Palladium catalyzed one-pot synthesis of 2-(pyridin-4-yl) quinolines *via* a multicomponent unprecedented reaction of pyridine-4-carbaldehyde, 2-iodoaniline and triethylamine

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Supporting Information

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2. General information

Pyridine-4-carbaldehydes were obtained from Alfa Aesar and all other reagents from Spectrochem, India. All the dry solvents were obtained by distillation over calcium hydride. With the help of thin layer chromatography using aluminium sheets silica gel 60 F254 (Merck) and a UV lamp (λ = 254 nm) all the reaction mixtures and compounds were analyzed. All yields were determined after purification through column chromatography using silica gel (60-120 mesh) purchased from Rankem, India. Either Bruker-200 (200 MHz) or Bruker-400 (400 MHz) was used to record ^{1}H, ^{13}C and ^{19}F NMR in $CDCl_3$. Chemical shifts (δ) are expressed in ppm, coupling constants (*J*) are given in Hz and multiplicities are abbreviated by broad s (broad singlet), s (singlet), d (doublet), t (triplet), dd (doublet of doublet), ddd (doublet of doublet of doublet), and m (multiplet). For ^{19}F chemical shifts (δ) are reported in ppm relative to trichloro-fluoro-methane as an external reference at 0.00 ppm. Infrared spectra are recorded using Perkin-Elmer IR73713 spectrophotometer and peaks are recorded in cm^{-1}. EIMS (70 ev) spectra were taken using a VG Auto mass spectrometer. Open capillaries were used to determine melting points and are uncorrected.

3. Methods

3.1 Preparations of Starting Materials

General procedure for the synthesis of *o*-iodoaniline 2b, 2c, 2d, 2e, 2f, 2g, and 2i.

Following protocols reported by Xiao *et al*., [1] 4-methylaniline (535 mg, 5 mmol) (for **2b**), 4-bromoaniline (860 mg, 5 mmol) (for **2c**), 4-chloroaniline (638 mg, 5 mmol) (for **2d**), 4-flouroaniline (555 mg, 5 mmol) (for **2e**), 3-chloro-4-fluoroaniline (728 mg, 5 mmol) (for **2f**), 2,4-dimethylaniline (605 mg, 5 mmol) (for **2g**) , or 4-nitroaniline (690 mg, 5 mmol) (for **2i**), $NaHCO_3$ (630 mg, 7.5 mmol) and water (5 mL) were placed in a 100 mL beaker. After maintaining the reaction mixture temperature at 10-15 °C with crushed ice, iodine (1.27g, 5 mmol) was added in portions over a period of 10 min and the reaction was allowed to complete till the free iodine color disappeared. The organic layer was extracted with DCM and then washed with $Na_2S_2O_3$ solution. The combined organic layers were dried with Na_2SO_4,

concentrated under vacuum to afford the crude products which were purified through column chromatography using EtOAc/pet ether (1/50) as eluent.

4-Methyl-2-iodoaniline (2b): Yield: 70%, pink solid: m.p. = 38-40°C. ^{1}H NMR (200 MHz, $CDCl_3$) δ = 7.53 (d, *J* = 2.2 Hz, 1H), 7.00 (dd, *J* = 1.4, 8.0 Hz, 1 H), 6.71 (d, *J* = 8.0 Hz, 1H), 3.86 (broad s, 2H), 2.26 (s, 3H).

The spectroscopic data matched with the data found in literature.[2]

4-Bromo-2-iodoaniline (2c): Yield: 65%, pink solid: m.p. = 70-71°C. ^{1}H NMR (200 MHz, $CDCl_3$) δ = 7.63 (d, *J* = 2.2 Hz, 1H), 7.11 (dd, *J* = 2.2, 8.6 Hz, 1 H), 6.49 (d, *J* = 8.6 Hz, 1H), 4.00 (broad s, 2H).

4-Chloro-2-iodoaniline (2d): Yield: 69%, pink solid: m.p. = 38-40 °C. ^{1}H NMR (200 MHz, $CDCl_3$) δ = 7.48 (d, *J* = 2.2 Hz, 1H), 6.98 (dd, *J* = 2.4, 8.6 Hz, 1 H), 6.51 (d, *J* = 8.4 Hz, 1H), 3.98 (broad s, 2H).

The spectroscopic data matched with the data found in literature.[2]

4-Fluoro-2-iodoaniline (2e). Yield: 64%, brown solid: m.p. = 38-40 °C. ^{1}H NMR (200 MHz, $CDCl_3$) δ = 7.38 (dd, *J*= 2.2, 8.0 Hz, 1H), 6.95-6.85 (m, 1H), 6.69-6.23 (m, 1H), 3.92 (broad s, 2H).

The spectroscopic data matched with the data found in literature.[2, 4]

5-Chloro-4-fluoro-2-iodoaniline (2f): Yield: 62%, pink solid: m.p. = 178-179 °C. ^{1}H NMR (200 MHz, $CDCl_3$) δ = 7.41 (d, *J* = 8.2 Hz, 1H), 6.75 (d, *J* = 6.4 Hz, 1H), 4.08 (broad s, 2H).

2-Iodo-4, 6-dimethylaniline (2g): Yield: 62%, pink solid: m.p. = 63-65 °C. ^{1}H NMR (200 MHz, $CDCl_3$) δ = 7.39 (s, 1H), 6.86 (s, 1H), 3.94 (broad s, 2H), 2.22 (s, 6H).

The spectroscopic data matched with the data found in literature.[3]

2-Iodo-4-nitroaniline (2i). Yield: 64%, brown solid: m.p. = 104-105 °C. ^{1}H NMR (200 MHz, $CDCl_3$) δ = 8.46 (d, *J* = 2.4 Hz, 1H), 7.99-7.93 (m, 1H), 6.64 (d, *J* = 8.8 Hz, 1H), 4.79 (broad s, 2H).

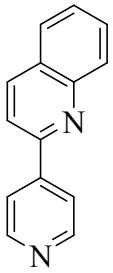
4-Nitroaniline (8). Yellow solid: 8.06 (d, *J* = 9.0 Hz, 2H), 6.62 (d, *J* = 9.0 Hz, 2H), 4.13-4.00 (m, 2H).

The spectroscopic data matched with the data of supplied 4-nitroaniline.

3.2 General procedure for the synthesis of 2-(pyridin-4-yl) quinolines 3:

Under an argon atmosphere, $Pd_2(dba)_3$ (5 mol%) and **L_2** (10 mol%) were added to a solution of pyridine-4-carbaldehyde **1** (0.654 mmol), 2-iodoaniline **2** (0.687 mmol), 4 Å MS (65 mg) and $MgSO_4$ (6 equiv.) in toluene (5 mL) in a two necked round- bottomed flask fitted with Dean-Stark apparatus at room temperature. Then Et_3N (2 equiv.) was added, and the mixture was stirred at reflux for 22-24 h till the completion of reaction as indicated by TLC. Next, the resulting reaction mixture was cooled to room temperature, diluted with water (30 ml) and extracted with EtOAc (20 mL) three times. The combined organic phases were washed with water (10 ml) two times, brine (20 mL) and dried over Na_2SO_4, concentrated in vacuum to get crude product which was then purified through column chromatography by using silica gel (60-120 mesh) and ethyl acetate/pet ether (1:5) as eluent.

4. Characterization data

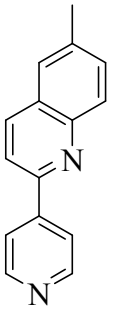


3a

2-(Pyridin-4-yl) quinoline (3a)

Pale yellow-brown solid (101 mg, 75%). Mp = 90 - 92 °C (lit.[5] 90 - 93 °C), R_f = 0.30 (EtOAc/pet ether 1:3). ^{1}H NMR (400 MHz, $CDCl_3$) δ = 8.77-8.76 (m, 2H), 8.27 (dd, *J* = 2.6, 8.6 Hz, 1 H), 8.18 (d, *J* = 8.8 Hz, 1H), 8.07-8.05 (m, 2H), 7.88 (dd, *J* = 3.2, 8.4 Hz, 1H), 7.84 (d, *J* = 8.0 Hz, 1H), 7.78-7.74(m, 1H), 7.59- 7.55(m, 1H). ^{13}C NMR (50 MHz, $CDCl_3$) δ = 154.2, 149.9 (2C),

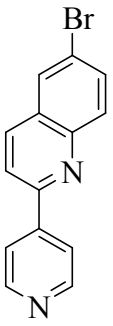
148.4, 147.2, 137.5, 130.3, 130.1, 127.9, 127.7, 127.4, 121.9 (2C), 118.5. IR (cm^{-1}) 2923, 2852, 2365, 1595, 816, 758. HRMS (ESI): $[M+H]^+$ calcd for $C_{14}H_{11}N_2$, 207.0917; found: 207.0917.



3b

6-Methyl-2-(pyridin-4-yl) quinoline (3b)

Brown solid (106 mg, 74%). Mp = 81 - 82 °C (lit.[6] 82 - 84 °C), R_f = 0.30 (EtOAc/pet ether 1:3)**.** ^{1}H NMR (400 MHz, $CDCl_3$) δ = 8.76 (d, *J* = 4.0 Hz, 2H), 8.16 (d, *J* = 8.8 Hz, 1H), 8.08-8.04 (m, 3H), 7.84 (d, *J* = 8.8 Hz, 1H), 7.59-7.57 (m, 2H), 2.55 (s, 3H). ^{13}C NMR (50 MHz, $CDCl_3$) δ = 153.6, 150.4 (2C), 147.1 (2C), 137.5, 136.7, 132.6, 129.8, 128.1, 126.5, 121.8 (2C), 118.6, 21.8. IR (cm^{-1}) 2923, 2847, 2365, 1112, 830, 810. HRMS (ESI): $[M+H]^+$ calcd for $C_{15}H_{13}N_2$, 221.1073; found: 221.1075.

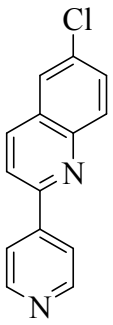


3c

6-Bromo-2-(pyridin-4-yl) quinoline (3c)

Brown solid (130 mg, 70%). Mp = 128 - 130 °C, R_f = 0.30 (EtOAc/pet ether 1:3). ^{1}H NMR (400 MHz, $CDCl_3$) δ = 8.78 (broad s, 2H), 8.17 (dd, *J* = 1.8, 8.6 Hz, 1 H), 8.05 (broad s, 2H), 8.02 (s, 1H), 8.00 (t, *J* = 1.8 Hz, 1 H), 7.90 (dd, *J* = 2.0, 8.4 Hz, 1 H), 7.81 (dt, *J* = 1.8, 8.8 Hz, 1 H). ^{13}C NMR (50 MHz, $CDCl_3$) δ = 154.9, 150.7 (2C), 147.0, 146.4, 136.4, 133.8, 131.8, 129.8, 129.0,

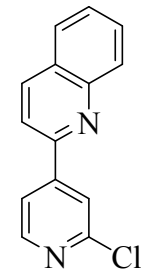
121.7 (2C), 121.4, 119.4. IR (cm^{-1}) 2921, 2852, 2359, 1594, 770. HRMS (ESI): $[M+H]^+$ calcd for $C_{14}H_{10}BrN_2$, 285.0022; found: 285.0020.



3d

6-Chloro-2-(pyridin-4-yl) quinoline (3d)

Brown solid (101 mg, 64%). Mp =139 - 141 °C (lit.[6] 138 - 140 °C), R_f = 0.28 (EtOAc/pet ether 1:3)**.** ^{1}H NMR (400 MHz, $CDCl_3$) δ = 8.78 (broad s, 2H), 8.18 (d, *J* = 8.4 Hz, 1H), 8.11 (d, *J* = 8.8 Hz, 1H), 8.04 (d, *J* = 4.4 Hz, 2H), 7.91 (dd, *J* = 1.2, 8.8 Hz, 1H), 7.83 (d, *J* = 1.2 Hz, 1H), 7.68 (ddd, *J* = 1.0, 2.2, 9.0 Hz, 1H). ^{13}C NMR (50 MHz, $CDCl_3$) δ = 154.8, 150.6 (2C), 146.8, 146.4, 136.5, 133.2, 131.7, 131.3, 128.5, 126.4, 121.7 (2C), 119.4. IR (cm^{-1}) 2922, 2851, 2360, 1634, 803, 771. HRMS (ESI): $[M+H]^+$ calcd for $C_{14}H_{10}ClN_2$, 241.0527; found: 241.0527.

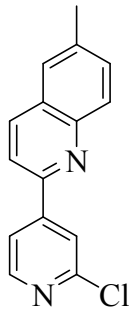


3e

2-(2-Chloro-pyridin-4-yl) quinoline (3e)

Brown solid (118 mg, 75%). Mp = 114-116 °C, R_f = 0.30 (EtOAc/pet ether 1:5)**.** ^{1}H NMR (400 MHz, $CDCl_3$) δ = 8.55 (d, *J* = 5.2 Hz, 1H), 8.34 (d, *J* = 8.4 Hz, 1H), 8.24 (d, *J* = 8.8 Hz, 1H), 8.15 (s, 1H), 8.01 (dd, *J* = 1.0, 5.0 Hz, 1H), 7.90 (d, *J* = 8.8 Hz, 2H), 7.81 (t, *J* = 7.6, 1H), 7.63 (t, *J* = 7.6 Hz, 1H). ^{13}C NMR (50 MHz, $CDCl_3$) δ = 153.1, 152.7, 150.4, 149.9, 148.4, 137.6, 130.5,

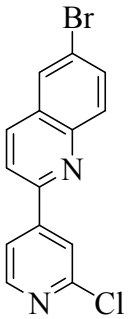
130.2, 128.2, 127.7 (2C), 122.5, 120.5, 118.4 ppm. IR (cm^{-1}) 2927, 2367, 1591, 1379, 1086, 824, 761. HRMS (ESI): $[M+H]^+$ calcd for $C_{14}H_{10}ClN_2$, 241.0527; found: 241.0550.



3f

2-(2-Chloro-pyridin-4-yl)-6-methyl-quinoline (3f)

Brown solid (121 mg, 73%). Mp = 88-90 °C, R_f = 0.26 (EtOAc/pet ether 1:5)**.** ^{1}H NMR (400 MHz, $CDCl_3$) δ = 8.52 (d, *J* = 5.2 Hz, 1H), 8.19 (d, *J* = 8.4 Hz, 1H), 8.12 (s, 1H), 8.07 (d, *J* = 8.4 Hz, 1H), 7.96 (dd, *J* = 1.2, 5.2 Hz, 1H), 7.83 (d, *J* = 8.8 Hz, 1H), 7.62-7.60 (m, 2H), 2.57 (s, 3H). ^{13}C NMR (50 MHz, $CDCl_3$) δ = 152.6, 152.2, 150.4, 150.0, 147.0, 137.9, 136.9, 132.9, 129.8, 128.2, 126.6, 122.4, 120.4, 118.4, 21.9. IR (cm^{-1}) 2927, 2367, 1592, 1362, 1123, 827. HRMS (ESI): $[M+Na]^+$ calcd for $C_{15}H_{11}ClN_2Na$, 277.0503; found: 277.0506.

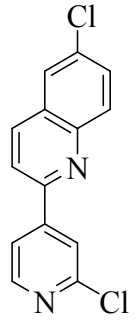


3g

6-Bromo-2-(2-chloro-pyridin-4-yl) quinoline (3g)

Brown solid (144 mg, 69%). Mp = 110-112 °C, R_f = 0.28 (EtOAc/pet ether 1:5)**.** ^{1}H NMR (400 MHz, $CDCl_3$) δ = 8.54 (d, *J* = 5.2 Hz, 1H), 8.21 (d, *J* = 8.4 Hz, 1H), 8.12 (s, 1H), 8.06-8.04 (m, 2H), 7.97 (dd, *J* = 1.2, 5.2 Hz, 1H), 7.89 (d, *J* = 8.8 Hz, 1H), 7.84 (dd, *J* = 2.2, 9.0 Hz, 1H). ^{13}C NMR (50 MHz, $CDCl_3$) δ = 153.5, 152.8, 150.6, 149.4, 147.0, 136.7, 134.1, 131.9, 129.8, 129.2,

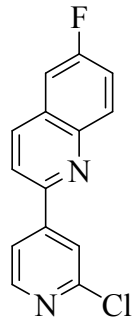
122.5, 121.9, 120.5, 119.3 . IR (cm^{-1}) 2922, 2851, 2355, 1588, 1464, 772. HRMS (ESI): $[M+H]^+$ calcd for $C_{14}H_9BrClN_2$, 318.9632; found: 318.9655.



3h

6-Chloro-2-(2-chloro-pyridin-4-yl) quinoline (3h)

Brown solid (116 mg, 65%). Mp = 140-142 °C**,** R_f = 0.30 (EtOAc/pet ether 1:5)**.** ^{1}H NMR (400 MHz, $CDCl_3$) δ = 8.53 (d, *J* = 5.2 Hz, 1H), 8.21 (d, *J* = 8.8 Hz, 1H), 8.13-8.10 (m, 2H), 7.96 (dd, *J* = 1.2, 5.2 Hz, 1H), 7.89 (d, *J* = 8.8 Hz, 1H), 7.84 (d, *J* = 2.4 Hz, 1H), 7.70 (dd, *J* = 2.4, 8.8 Hz, 1H). ^{13}C NMR (50 MHz, $CDCl_3$) δ = 153.3, 152.7, 150.5, 149.3, 146.7, 136.8, 133.6, 131.7, 131.6, 128.7, 126.4, 122.4, 120.4, 119.3. IR (cm^{-1}) 2923, 2365, 1587, 1110, 815. HRMS (ESI): $[M+H]^+$ calcd for $C_{14}H_9Cl_2N_2$, 275.0137; found: 275.0168.

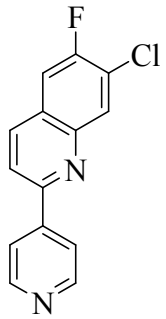


3i

2-(2-Chloro-pyridin-4-yl)-6-fluoro-quinoline (3i)

Pale yellow - brown solid (98 mg, 58%). Mp = 130-132°C, R_f = 0.32 (EtOAc/pet ether 1:5)**.** ^{1}H NMR (400 MHz, $CDCl_3$) δ = 8.53 (dd, *J* = 2.8, 4.8 Hz, 1H), 8.24 (dd, *J* = 2.8, 8.4 Hz, 1H), 8.19-8.16 (m, 1H), 8.11 (s, 1H), 7.95 (dd, *J* = 1.4, 3.8 Hz, 1H), 7.89 (dd, *J* = 3.0, 8.6 Hz, 1H), 7.57-7.52 (m, 1H), 7.48-7.46 (m, 1H). ^{13}C NMR (50 MHz, $CDCl_3$) δ = 161.2 (d, $^1J_{C,\,F}$ = 249.0 Hz),

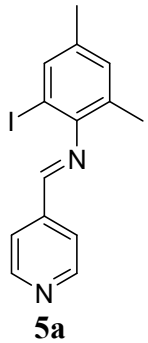
152.8, 152.5 (d, $^{4}J_{C,F}$ = 2.5 Hz), 150.5, 149.6, 145.5, 137.0 (d, $^{4}J_{C,F}$ = 5.5 Hz), 132.8 (d, $^{3}J_{C,F}$ = 9.0 Hz), 128.9 (d, $^{3}J_{C,F}$ =10.0 Hz), 122.4, 120.9 (d, $^{2}J_{C,F}$ = 25.5 Hz), 120.4, 119.2, 110.8 (d, $^{2}J_{C,F}$ = 22.0 Hz). ^{19}F NMR (376 MHz, CDCl3) δ = -112.2 ppm. IR (cm^{-1}) 2923, 2369, 1593, 1371, 1247, 1126, 815, 685. HRMS (ESI): $[M+H]^{+}$ calcd for $C_{14}H_9ClFN_2$, 259.0433; found: 259.0431.



