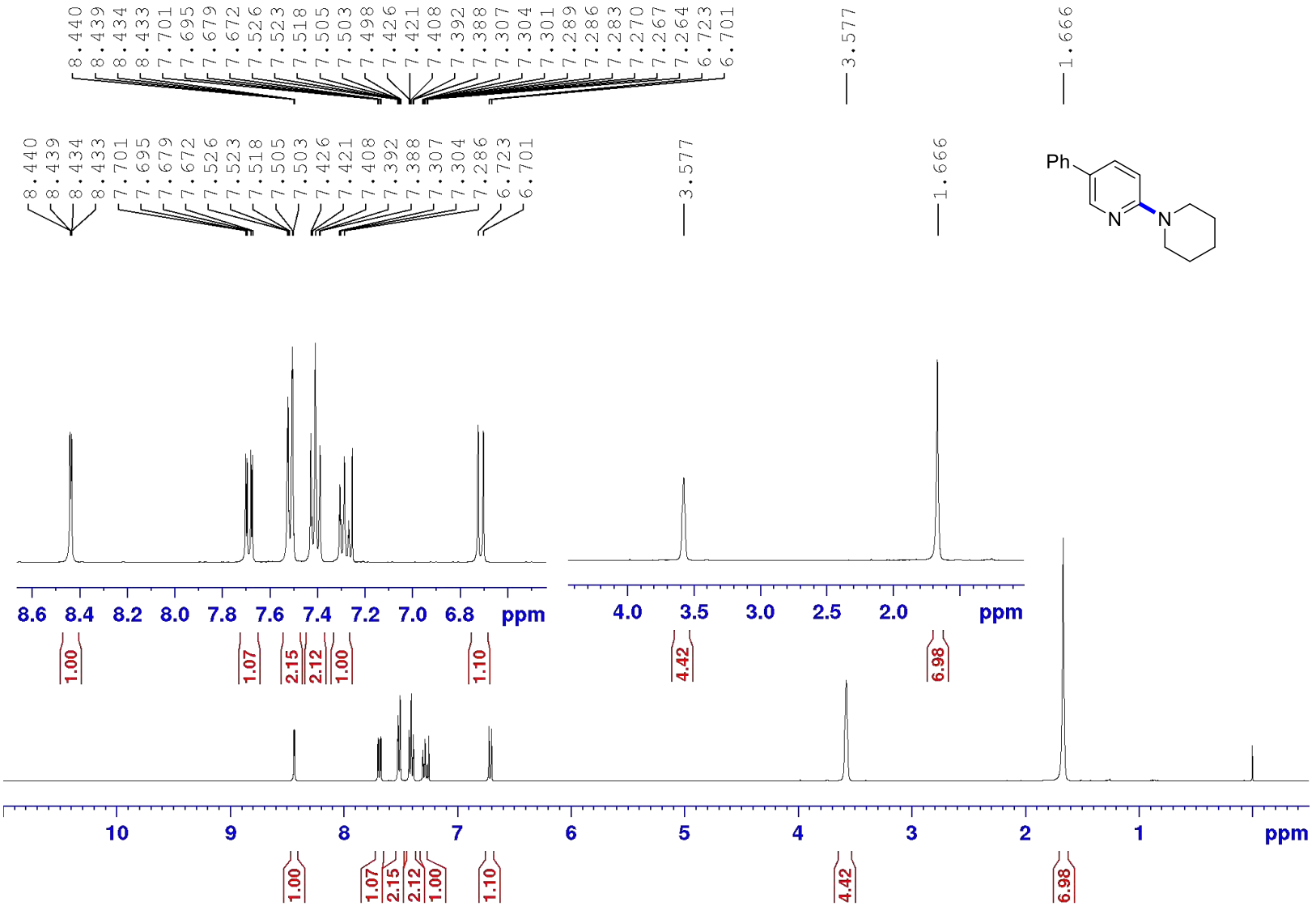
^{1}H NMR Spectrum of **3ja** (400 MHz, $CDCl_3$)



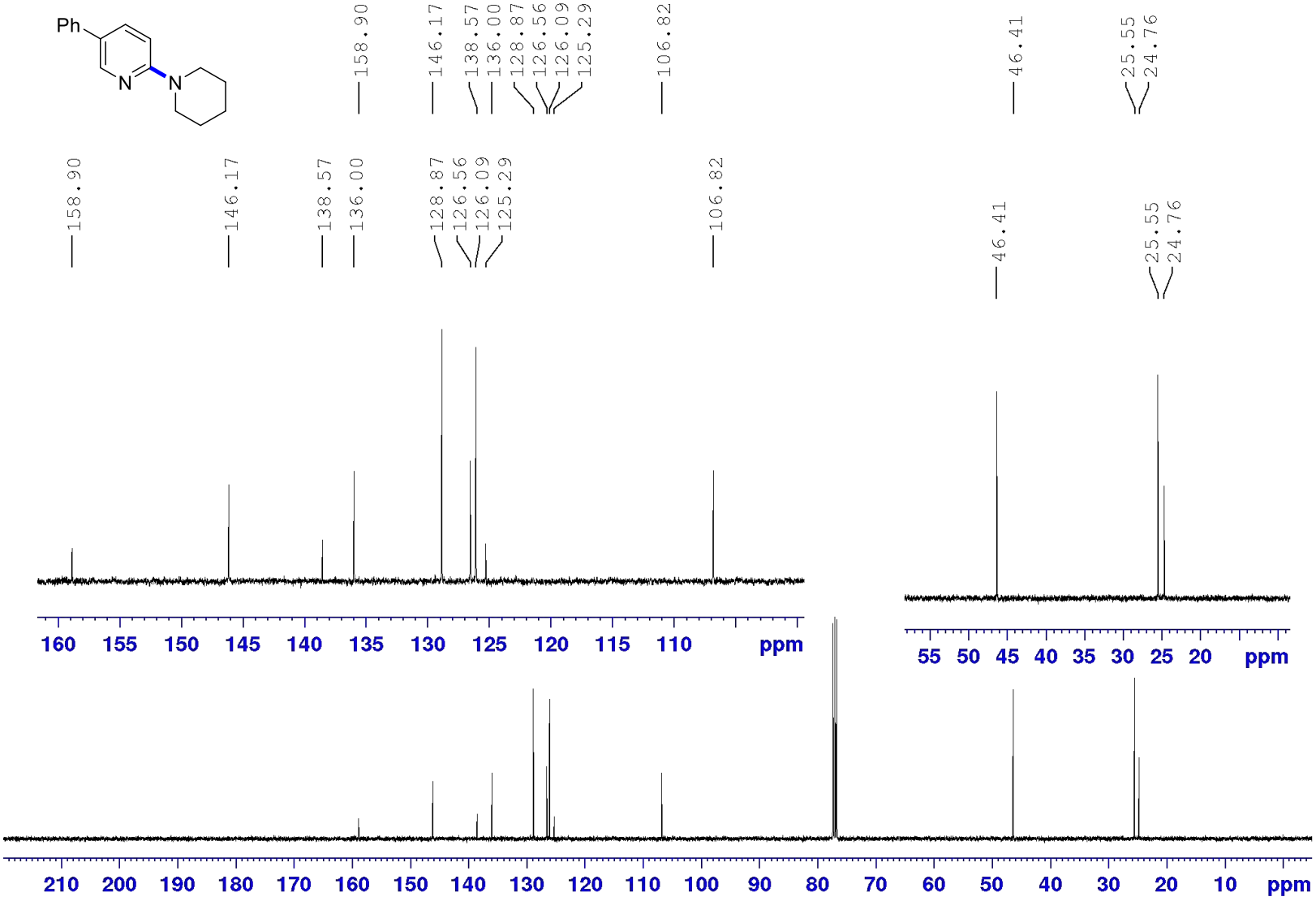
^{13}C NMR Spectrum of **3ja** (100 MHz, $CDCl_3$)



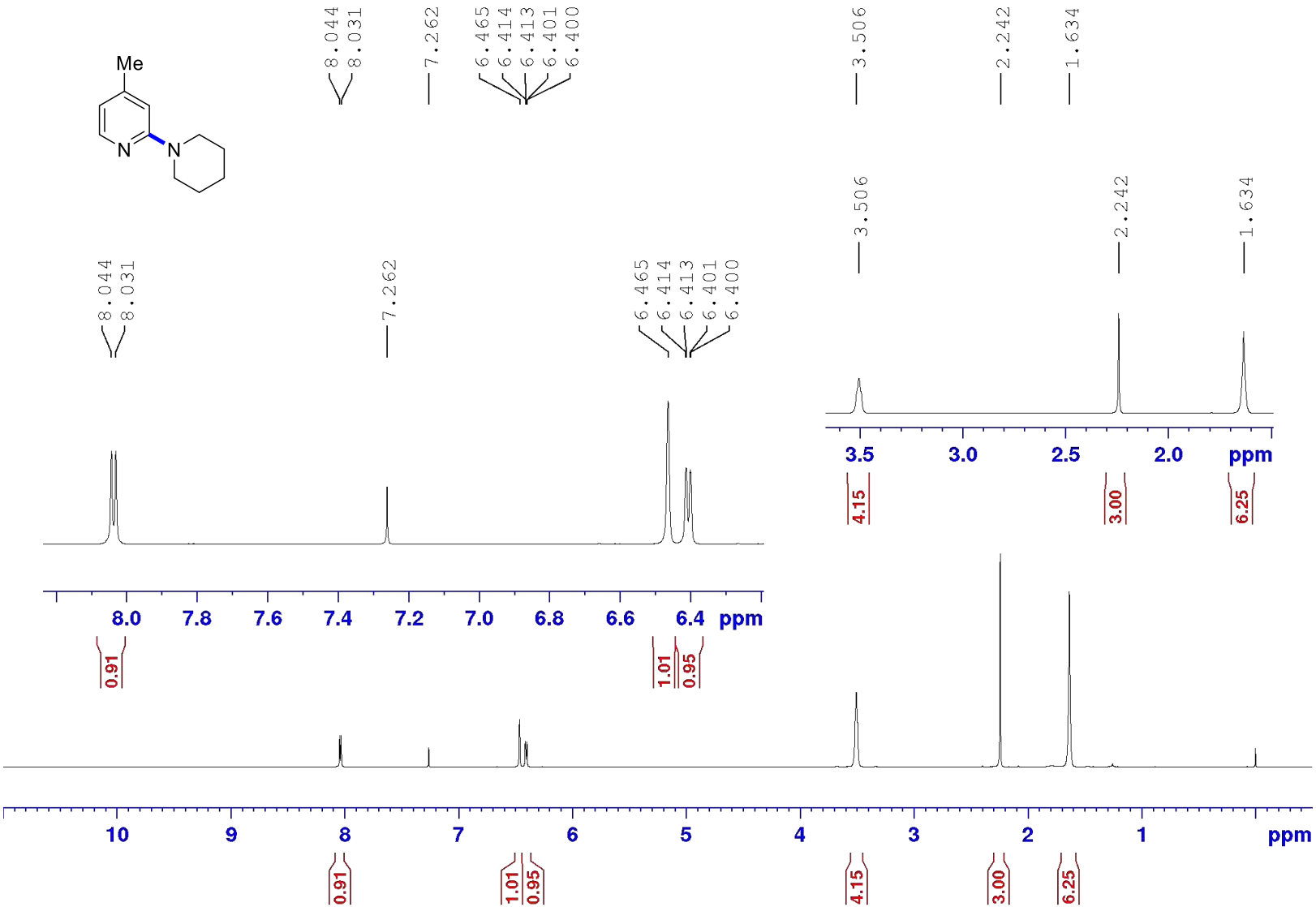
^{1}H NMR Spectrum of **3ka** (400 MHz, $CDCl_3$)



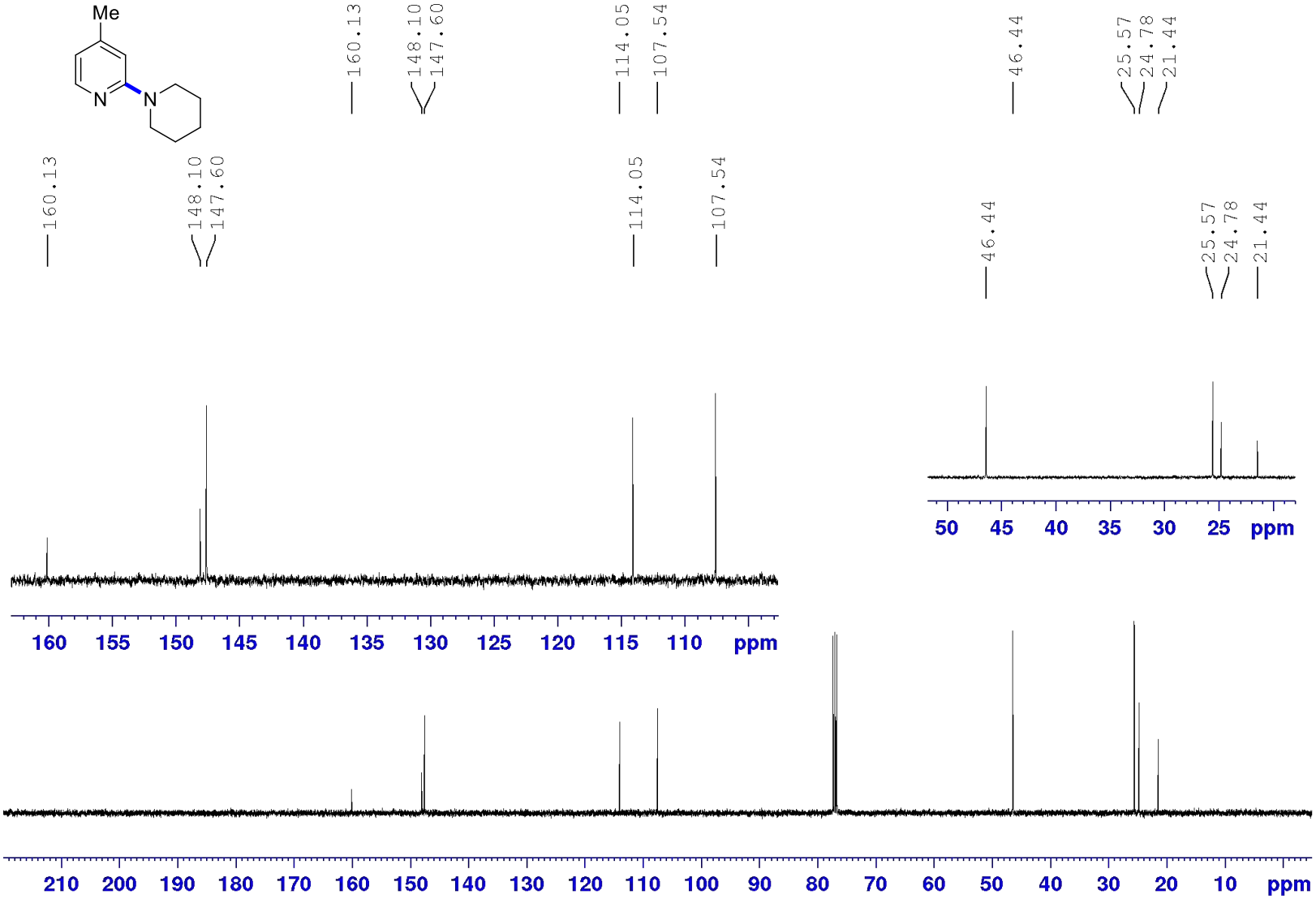
^{13}C NMR Spectrum of **3ka** (100 MHz, $CDCl_3$)



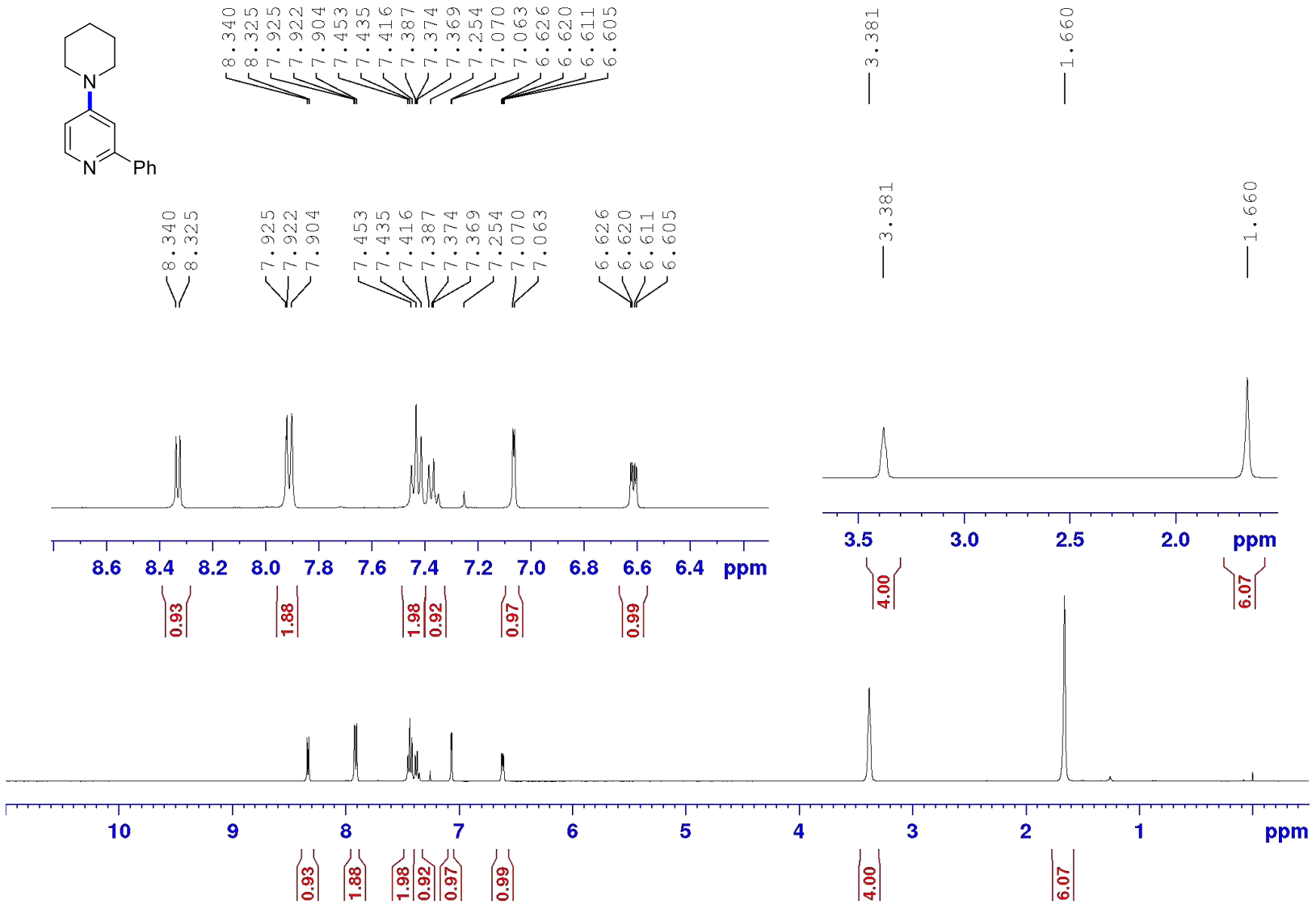
^{1}H NMR Spectrum of **3la** (400 MHz, $CDCl_3$)



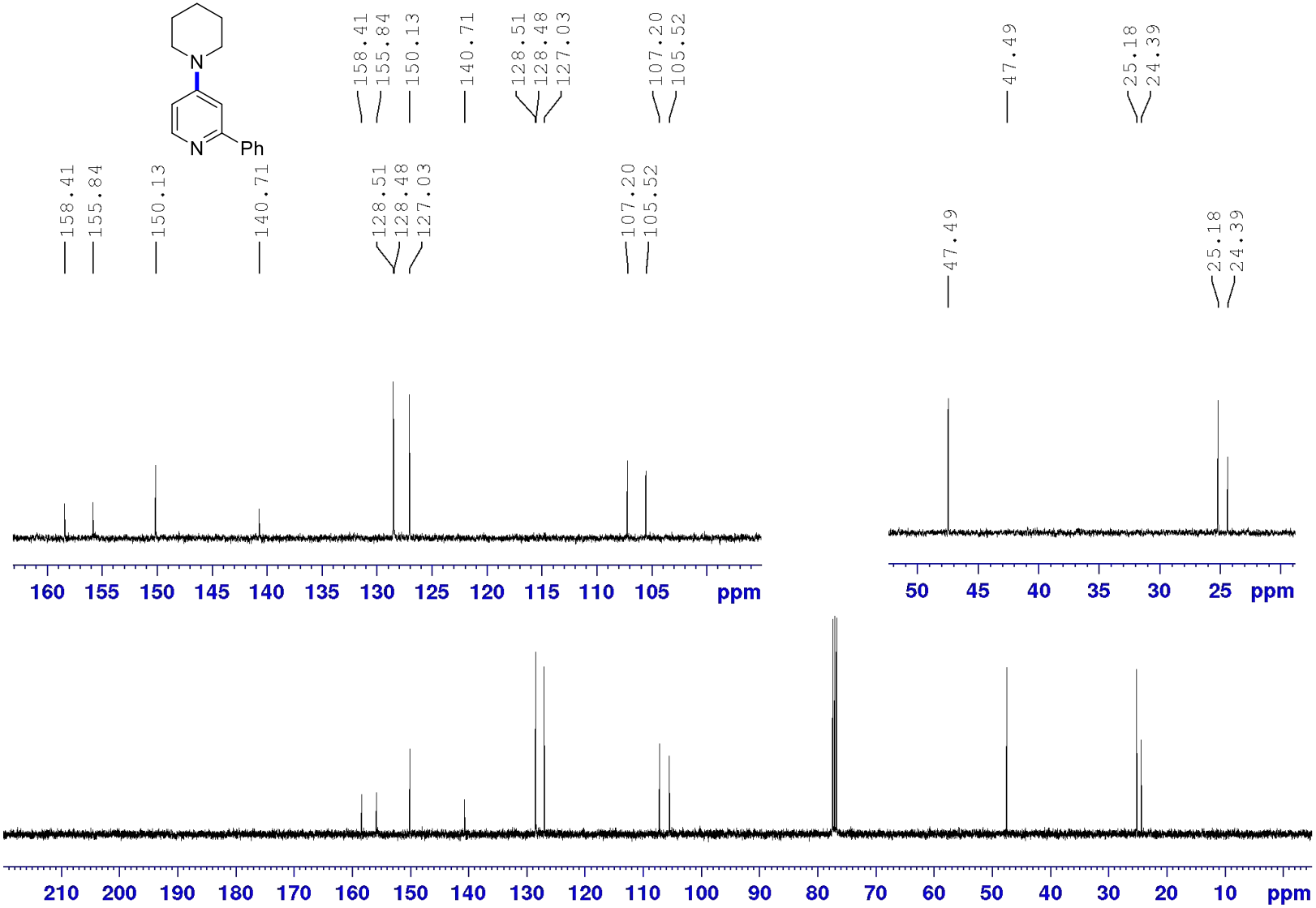
^{13}C NMR Spectrum of **3la** (100 MHz, $CDCl_3$)



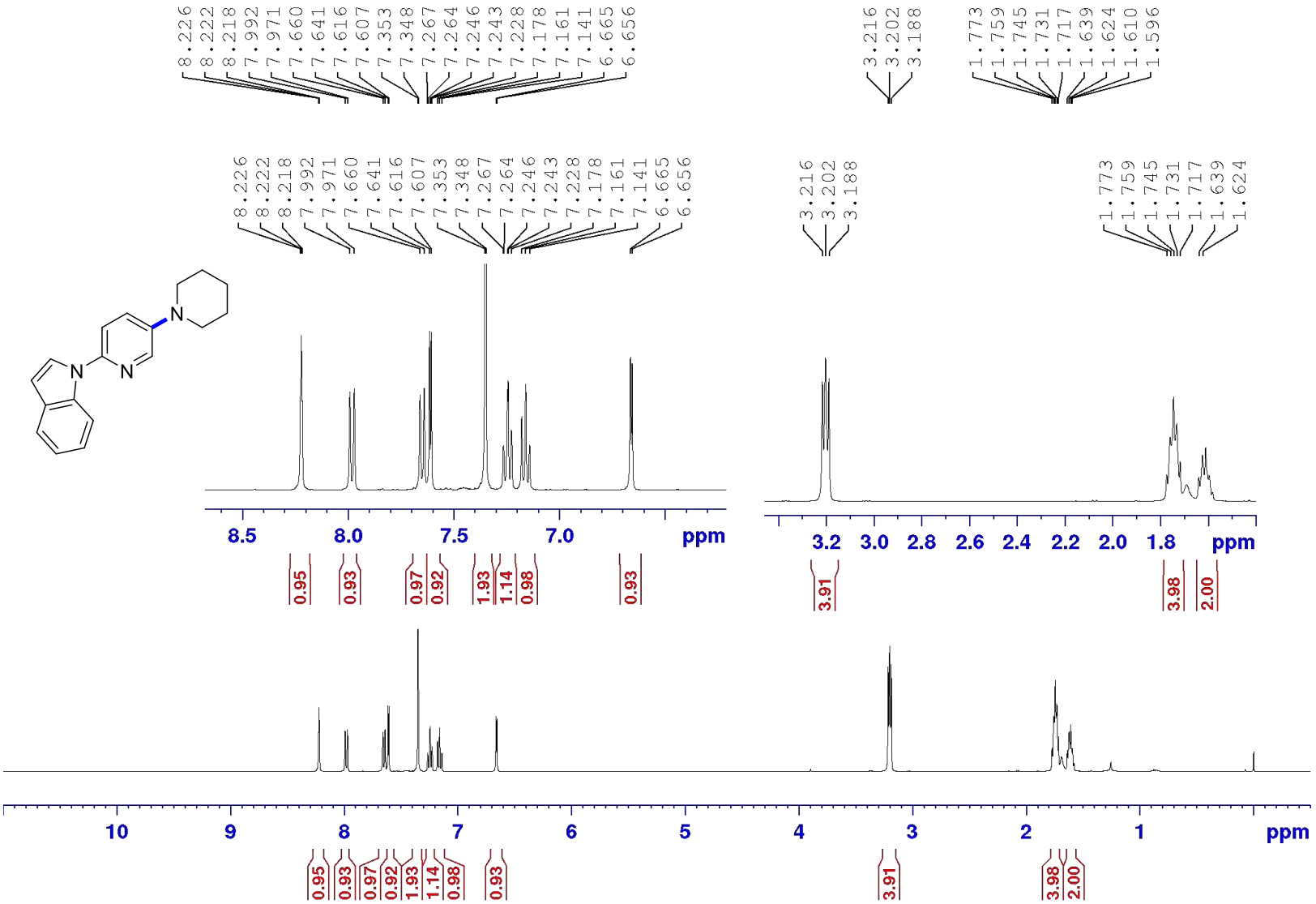
^{1}H NMR Spectrum of **3ma** (400 MHz, $CDCl_3$)