3j

7-Chloro-6-fluoro-(2-pyridin-4-yl) quinoline (3j)

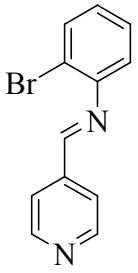
Brown solid (90 mg, 53%). Mp = 104-106 °C, R_f = 0.33 (EtOAc/pet ether 1:5)**.** ^{1}H NMR (400 MHz, $CDCl_3$) δ = 8.78 (d, *J* = 4.8 Hz, 2H), 8.27 (d, *J* = 7.2 Hz, 1H), 8.22 (d, *J* = 8.8 Hz, 1H), 8.04 (d, *J* = 5.2 Hz, 2H), 7.92 (d, *J* = 8.4 Hz, 1H), 7.56 (d, *J* = 9.2 Hz, 1H). ^{13}C NMR (50 MHz, $CDCl_3$) δ = 156.5 (d, $^{1}J_{C,F}$ = 250.5 Hz), 154.9 (d, $^{4}J_{C,F}$ = 2.5 Hz), 150.7 (2C), 146.1, 145.4, 136.6 (d, $^{3}J_{C,F}$ = 5.0 Hz), 131.9, 127.2 (d, $^{3}J_{C,F}$ = 8.5 Hz), 126.0 (d, $^{2}J_{C,F}$ = 21.0 Hz), 121.6 (2C), 119.4, 111.9 (d, $^{2}J_{C,F}$ = 21.5 Hz). ^{19}F NMR (376 MHz, CDCl3) δ = -115.7 ppm. IR (cm^{-1}) 2923, 2852, 2364, 1599, 1233, 883, 808, 772. HRMS (ESI): $[M+H]^{+}$ calcd for $C_{14}H_9ClFN_2$, 259.0433; found: 259.0431.



5a

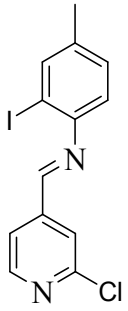
(2-Iodo-4, 6-dimethyl-phenyl)-Pyridin-4-ylmethylene-amine (5a): The general procedure **3.2** was employed to afford cyclized product from pyridine-4-carbaldehyde **1a** (70 mg, 0.654 mmol),

2-iodo-4, 6-dimethylaniline **2g** (170 mg, 0.687 mmol) and Et_3N (0.18 mL, 1.308 mmol). But **5a** was isolated through column chromatographic purification using ethyl acetate/pet ether (1:10) as eluent; yield: 198 mg (90%), pale yellow solid: m.p. = 70-72 °C. ^{1}H NMR (200 MHz, $CDCl_3$) δ = 8.76 (d, *J* = 5.8 Hz, 2H), 8.21 (s, 1H), 7.79-7.77 (m, 2H), 7.54 (s, 1H), 6.99 (s, 1H), 2.27 (s, 3H), 2.15 (s, 3H). ^{13}C NMR (50 MHz, $CDCl_3$) δ = 163.2, 150.8 (2C), 149.9, 142.2, 137.3, 136.1, 131.7, 128.0, 122.3 (2C), 88.8, 20.4, 19.2. IR (cm^{-1}) 2921, 2851, 2361, 1641, 1216, 819, 769. HRMS (ESI): $[M+H]^+$ calcd for $C_{14}H_{14}IN_2$, 337.0196; found: 337.0196.



5b

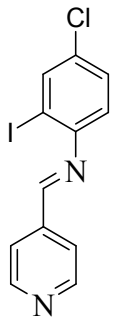
(2-Bromo-phenyl)-Pyridin-4-ylmethylene-amine (5b): The general procedure **3.2** was employed to afford **3a** from pyridine-4-carbaldehyde **1a** (70 mg, 0.654 mmol), 2-bromoaniline **2h** (118 mg, 0.687 mmol) and Et_3N (0.18 mL, 1.308 mmol). But **5b** was isolated through column chromatographic purification using ethyl acetate/pet ether (1:10) as eluent; yield: 162 mg (95%), pale yellow oil. ^{1}H NMR (200 MHz, $CDCl_3$) δ = 8.67 (d, *J* = 5.6 Hz, 2H), 8.24 (s, 1H), 7.70-7.67 (m, 2H), 7.54 (d, *J* = 7.8 Hz, 1H), 7.27-7.19 (m, 1H), 7.05-6.97 (m, 1H), 6.92 (dd, *J* = 1.4, 7.8 Hz, 1H). ^{13}C NMR (50 MHz, $CDCl_3$) δ = 159.6, 150.7 (2C), 149.8, 142.4, 133.3, 128.5, 127.7, 122.5 (2C), 119.5, 118.4. IR (cm^{-1}) 2924, 2854, 2361, 1599, 1466, 1216, 815, 769. HRMS (ESI): $[M+H]^+$ calcd for $C_{12}H_{10}BrN_2$, 261.0022; found: 261.0021.



5c

(2-Chloro-pyridin-4-ylmethylene)- (2-iodo-4-methyl-phenyl)-amine (5c)

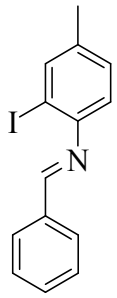
The general procedure **3.2** was employed to afford **3f** from pyridine-4-carbaldehyde **1b** (92 mg, 0.654 mmol), 2-iodo-4-methylaniline **2b** (160 mg, 0.687 mmol) and Et_3N (0.18 mL, 1.308 mmol) by allowing the reaction time for 12h or in absence of Palladium source for 24h. But **5c** was isolated through column chromatographic purification using ethyl acetate/pet ether (1:10) as eluent; yield: 162 mg (92%), pale yellow solid: m.p. = 80-82 °C. ^{1}H NMR (200 MHz, $CDCl_3$) δ = 8.48 (d, *J* = 5.2 Hz, 1H), 8.24 (s, 1H), 7.78 (s, 1H), 7.72 (s, 1H), 7.69 (d, *J* = 1.0 Hz, 1H), 7.18-7.13 (m, 1H), 6.91 (d, *J* = 8.0 Hz, 1H), 2.31 (s, 3H). ^{13}C NMR (50 MHz, $CDCl_3$) δ = 156.2, 152.5, 150.5, 148.7, 145.7, 139.9, 139.1, 130.2, 123.3, 121.2, 117.6, 96.3, 20.6. IR (cm^{-1}) 2921, 2851, 2360, 1458, 772. HRMS (ESI): $[M+H]^+$ calcd for $C_{13}H_{11}ClN_2$, 356.9650; found: 356.9655.



5d

(4-Chloro-2-iodo-phenyl)-pyridin-4-ylmethylene-amine (5d).

The general procedure **3.2** was employed with combining pyridine-4-carbaldehyde **1a** (70 mg, 0.654 mmol), 4-chloro-2-iodoaniline **2d** (174 mg, 0.687 mmol) and Et_3N (0.18 mL, 1.308 mmol) in absence of palladium source. **5d** was purified through column chromatography using ethyl acetate/pet ether (1:5) as eluent; Pale yellow solid: m.p. = 96-98 °C, yield: 73%. ^{1}H NMR (400 MHz, $CDCl_3$) δ = 8.73 (broad s, 2H), 8.23 (s, 1H), 7.83 (d, *J* = 2.4 Hz, 1H), 7.74 (d, *J* = 5.6 Hz, 2H), 7.29 (dd, *J* = 2.0, 8.4 Hz, 1H), 6.89 (d, *J* = 8.4 Hz, 1H). ^{13}C NMR (50 MHz, $CDCl_3$) δ = 159.0, 150.6, 150.4, 142.1, 138.5, 132.6, 129.5, 122.5, 118.5, 95.7. IR (cm^{-1}) 2923, 2853, 2360, 1456, 771. HRMS (ESI): $[M+H]^+$ calcd for $C_{12}H_9ClIN_2$, 342.9493; found: 342.9489.



7

Benzylidene-(2-iodo-4-methyl-phenyl)-amine (7)

The general procedure **3.2** was employed to afford quinoline from benzaldehyde **6** (69 mg, 0.654 mmol), 2-iodo-4-methylaniline **2b** (160 mg, 0.687 mmol) and Et_3N (0.18 mL, 1.308 mmol). But 7 was isolated through column chromatographic purification using ethyl acetate/pet ether (1:30) as eluent; yield: 231 mg (72%), pale yellow solid: m.p. = 61-62 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ =8.32 (s, 1H), 7.99-7.97 (m, 2H), 7.76 (s, 1H), 7.51-7.49 (m, 3H), 6.95 (t, *J*= 7.8 Hz, 2H), 2.34 (s, 3H). ^{13}C NMR (50 MHz, $CDCl_3$) δ = 160.5, 150.5, 139.6, 137.3, 136.1, 131.7, 130.2, 129.2 (2C), 129.0 (2C), 118.0, 95.4, 20.5. HRMS (ESI): $[M+H]^+$ calcd for $C_{14}H_{13}IN$, 322.0087; found: 322.0089.

5. References

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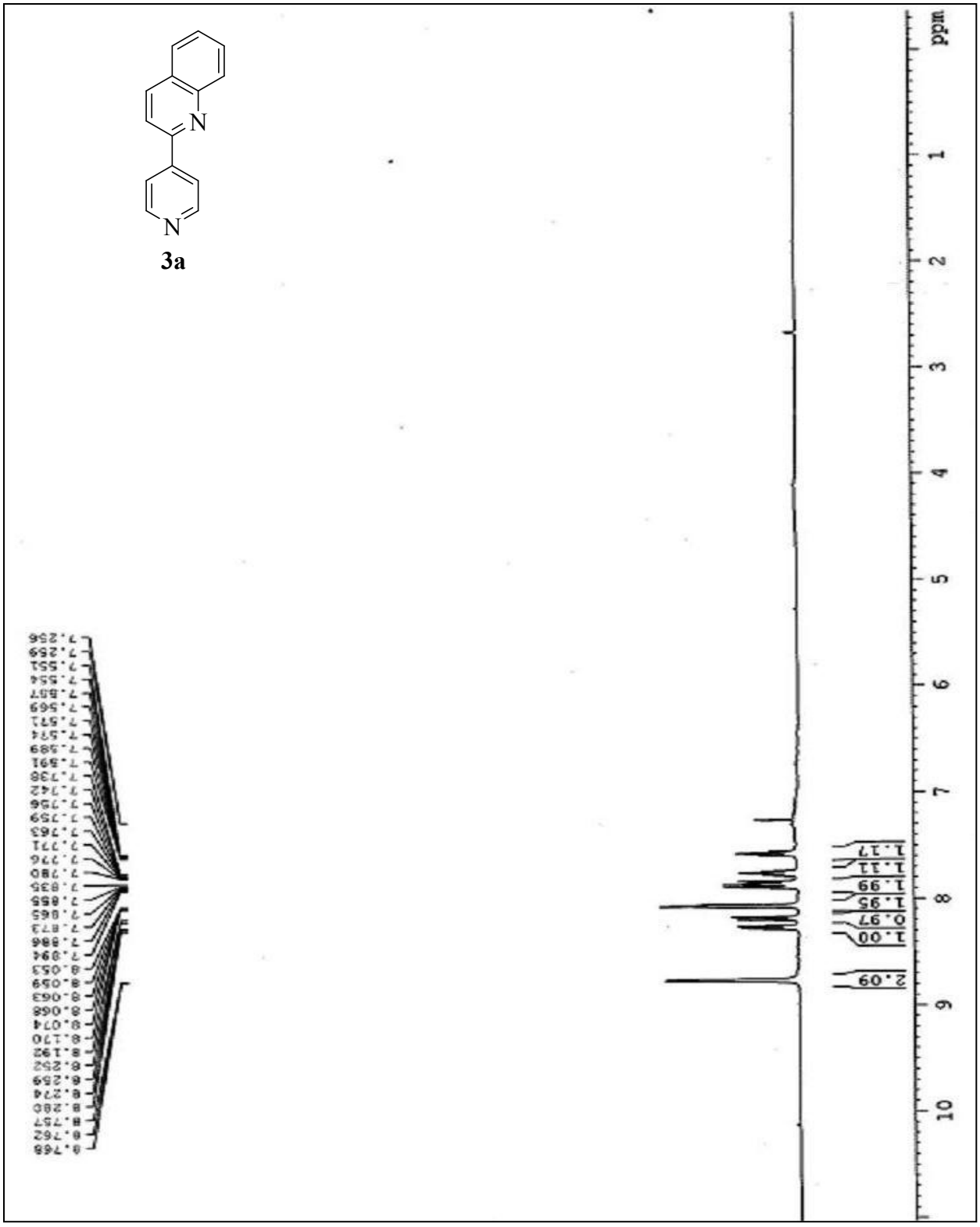
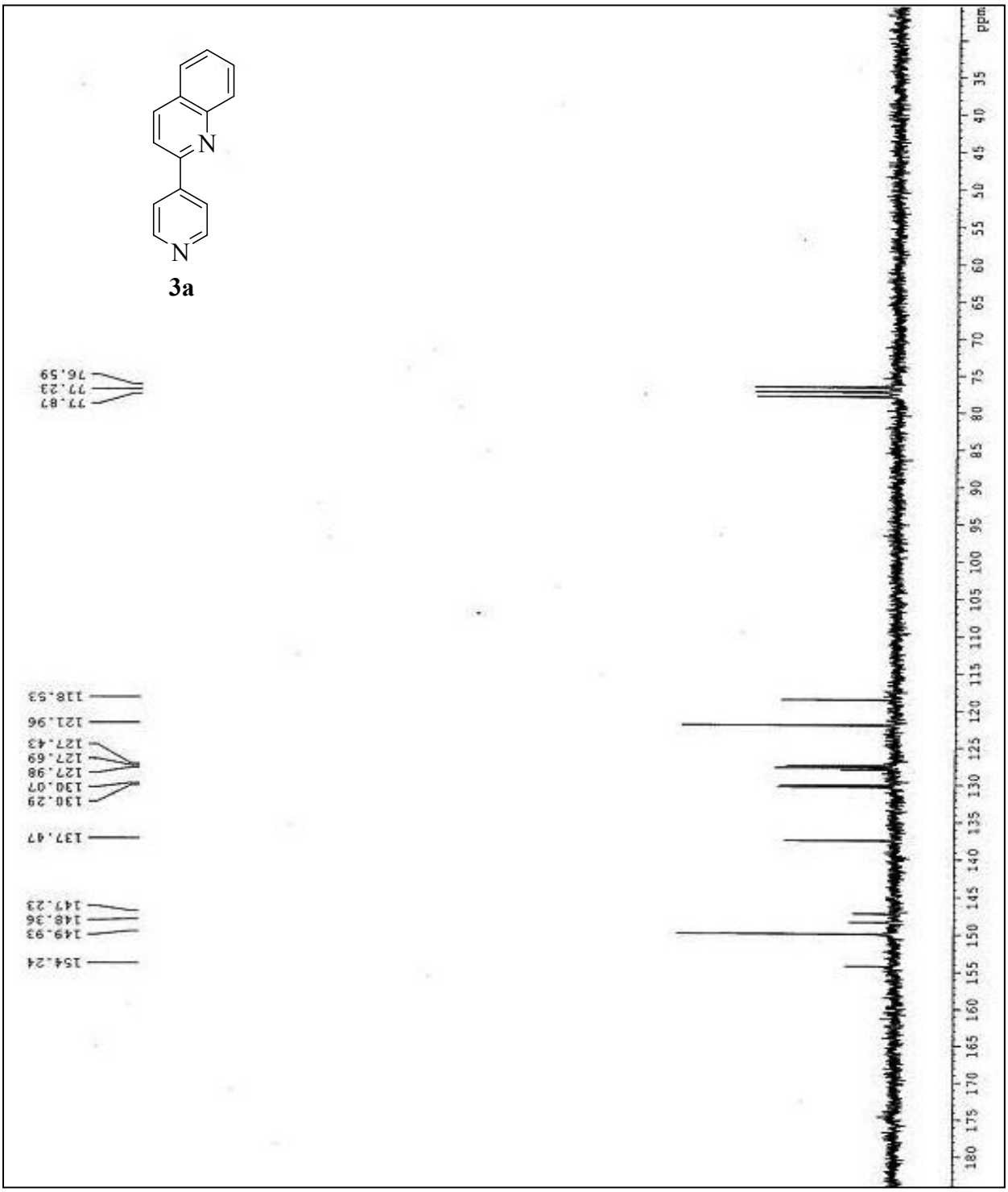
6. V. V. Kouznetsov, C. M. M. Gomez, M. G. Derita, L. Svetaz, E. D. Olmo and S. A. Zacchino, *Bioorg. Med. Chem.,* 2012, ***20,*** 6510.