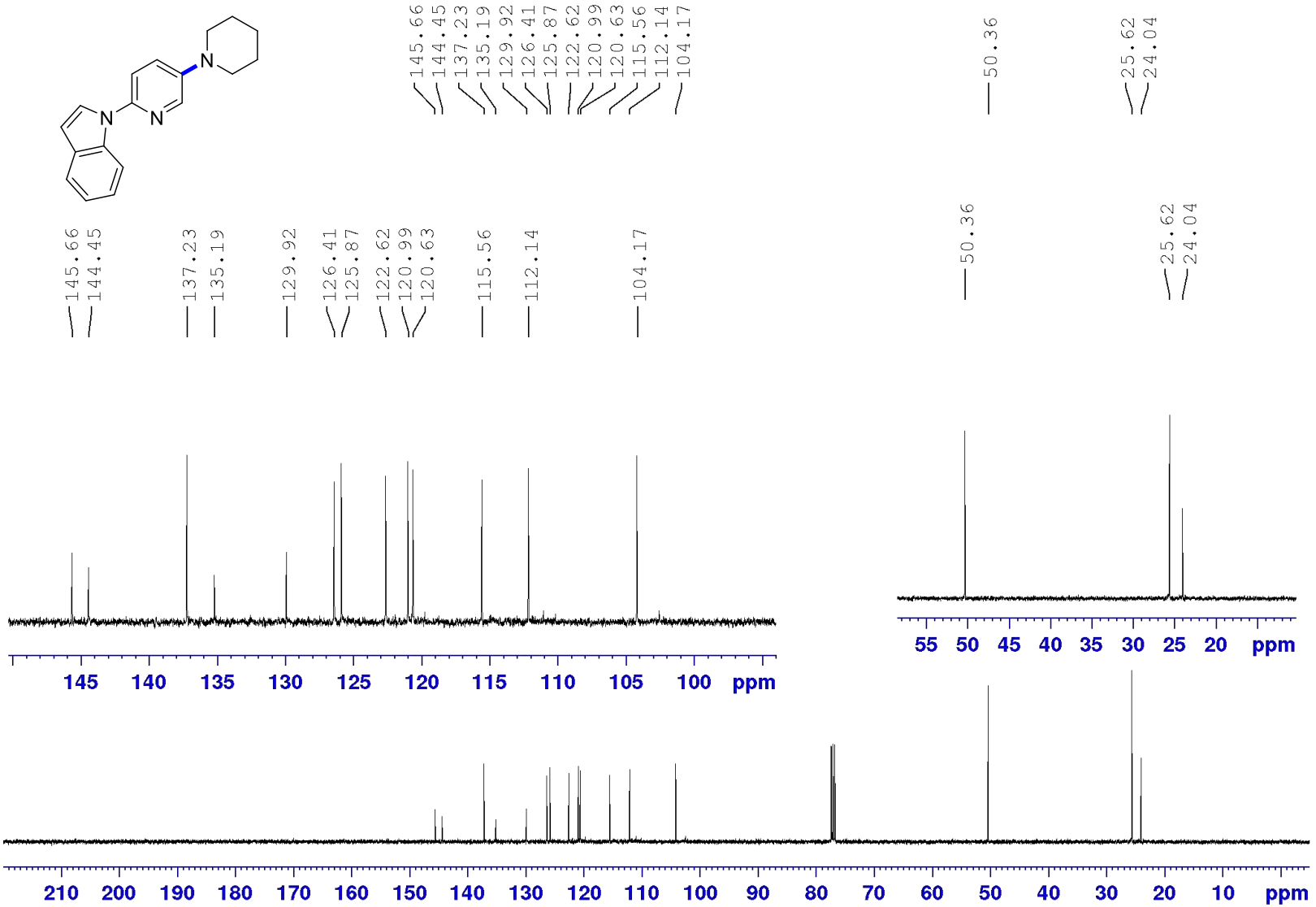
^{13}C NMR Spectrum of **3ma** (100 MHz, $CDCl_3$)



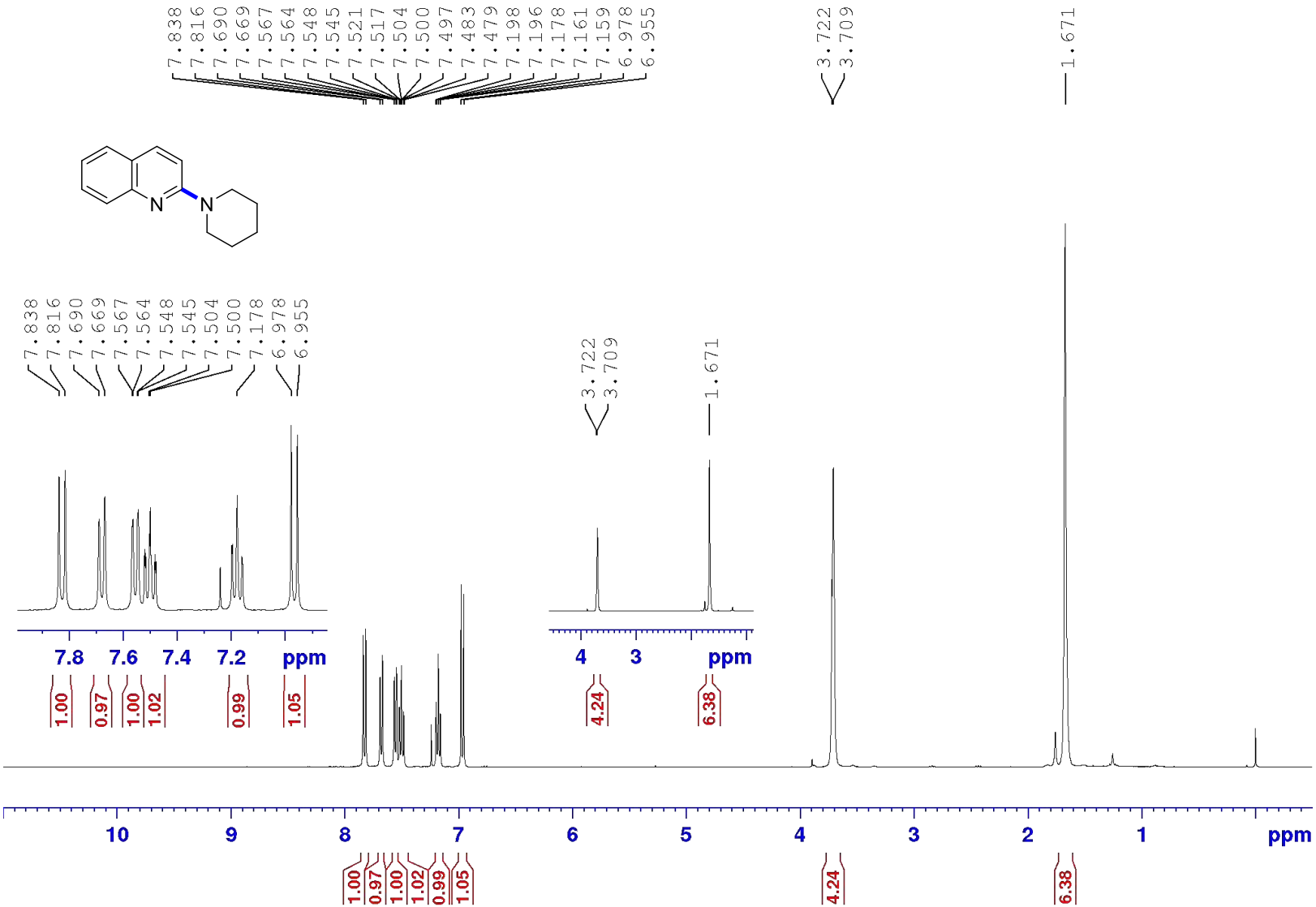
^{1}H NMR Spectrum of **3na** (400 MHz, $CDCl_3$)



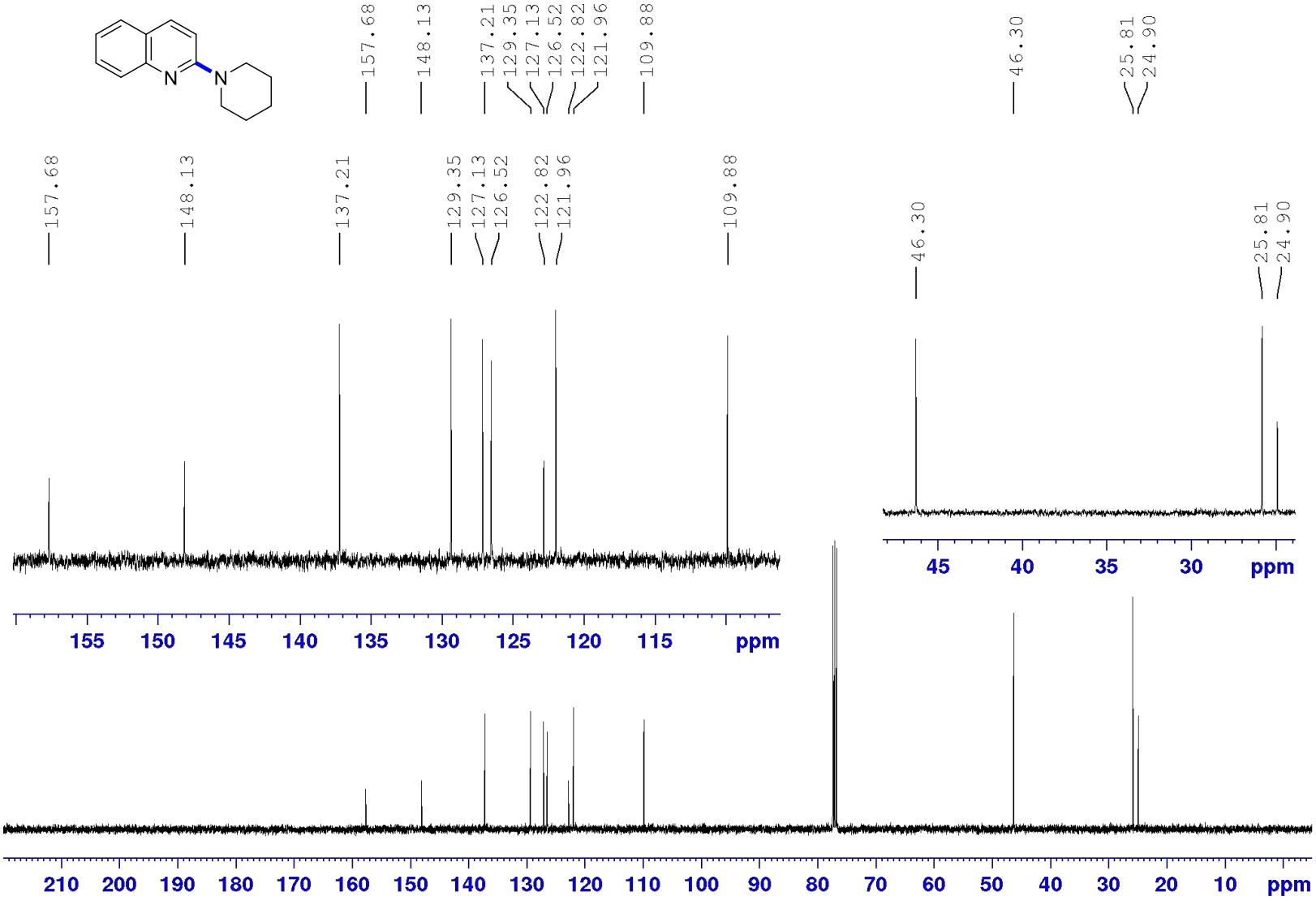
^{13}C NMR Spectrum of **3na** (100 MHz, $CDCl_3$)



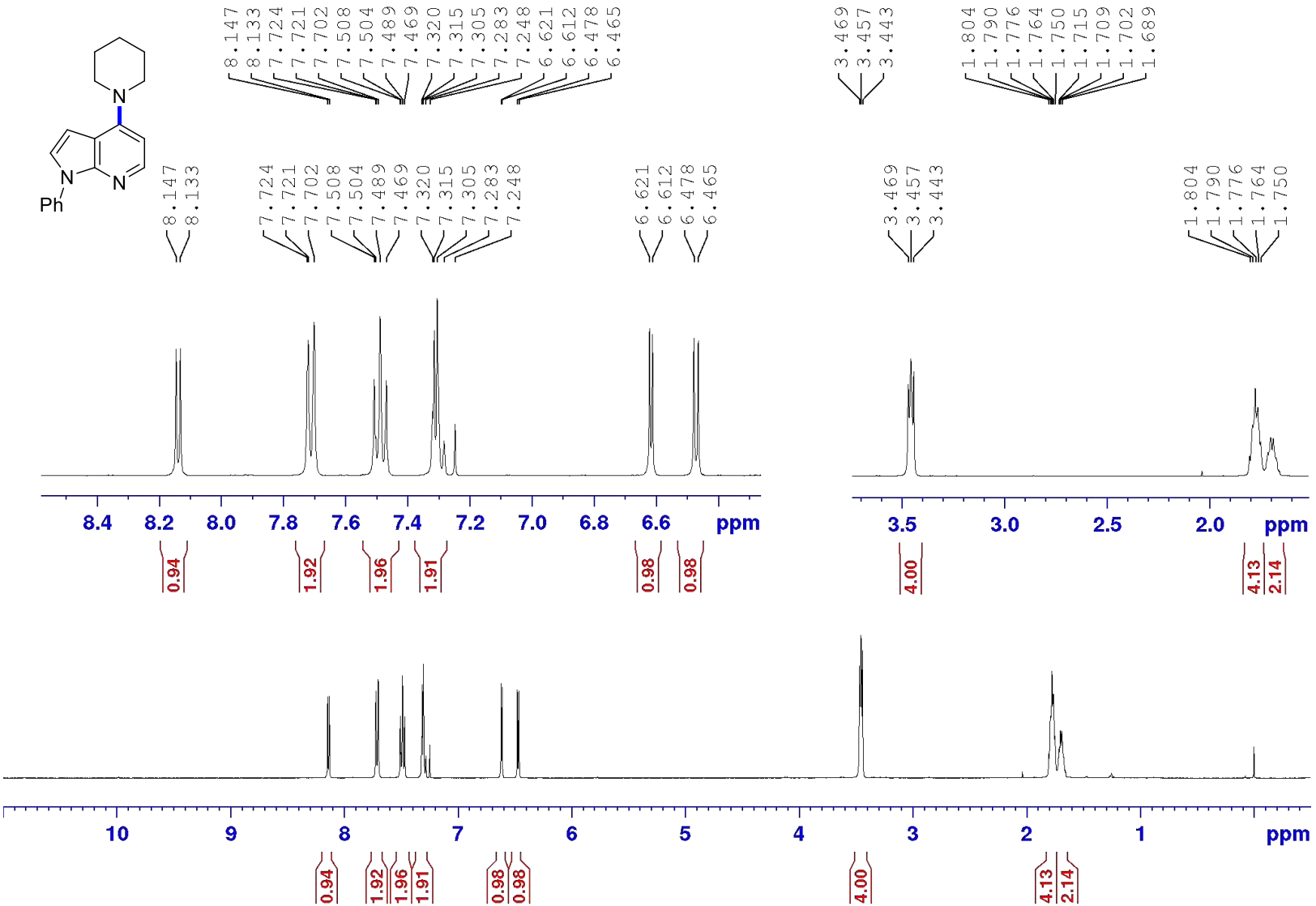
^{1}H NMR Spectrum of **3oa** (400 MHz, $CDCl_3$)



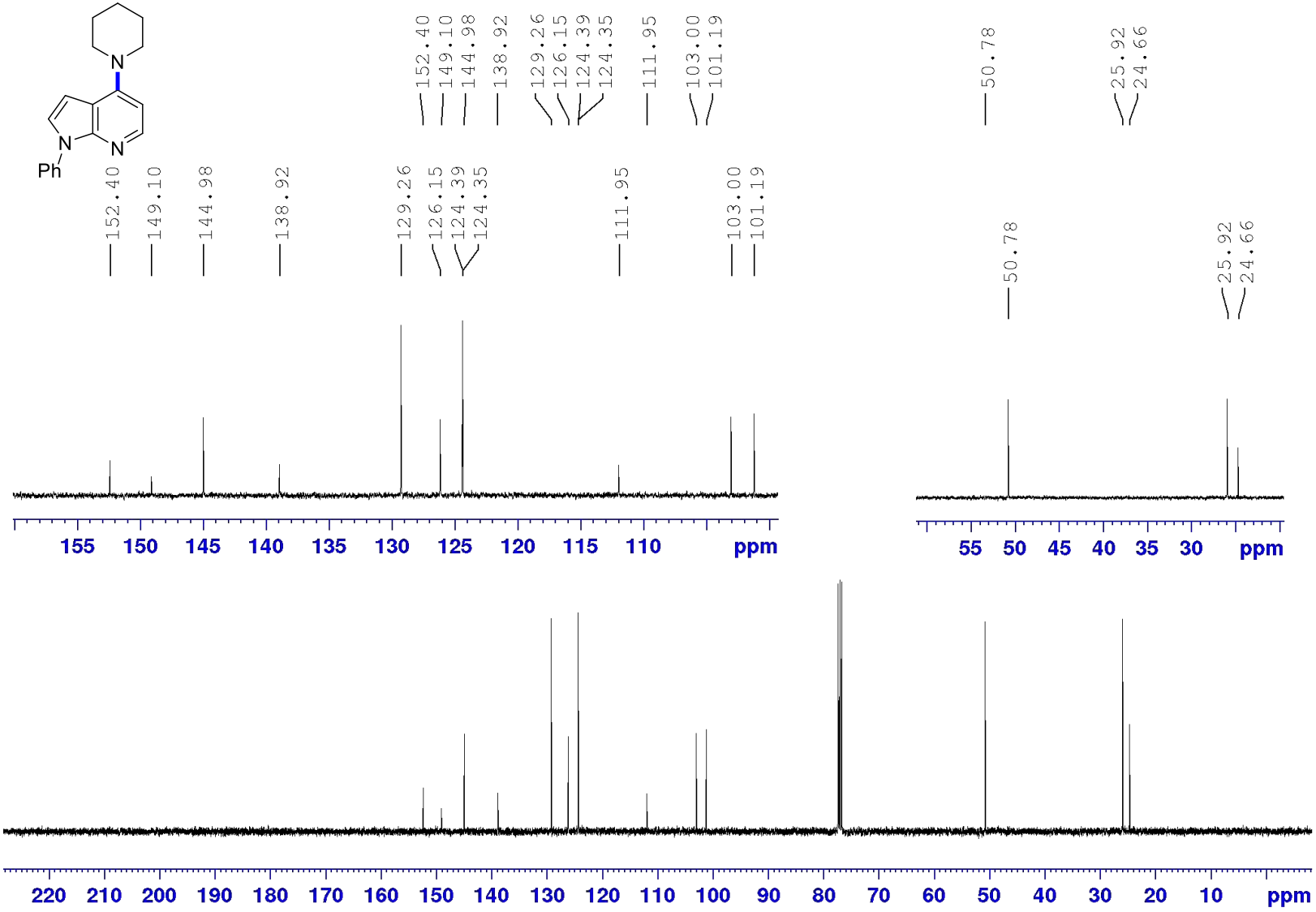
^{13}C NMR Spectrum of **3oa** (100 MHz, $CDCl_3$)



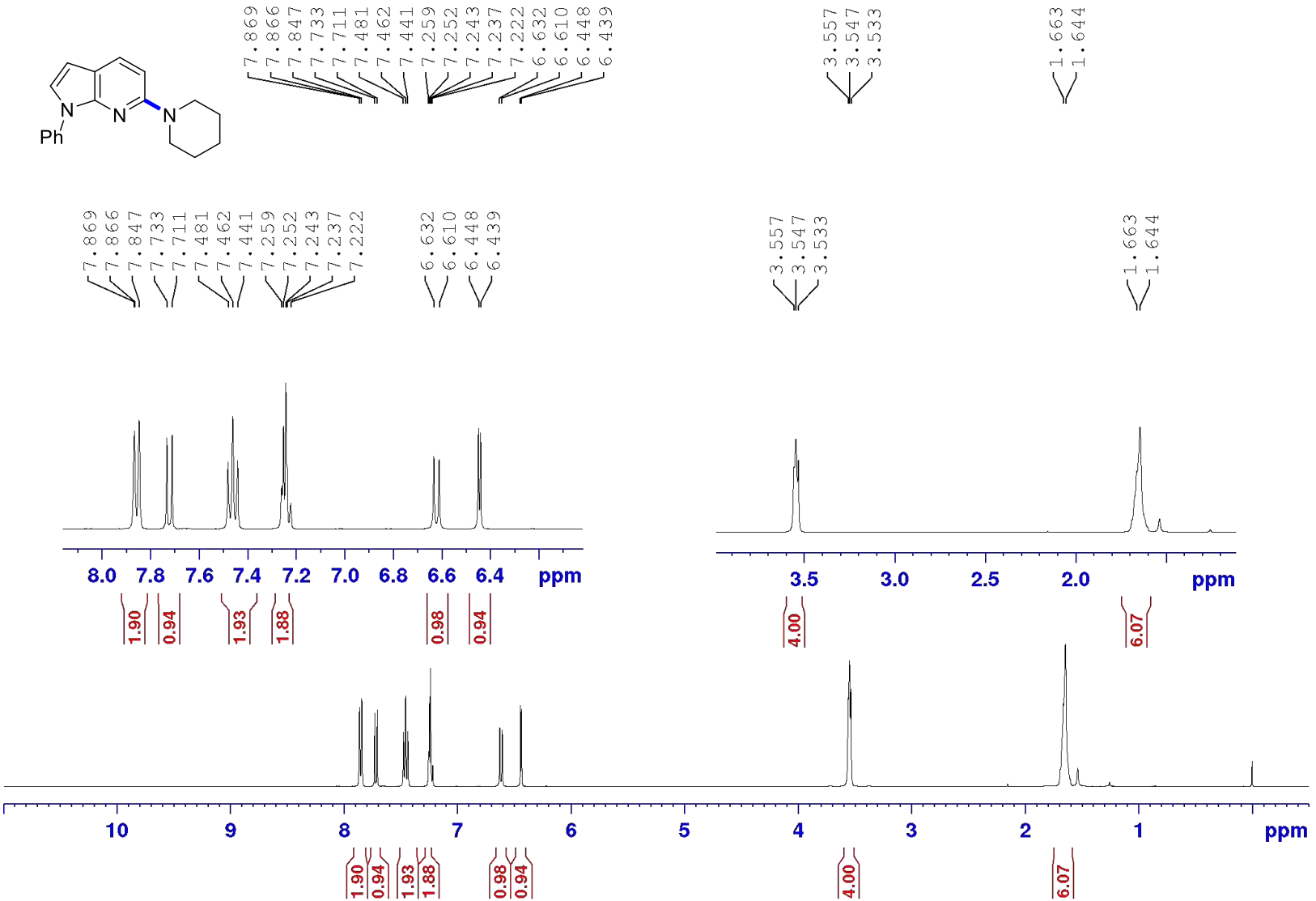
^{1}H NMR Spectrum of **3pa** (400 MHz, $CDCl_3$)



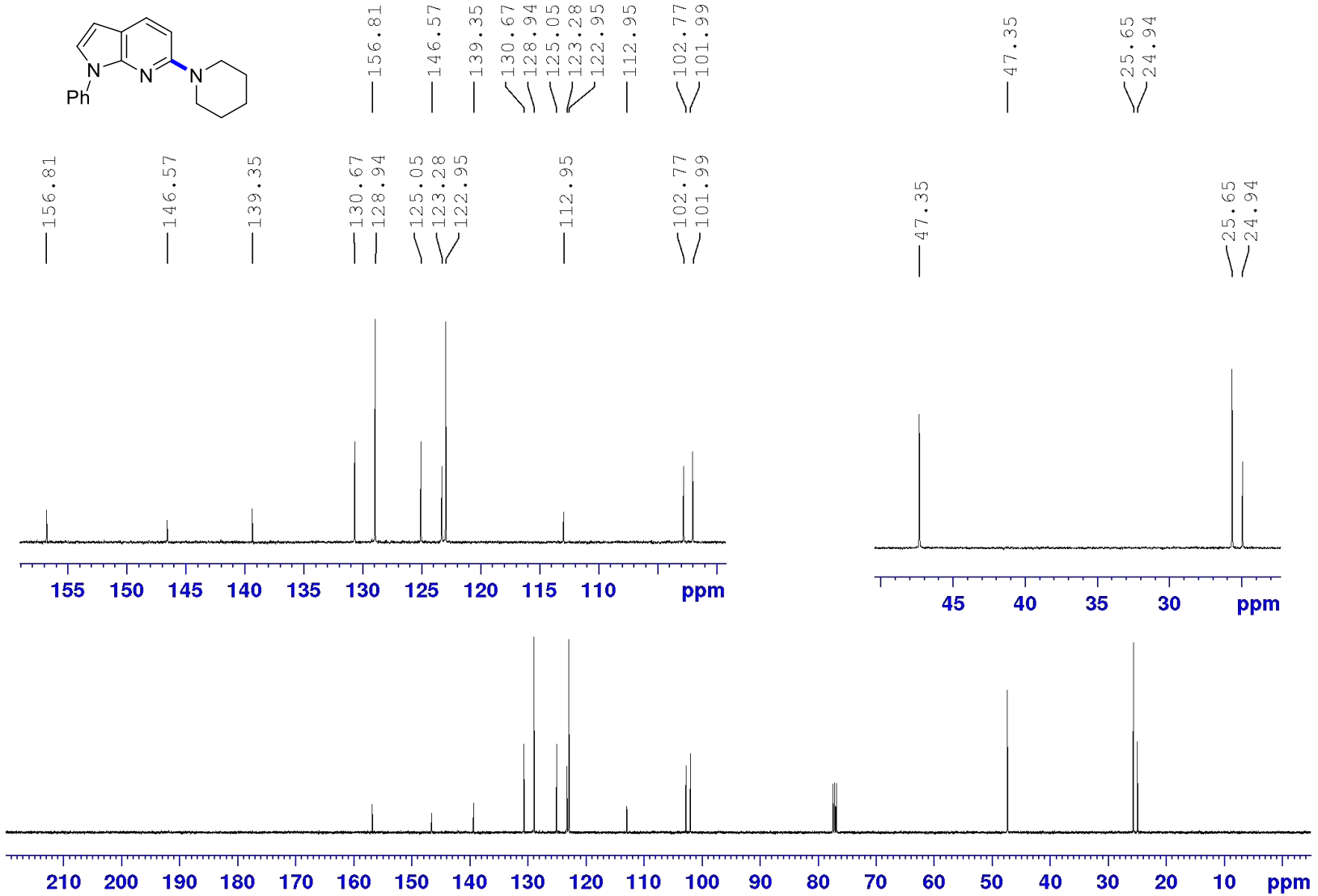
^{13}C NMR Spectrum of **3pa** (100 MHz, $CDCl_3$)