6. NMR Spectra

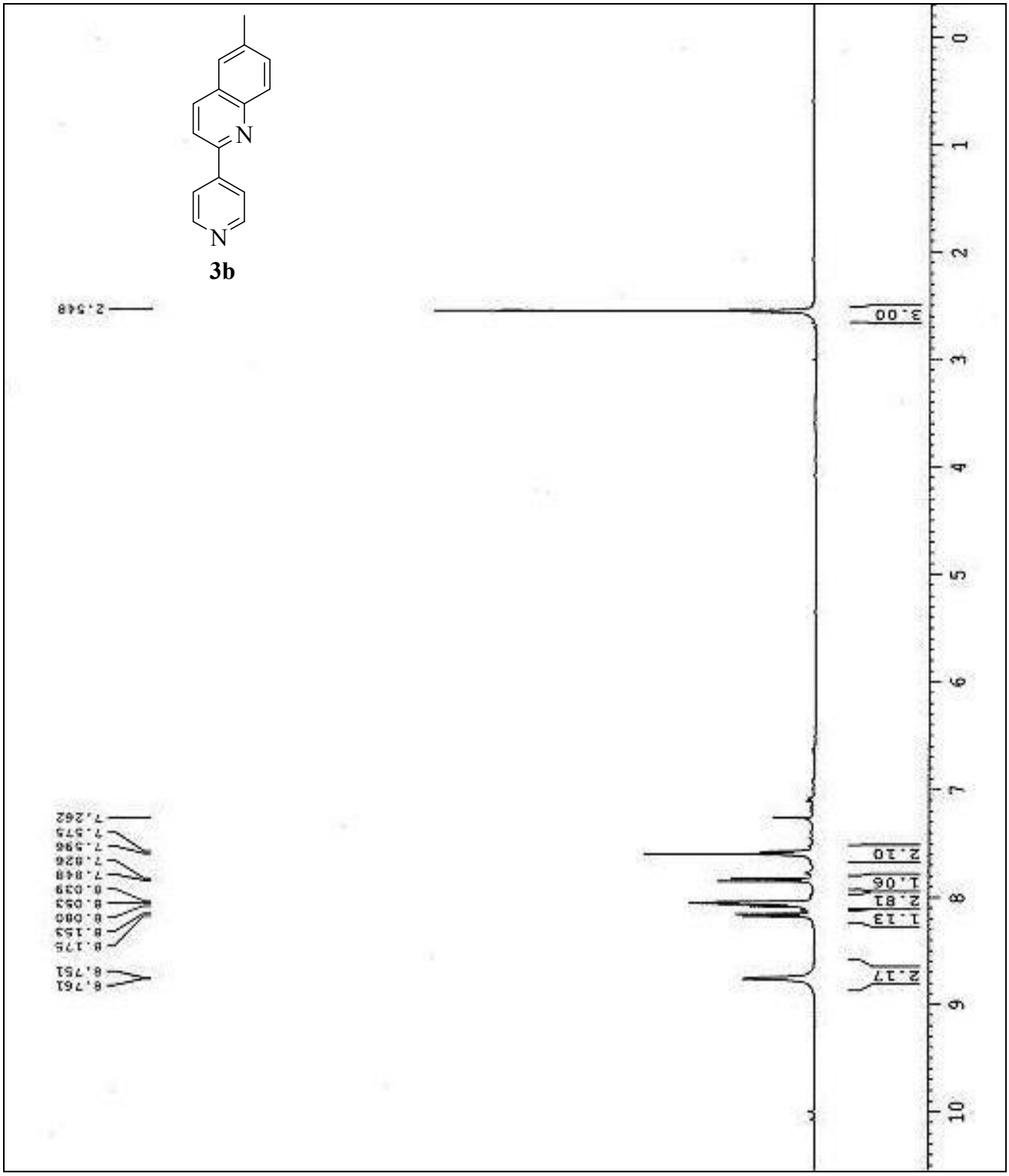
^{1}H NMR Spectrum (400 MHz in $CDCl_3$) of compound 3a:



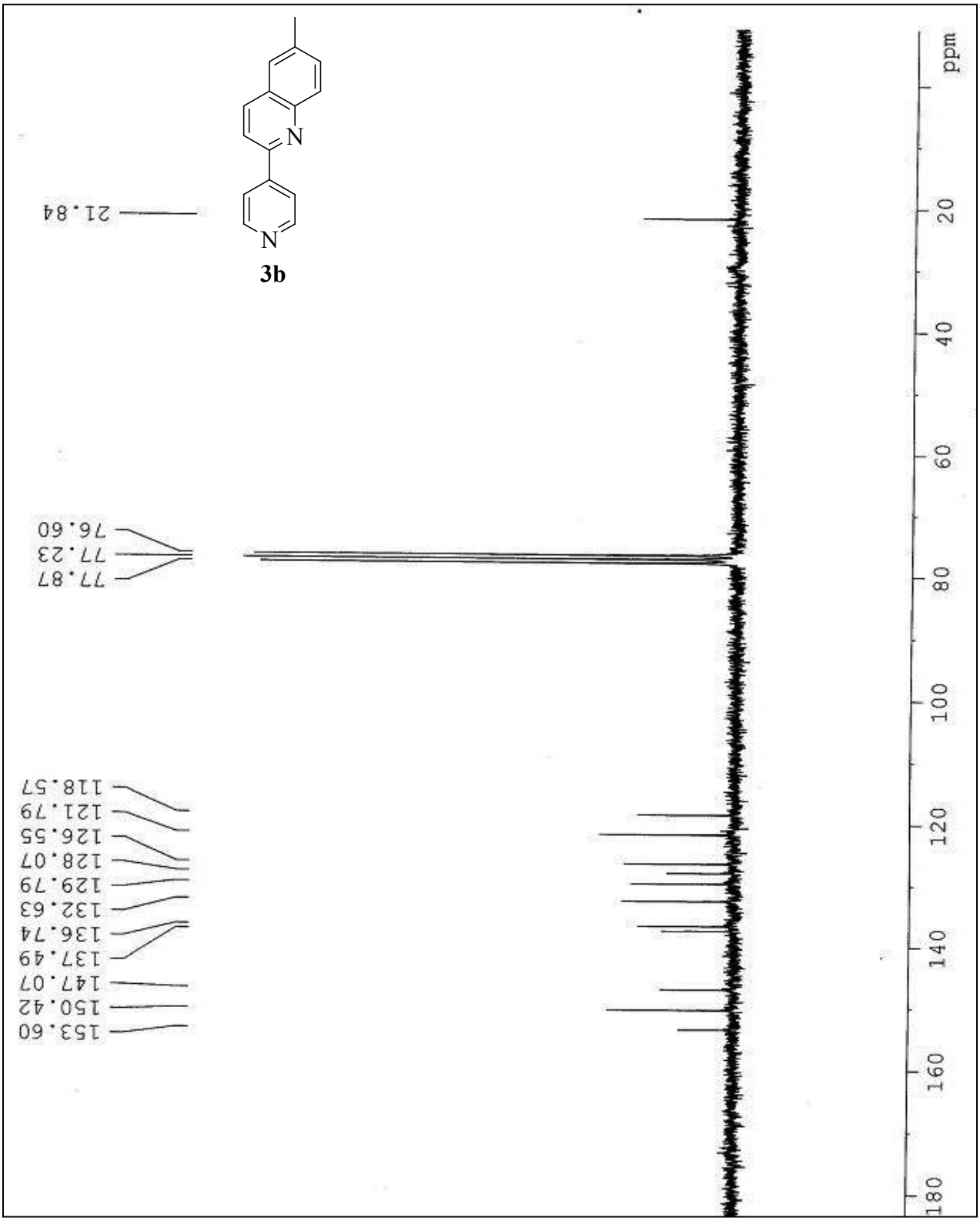
^{13}C NMR (50 MHz in $CDCl_3$) of compound 3a:



^{1}H NMR Spectrum (400 MHz in $CDCl_3$) of compound 3b:

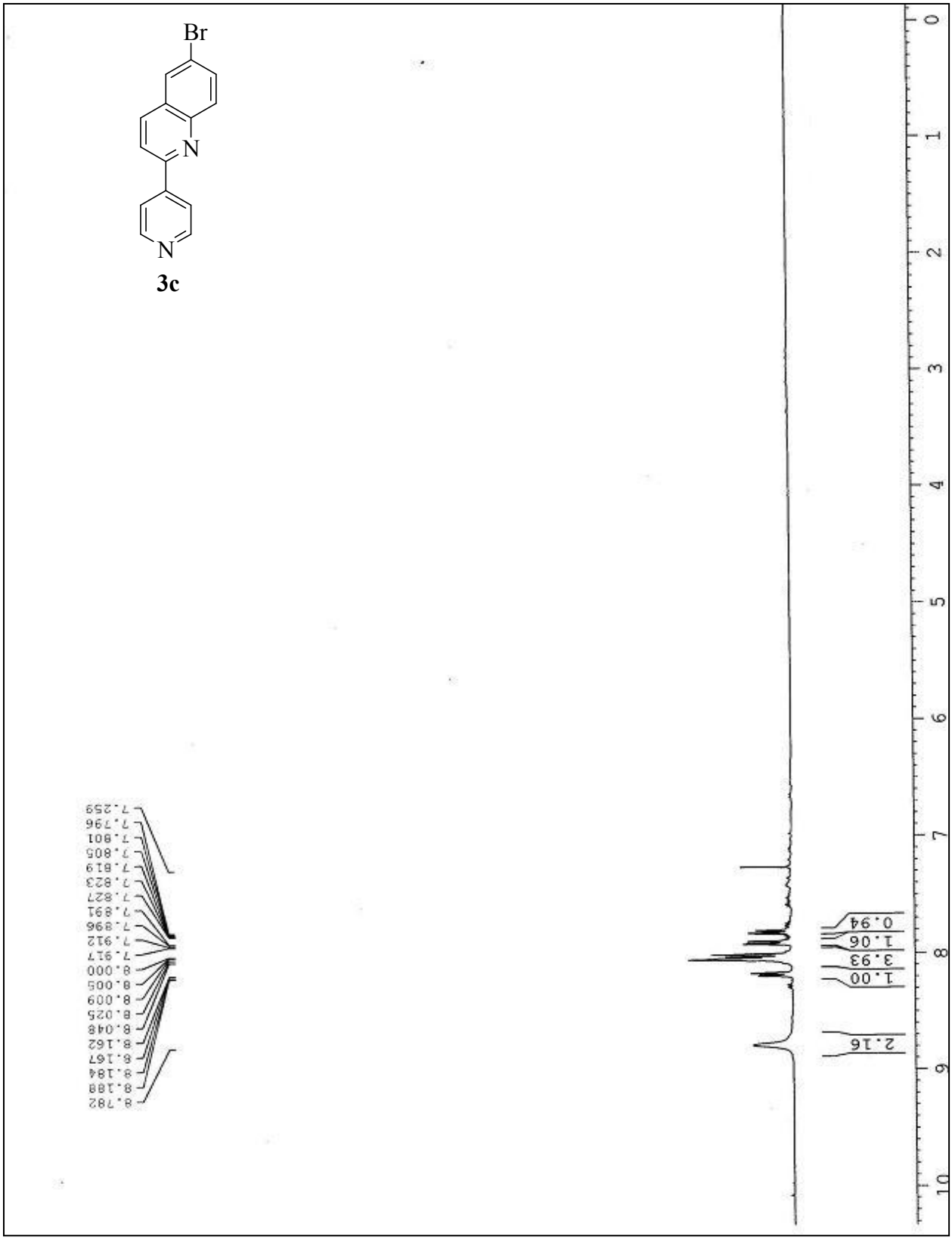


^{13}C NMR (50 MHz in $CDCl_3$) of compound 3b:

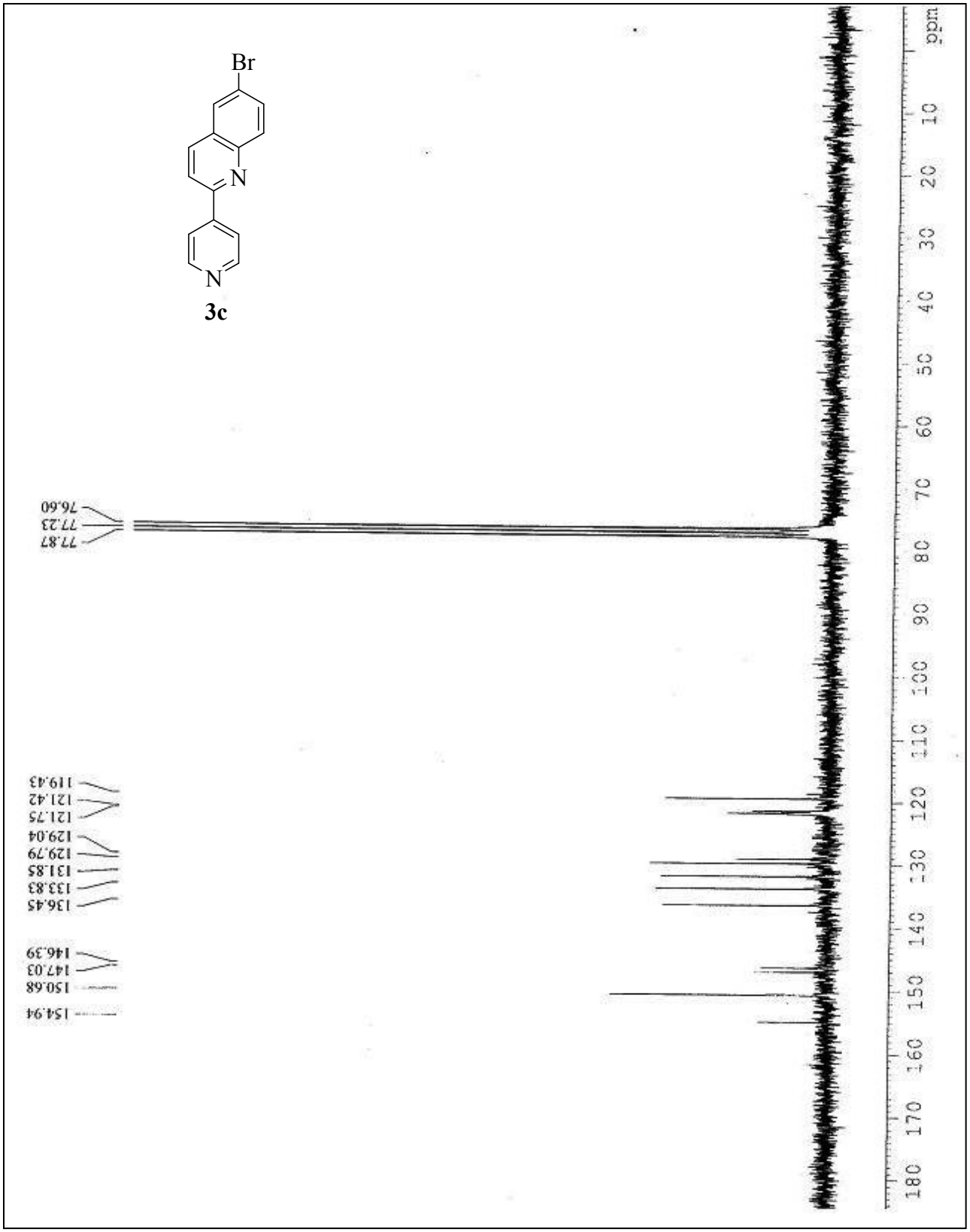


3b

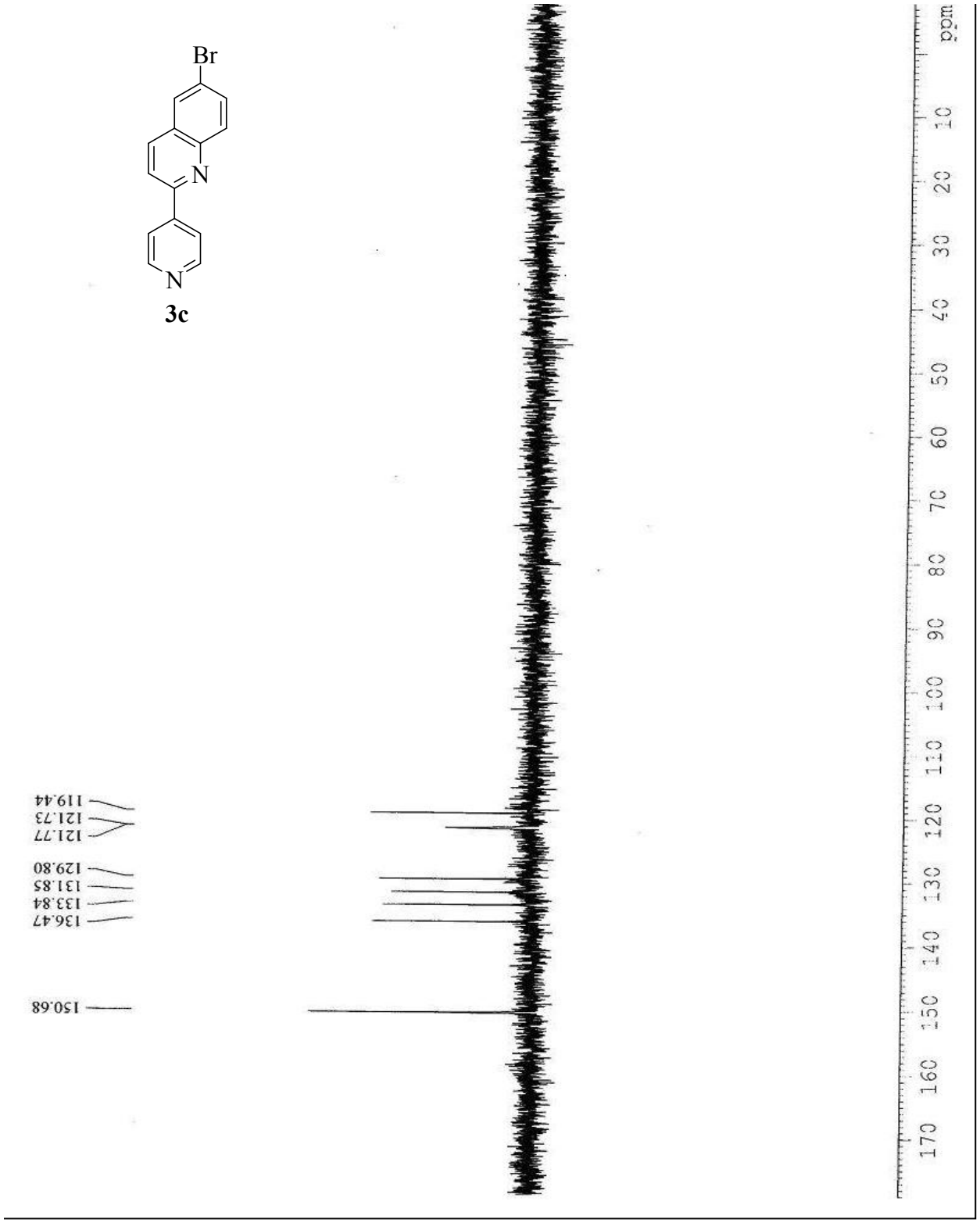
^{1}H NMR Spectrum (400 MHz in $CDCl_3$) of compound 3c:



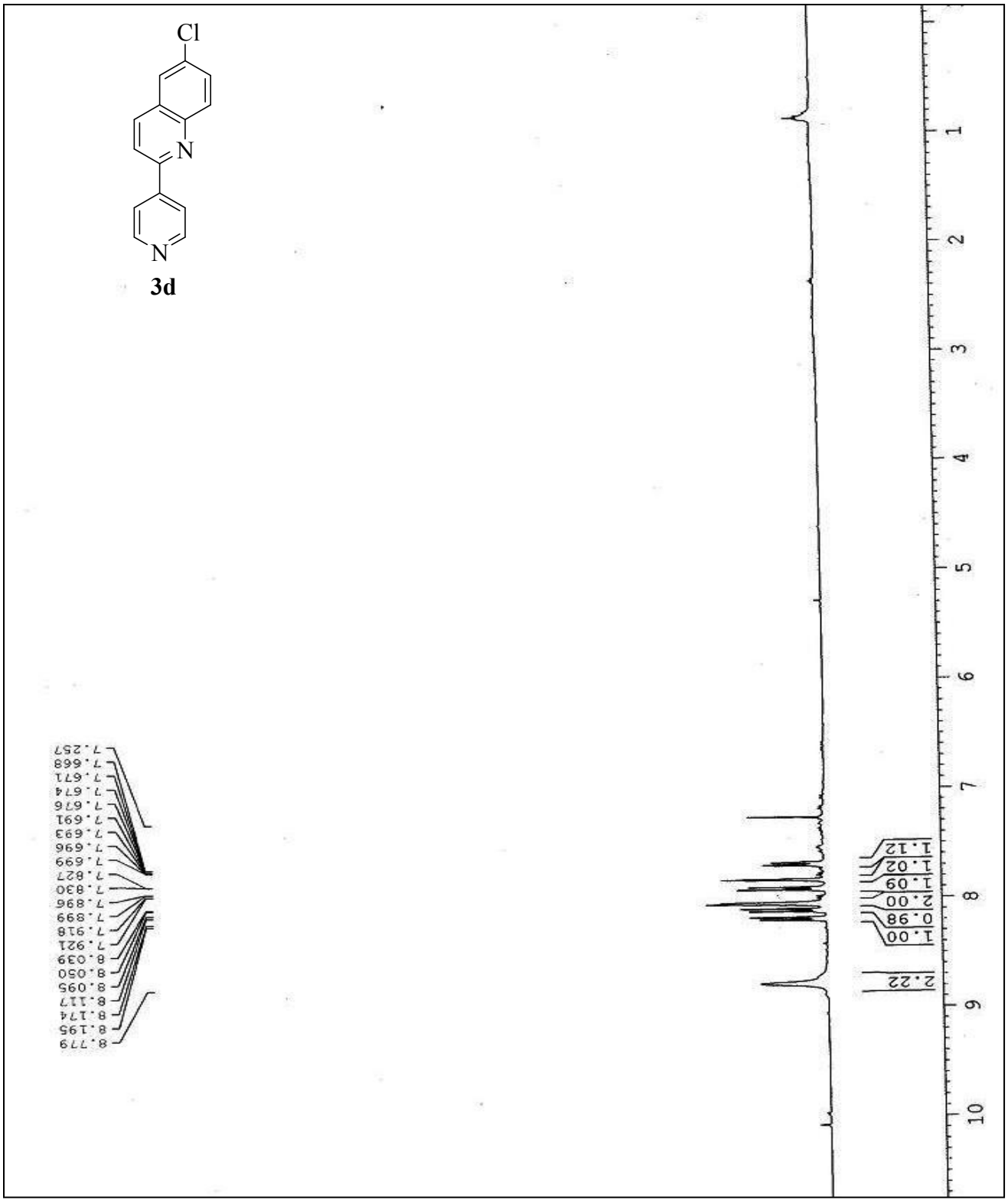
^{13}C NMR (50 MHz in $CDCl_3$) of compound 3c:



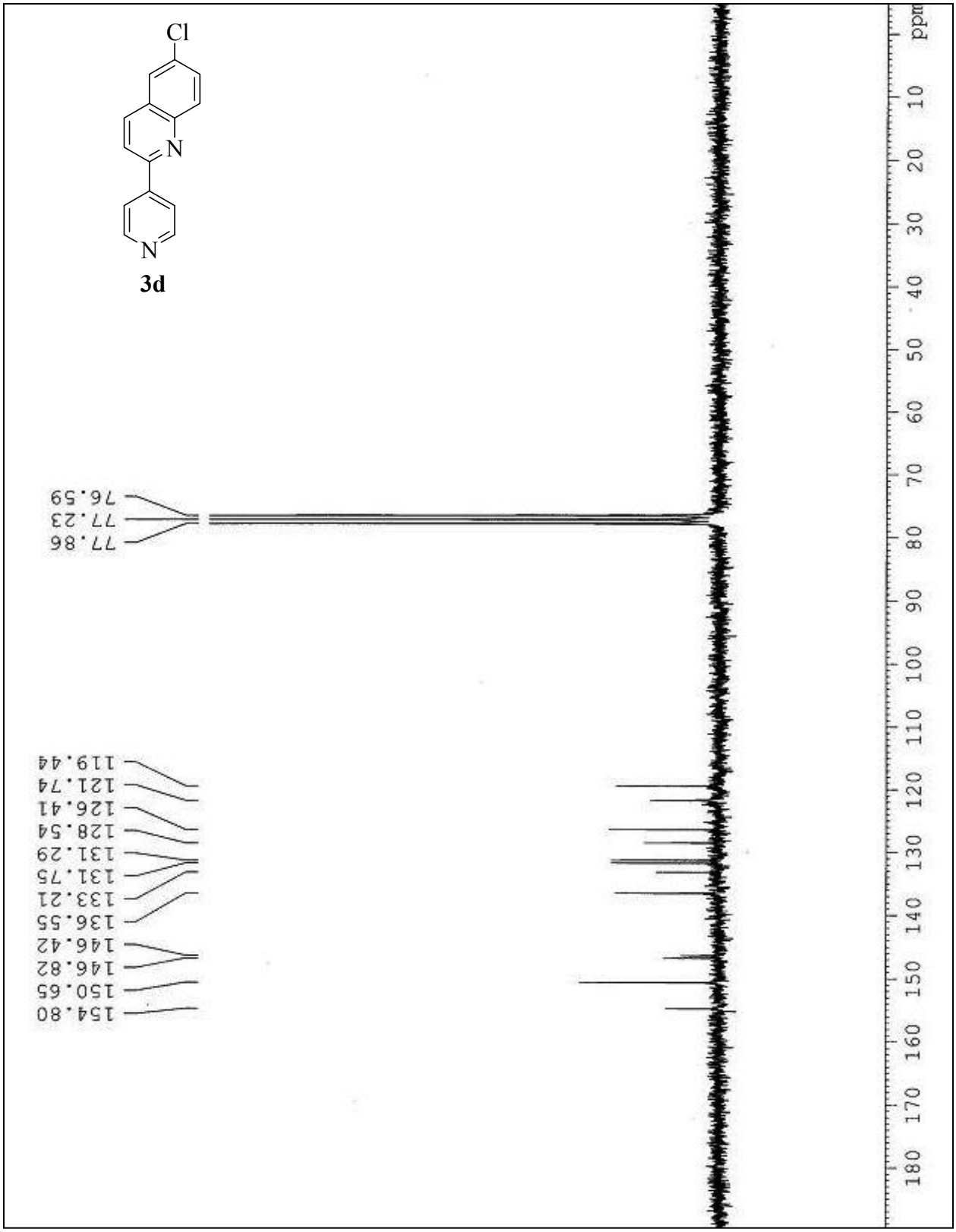
DEPT 135 (50 MHz in $CDCl_3$) of compound 3c:



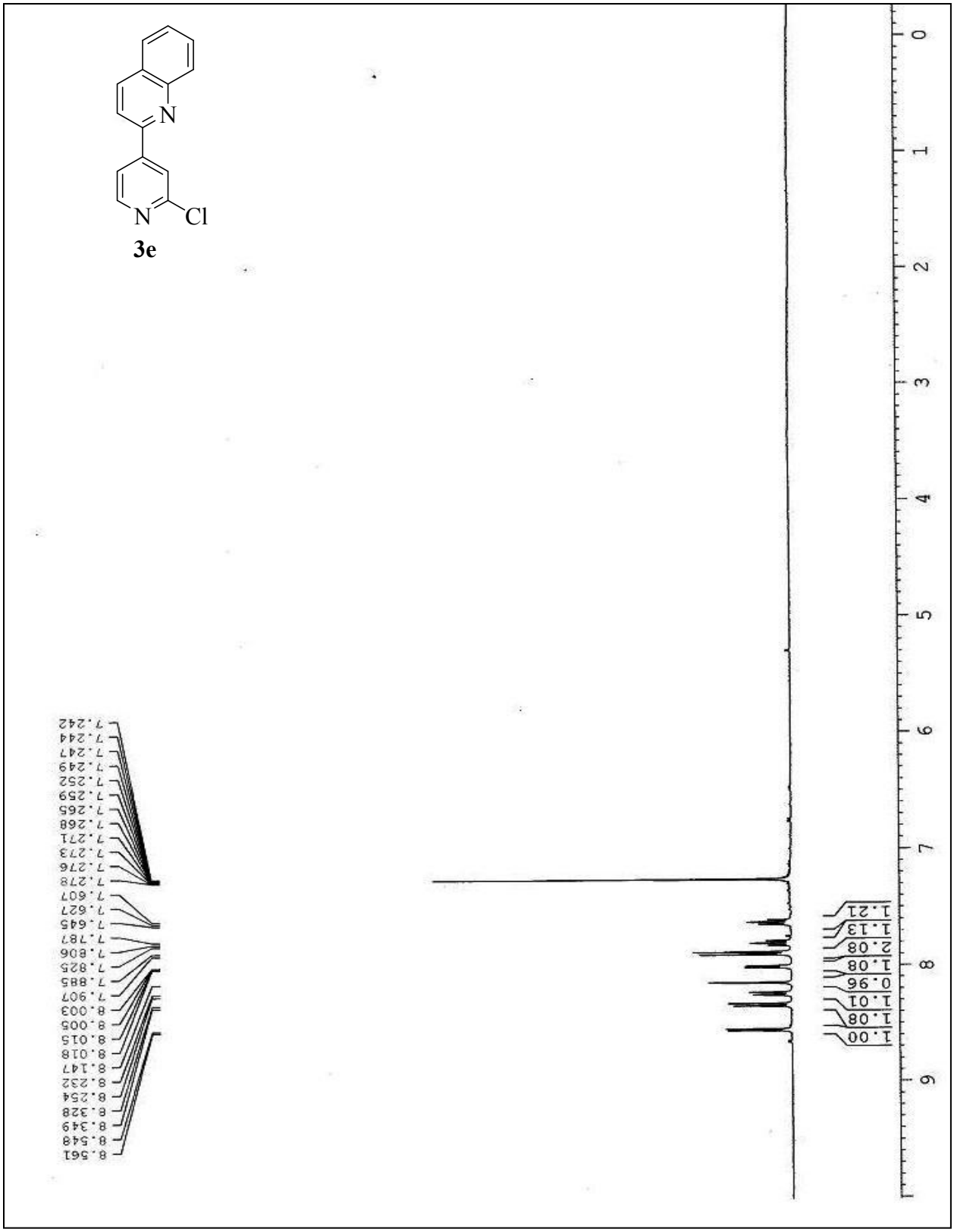
^{1}H NMR Spectrum (400 MHz in $CDCl_3$) of compound 3d:



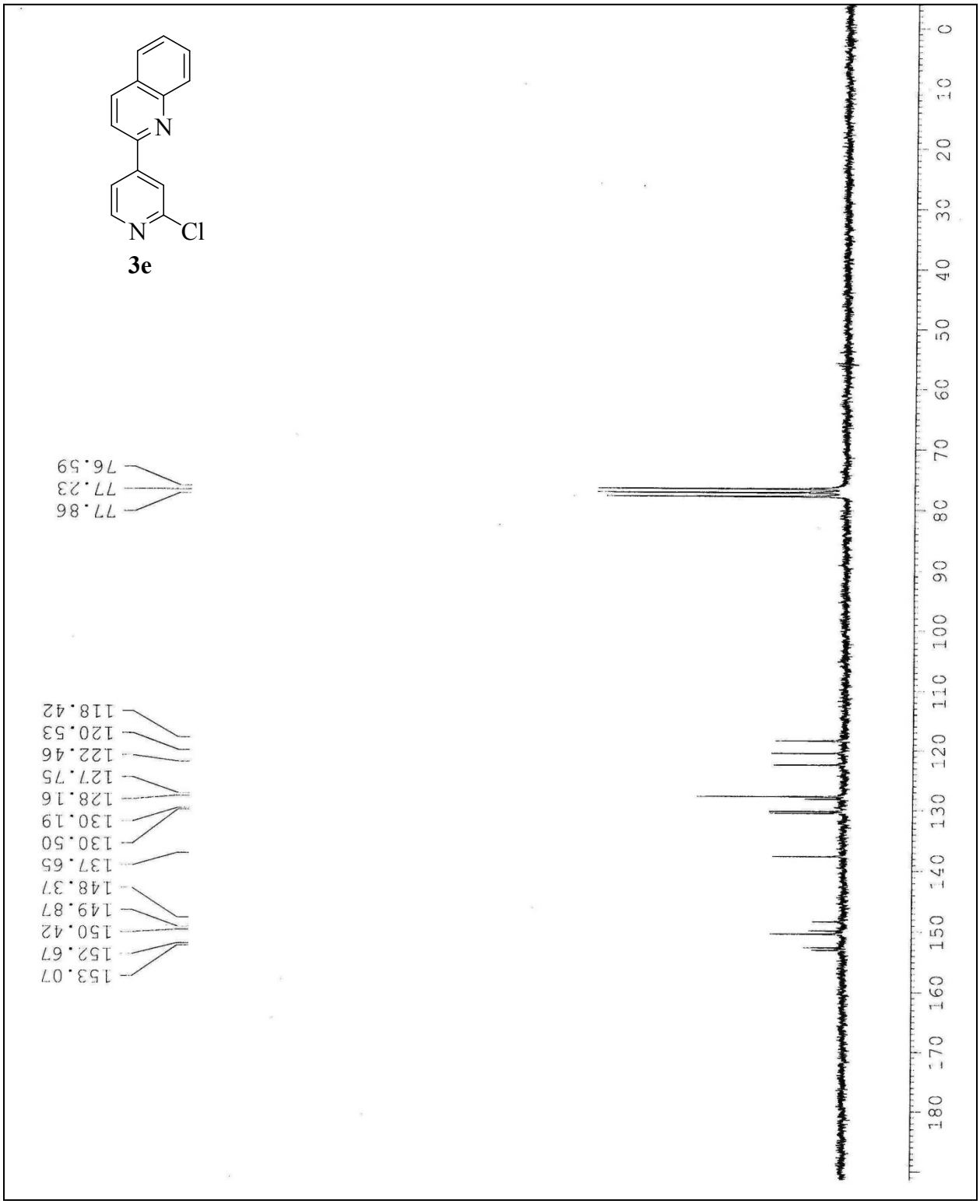
^{13}C NMR (50 MHz in $CDCl_3$) of compound 3d:



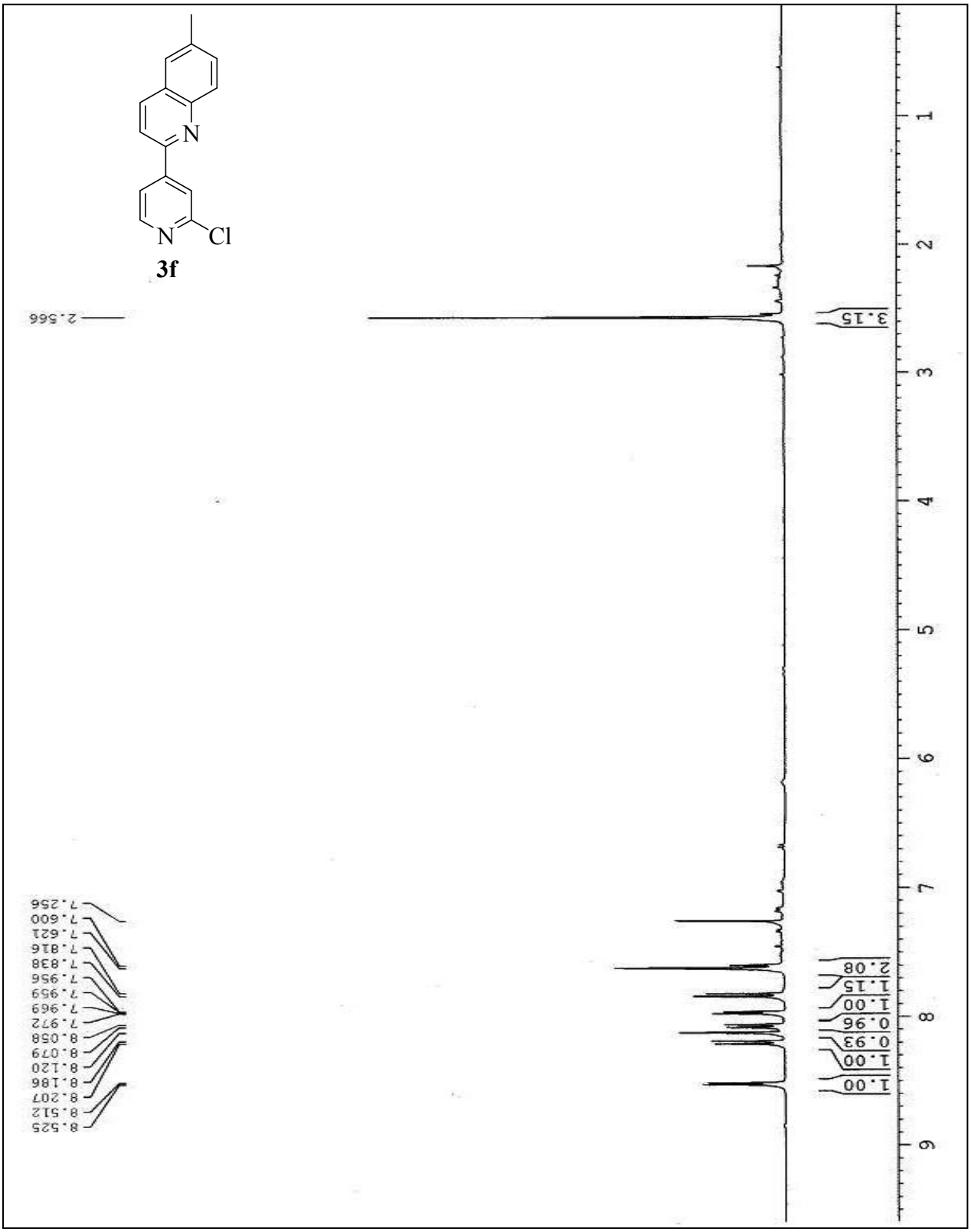
^{1}H NMR Spectrum (400 MHz in $CDCl_3$) of compound 3e:



^{13}C NMR (50 MHz in $CDCl_3$) of compound 3e:



^{1}H NMR Spectrum (400 MHz in $CDCl_3$) of compound 3f:



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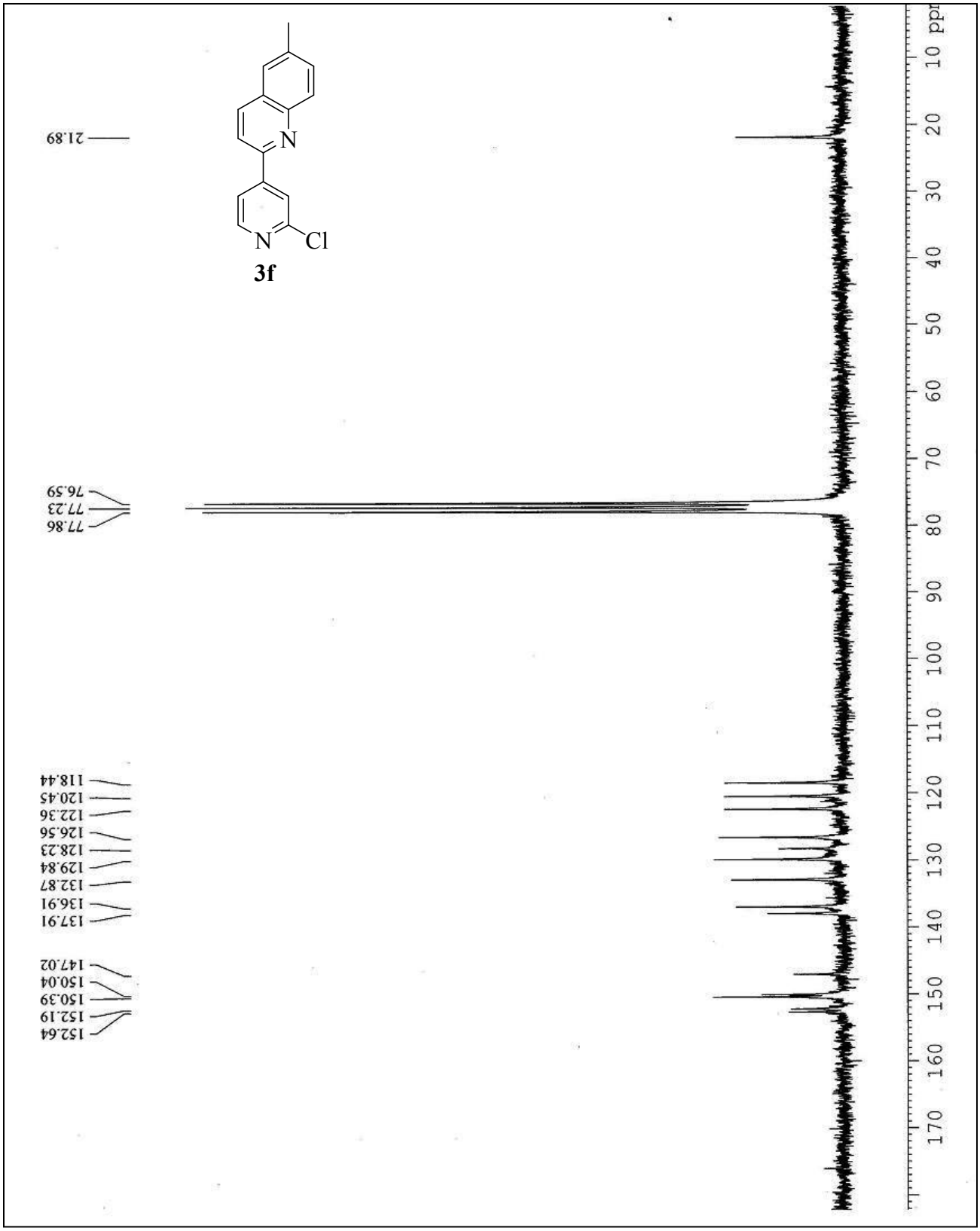
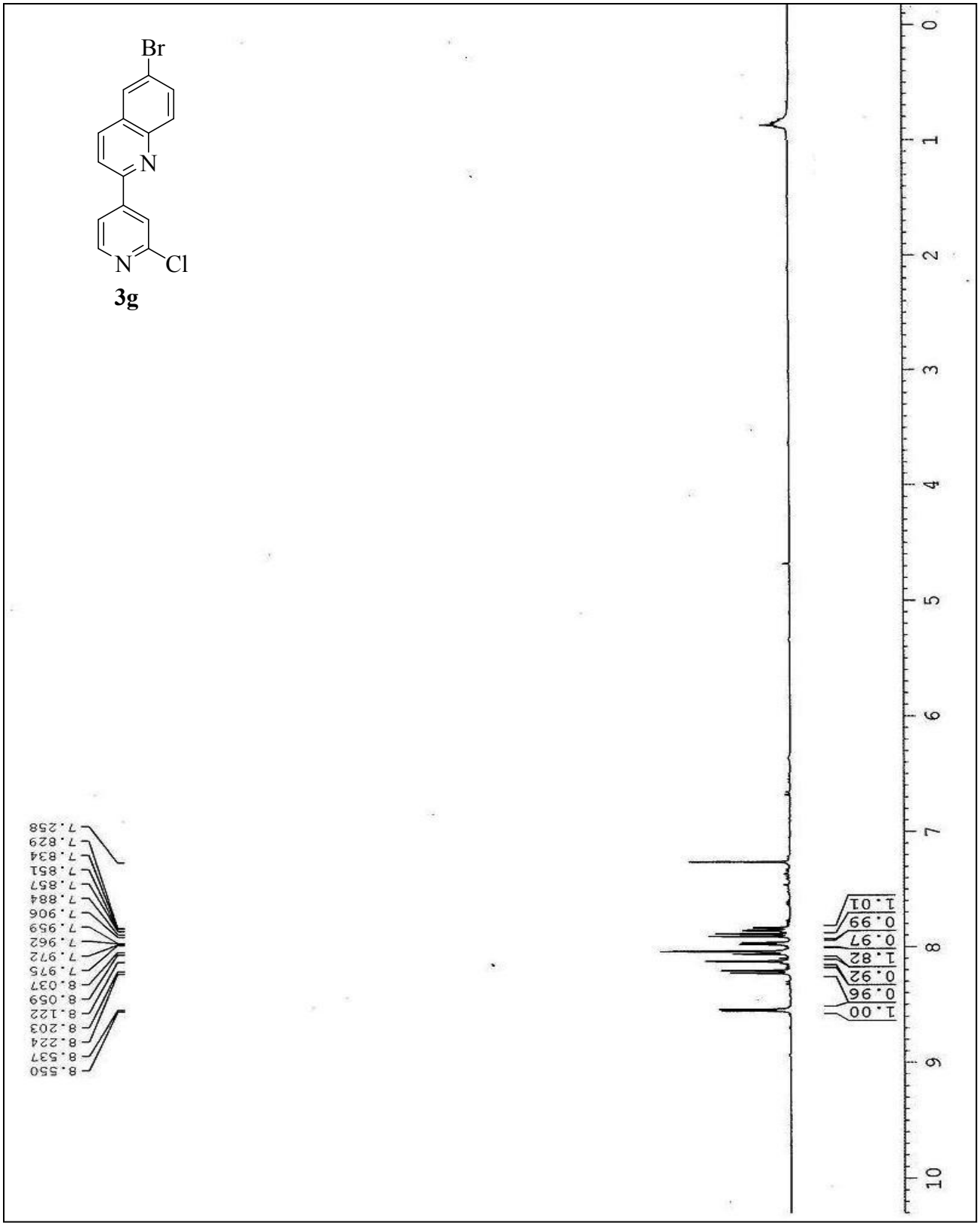
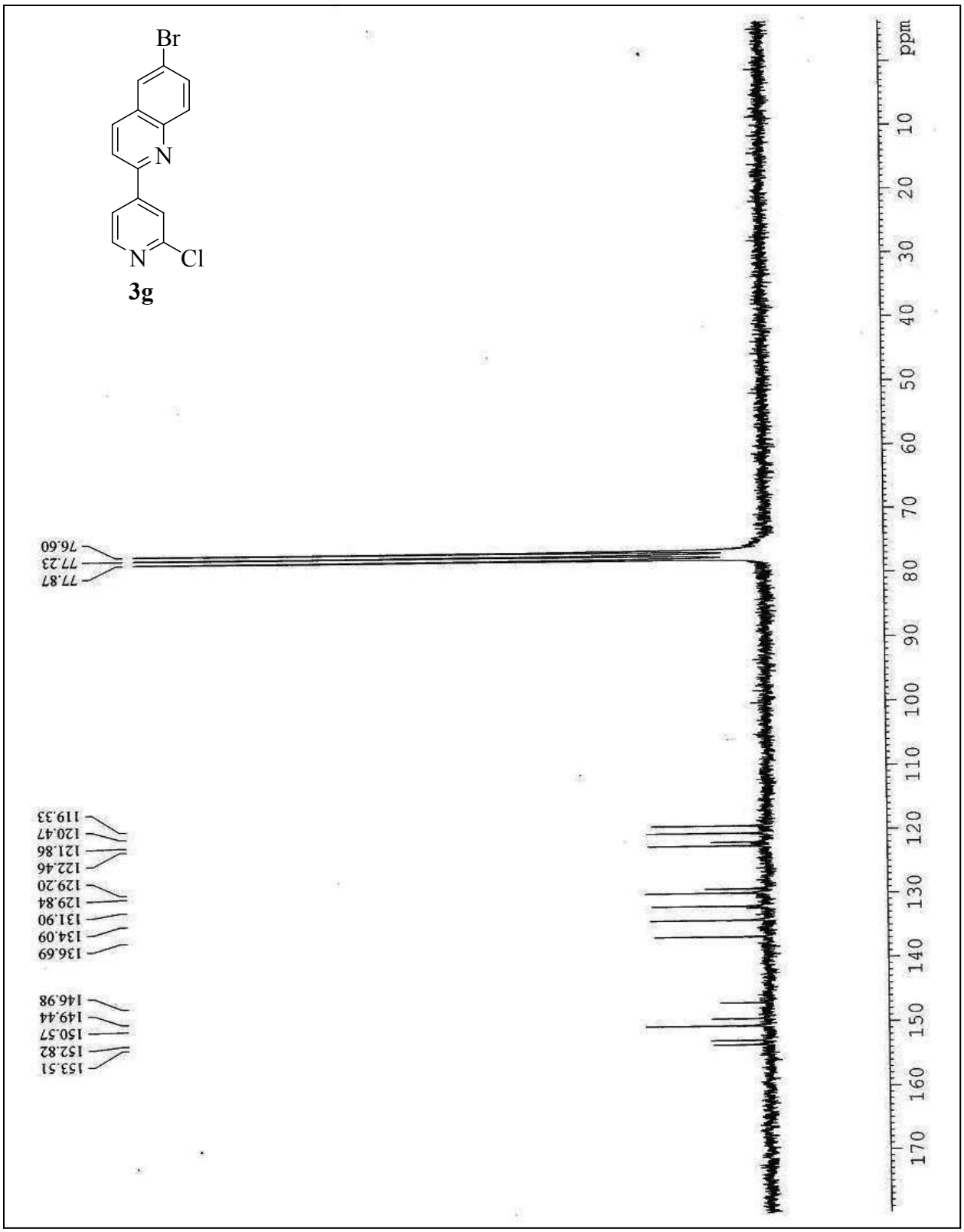


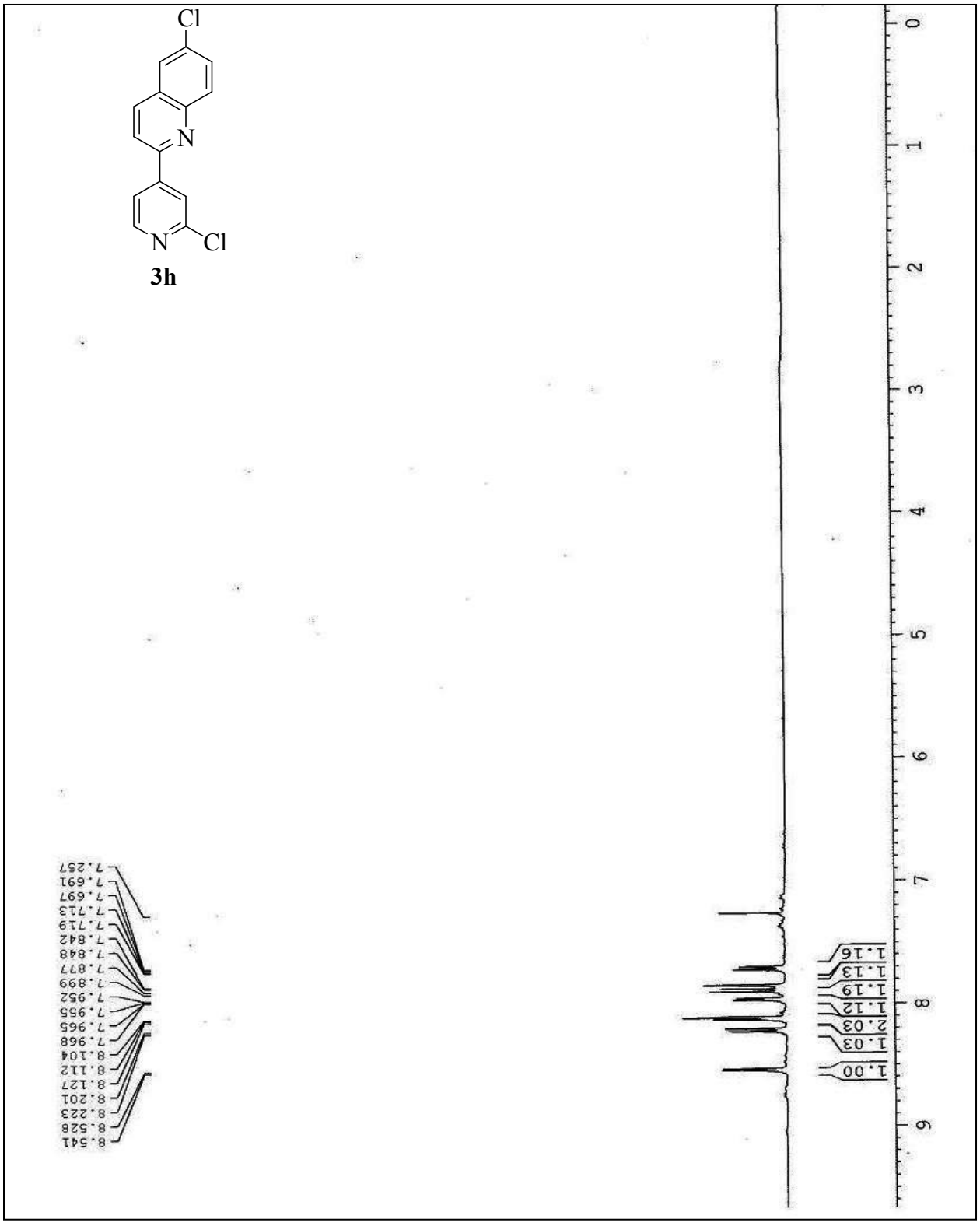
^{1}H NMR Spectrum (400 MHz in $CDCl_3$) of compound 3g:



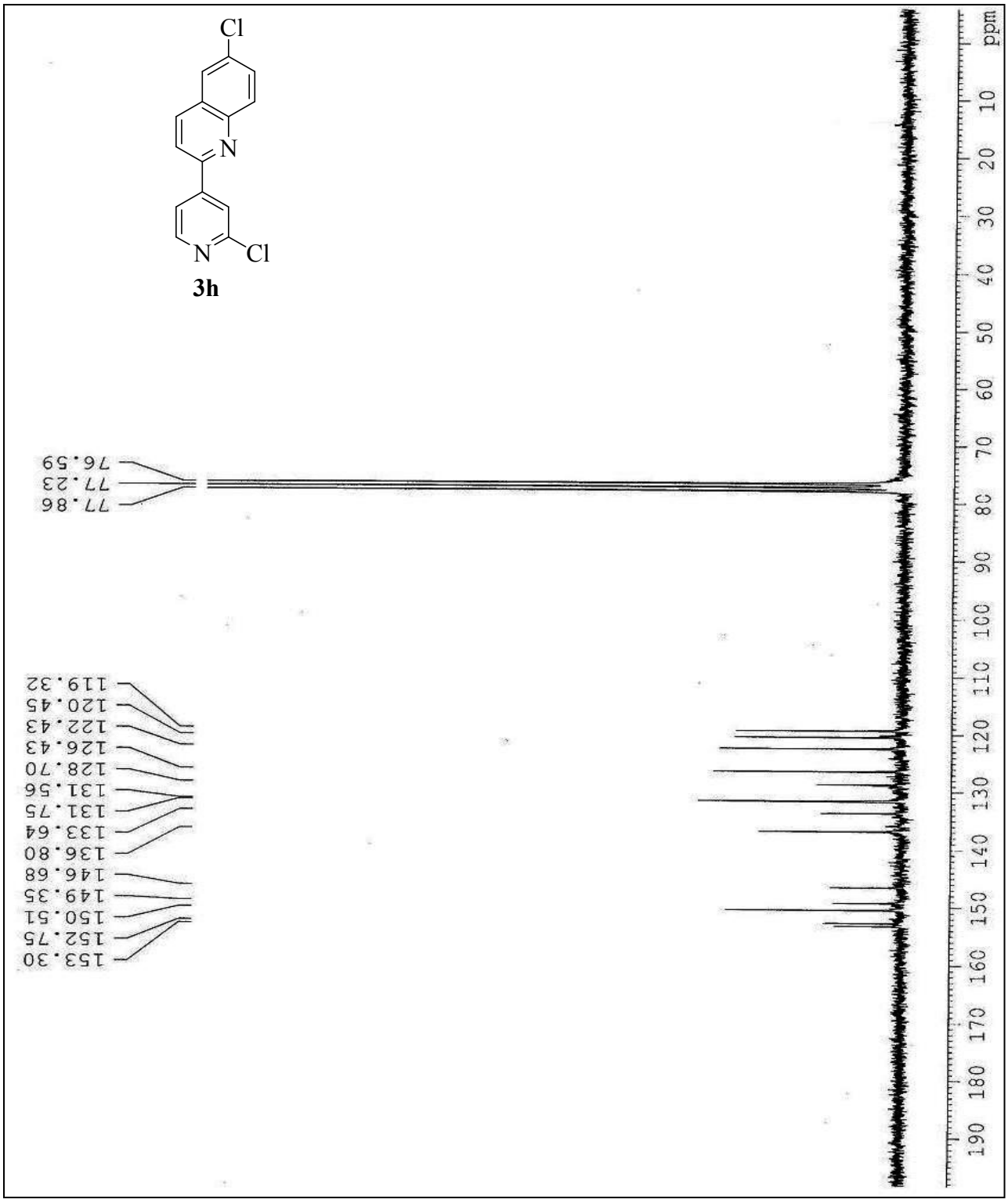
^{13}C NMR (50 MHz in $CDCl_3$) of compound 3g:



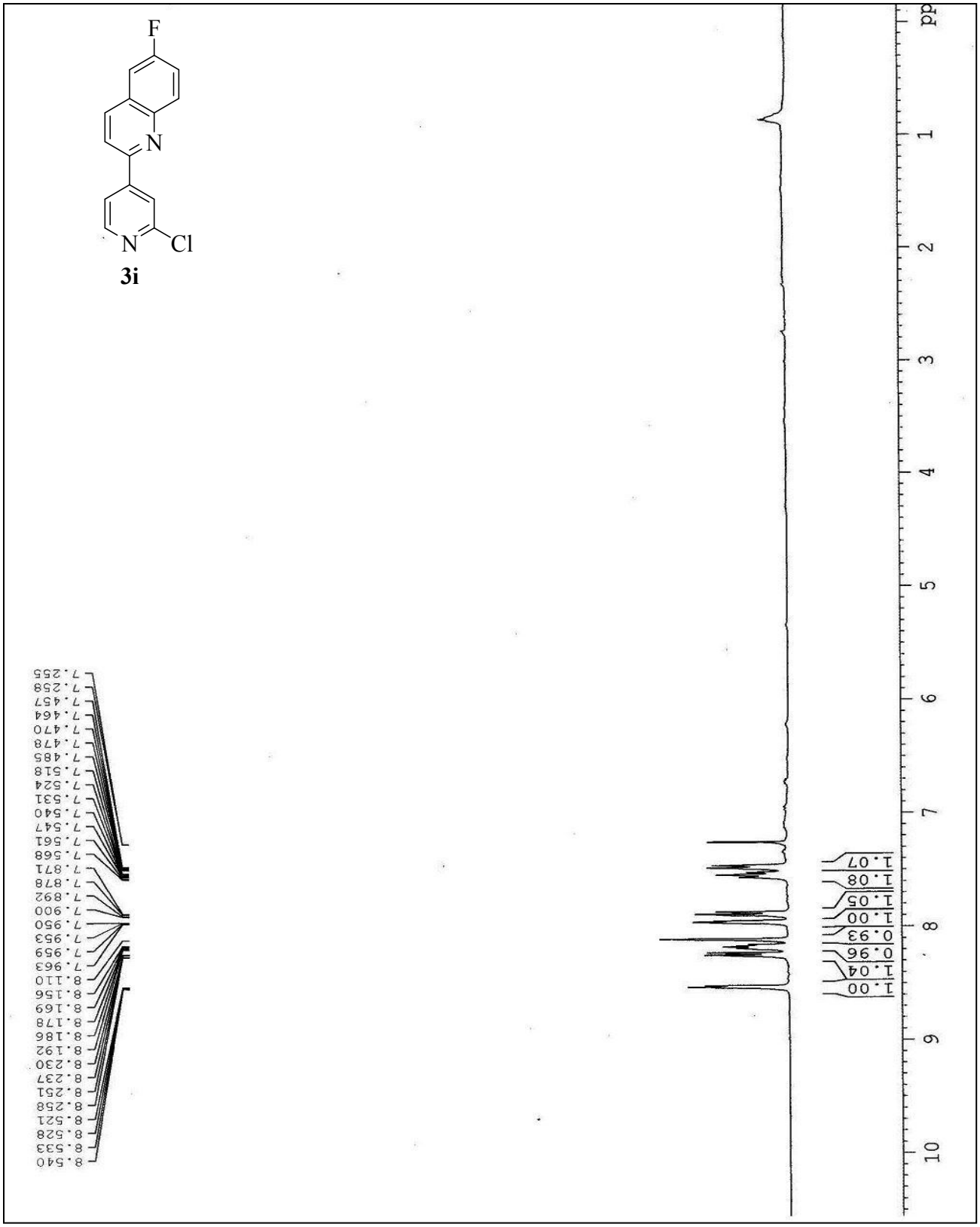
^{1}H NMR Spectrum (400 MHz in $CDCl_3$) of compound 3h:



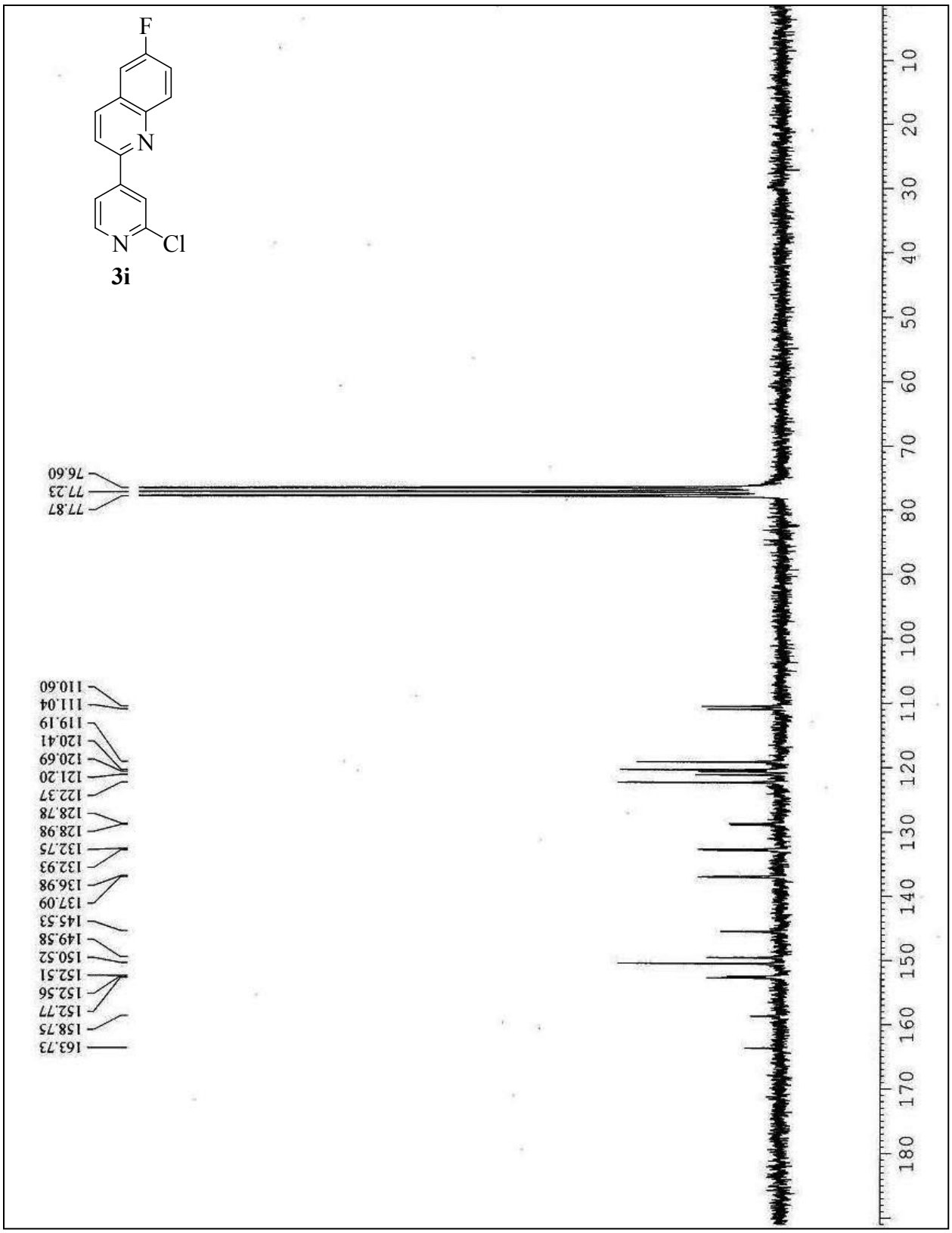
^{13}C NMR (50 MHz in $CDCl_3$) of compound 3h:



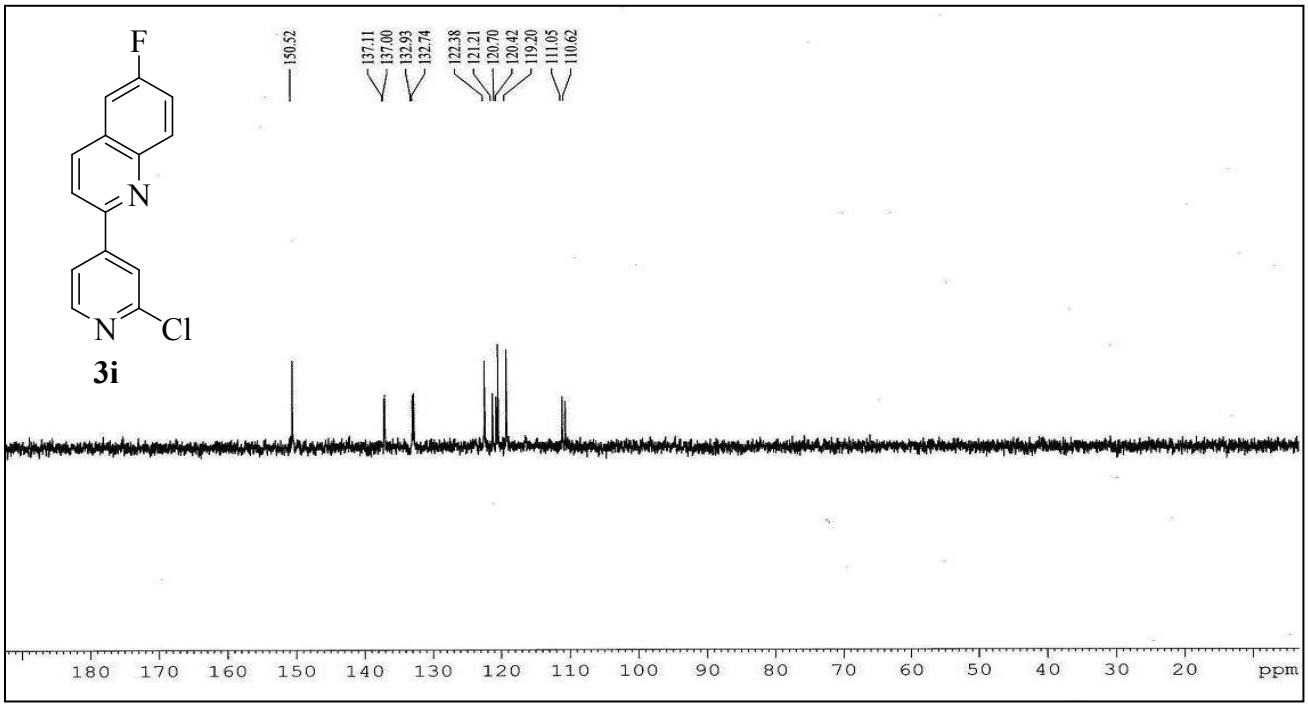
^{1}H NMR Spectrum (400 MHz in $CDCl_3$) of compound 3i:



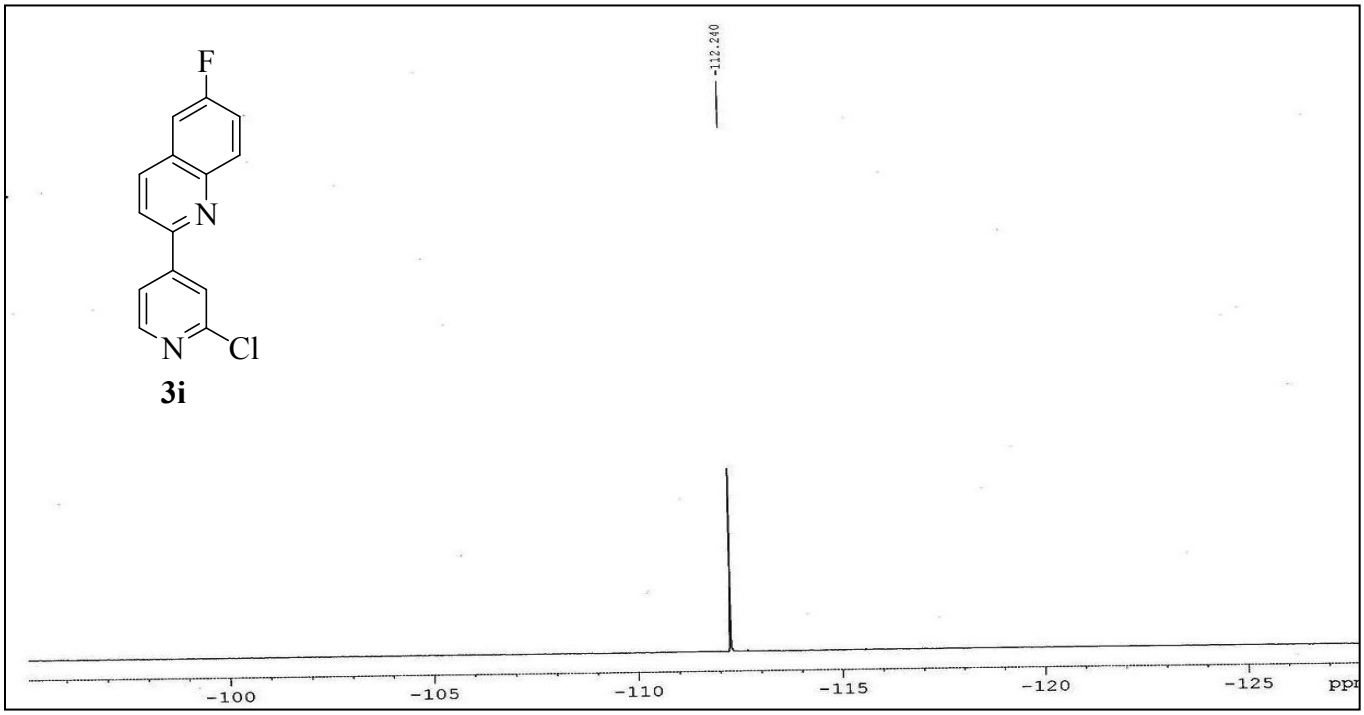
^{13}C NMR (50 MHz in $CDCl_3$) of compound 3i:



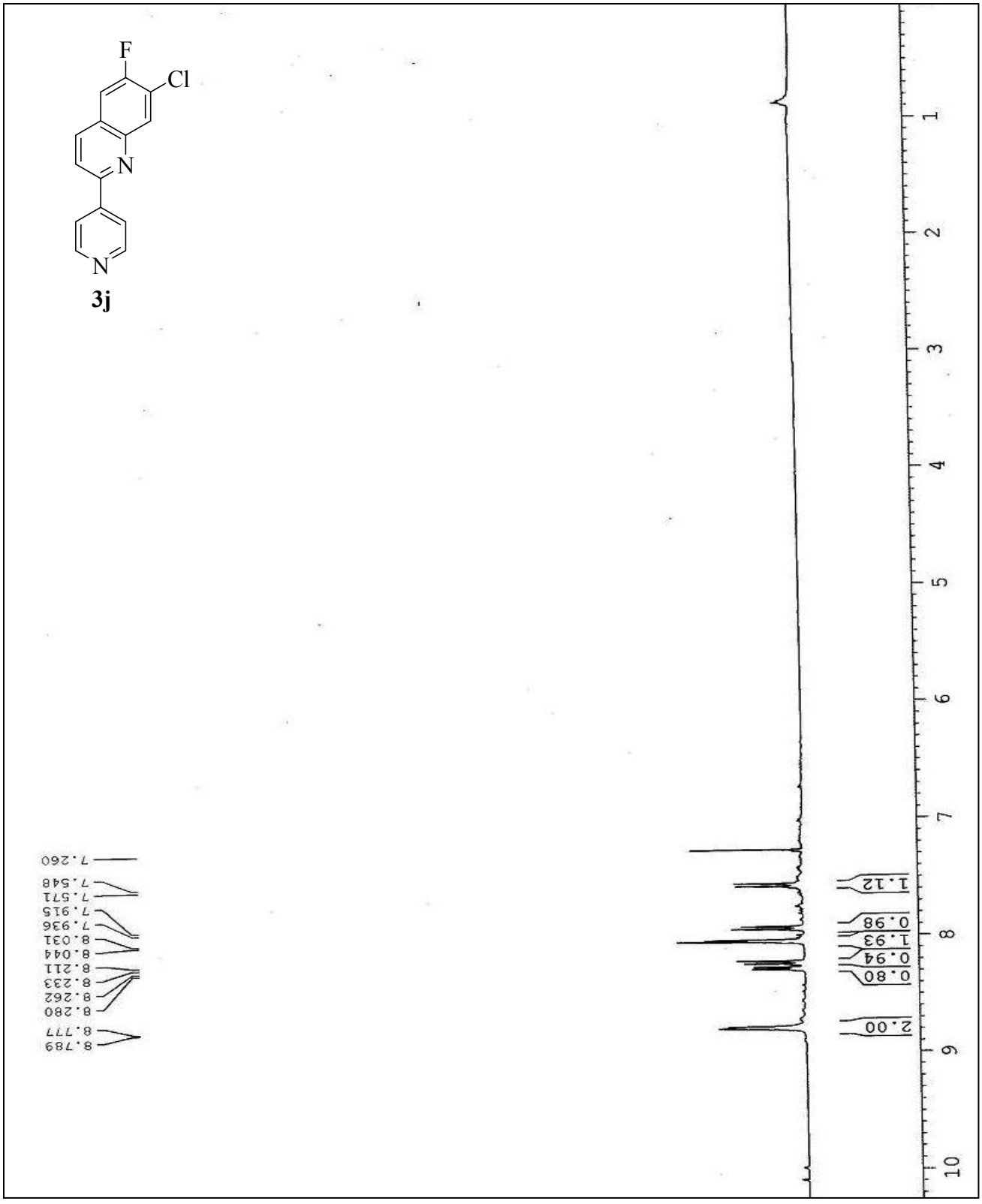
DEPT 135 (50 MHz in $CDCl_3$) of compound 3i:



^{19}F NMR Spectrum (376 MHz in $CDCl_3$) of compound 3i:



^{1}H NMR Spectrum (400 MHz in $CDCl_3$) of compound 3j:



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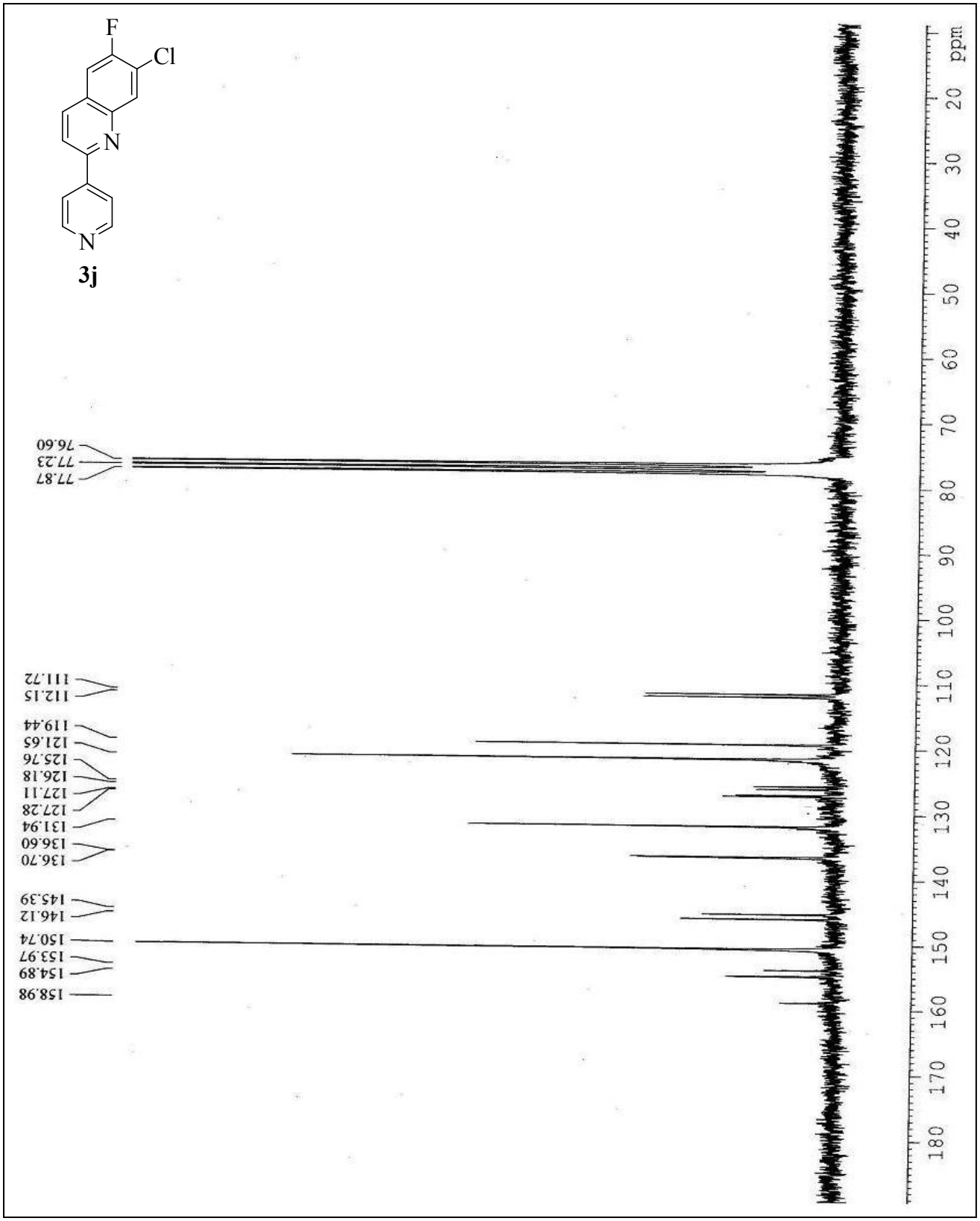
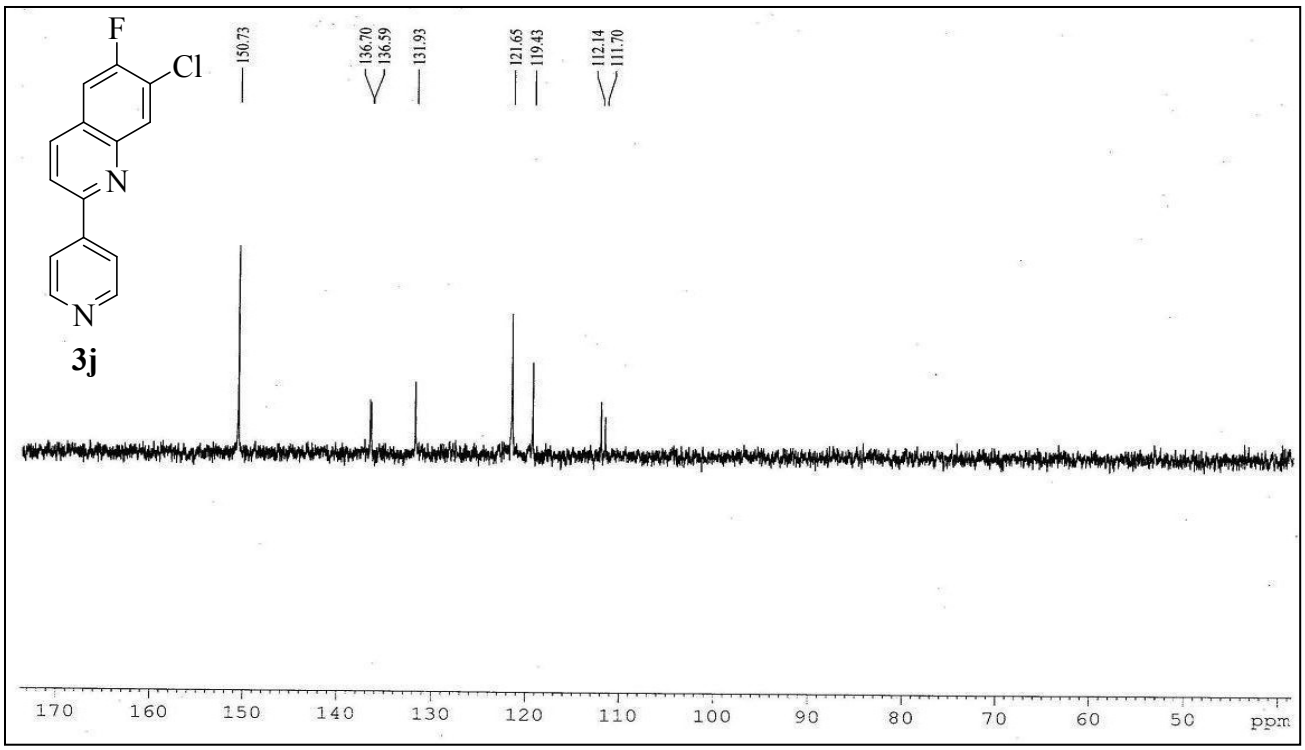
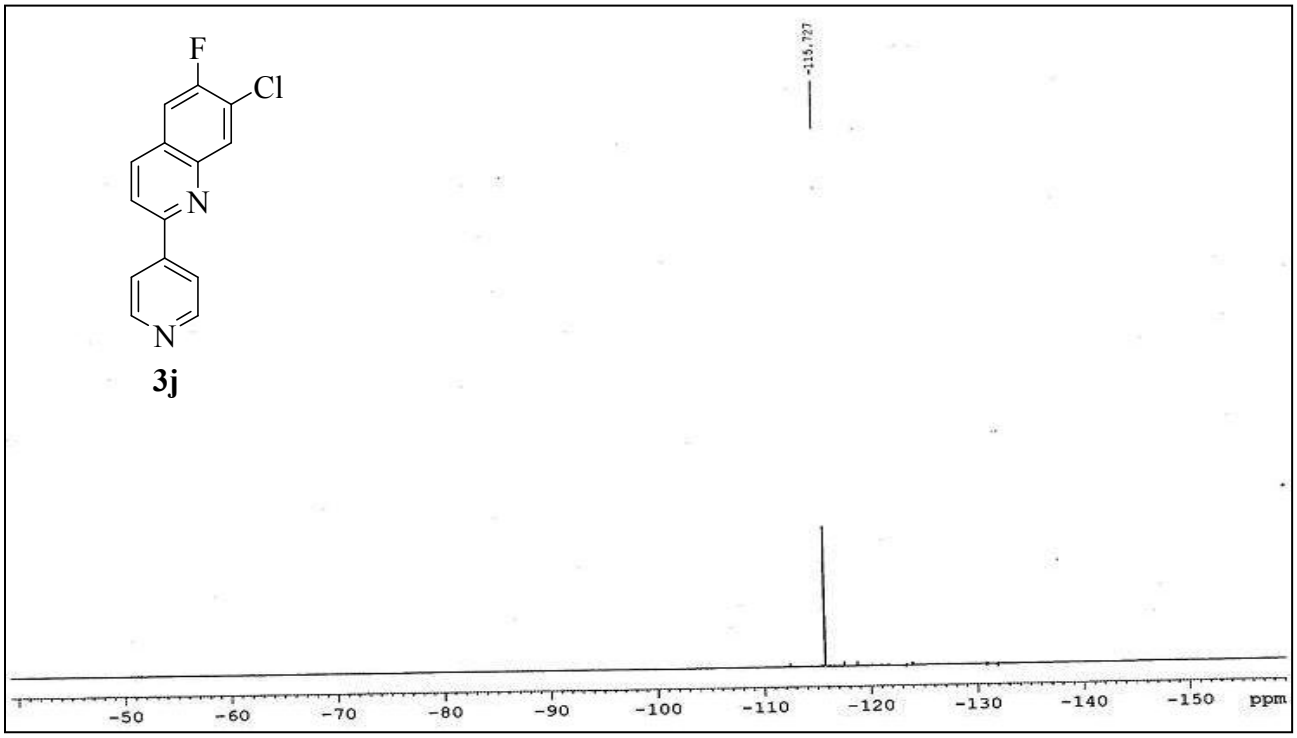


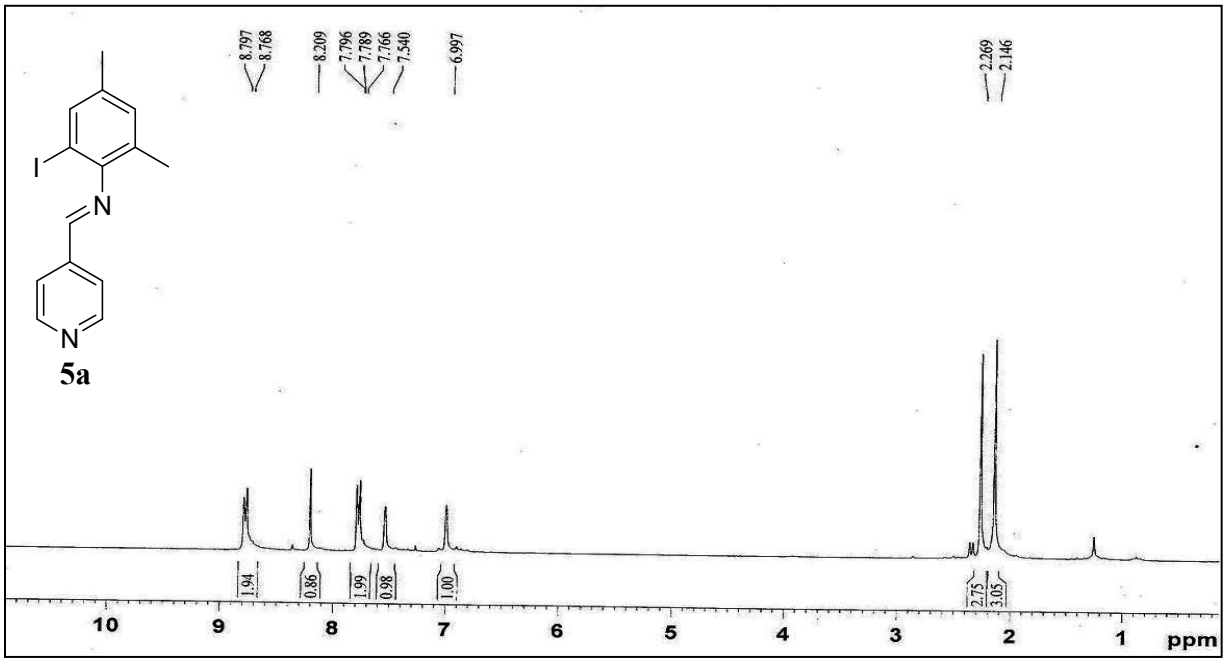
DEPT 135 (50 MHz in $CDCl_3$) of compound 3j:



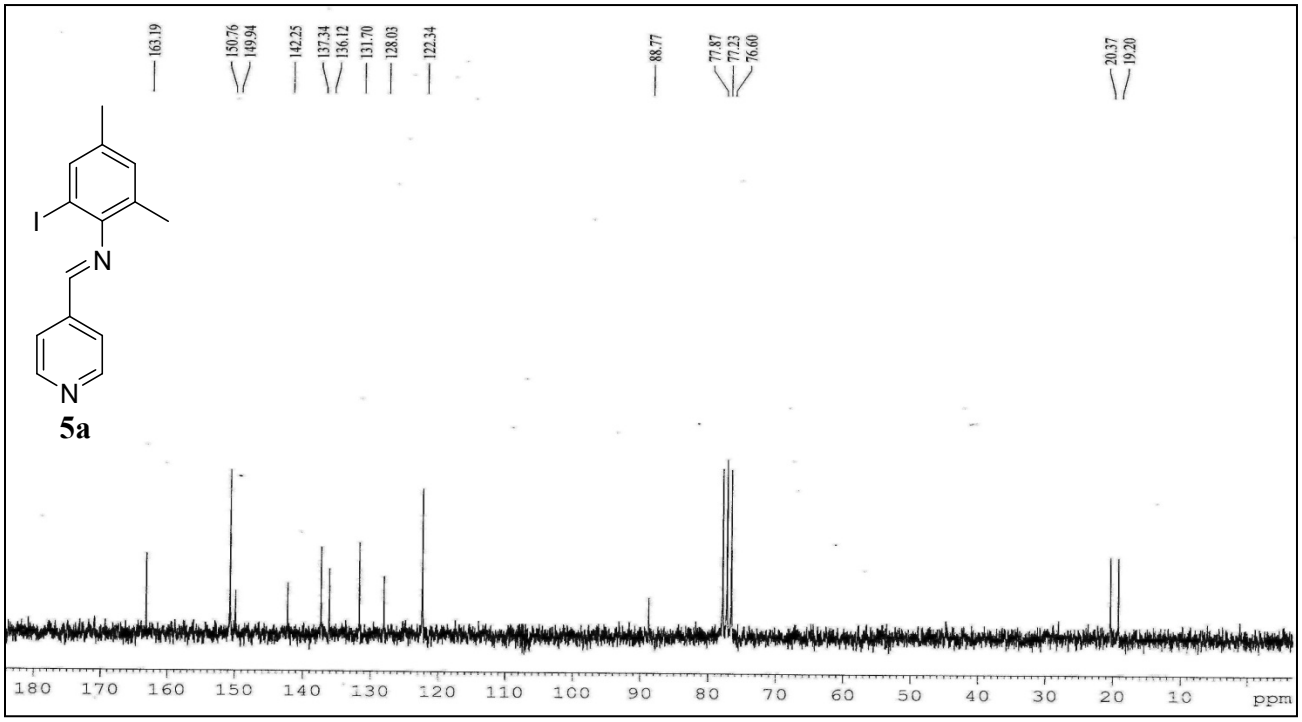
^{19}F NMR Spectrum (376 MHz in $CDCl_3$) of compound 3j:



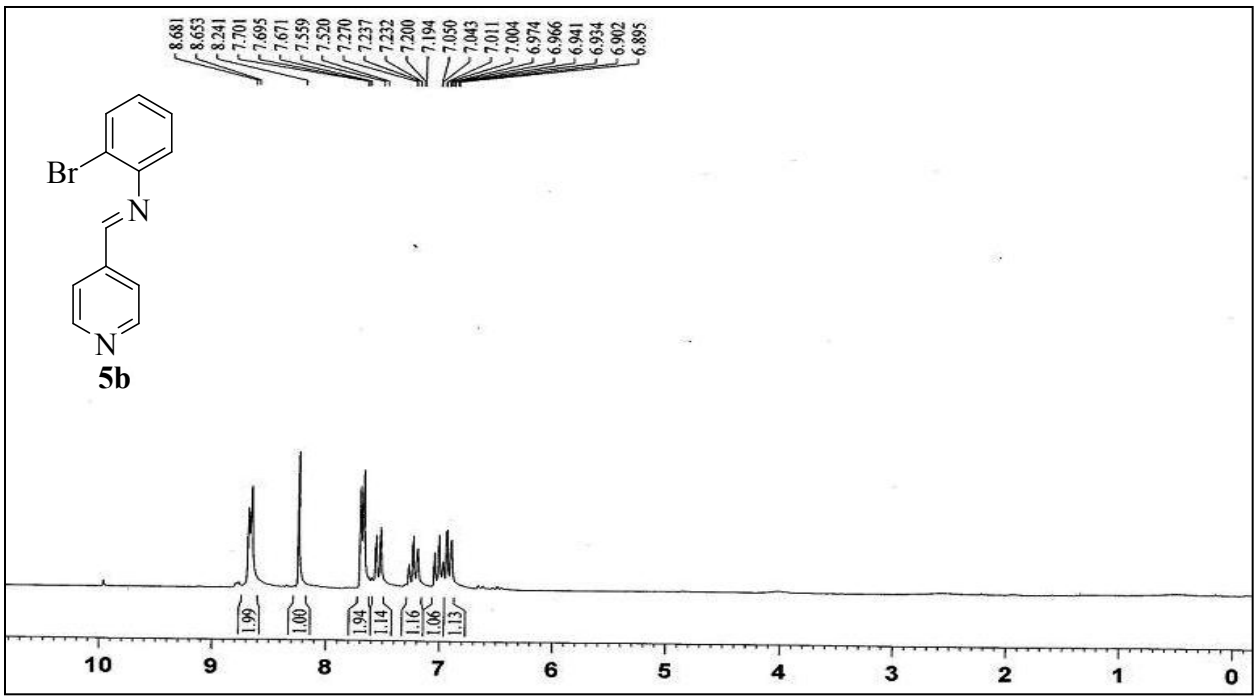
^{1}H NMR Spectrum (200 MHz in $CDCl_3$) of compound 5a:



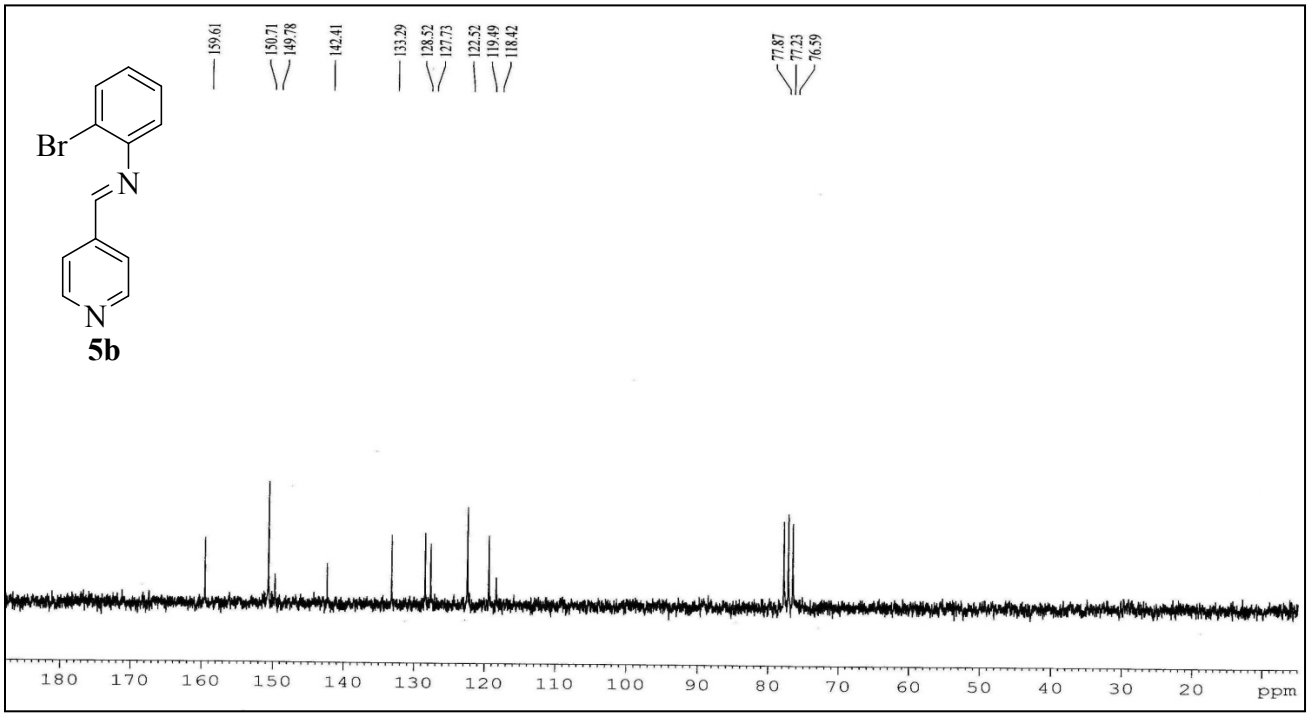
^{13}C NMR (50 MHz in $CDCl_3$) of compound 5a:



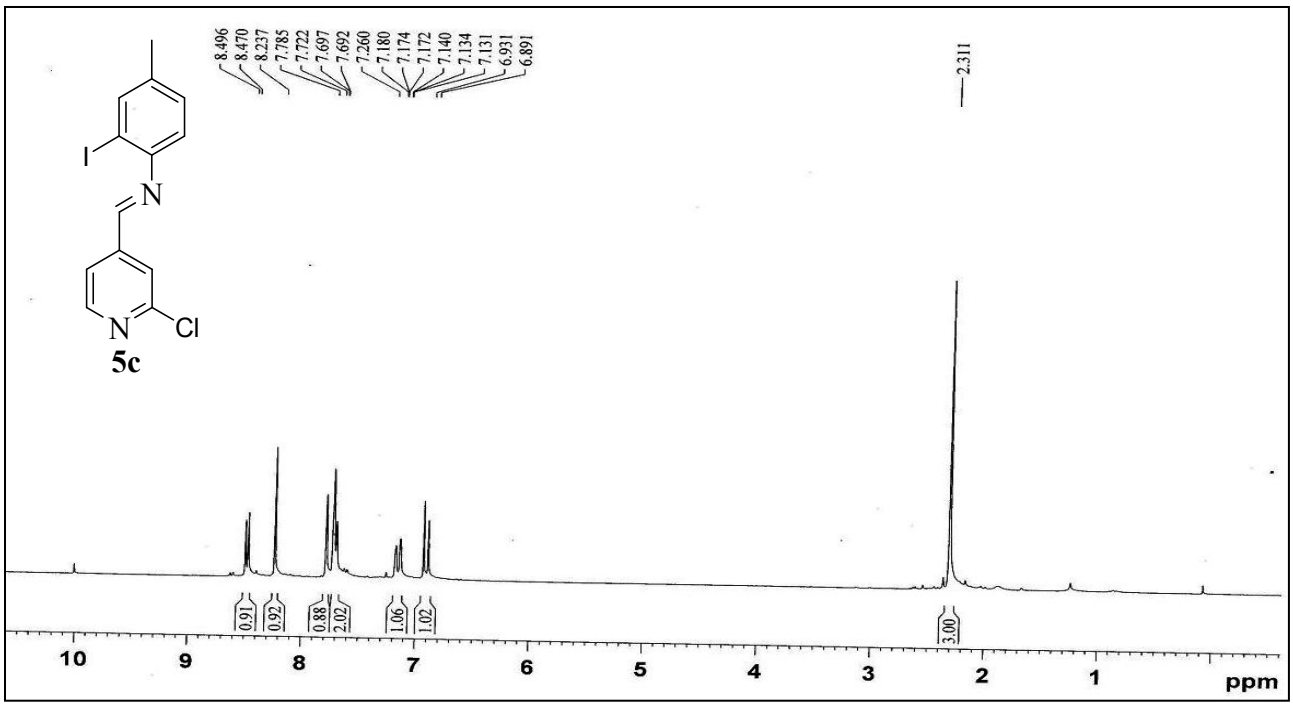
^{1}H NMR Spectrum (200 MHz in $CDCl_3$) of compound 5b:



^{13}C NMR (50 MHz in $CDCl_3$) of compound 5b:



^{1}H NMR Spectrum (200 MHz in $CDCl_3$) of compound 5c:



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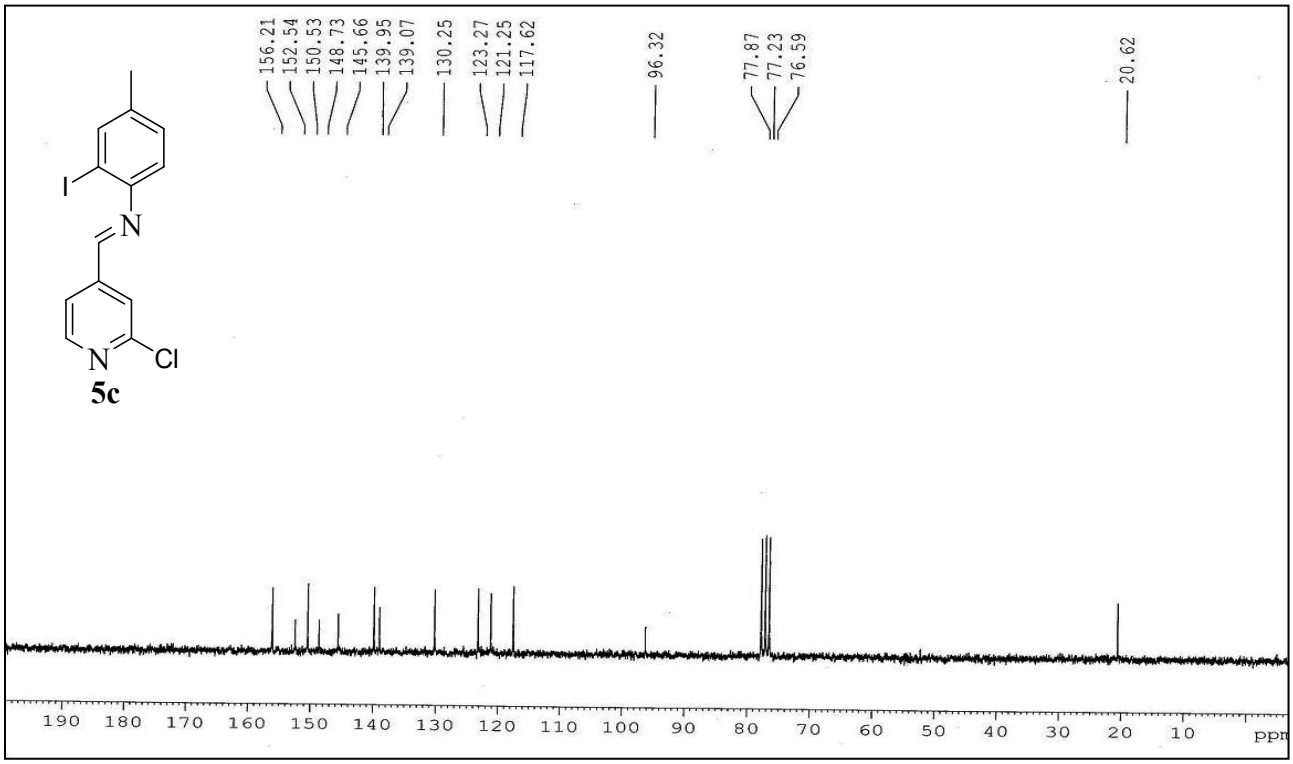
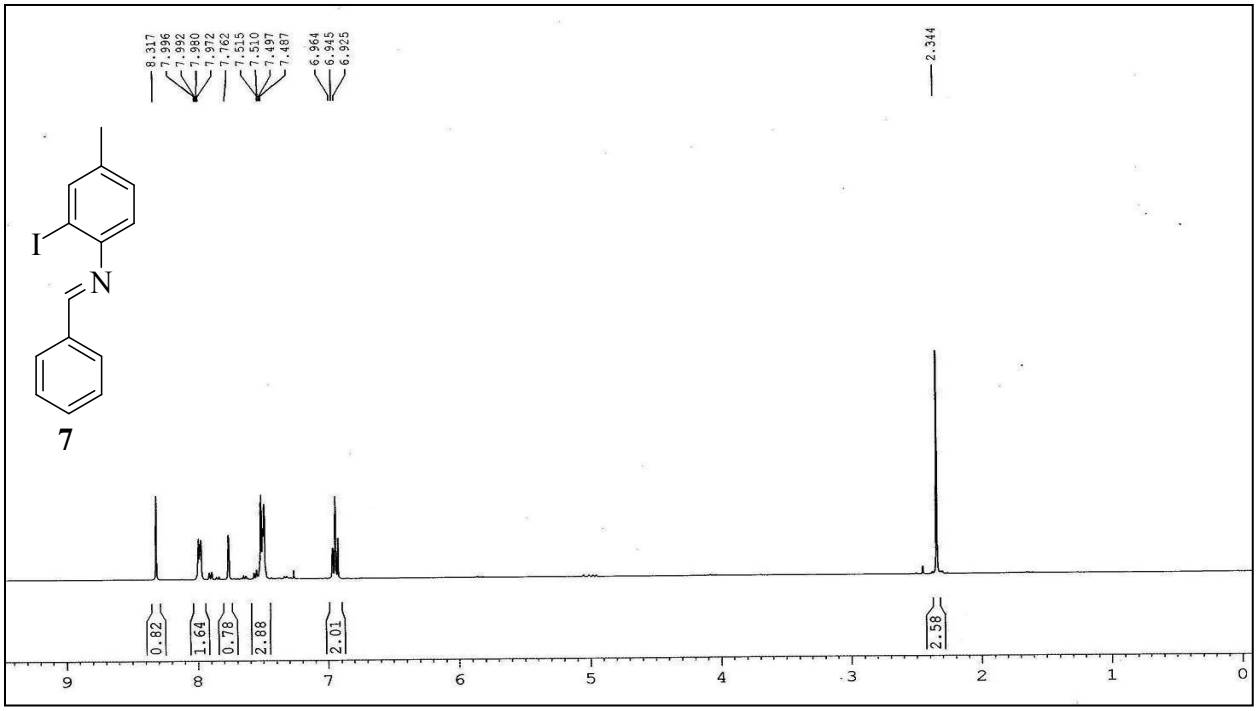


^{1}H NMR Spectrum (400 MHz in $CDCl_3$) of 7:



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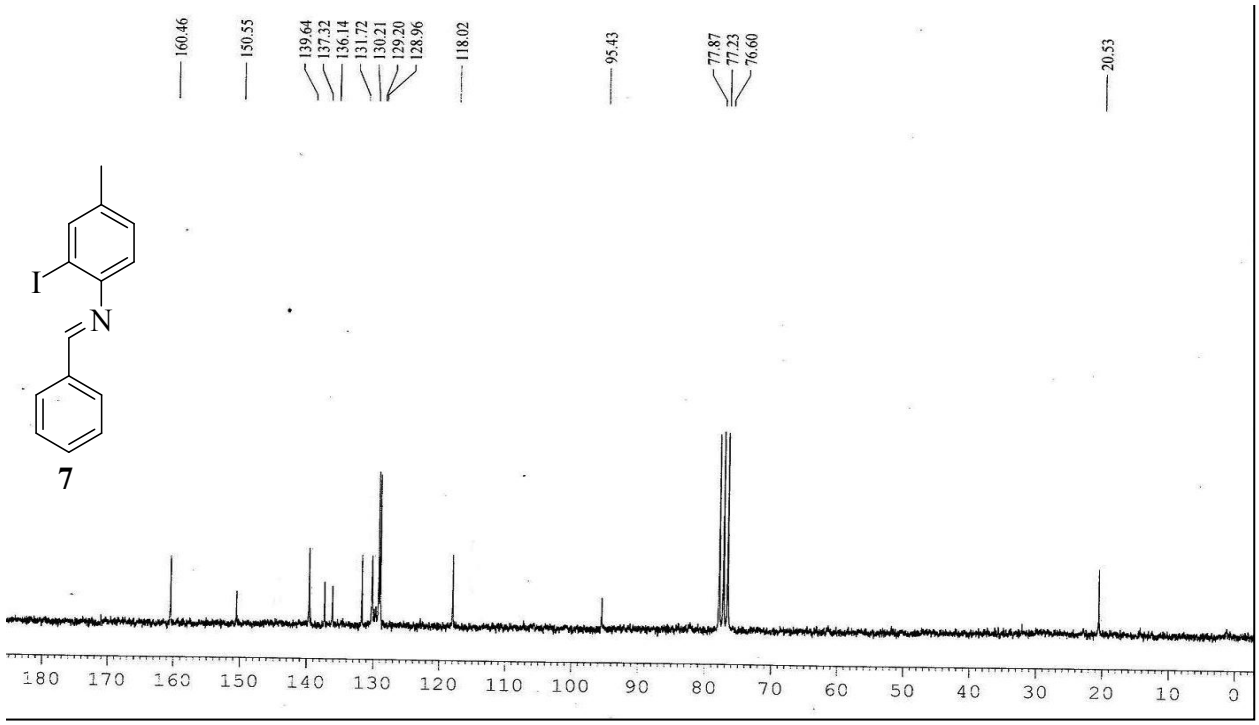
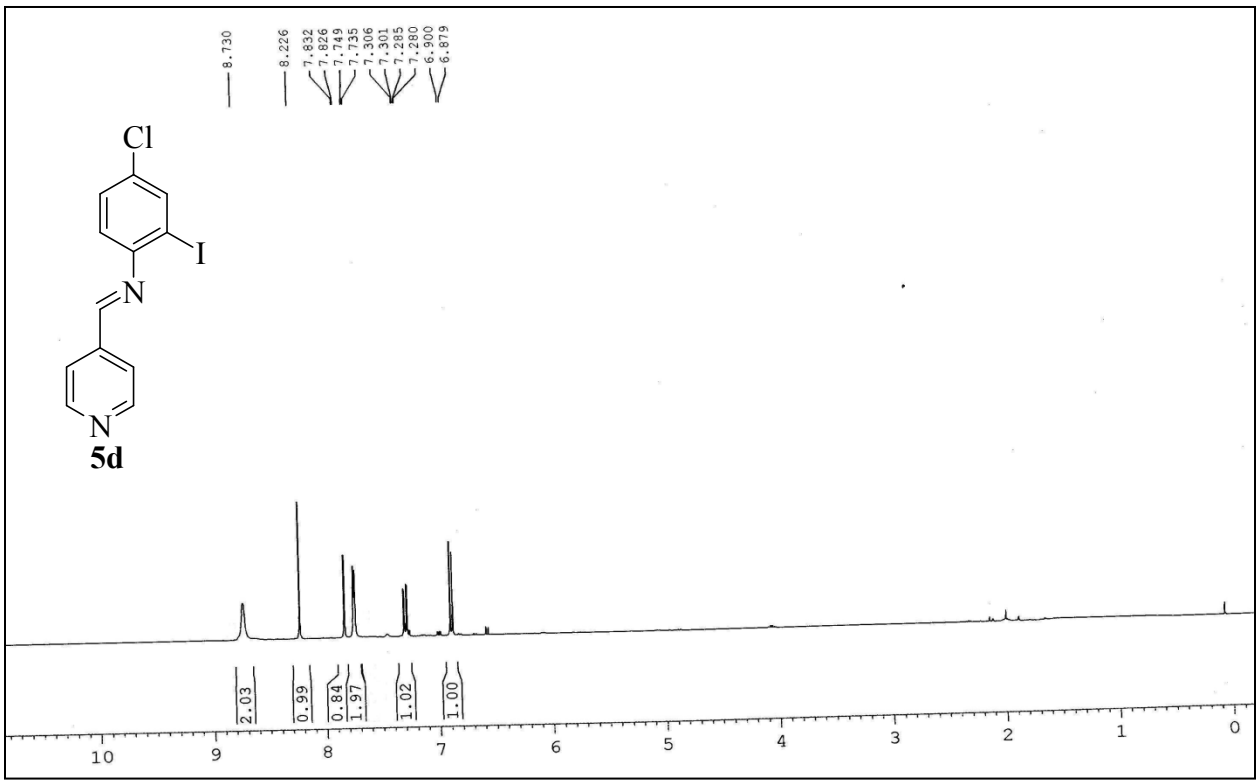
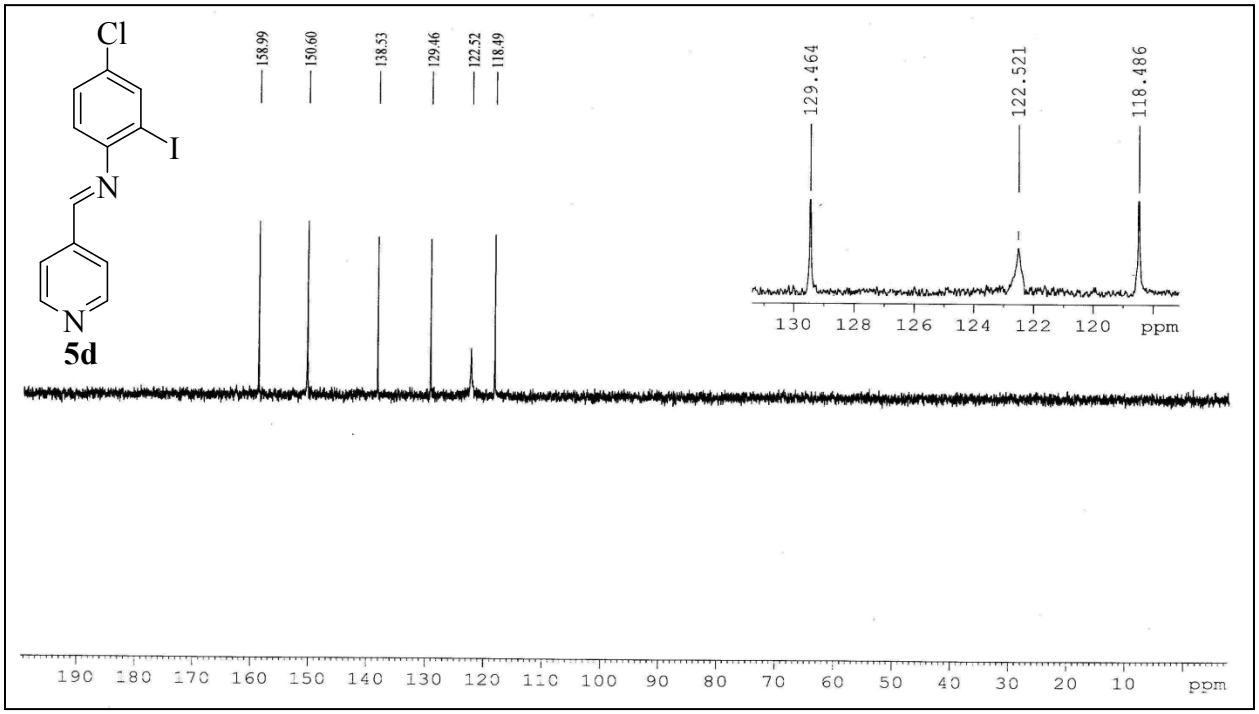


^{1}H NMR Spectrum (400 MHz in $CDCl_3$) of compound 5d:



DEPT 135 (50 MHz in $CDCl_3$) of compound 5d:



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