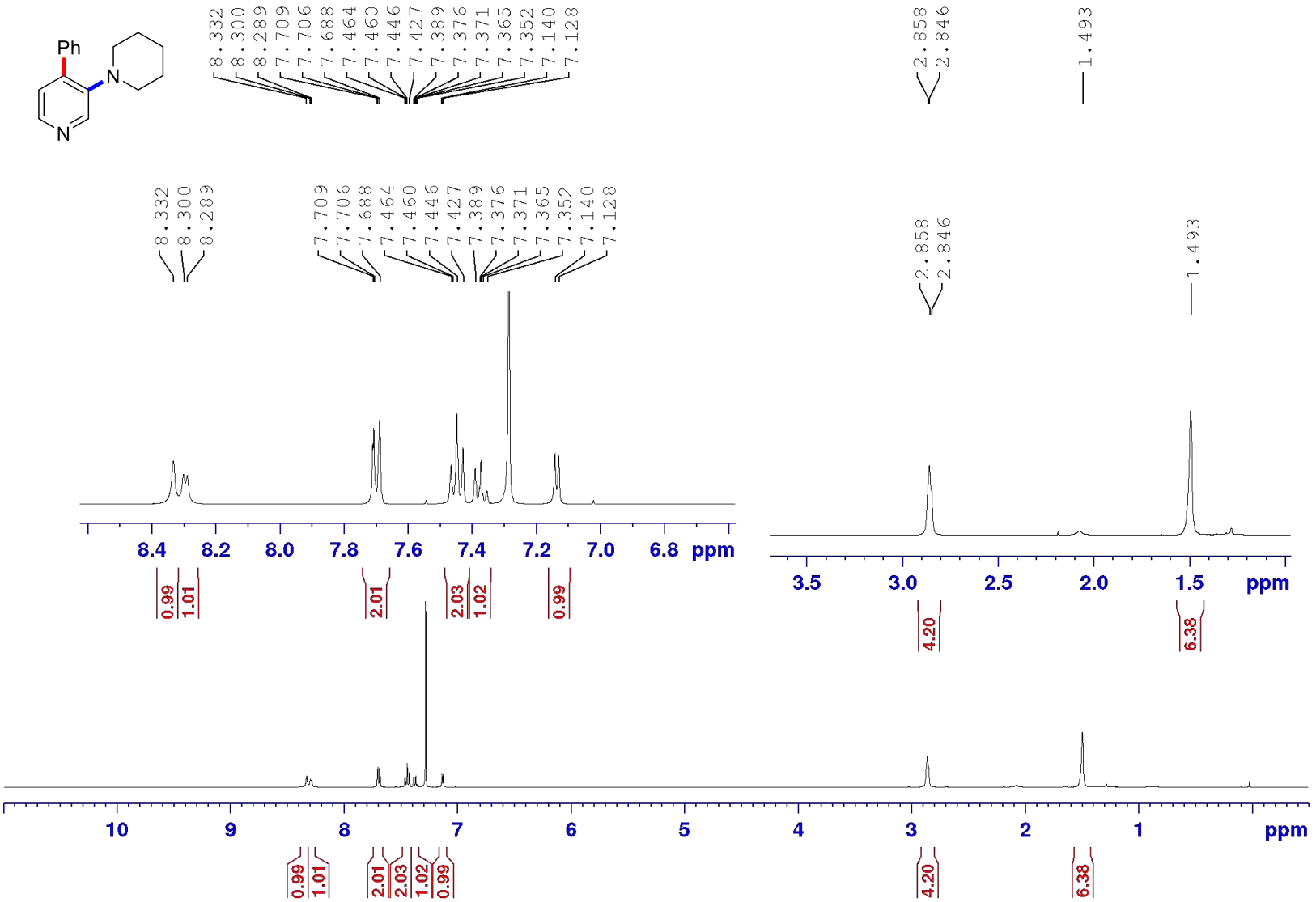
^{1}H NMR Spectrum of **3qa** (400 MHz, $CDCl_3$)



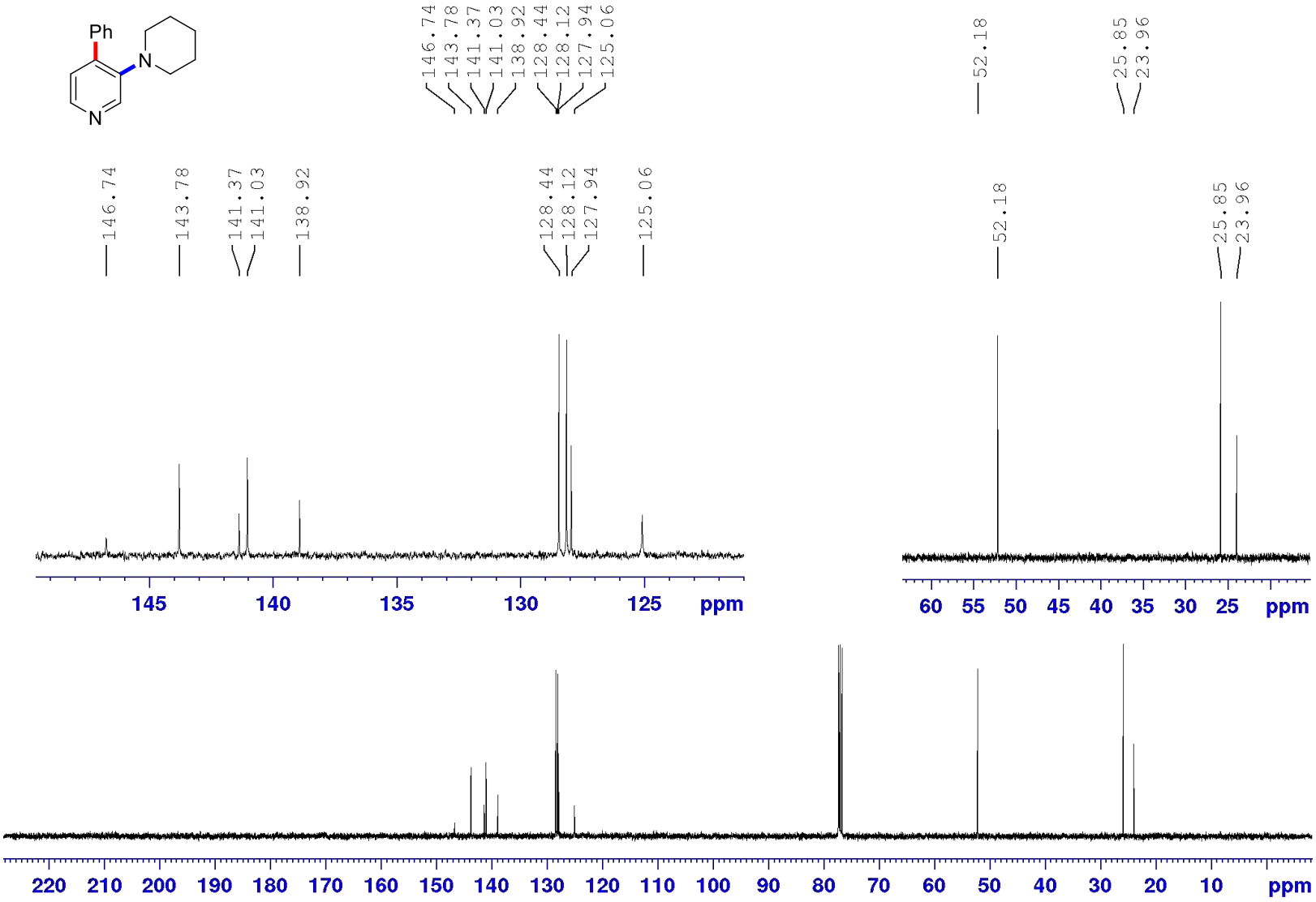
^{13}C NMR Spectrum of **3qa** (100 MHz, $CDCl_3$)



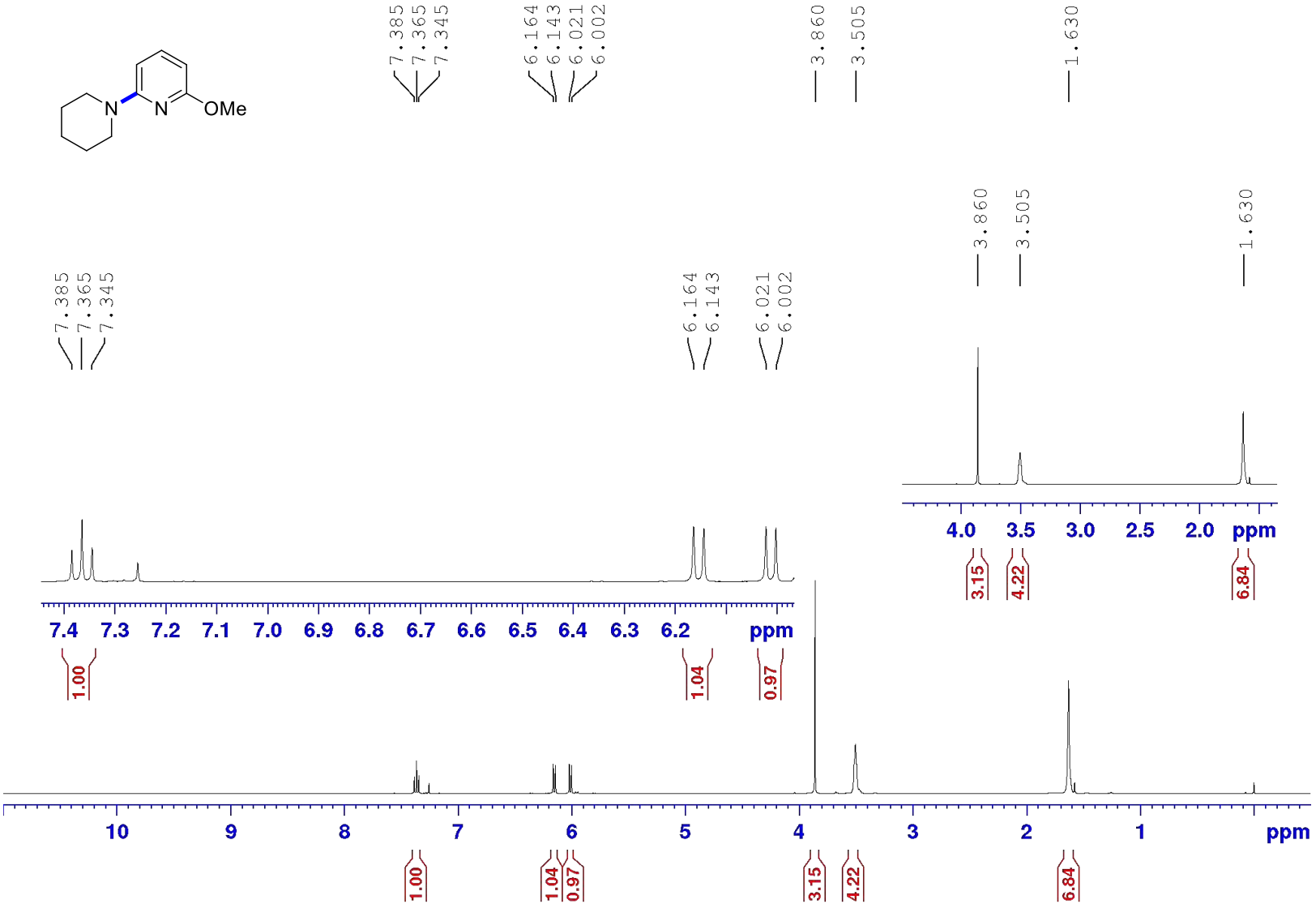
^{1}H NMR Spectrum of **5** (400 MHz, $CDCl_3$)



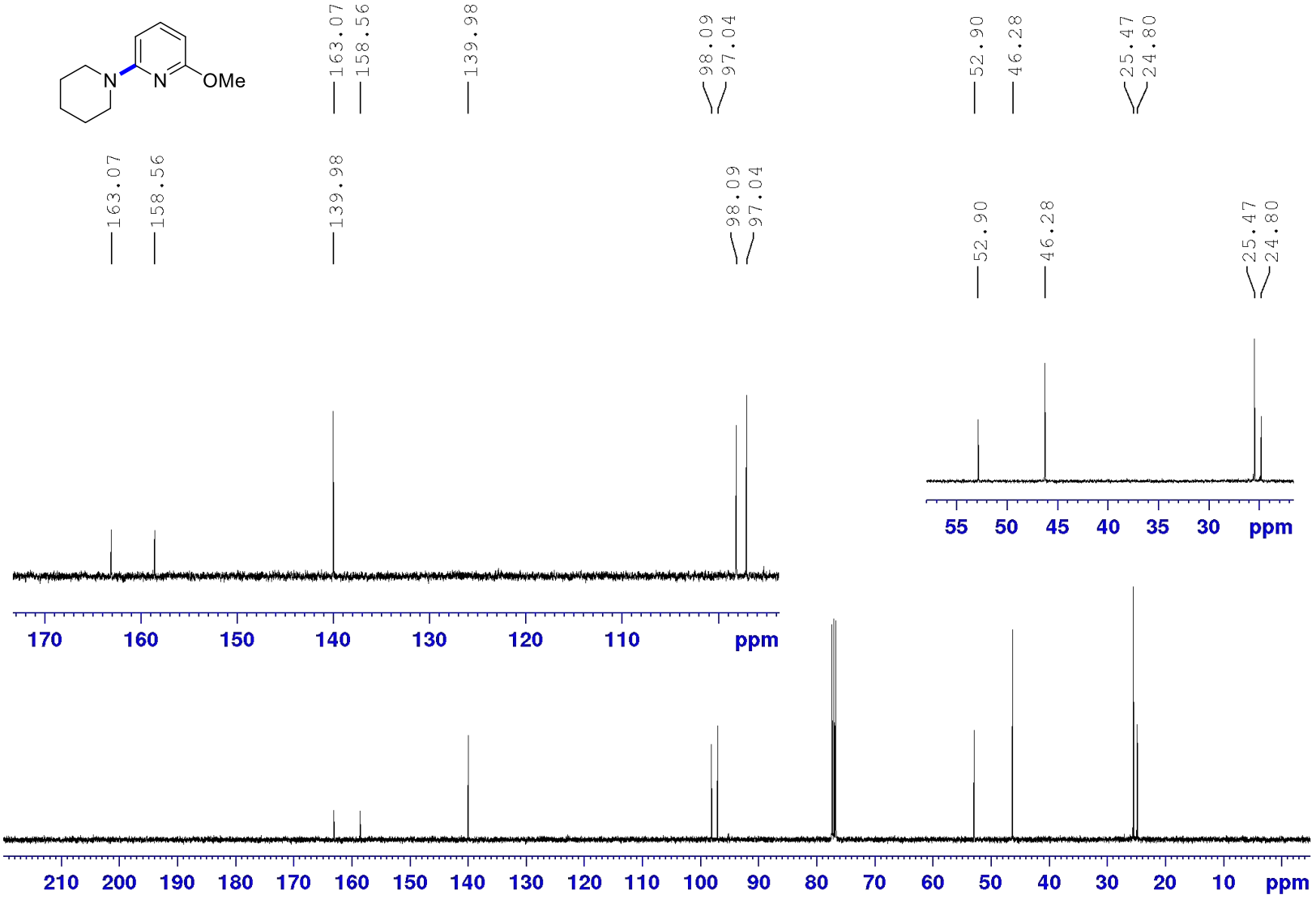
^{13}C NMR Spectrum of **5** (100 MHz, $CDCl_3$)



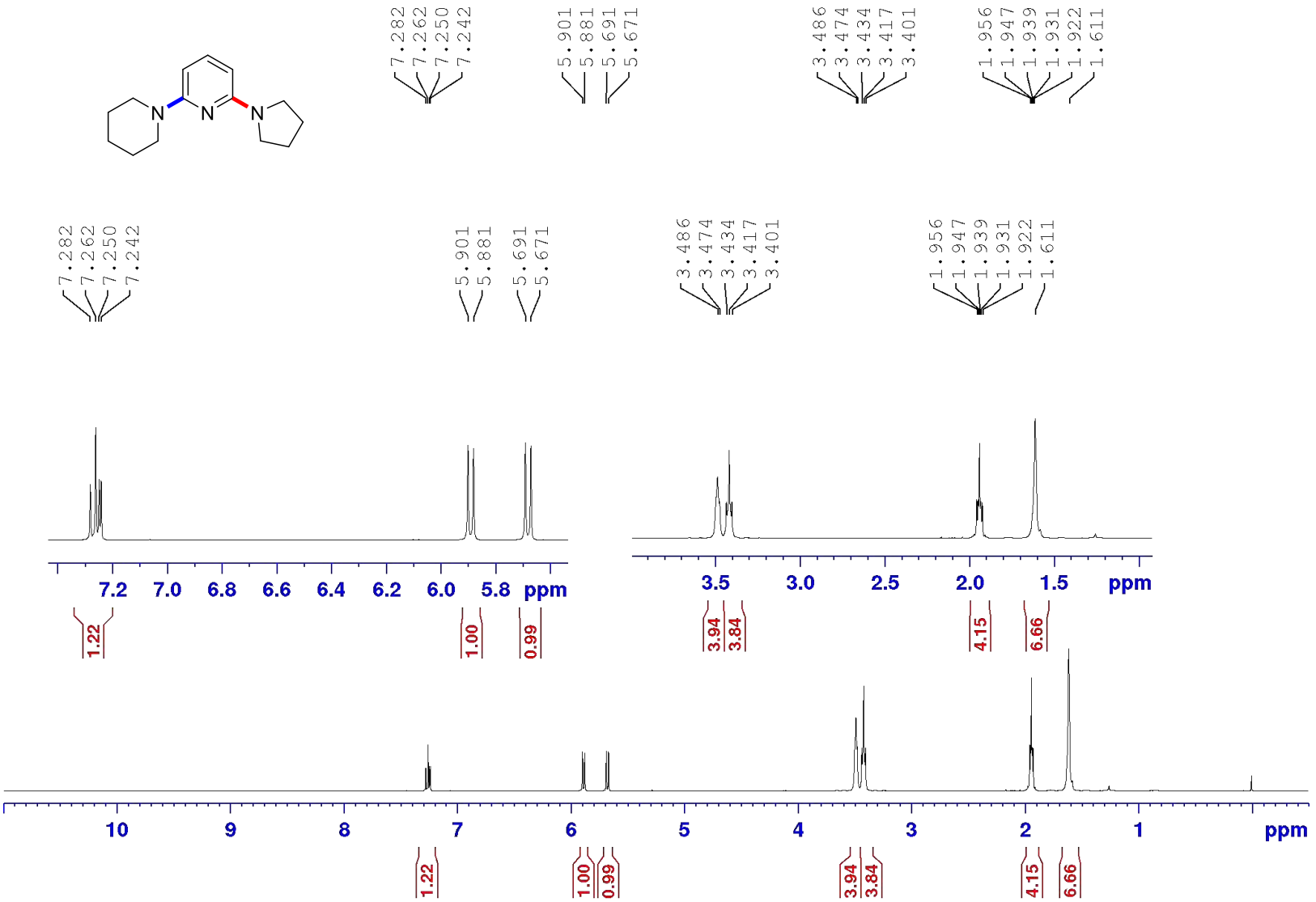
^{1}H NMR Spectrum of **3ra** (400 MHz, $CDCl_3$)



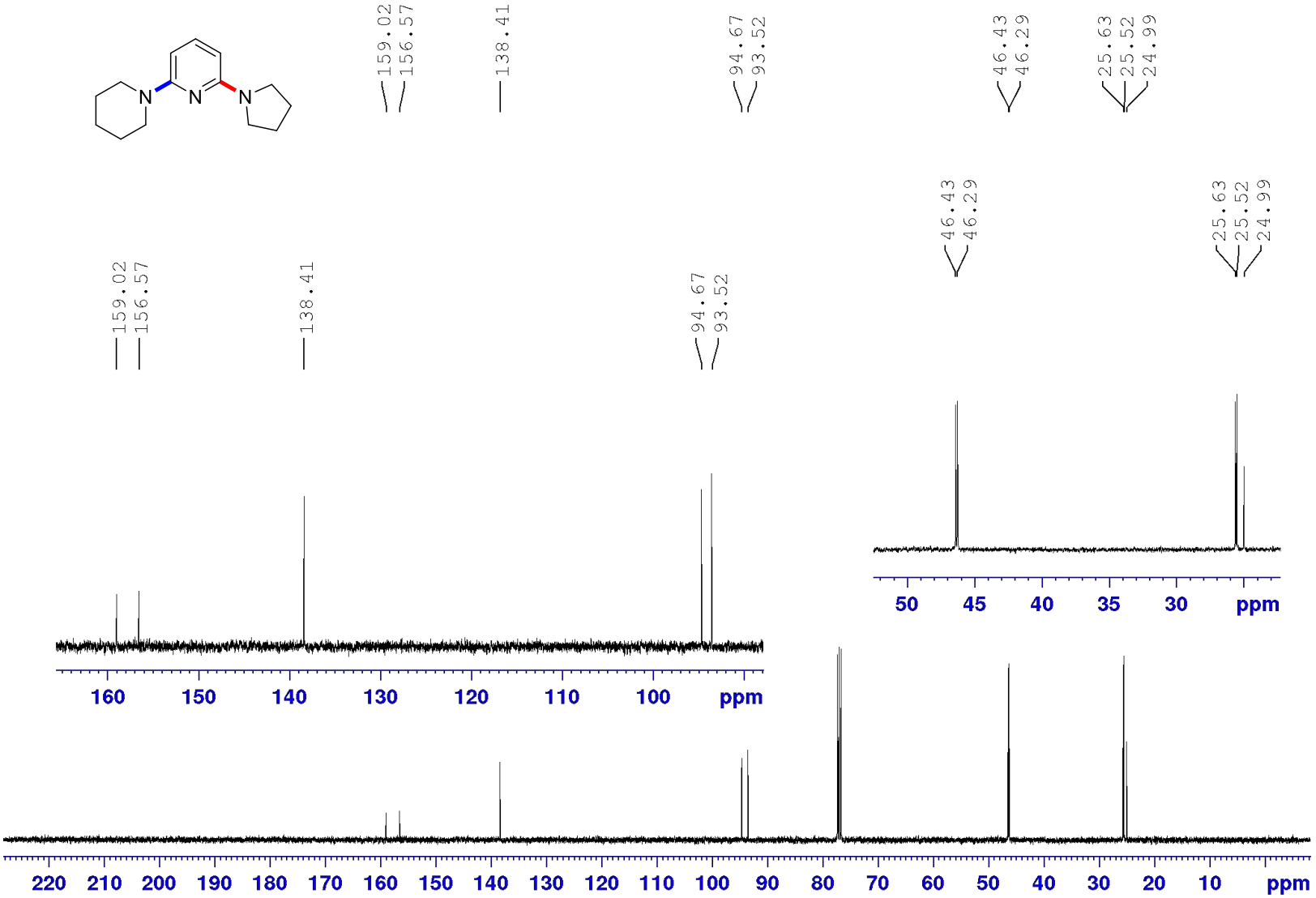
^{13}C NMR Spectrum of **3ra** (100 MHz, $CDCl_3$)



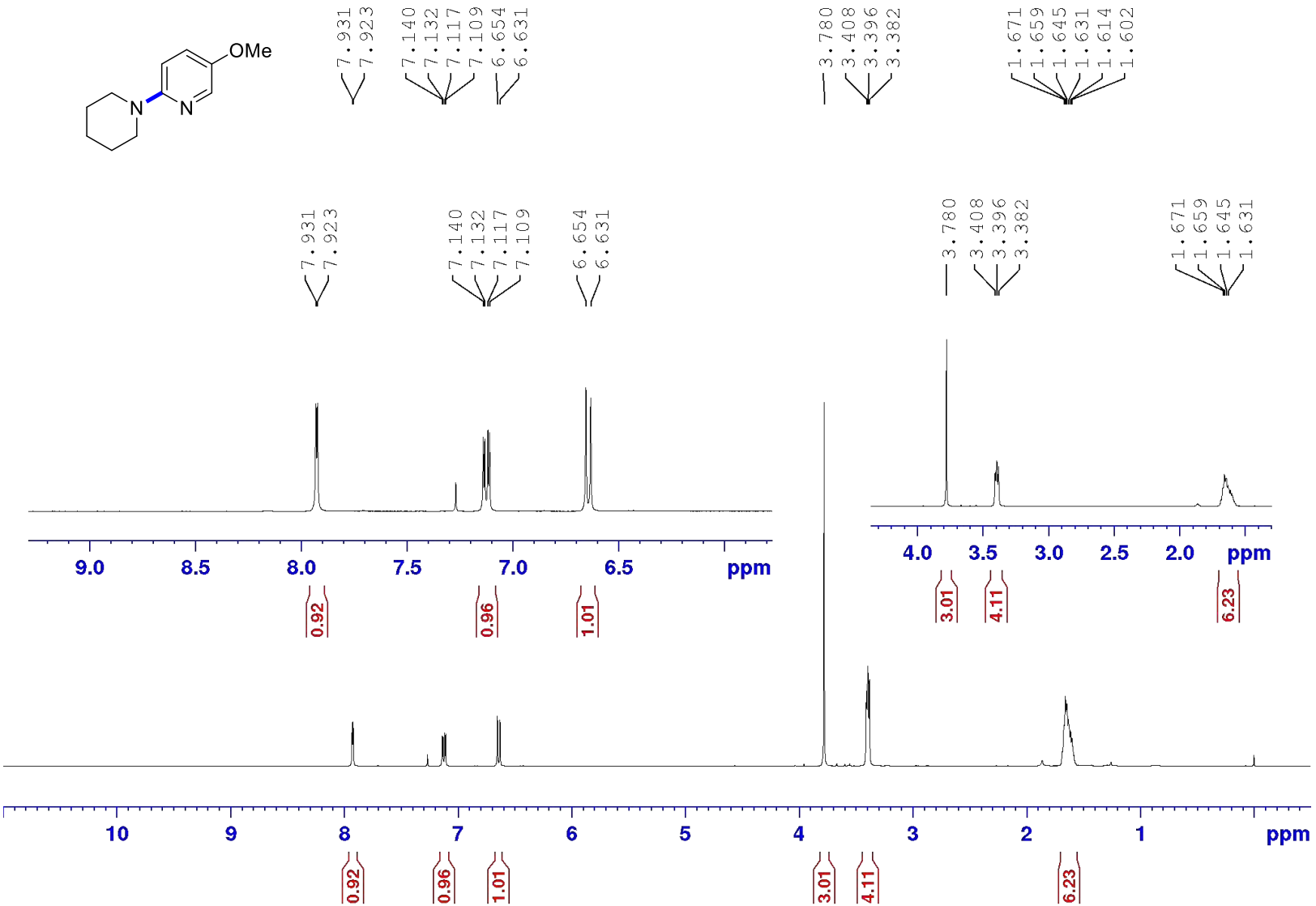
^{1}H NMR Spectrum of **6** (400 MHz, $CDCl_3$)



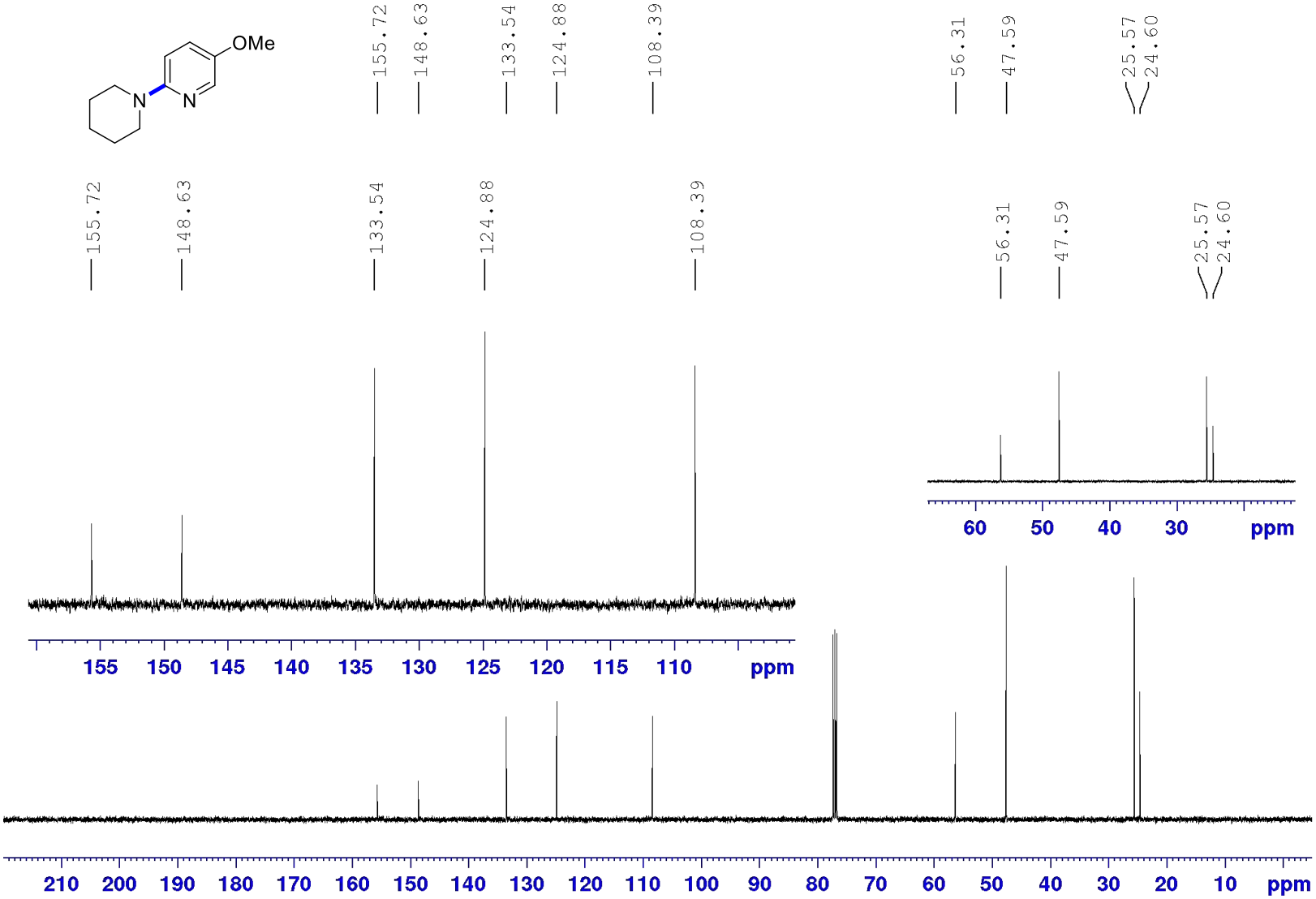
^{13}C NMR Spectrum of **6** (100 MHz, $CDCl_3$)



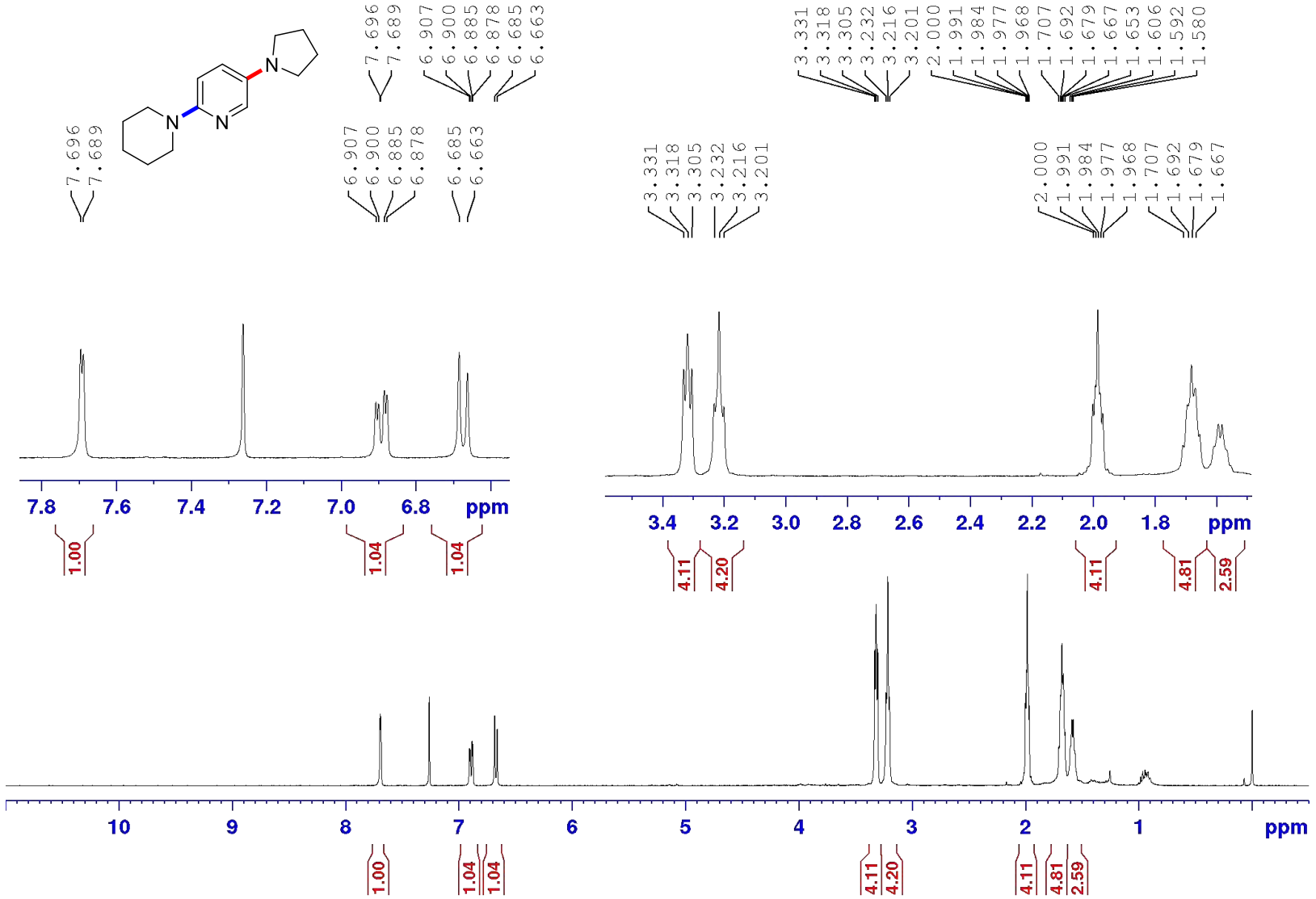
^{1}H NMR Spectrum of **3sa** (400 MHz, $CDCl_3$)



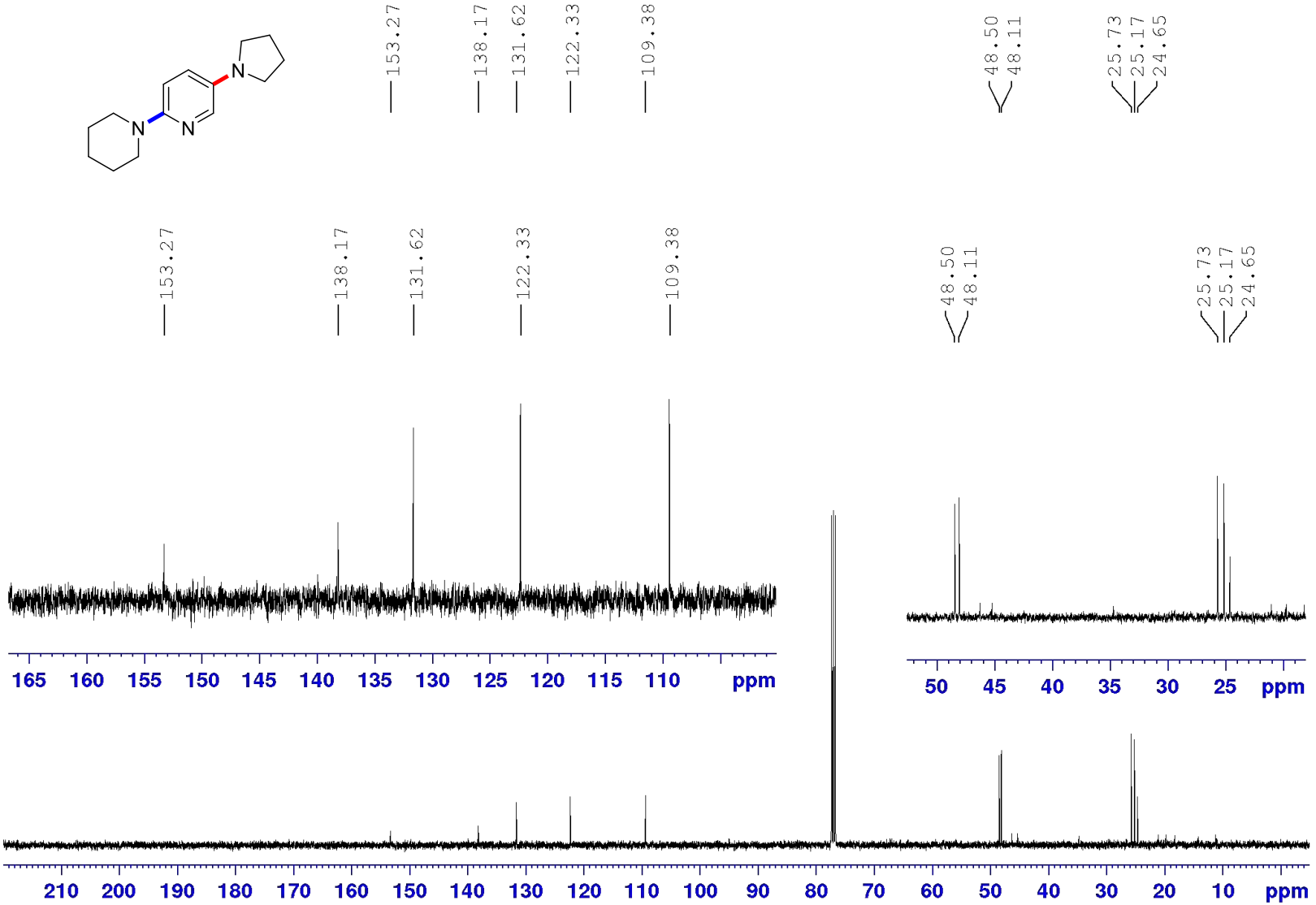
^{13}C NMR Spectrum of **3sa** (100 MHz, $CDCl_3$)



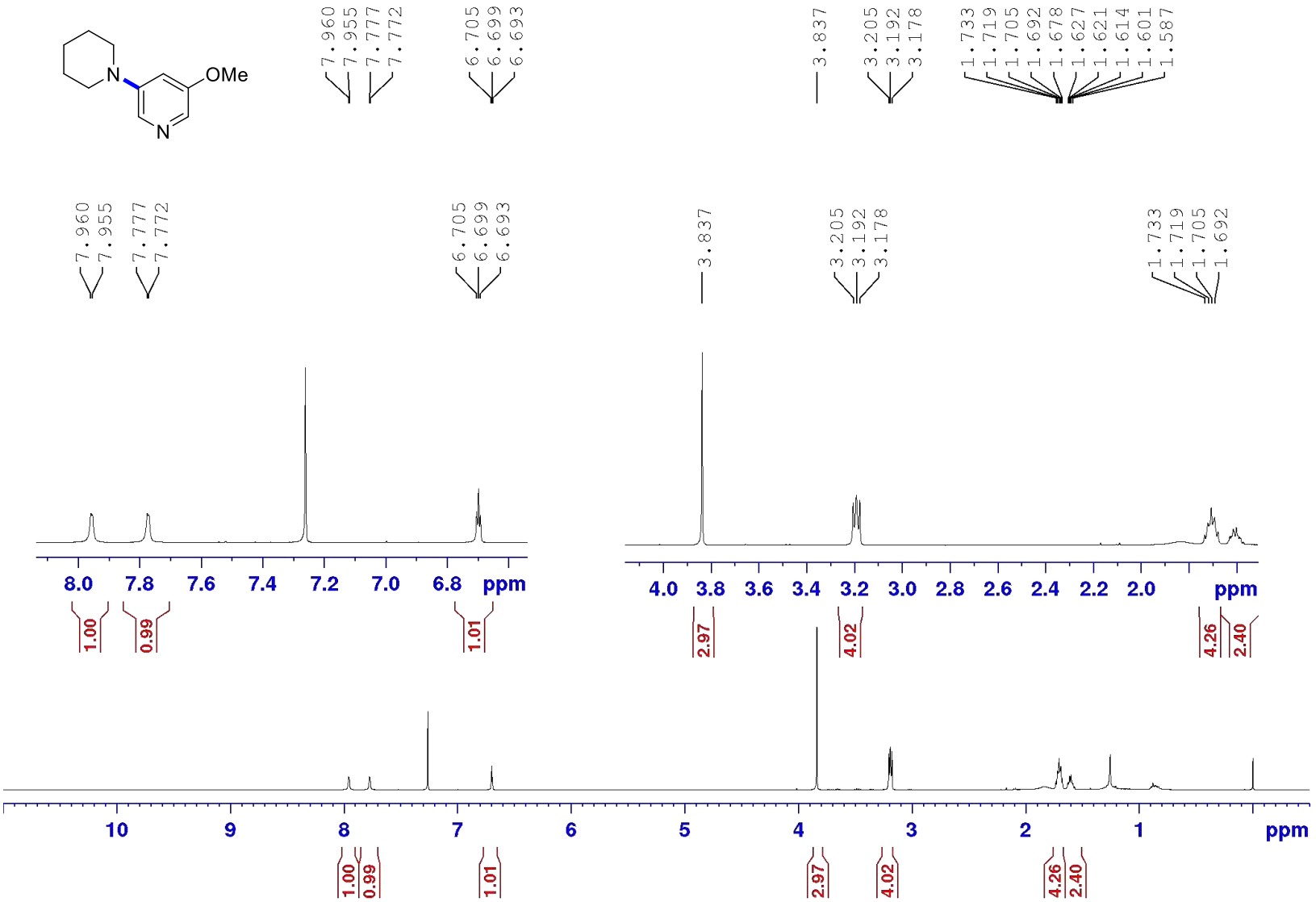
^{1}H NMR Spectrum of **7** (400 MHz, $CDCl_3$)



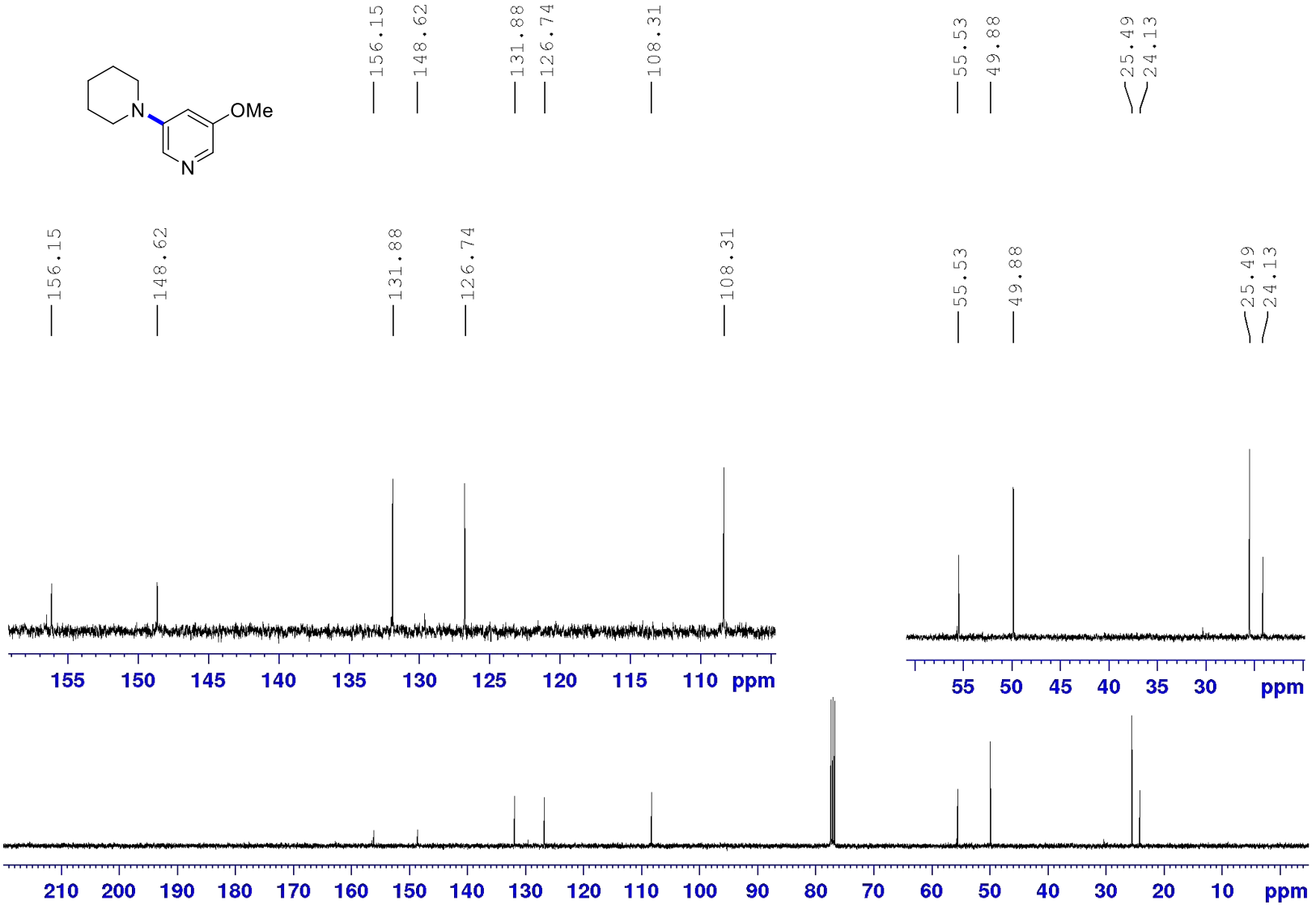
^{13}C NMR Spectrum of **7** (100 MHz, $CDCl_3$)



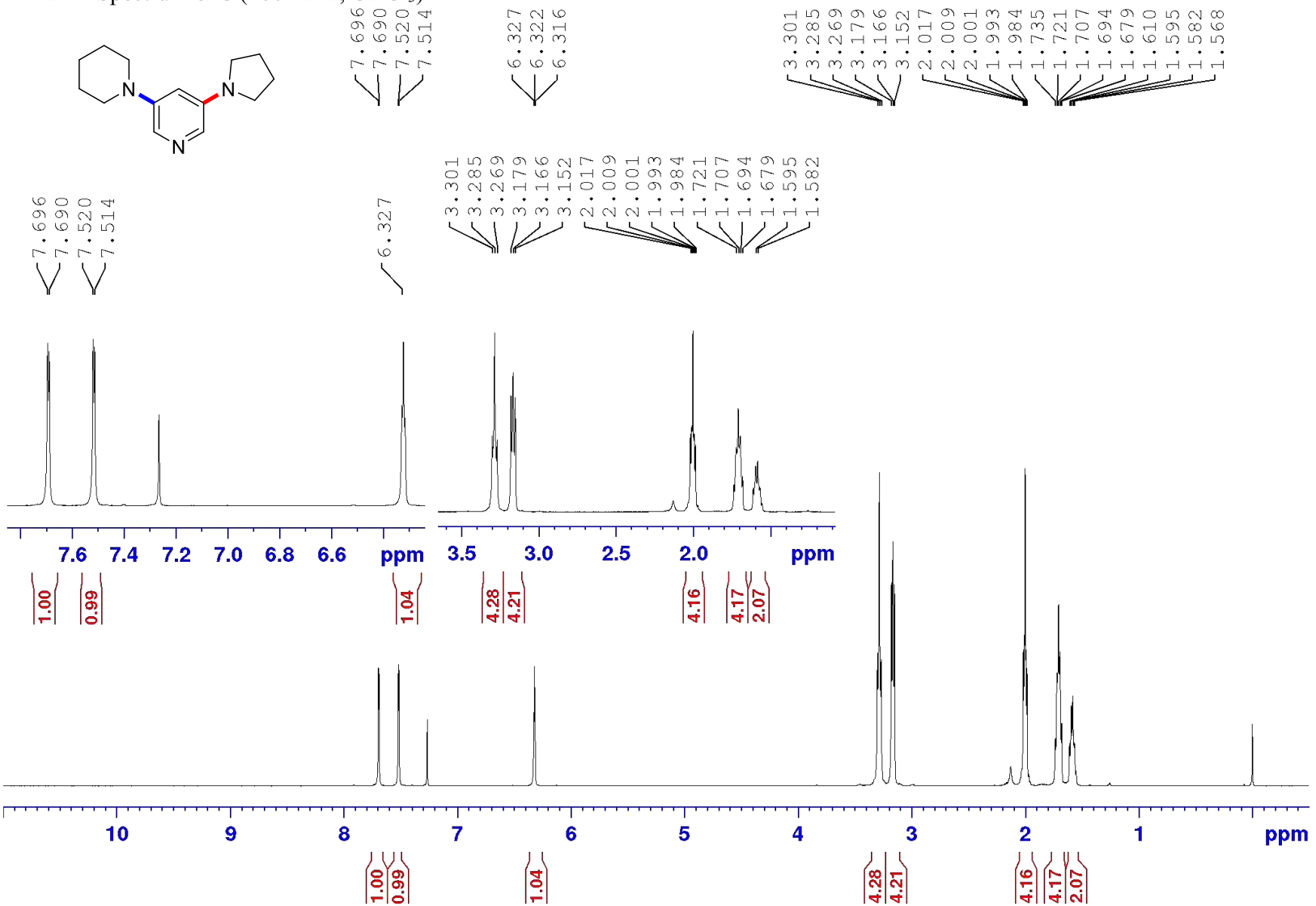
^{1}H NMR Spectrum of **3ta** (400 MHz, $CDCl_3$)



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



^{1}H NMR Spectrum of **8** (400 MHz, $CDCl_3$)



^{13}C NMR Spectrum of **8** (100 MHz, $CDCl_3$)